United Nations Development Programme

Country: Yemen

PROJECT DOCUMENT

Project Title: *Integrated Water Harvesting Technologies to Adapt to Climate Induced Water Shortages.*

UNDAF Outcome(s): *UNDAF Outcome 2: Local authorities and communities effectively engaged in sustainable management of natural resources, biodiversity conservation, and adaptation to climate change and disaster risk reduction (DRR) by 2015.*

UNDP Strategic Plan Primary Outcome: *Outcome 1: Growth and development are inclusive and sustainable, incorporating productive capacities that create employment and livelihoods for the poor and excluded.*

UNDP Strategic Plan Secondary Outcome: *Outcome 5: Countries are able to reduce the likelihood of conflict, and lower the risk of natural disasters, including from climate change.*

Expected CP Outcome(s): *Local authorities and communities effectively engaged in sustainable management of natural resources, biodiversity conservation, and adaptation to climate change and Disaster Risk Reduction (DRR) by 2015.*

Expected CPAP Outcome(s): *Local communities engaged in biodiversity, conservation and climate change initiatives.*

Implementing Partner: *National Water Resources Authority (Ministry of Water and Environment); Social Fund for Development, Ministry of Agriculture and Irrigation.*

Implementing Entity/Responsible Partners: *United Nations Development Programme – Yemen.*

Programme Period:	**48 months**
Atlas Award ID:	00082016
Project ID:	00091112
PIMS #	4989
Start date:	1 November 2014
End Date	30 October 2018
Management Arrangements	NIM
PAC Meeting Date	_____

Total resources required	US$33,720,596
Total allocated resources:	
○ GEF	US$4,920,000
○ Government in-kind	US$2,000,000
○ Government grant	US$26,200,000
○ UNDP	US$600,596

Agreed by (Government):

Date/Month/Year

Agreed by (Implementing Partner):

Date/Month/Year

Brief Description

Water security is a major concern in Yemen. Currently, only 48% of Yemen's population has secured access to water. Annual water resources of only 135 m^3 per person will be further strained by predicted climate change. Rain-dependent farmers, pastoralists and poor households across the country need to adapt to increasing water scarcity caused by climate change and aquifer depletion. The **problem** that the LDCF-financed project seeks to address, is that **climate change is expected to increase water scarcity and aquifer depletion in Yemen.**

The long-term preferred **solution** is **a revival of traditional water harvesting techniques and the introduction of innovative improvements**. This approach to water management includes containing water in built structures or slowing its course through natural pathways. Examples of traditional techniques include terrace and spate irrigation systems. Innovative water harvesting techniques include fog harvesting and artificial recharge structures. Management of water harvesting is typically decentralised, increasing ownership and incentive to maintain and improve these systems.

Significant **barriers** to achieving the revival of traditional water harvesting techniques and introduction of innovations include: i) **limited traditional and innovative water harvesting knowledge amongst stakeholders**; ii) **limited capacity of GoY institutions and Water Management Organisations (WMOs) to implement and promote water harvesting techniques**; iii) **data availability and analysis limitations hinder decision making**; iv) **scepticism of local communities towards the reliability of rainwater harvesting**; and v) **reluctance of local institutions to change the status-quo and promote the water harvesting sector**.

The LDCF-financed project will address these barriers through three integrated and complementary **components**. Component 1 will **develop the scientific knowledge base to support policy proposals and water basin management plans**. Component 2 will: **i) introduce and rehabilitate traditional water harvesting methods; ii) introduce innovative water harvesting methods; iii) train local communities in maintenance and construction** of these techniques; and **iv) promote awareness of the socio-economic benefits** of water harvesting. Component 3 will **strengthen WUAs, increase the capacity of the SFD Engineering Unit and promote financial incentives** to local communities for water harvesting.

The **outcomes** of the proposed project will allow local communities to be more self-sufficient in their water requirements. Decentralised water harvesting systems will be more efficient, sustainable and cost-effective in capturing and making harvested water available than centralised water supply systems. Decentralised systems also have limited exposure to negative political forces at both a local and national level.

Water harvesting will have significant socio-economic benefits for Yemen. The project also promotes the goal of gender equality through GEF operations. For example, making drinking water available close to households relieves women and children of the time-consuming and physically demanding task of fetching water. Additionally, Yemen has a large agricultural sector, water is a primary driver of the economy. Therefore, increasing water availability through cost-effective means will significantly increase the economic potential of the intervention sites. It will allow communities to be more productive from both having increased access to this key input, and from repurposing resources that would otherwise be dedicated to purchasing or securing water**.**

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List of Acronyms

4TH DPPR	Fourth Five-Year Development Plan
AMAT	Adaption monitoring and Assessment Tool
AREA	Agricultural Research and Extension Authority
CBOs	Community-Based Organisations
CCR	Catchment to Crop Ratio
CLP	Community Livelihoods Project
CO	Country Office
COP	Conference of the Parties
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSR	Corporate Responsibility
DEM	Digital Elevation Models
EPA	Environmental Protection Agency
EPM	Economic Policy Model
FAO	Food and Agriculture Organisation
FBUR	First Biennial Update Report
GARWSP	General Authority of Rural Water Supply Project
GCM	Global Climate Model
GDP	Gross Domestic Product
GEF	Global Environment Facility
GIS	Geographic Information Systems
GoY	Government of Yemen
GSCP	The Groundwater and Soil Conservation Project
GSM	Groundwater Simulation Model
IFAD	The International Fund for Agricultural Development
IP	Implementation Progress
IPCC	Inter-governmental Panel on Climate Change
IRR	Internal Rate of Return
ISR	Implementation Status and Results
ISM	Irrigation Simulation Model
IWRM	Integrated Water Resource Management
LDCF	Least Developed Countries fund
LIWP	Labour Intensive Works Project
MIROC	Model for Interdisciplinary Research on Climate
MoAI	Ministry of Agriculture and Irrigation
MoWE	Ministry of Water and Environment
MoSAL	Ministry of Social Affairs and Labour
NAPA	National Adaptation Programme of Actions
NASS	National Agriculture Sector Strategy
NGO	Non-Governmental Organisation
NIP	National Irrigation Programme
NPIWRM	National Programme on Integrated Water Resource Management
NWRA	National Water Resources Authority
NWSSIP	National Water Sector Strategy and Investment Programme
PDO	Project Development Objectives

PTSP	Peace and Transition Support Project
RALDP	Rain-fed and Livestock Development Project
RBM	Result-Based Management Framework for Adaptation to Climate Change
RRM	Rain Run-off Model
SBWMP	Sana'a Basin Water Management Project
SFD	Social Fund for Development
SGP	Small Grants Programme
TNC	Third National Communication
UNDAF	United Nations Development Assistance Framework
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
WAM	National Foundation for Watershed Management & Services
WASH	Water, Sanitation and Hygiene
WCs	Water Councils
WEC	Water and Environment Centre-University of Sana'a
WGP-AS	Water Governance Programme for Arab States
WMOs	Water Management Organisations
WSSP	Water Sector Supply Programme
WUAs	Water User Associations
WUGs	Water User Groups
YRSC	Yemen Remote Sensing and GIS Centre

List of Annexes

1. Situation analysis

1.1. Introduction

1. Yemen is one of the poorest countries in the Arab region with a per capita GDP of US$1,160 and faces a wide range of developmental challenges[1]. These challenges are compounded by Yemen's high population growth rate – ~3% – which further increases the demand for water, food, employment opportunities and educational and health services. The GoY is struggling to address these challenges and, as indicated in the first and second MDG Reports, the country is not expected to meet any of the MDGs.[2]

2. The conflicts in 2011 caused economic activity to contract by ~11%, exacerbating already high unemployment rates. Consequently, the percentage of Yemeni living below the national poverty line increased from 42% in 2009 to 54% in 2012. Oil production – the greatest contributor to Yemen's GDP – decreased by ~25% and this had detrimental knock-on effects across multiple sectors. The reduction in fuel availability – particularly diesel – further aggravated shortages in electricity and water supplies. As a result, the agricultural, service and industrial sectors faced significant cost increases for inputs such as irrigation, transportation, and marketing ultimately reducing production and exports.

3. Approximately 75% of Yemen's population live in rural areas and agriculture is the main source of employment for 55% of Yemeni. Agriculture contributes 20% to the country's GDP and consumes 93% of Yemen's surface and groundwater resources. Water is integral to the agricultural economy and therefore is a main determinant of the livelihood of the majority of Yemeni. However, Yemen is already suffering from chronic water shortages and the predicted effects of climate change will further exacerbate these.

1.2. Climate change-induced problem

1.2.1 Climate change scenarios and climate variability

4. Yemen is predominantly characterised by an arid to hyper-arid climate. However, there is considerable variation in rainfall across the country because the coastal escarpment blocks the passage of rain-producing weather systems, casting a rain shadow that causes the aridity of the interior. The western highlands receive 400 to 600 mm of rainfall year^{-1}. The interior, eastern areas and the coastal plains, known as the Tihama, receive less than 200 mm of rainfall year^{-1}. Daily temperatures are also variable and follow a similar spatial distribution to rainfall. The Tihama and areas within the rain shadow are hottest. Accordingly, evapotranspiration rates are high and can exceed 3000 mm year^{-1} [3].

5. Yemeni civilization was founded on rain-fed agriculture. This success was achieved through a strategy that captured as much water as possible when it was available and limited the excess run-off to minimise flooding damage. Water harvesting, including terraces and spate irrigation systems, was the response then to the challenging climate. However, climate change, amongst other factors, is now threatening this system of agriculture.

6. Rainfall records were first documented by the British colonial administration in Aden in the late 1800s. Data have subsequently been recorded at an increasing number of sites across Yemen. Although there is no obvious trend towards a generally drier or wetter climate, the data indicate that inter-annual rainfall is strongly variable and intense rainfall events are increasing. This trend is leading to greater flooding[4] and more intense erosion. Indeed, severe rainfall events are exceeding the capacity of water harvesting techniques to limit flooding and erosion.

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[1] JSEA (2012). Available at: http://www.fao.org/docs/eims/upload/310689/WorldBank%20UN%20EU%20JointEconomicSocialAssessmentYemen23May2012.pdf. Accessed on: 26 August 2014.
[2] JSEA (2012). Available at: http://www.fao.org/docs/eims/upload/310689/WorldBank%20UN%20EU%20JointEconomicSocialAssessmentYemen23May2012.pdf. Accessed on: 26 August 2014.
[3] Hydrology of Yemen, Yemen Water. Available at: http://www.yemenwater.org/wp-content/uploads/2013/03/Hydrology-of-Yemen.pdf Accessed on: 26 August 2014.
[4] For example, in 2008 a flood in Hadramout and Mahrah Governorates caused the death of 140 people and left a further 20,000 without shelter.

7. Statistical models are unable to present a clear outlook for Yemen's future climate as different models generate different outcomes[5]. For example, the Model for Interdisciplinary Research on Climate (MIROC) Global Climate Model (GCM) shows a significant increase in rainfall over the wet season by 2050. By contrast, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) projection indicates minimal changes in rainfall patterns over the same period. These two models are shown in Figure 1. The Inter-governmental Panel on Climate Change (IPCC) has two scenarios that also have opposing projections for annual rainfall, ranging from -95.4% to +37.7% by 2100. Yemen's varied climatic zones make it difficult to project climate change accurately because national projections for Yemen fail to account for local conditions.

8. Temperature data recorded since the 1970s show an increase in average daily temperature. Projections for temperature are clearer than rainfall and show an increase in mean temperature of 3–4°C by 2080 (Figure 2). Therefore, Yemen is predicted to become warmer 1.5 times faster than the global average[6]. Furthermore, this increase in temperature will affect the hydrological regime of the country.

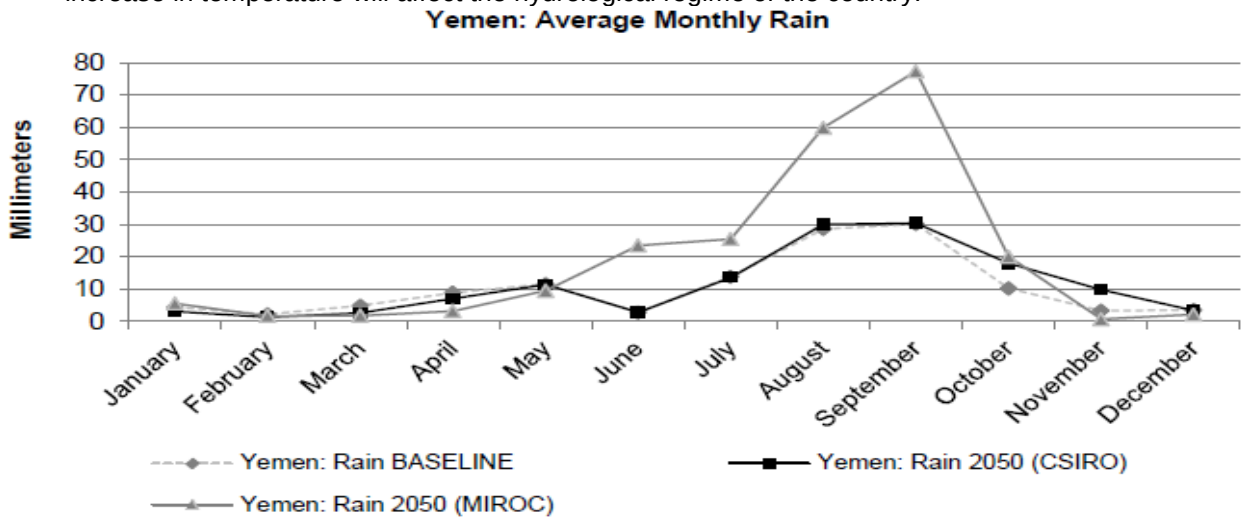


Figure 1: Average monthly rainfall in millimetres predicted by MIROC GSM and CSIRO models (Source: Wiebelt, et al. 2011)

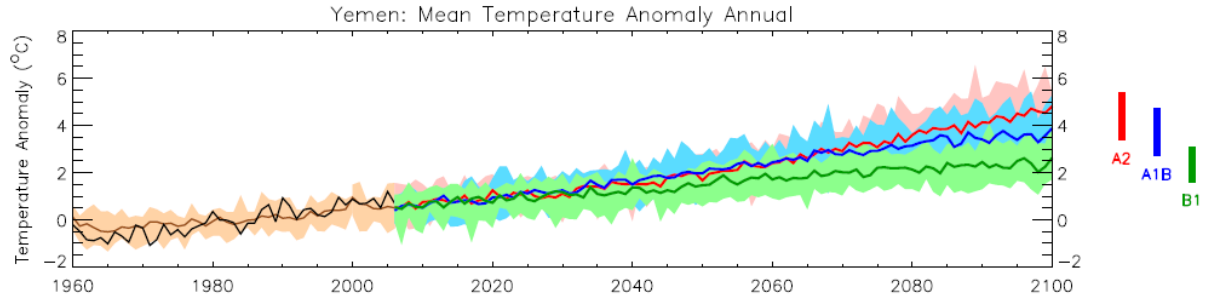


Figure 2: Mean average temperature records and projected change under three Special Report on Emissions (SRES) emissions scenarios. (Source: UNDP Climate Change Country Profiles – Yemen)

9. As described above, current predictions are that Yemen will become warmer. Higher temperatures will increase evapotranspiration rates for crops, pastures and natural vegetation. A variable climate will reduce plant growth, resulting in decreased vegetation cover. This will cause an increase in erosion and consequent environmental degradation, further exacerbating poverty and food insecurity. Agriculture and pastoralism will therefore require additional water, a scenario that is compounded by a growing population. Yet, the provision of water will be challenging given the country's rainfall variability.

[5] Wiebelt, M., Breisinger, C., Ecker, O., Al-Riffai, P., Robertson, R., Thiele, R. 2011. Climate change and floods in Yemen: impacts on food security and options for adaptation. IFPRI Discussion Paper 01139

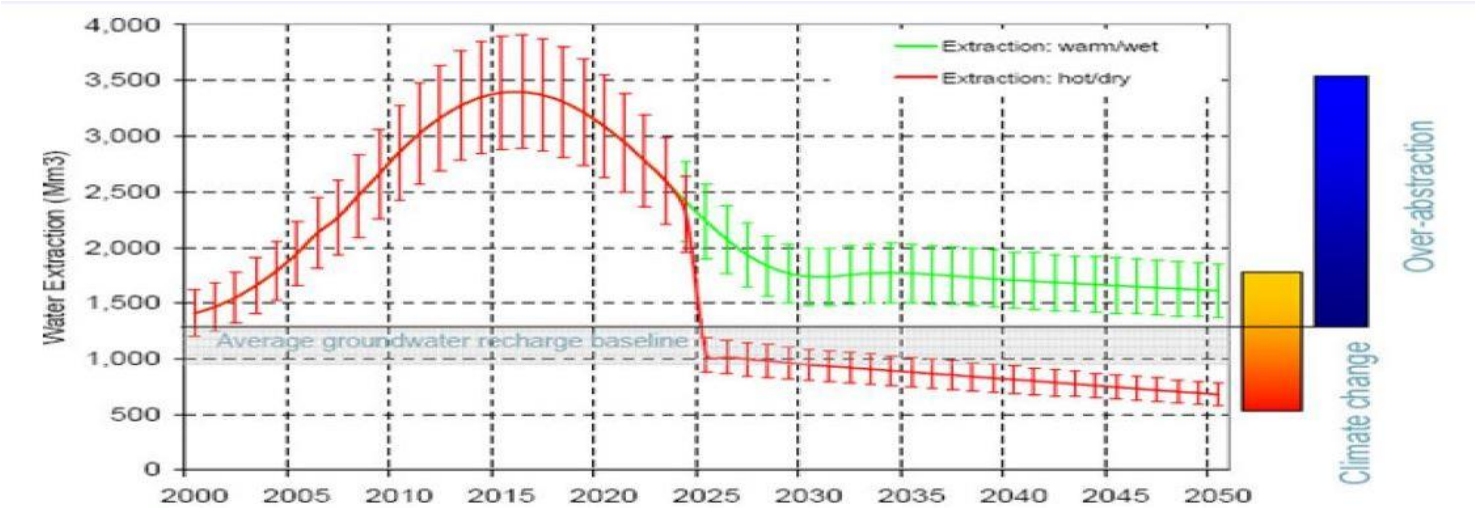
[6] Zubrycki, K., Crawford, A., Hove, H., Parry, J-E. 2011. Review of current and planned adaptation action: north Africa. International Institute for Sustainable Development, Adaptation Partnership. Available at: http://www.adaptationpartnership.org/sites/default/files/North%20Africa%20Country%20Profiles%20(Yemen).pdf. Accessed on 2013-11-04

10. Irrigated crops will require additional water to maintain productivity under predicted increases in temperature. Currently ~60% of the value of crop production is dependent on groundwater for irrigation[7] and aquifers are rapidly becoming depleted. Abstraction is 2.5 times the rate of recharge and under predicted climate change scenarios, increased temperatures and reduced infiltration will further reduce recharge rates (Figure 3). Once aquifers are depleted, productivity will be limited to the groundwater recharge rate.

11. Furthermore, the predicted rainfall regime will cause additional challenges to vulnerable Yemeni communities. Long, hot dry spells and sporadic heavy downpours are typical in the semi-arid to arid parts of Yemen. Whether wetter or drier annually, the predicted increase in heavy rainfall events is anticipated to reduce plant growth, resulting in decreased vegetation cover and slower infiltration rates into soil. Consequently, during periods of heavy rainfall, water run-off will increase, causing soil erosion and intensifying the risk of environmental degradation. This will negatively affect the agricultural production of arable and rangeland. A loss of fertile topsoil from erosion reduces the potential to grow crops. In addition, slower infiltration rates and increased intensity of rainfall magnify the severity of flooding – an effect expected in both the wetter and drier scenarios. Under the predicted drier scenario described above, although flooding will be less frequent, when it does occur it will be severe. The wetter scenario predicts more frequent and severe flooding. Therefore, under baseline scenarios climate change is expected to result in increased flood damage, topsoil losses and decreased agricultural production in Yemen. Predicted climate changes and their effects – described above – have become noticeable in Yemen, with increased rainfall and temperatures resulting in more frequent and severe natural disasters[8].

1.2.2 Socio-economics of Water Resources

Figure 3: Projected changes in groundwater recharge and extraction (Source: World Bank. 2010. Assessing the Impact of Climate Change and Variability on the Water and Agriculture Sectors, and the Policy Implications. Report No. 54196-YE)



12. Yemen already faces extreme water scarcity and as water is integral to the country's economy, its increased scarcity exacerbates poverty levels. The average individual consumption of water in rural areas is 40 litres a day, compared to 120 litres in the rural areas of other countries in the region. Currently only 48% of the total population has secured access to water. This scarcity will be further strained by more frequently occurring droughts under predicted climate changes.

13. As described above, Yemen's agriculture sector is reliant on groundwater irrigation and uses a large portion of the country's water budget. The use of groundwater resources has allowed Yemen to expand its irrigated area from 37,000 hectares in 1970 to 400,000 hectares in 2004. This trend was partly a result of the general modernisation of agricultural practices and has brought about a degree of food security to the country[9]. The

[7] Lichtenthaeler, G. 2013. Water conflict and cooperation in Yemen. *MER254: Running Dry*. Available at: http://www.merip.org/mer/mer254/water-conflict-cooperation-yemen. Accessed on 11 March 2013.
[8] Desinventar Country Profile: Yemen. Available at: http://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=yem#more_info. Accessed on 28 August 2014.
[9] Although Yemen grows sufficient fruits and vegetables to meet its own demand, it is still a net importer of grain and cereal.

pumping of Yemen's groundwater has been facilitated by GoY diesel subsidies. Low pumping costs from subsidised fuel has allowed boreholes to be sunk to depths that would otherwise be unfeasible, resulting in the rapid depletion of aquifers. However, fuel subsidies were abolished in July 2014 and this provides an opportunity to promote rainwater harvesting as a cost-effective and sustainable alternative to groundwater.

14. The agricultural gains experienced in Yemen, however, are not sustainable. The demand for water exceeds supply in the country, creating a water deficit estimated at ~900 million m^3 per year in 2000 and ~1.28 billion m^3 per year in 2005[10]. To offset this deficit, wells have increased in number and depth, and aquifers are pumped excessively. Consequently, the area covered by rain-fed agricultural land has decreased from 1.2 million hectares to 460,000 hectares in 2000. Food production has, however, increased because irrigated agriculture is more productive than relying on rain. Furthermore, the lucrative diversification from more traditional crops to *qat* has enhanced groundwater depletion, since *qat* fields are typically flooded twice a month, consuming ~30% of Yemen's water — most of which is pumped from underground aquifers. Groundwater levels are declining by 2–8 m per year in the main agricultural areas, such as the Tihama[11], Sana'a and Ibb. The depletion of aquifers is predicted to lead to a decrease in agricultural production of ~40% by 2030. In addition, pumping costs will increase as groundwater levels drop because additional energy is required to bring water to the surface.

15. It is estimated that more than 90% of the predicted long-term annual average rainfall of 88.17 billion m^3 is lost to evaporation. The retention of an additional 1.6% of rainfall will alleviate pressure on groundwater reserves. Although rainfall is not evenly spread across the country, higher rainfall areas correspond roughly with population and agricultural density[12]. Therefore, rainwater harvesting provides a viable opportunity to reduce this deficit.

16. The depletion of groundwater not only affects irrigation, but also domestic water supply. As groundwater is depleted in rural areas, local wells or streams run dry. This forces local communities to use distant sources that take longer to reach and lead to conflict with previously existing users. Urban areas are also affected. In Sana'a, groundwater levels are between 800 m and 1,200 m deep. The cost of accessing this water is passed onto the consumer. The declining number of wells is concentrating the water market, which causes further price increases and delays in delivery via truck.

1.2.3 Water harvesting systems

17. Traditional agricultural practices in Yemen apply various techniques to maximise the productivity of water when it is available. Rainfall primarily occurs during the spring and summer monsoons, known locally as the *Seif* and *Kharif*, respectively. As a result of orographic forces, rainfall is heaviest on areas characterised by steep slopes. In consequence, rain-fed agriculture in mountainous areas is challenging because of the erosion of topsoil by heavy rainfall. In response to this challenge, farmers in mountainous areas in Yemen developed terraces on steep slopes to reduce run-off and increase infiltration of water into soil profiles.

18. Despite the beneficial effect of terraces in retaining water and reducing run-off, periods of intense rainfall frequently result in the flooding of *wadis*. Floods in Yemeni *wadis* tend to be abrupt, with sharp rising peaks that diminish rapidly. With the exception of these brief flooding events, the *wadis* are dry or have minor base flows for most of the year.

19. Spate irrigation systems – also known as 'large catchment water harvesting' – were developed by farmers adjacent to *wadi* channels to divert flood waters to agricultural areas. This technique consists of a stone barrier that is constructed partially or entirely across a *wadi* channel that redirects floodwaters and fertile sediment towards agricultural fields. At its simplest, a barrier can divert water to an individual channel leading directly to a field. Alternatively, a barrier can supply a number of farmers through a network of primary and secondary canals. This latter system requires the establishment of management arrangements between different users. A list of the different types of systems for floodwater diversions and a description of their functions is available in Annex 9.

An estimated 30% of irrigation water is used for *qat* – a narcotic leaf that is part of Yemeni culture. Its consumption has increased dramatically in recent years, and it is the most profitable crop for farmers.

[10] IRIN. 2009. Yemen: unprecedented water rationing in cities. Available at: http://www.irinnews.org/report/85734/yemen-unprecedented-water-rationing-in-cities. Accessed on 12 March 2014.

[11] The Tihama is the coastal plain of Yemen.

[12] The exception is the Tihama, which is intensively farmed, but arid. In this scenario, floodwater harvesting systems offer a potential solution.

20. The traditional management system generally gives first rights of use to farmers in upstream areas. Once a farmer's irrigation requirements have been met, they are obliged to release water for downstream users. Traditionally, barriers were modest and temporary such that downstream farmers usually received sufficient amounts of water for their irrigation needs. The first floods of the *Seif* would sustain the season's crops during that period. Farmers would then break the barrier in the *wadi* or canal to allow the next floods downstream. Later in the season, the barrier would be rebuilt to redirect rainfall from the *Kharif* to irrigate maturing crops. All users perceived this system to be fair.

Recent Irrigation Developments

21. Despite the success and the heritage value of the terrace and spate systems, many of these systems have become neglected in recent decades. Since the 1980s, rain-fed agriculture and low-value crops such as wheat and sorghum could only offer relatively low wages compared to work opportunities in urban centres in Yemen and the neighbouring Gulf States. This resulted in a shortage of labour in rural areas and led to an increase in rural wages. As a result, the cost of maintaining terraces became unfeasible for many farmers.

22. Mechanised pumping was introduced to Yemen in the 1970s to facilitate the extraction of groundwater from *wadi* valleys and plains. This resulted in a change in local water consumption patterns and contributed to the neglect of traditional spate irrigation systems. The constant availability of groundwater created a perception that it was limitless. Groundwater was often referred to as *bahr* – the sea. This perception contributed to the adoption of inefficient practices in irrigation using groundwater. Consequently, the yield gap for most crops in Yemen is 20% – 40% below the optimum. A yield gap is defined as the difference between yield potential and the average farmer's yield over a specified spatial and temporal scale. Yield potential is defined as the yield of a crop grown without limitations from water, pests, nutrients and diseases. A number of economic factors contributed to further increases in the reliance on groundwater. These factors include: i) a ban on imported fruit in the 1980s that stimulated the local fruit industry and increased demand for irrigation; ii) devaluation of the Yemeni Rial that encouraged investments in land and infrastructure (e.g. improvements to groundwater infrastructure); and iii) increased remittances from the Yemeni diaspora in the Gulf States, which provided capital for investment in groundwater infrastructure.

Domestic water supply

In Yemen, traditional rainwater harvesting techniques provided water for both irrigation and domestic use. Water capture techniques depend on local conditions. For example, the run-off from a natural catchment will have a diversion barrier placed across natural flow lines to redirect water to storage. These systems are typically shared between members of a local community. Where this is not practical, rooftop harvesting systems are used.

1.2.4 Political situation

23. Yemen's political instability and numerous security threats contribute to the vulnerability of local communities and ecosystems. The current instability is caused by poverty and conflict, which are consequences of environmental stress. For example, research has shown that 70–80% of communal conflicts result from water insecurity[13]. This situation has prompted Yemen to be described as the world's first "ecologically failed state"[14].

24. A complex tribal culture is also contributing to the current instability in Yemen. Conflict between the GoY, tribal factions and separatists has made areas unsafe and restricts government engineers and hydrologists from conducting their work. The GoY is constrained in addressing the water crisis when its authority is not recognised by local communities and its representatives are threatened.

25. Following the conclusion of the National Dialogue Conference on 25 January 2014, Yemen is undergoing a transition from an autocratic unitary state to a federal democracy with six sub-national governorates. The effects of climate change will place additional challenges to solving the water crisis and the peaceful development of Yemen.

[13] Sipkin, S. 2010. Water conflict in Yemen: inventory of conflict and environment. Case Study 235. Available at: http://www1.american.edu/ted/ice/Yemen-Water.htm. Accessed on 11 December 2013.
[14] Moore, S. 2011. Parchedness, politics and power: the state hydraulic in Yemen. *Journal of Political Ecology* 18: 38–50.

1.3. Long-term solution and barriers to achieving the solution

26. ***Preferred Solution:*** The long-term preferred solution – that the LDCF-financed project will contribute towards – is **a revival of traditional water harvesting techniques**[15] **and introduction of innovative water harvesting techniques to supplement domestic and agricultural water supply**. Rainwater harvesting will contribute to reducing water scarcity and stress on aquifers, however Yemeni water security cannot be achieved by these systems in isolation. Therefore, the project is part of the national response, which also includes irrigation efficiency and the promotion of drought resistant crops and varieties of drought resistant crops. Traditional water harvesting approaches to water management include containing water in built structures, or slowing its course through natural pathways[16]. Examples of traditional techniques include terrace and spate irrigation systems and storage systems made by excavation and/or masonry. Innovative water harvesting techniques include fog harvesting and artificial recharge structures such as check dams. The management of water harvesting systems is typically decentralised, as the structures are small in scale and so serve an individual farmer or household, or a small community. Such structures are, therefore, easier and more affordable to maintain. Additionally, in the case of traditional methods, the materials are locally available to communities and can be constructed with minimal tools or expert knowledge.

27. Rainwater harvesting will relieve pressure on Yemen's groundwater resources. Considering the current groundwater situation in Yemen together with the projected effects of climate change, rainwater harvesting is part of a solution that will provide sustainable water resources in a cost effective manner. The volume of water made available through rainwater harvesting will often be less than a borehole and pump, however, costs per volume will be much less than for pumped groundwater. Additionally, rainfall is predicted to become increasingly erratic. Therefore, rainwater harvesting maximises its use, when it is available, and reduces the negative effects of intense rainfall events, *inter alia* erosion and floods.

28. ***Barriers to be overcome:*** The main barriers that need to be addressed in order to contribute towards the achievement of the long-term preferred solution include:

29. ***Limited traditional and innovative water harvesting knowledge under predicted climate change scenarios amongst stakeholders.*** There is limited knowledge amongst national institutions, such as the National Water Resources Authority (NWRA) and the Environmental Protection Agency (EPA), local institutions, such as Water User Associations (WUAs), and individual farmers and pastoralists on traditional and innovative water harvesting techniques under predicted climate change scenarios. Additionally, there are institutions that hold knowledge on a particular technique in isolation of other institutions – such as the Social Fund for Development's (SFD) experience in rooftop harvesting. Similarly, policy- and decision-makers in the Ministry of Water and Environment (MoWE) and the Ministry of Agriculture and Irrigation (MoAI) have limited awareness of climate change and its implications. Knowledge on rainwater harvesting was lost in places as mechanised pumping displaced traditional techniques. Furthermore, migration of locals to cities and abroad in search of better work opportunities has reduced water harvesting knowledge in rural areas.

30. ***Limited capacity of GoY institutions and Water Management Organisations (WMOs)[17] to implement and promote water harvesting techniques under predicted climate change scenarios.*** At present there are no policies or financial incentives in place to make water harvesting preferable to the current trend of groundwater abstraction. Furthermore, technical skills to integrate climate change into the development of the water sector are limited within MoWE and MoAI. This skills shortage exists at both the national and governorate level. The ministries are constrained by limited financial and human resources. In addition, climate change is not integrated into water reform policies and these are not adequately enforced. WMOs are also underdeveloped and do not perform a leading role in water rights and distribution decisions at a local community level. To address this policy gap, the MoWE has requested the SFD's support to develop a national policy to promote water harvesting. However, the SFD is currently unable to provide this support because of limited available funding.

31. ***Data availability and analysis limitations hinder climate-resilient decision-making.*** There are limited data available to make the required decisions for effective water management under predicted climate change

[15] Water harvesting is defined as the collection of water for productive use. It is used as an overarching term for a range of methods of collecting and conserving rainwater and runoff water.
[16] In the case of fog harvesting, water is taken from an airborne pathway, and so draws water from a previously untapped part of the water cycle.
[17] WMOs encompass both formal and informal water-interest groups. Water User Groups (WUGs) are informal, while WUAs have been formally registered with the GoY.

scenarios. Furthermore, these data are housed in different institutions, and policy- and decision-makers may not be aware of the existence of these data or know how to obtain them. For example, GIS resources are fragmented with the Water and Environment Centre (WEC) in the University of Sana'a, NWRA and the GIS and Remote Sensing Centre all working separately on similar projects in an uncoordinated manner[18]. In terms of rainfall data, apart from Aden Sana'a, Taiz and Rayan, rainfall records are inadequate for assessing long-term trends. Rainfall and *wadi*-level gauging stations are situated in areas of high rainfall and dense populations, and stations were often placed for the purposes of a particular project. Consequently, a national co-ordinated data network does not exist, and available data have short and frequently interrupted temporal scales and an uneven spatial distribution. In addition, at governorate and watershed level, there are limited technical skills and financial resources available to analyse climate change data to determine the appropriate actions required for Yemen's highly variable topography. Furthermore, the quality of the existing data limits its reliability. For example, climate change projections are based on low-resolution data and have only accounted for climate change on a national scale.

32. ***Scepticism of local communities towards the reliability of rainwater harvesting under climate change scenarios*.** Two factors cause communities to perceive that committing resources to water harvesting is not justifiable. Firstly, rainfall has strong inter-annual variability[19] and this will increase under predicted climate changes. Consequently, relying on rain leaves a farmer vulnerable to its variability. This vulnerability will increase with the uncertainty caused by predicted climate changes. Secondly, rain-fed agriculture is less productive than irrigated agriculture. The perceived risks associated with water harvesting prevents local communities from investing their resources into these proposed adaption measures. Socioeconomic factors, including limited knowledge, limited co-operation, and access to groundwater through modern pumping, coupled with the predicted increase in variability of rainfall in Yemen, have resulted in rainwater harvesting structures falling into disrepair. However, with the abolishment of fuel subsidies, there are opportunities for promoting rainwater harvesting as a sustainable and cost-effective means of supplying water for domestic and agricultural use.

33. ***Reluctance of local institutions to change the status-quo and promote water harvesting under predicted climate change scenarios.*** Despite predictions of rapidly approaching aquifer depletion, local WMOs perceive that there are risks involved in moving away from groundwater dependency. Local institutions, such as those WMO's that formed to manage groundwater, have inadequate knowledge of water harvesting to assess its benefits. As such, there is reduced motivation to abandon established methods and adopt unknown "new" methods that require a new set of skills and understanding. There also is a perception prevalent among institutions and local communities that an increase in rainfall would negate the need to invest in water harvesting, as the problem will solve itself. Conversely, if there is a decrease in rainfall, investment in water harvesting will not produce sufficient water. Therefore, the perception amongst policy and decision-makers is that investment in water harvesting infrastructure is not justifiable. This perception is reinforced by the uncertainty caused by the disparate outcomes of different projected rainfall scenarios – shown in Figure 1.

34. The LDCF-financed project will address the barriers to the preferred long-term solution through three integrated and complementary components. Component 1 will **develop the scientific knowledge base to support integrating climate change and rainwater harvesting into policy proposals and water basin management plans**. Component 2 will: **i) reintroduce and rehabilitate traditional water harvesting methods; ii) introduce innovative water harvesting methods that are appropriate under predicted climate change scenarios; iii) train local communities in maintenance and construction** of these techniques; and **iv) promote awareness of the socio-economic benefits** of water harvesting. Component 3 will **strengthen WUAs, increase the capacity of the SFD Engineering Unit and promote financial incentives** to local communities for water harvesting under predicted climate changes.

35. No single initiative can completely remove all of the barriers aforementioned. Nonetheless, this project will work in coordination with other adaptation and water-related initiatives to build on their advances in removing these barriers.

2. Strategy

2.1. Introduction

[18] Al-Hakimi, S., personal communications, 28 March 2014
[19] Hydrology of Yemen. 2013. Yemen Water. Available at: http://www.yemenwater.org/wp-content/uploads/2013/03/Hydrology-of-Yemen.pdf. Accessed on 26 March 2014.

36. Rainwater harvesting will contribute to reducing water scarcity and stress on aquifers, however Yemeni water security cannot be achieved by these systems in isolation. Therefore, the project is part of the national response, which also includes irrigation efficiency and the promotion of drought resistant crops and varieties. At the commencement of the PPG phase, a review of relevant policies, strategies, frameworks and projects was undertaken in order to: i) align the objective, strategy and interventions of the LDCF-financed project with national priorities; ii) identify the efficacy of rainwater harvesting techniques and innovations in adapting to climate change; iii) collect baseline data; and iv) inform stakeholder consultations during the remainder of the PPG phase.

37. The project objective is **to re-introduce traditional and introduce innovative water harvesting techniques to improve water availability.** The beneficiaries will be rain-dependent farmers and pastoralists, and rural and urban poor households in the Yemeni governorates of Ibb, Taiz, Sana'a, Dhamar Raymah and Al Mahweet. **The proposed project will use LDCF resources to develop the technical capacity of national and local institutions to identify and implement sustainable, climate-resilient water harvesting techniques to increase the resilience of vulnerable communities to climate change. The project will design, implement and provide training on water harvesting technologies and develop community-based water harvesting management to improve quality and availability of water for vulnerable communities.** The outcomes of the LDCF-financed project will support vulnerable communities to access adequate water for domestic and productive purposes under conditions of climate change. The increased availability of water will support the development of Yemen's agricultural sector, which is a major contributor to the national economy and the most important livelihood in rural areas. The increased availability and improved quality of water for drinking and domestic use will reduce the burden of water collection on women and children and reduce the incidence of waterborne diseases. Therefore, increasing water availability through cost effective means will support social and economic development at the intervention sites and will reduce the negative impacts of climate change on vulnerable communities.

38. The LDCF-financed project is designed to secure the sustainability of its interventions by: i) building an evidence base of the cost-effectiveness of interventions; ii) promoting decentralised ownership of interventions to devolve responsibility for their operation and maintenance; iii) providing training on intervention construction and maintenance, as well as using designs that are simple to build and maintain; iv) providing training on communal water resources management.

39. Great attention has been paid in the project design to ensure that i) lessons are replicable; ii) sufficient training builds capacity to transfer expertise into other initiatives; and iii) necessary replication mechanisms are in place. This will allow for upscaling of appropriate interventions beyond the scope of the project.

2.2. Country ownership: country eligibility and country driven

40. The LDCF-financed project will contribute towards the adaptation prioritises identified in the Yemeni National Adaptation Programme of Actions (NAPA), therefore achieving the criteria outlined in UNFCCC Decision 7/CP.7 and GEF/C.28/18. Yemen has been party to the UNFCCC since 21 February 1996 and is eligible to receive funding from the LDCF. The Environmental Protection Agency (EPA) is the national focal point for the implementation of the UNFCCC and is the mandated agency to coordinate Yemen's efforts to adapt to climate change. Since becoming a signatory to the UNFCCC, the EPA has made considerable efforts to establish legislative, institutional and policy frameworks in order to fulfil the requirements of the Convention.

41. Yemen will soon submit its First Biennial Update Report (FBUR) and Third National Communication (TNC) reports, in accordance with Article 12 of the UNFCCC. The FBUR will be submitted to the UNFCCC at COP20 in 2014 and the TNC is expected to be submitted in 2016. Yemen's EPA, through its Climate Change Unit, is both the implementing and implementing partner responsible for the FBUR and TNC. The National Communication and Biennial Report provide information on emissions and removals of greenhouse gases in Yemen, as well as details of the activities undertaken to implement the convention. The FBUR and TNC build on the Initial and Second Communications by, *inter alia*:
    - conducting climate change impact assessments in sectors omitted from the previous national communications, such as health and eco-tourism;
    - conducting further climate change impact assessments in sectors covered by the previous national communications, such as agriculture, water and coastal areas, targeting different pilot areas and crops; and
    - updating climate and socio-economic information in the national circumstances provided by the Second National Communication.

42. The LDCF-financed project is in line with the Initial, Second and Third National Communications, in that the project will assist the GoY to fulfil its commitments to the UNFCCC by strengthening climate change resilience in vulnerable Yemeni communities.

43. The project is fully aligned with the UNDAF for Yemen for 2012-2015. It corresponds with UNDAF Priority Area 1 – support inclusive and diversified economic growth. Under this Priority Area, Outcome 2 – local authorities and communities effectively engaged in sustainable management of natural resources, biodiversity conservation, adaptation to climate change and disaster risk reduction by 2015 – is directly relevant to the project's objectives. This is in direct response to the findings that have emerged from the Common Country Assessment that highlights "an aggravation of the crisis of water resources and environment". UNDAF Priority Area 2 – ensure sustainable and equitable access to quality basic social services to accelerate progress on MDGs – will also be promoted by this project. The activities of the project will contribute to both Outcome 3 – by 2015, vulnerable groups and deprived districts (including those in humanitarian emergency situations) have improved access to sustainable quality basic social services – and Outcome 4 – by 2015, food security, nutrition and resiliency of vulnerable groups and communities to crisis and shock are improved. Priority Area 4 - strengthening good governance and social cohesion – is another aspect to be addressed by this project. Outcome 8 – national capacities for evidence-based planning, implementation and monitoring of development policies and programmes are strengthened at all levels by 2015 – will be implemented as part of the project.

44. The project is also aligned with UNDP's Strategic Plan for 2014–2017. The project's activities will contribute to Outcome 1 – Growth and development are inclusive and sustainable, incorporating productive capacities that create employment and livelihoods for the poor and excluded and Output 1.4 – Scaled up action on climate change adaptation and mitigation across sectors which is funded and implemented.

Stakeholder baseline analysis

45. At the commencement of the PPG phase, a review of relevant policies, strategies, frameworks and projects was undertaken in order to: i) align the objective, strategy and interventions of the LDCF-financed project with national priorities; ii) identify the efficacy of rainwater harvesting techniques and innovations in adapting to climate change; iii) collect baseline data; and iv) inform stakeholder consultations during the remainder of the PPG phase. Extensive stakeholder consultations were conducted which included: i) a one-day inception workshop held on 15 December 2013; ii) one-to-one meeting sessions with stakeholders during the in-country mission 4–18 December 2013; and iii) national consultants' additional contact with stakeholders at later times. The consultations were held with government institutions, development partners, academic institutions, NGOs and members of potential target communities. These stakeholders were namely the MoWE, EPA, NWRA, SFD, MoAI, Sana'a University, Women's National Union (WNU) and Watershed Management Society (WMS). These consultations served to align the LDCF-financed project design with national and local priorities as well as ongoing initiatives. The main stakeholder consultation events during the PPG are described below.

- An inception workshop was held in the UNDP country office headquarters, in Sana'a, on 15 December 2013. This workshop served to inform stakeholders of the outline of the LDCF-financed project and the opportunities that exist in Yemen for rainwater harvesting as an alternative source for water. Attendees of the workshop, their affiliation and contact addresses are listed in Annex 2.1.
- Three stakeholder working groups were formed during the inception workshop to discuss the LDCF-financed project components under the following themes: i) developing capacity and policies for traditional and innovative water harvesting; ii) introducing water harvesting and rehabilitating traditional water harvesting structures; and iii) developing decentralized and community-led water management systems to adapt to the long-term effects of climate change on water availability. The component outputs and activities were also discussed.
- National and international consultants, along with relevant stakeholders, developed site selection criteria for rainwater harvesting in six governorates of Yemen. These governorates are Sana'a, Taiz, Dhamar, Ibb, Raymah and Al-Mahweet.
- National consultants conducted preliminary field-visits to ten rainwater harvesting sites in six governorates (17–29 May 2014). These visits included socio-economic assessments.
- The Socio-economist consultant collected demographic and socio-economic data.
- Hadramout Governorate was not included in the field visits because of security concerns in the area and subsequently will no longer be a target governorate for the project. However, should the security situation improve, the project will remain open to implementing interventions in the Al Mukalla municipality of Hadramout.

- A consultative meeting was held at the UNDP Office in January 2014. The meeting was attended by various stakeholders of the PPG, including the Rainwater Harvesting National Consultant and representatives from UNDP, NWRA, SFD, EPA and MoAI. The meeting served to: i) update and motivate stakeholders on plans in project design; and ii) collect information on national priorities and institutional arrangements.

The project was developed in consultation with the following national institutions:

46. *Ministry of Water and Environment:* The MoWE is responsible for consolidating all water and environment-related functions and institutions under one ministry. The MoWE will assume responsibility for the implementation of this project through two line agencies, namely the National Water Resources Authority (WRA) and the Environmental Protection Agency (EPA) (described below). Responsibilities of MoWE as the implementing agency will include the timely and verifiable attainment of project objectives and outcomes concerning water and environmental matters.

47. *National Water Resources Authority:* NWRA is an administrative body within MoWE which is responsible for the sustainable management of Yemen's water resources. The NWRA is well placed to implement the project as the agency responsible for coordination and implementation of Yemen's National Water Sector Strategy and Investment Programme (NWSSIP). NWRA has extensive experience in establishing water basin management plans and will support the project by providing technical inputs, sharing lessons learned, and assuming a leading role in managing the project's activities.

48. *Environmental Protection Authority:* The EPA is an administrative body within the MoWE that is responsible for conservation, environmental management and enforcement of environmental laws. The EPA was the implementing agency for Yemen's NAPA and is mandated with the coordination of matters related to climate change. The EPA is also the focal point for the PPCR project in Yemen. Consequently, the EPA is well placed to support the project by providing technical expertise, administrative support and ensuring that the project complies with national environmental policies.

49. *Social Fund for Development:* The SFD is mandated to contribute towards implementing national priorities and development plans related to poverty alleviation, social development, and increasing the availability of services to vulnerable sectors and communities. Focal areas within the SFD's ongoing work programmes include sectors such as water, agriculture, poverty alleviation, social protection and capacity building. Therefore, the SFD will coordinate closely with the project and support it by providing technical inputs and lessons learned, based on previous experiences related to: i) increasing household access to water; ii) capacity building and training of communities; and iii) stakeholder engagement.

50. *Ministry of Agriculture and Irrigation:* MoAI is mandated to implement the National Agriculture Sector Strategy (NASS) that's intended to work with existing strategies in the areas of water, food security and climate change.

2.3. Project rationale and policy conformity

51. In May 2013, Yemen's **Second National Communication** was submitted to the UNFCCC. The three main climate-related hazards prioritised by the SNC include: i) rising sea levels; ii) drought; and iii) associated water scarcity[20]. Yemeni livelihoods are particularly vulnerable to food insecurity and water scarcity. In the LDCF-financed project implementation areas, this vulnerability is a consequence of unsustainable agricultural practices, such as aquifer depletion, and climate change. The project's activities are particularly aligned to address the latter two climate-related hazards as well as predicted temperature increases and variable rainfall patterns.

52. The **National Adaptation Plan of Action** (NAPA) was finalised in 2009 and outlines the country's immediate and urgent needs for climate change adaptation. This document identifies 12 priorities. Of these, the most relevant to the LDCF-financed project is Priority 7 "rainwater harvesting through various techniques, including traditional methods". Other relevant priorities include: i) Priority 2 "water conservation through reuse of treated waste water and grey water from mosques, and irrigation saving techniques"; ii) Priority 3 "develop and implement an awareness-raising programme on adaptation to the potential impacts of climate change"; iii) Priority 4 "establish and maintain database for climate change and adaptation"; iv) Priority 6 "develop and implement programmes to improve Yemen's preparedness to cope with extreme weather events"; v) Priority 8

[20] Adaptation Learning Mechanism, Yemen – Second National Communication. Available at: http://www.undp-alm.org/projects/trust-yemen-second-national-communication. Accessed on 12 March 2014.

"rehabilitation and maintenance of mountainous terraces"; and vi) Priority 12 "incorporation of climate change and adaptation to school education".

53. The **National Water Sector Strategy and Investment Programme** (NWSSIP) identifies the strategic importance of "rain water harvesting in rural and urban areas". The programme is a sectoral priority for the Ministry of Agriculture and Irrigation (MoAI). The MoAI is responsible for water harvesting in Yemen.

54. The LDCF-financed project is strongly aligned with the **Social Fund for Development's** (SFD) strategic priorities. The SFD's Fourth Investment Phase has been synchronised with the Five-Year Plan for Economic and Social Development and Poverty Reduction (2010–2015) and the Water Sector Strategy. The fund emphasises the importance of the water sector for development and poverty alleviation and the role of SFD as a financial mechanism for achieving these priorities. The fund's Mid-term Vision themes include improving access to water through water harvesting.

55. The **Transitional Programme for Stabilisation and Development** (TPSD 2011–2015) highlights the challenging socio-economic and humanitarian situation in Yemen. The programme lists the top priorities and urgent actions necessary to transform the country. The LDCF-financed project is aligned with the TPSD, particularly the three Focal Areas under the Socio-economic recovery pillar: i) Focal Area 3 – humanitarian, reconstruction and emergency needs; ii) Focal Area 4 – economic recovery, stabilisation and growth foundations; and iii) Focal Area 5 – human development and emergency MDG.

56. The **Fourth Five-Year Developmental Plan** (4th DPPR 2011–2015) identified climate change as one of the emerging challenges facing Yemen. The plan will address these through the development and implementation of appropriate adaptation measures. The 4th DPPR has recognised that Yemen is using water unsustainably because of a number of challenges, one of which is climate change. The plan highlights that current water shortages will be aggravated by droughts, increased temperatures and changes in rainfall patterns.

57. The LDCF-financed project is also aligned with the EU-lead **Joint Socio-Economic Assessment** (JSEA) of 2012. The JSEA's main objective is to assess the social and economic effect of the recent conflicts in Yemen and to identify challenges and main priorities for early interventions – including climate change and its effect on water and food security.

58. Yemen's **Water Law** was enacted on 31 August 2002 and ratified by Parliament in December 2006[21]. The following policies and their strategies culminated in Yemen's Water Law and were developed after an assessment of the water sector and irrigation sub-sector indicated that water resources were being depleted:
    - Water Resources Policy And Strategy (1999–2000);
    - Irrigation Water Policy (2001);
    - Watershed Policy (2000);
    - Agricultural Sector Reform Policy (2000); and
    - Urban Water Supply and Sanitation Sector Reform Policy (1997).

59. Yemen's Water Law catalysed the creation of WMOs, including formalised Water User Associations (WUAs) and Water Councils (WCs)[22], and informal Water User Groups (WUGs). These organisations were established to decentralise the operations and maintenance of spate and groundwater irrigation systems. WMOs have been trained in technical, financial and administrative management through projects such as the Rural Water Supply and Sanitation Project (RWSSP), the Groundwater and Soil Conservation Project (GSCP) and the Sana'a Basin Water Management Project (SBWMP).

LDCF conformity

60. The LDCF project is consistent with LDCF objectives CCA-1 "Reduce vulnerability to the adverse impacts of climate change" and CCA-3 "Promote transfer and adoption of adaptation technologies". Specific contributions to these objectives are described below.

61. Component 1 will support mainstreaming of climate change adaptation by integrating water harvesting regulations into Yemen's Water Law, and incorporating climate change into national and sub-national policies and strategies. Component 2 will increase water availability through on-the-ground water harvesting

[21] Aquastat Yemen, 2008. Available at: http://www.fao.org/nr/water/aquastat/countries_regions/YEM/index.stm. Accessed 25 February 2014.
[22] WCs are official sub-national water management bodies.

interventions. This is aligned with LDCF Objective CCA-1, Outcome 1.2 ("Reduce vulnerability in development sectors") and Output 1.2.1 ("Vulnerable physical, natural and social assets strengthened in response to climate change impacts, including variability"). Component 3 will develop decentralised and community-led water management systems. This is aligned with LDCF Objective CCA-3, Outcome 3.1 ("Successful demonstration, deployment, and transfer of relevant adaptation technology in targeted areas").

GEF conformity

The project has been designed to meet overall GEF requirements in terms of design and implementation. For example:

62. Sustainability: The LDCF-financed project is designed to secure the sustainability of its interventions by: i) building an evidence base of the cost-effectiveness of interventions; ii) promoting decentralised ownership of interventions to devolve responsibility for their operation and maintenance; iii) providing training on intervention construction and maintenance, as well as using designs that are simple to build and maintain; iv) providing training on communal water resources management (see Section 2.7.).

63. Monitoring and Evaluation: The project is accompanied by an effective M&E framework, that will enable on-going adaptive management of the project, ensuring that lessons are learned, management decisions are taken based on relevant and up-to-date information, and regular progress reports are available for concerned parties.

64. Replicability: Great attention has been paid in the project design to ensure that i) lessons are replicable; ii) sufficient training builds capacity to transfer expertise into other initiatives; and iii) necessary replication mechanisms are in place.

65. Stakeholder involvement: Following on from the NAPA process, the design of this project was undertaken in a participatory and inclusive manner. Moreover, the design of the project has ensured the appropriate involvement of stakeholders (actors and users) in project development and implementation (See Section 2.9.).

66. Multi-disciplinary approach: Ministries, local government actors, academia, NGOs and CBOs will all be engaged to build capacities and promote synergy through contributions from a variety of disciplines.

67. Gender equality: The project will benefit women by: i) increasing the role of women in community decision-making by providing training to support women's participation in WMOs; and ii) promoting gender equity in the selection of technical staff for participation in training programmes. By increasing household access to water for drinking and domestic use, the project will reduce the burden of labour and time spent by women for collection of water from remote sources. In addition, the project's activities will further reduce the burden on women by improving the quality of water available to households, thereby reducing the incidence of waterborne diseases and similar sanitary issues.

68. Complementary approach: With numerous agricultural, service provision and health and sanitation projects ongoing and or soon to be implemented in Yemen, there is a strong opportunity for mutual benefits to flow to and from the LDCF-financed project. These opportunities are discussed further in Section 2.3.

69. The LDCF-financed project has been prepared in line with guidance provided by the GEF and the LDCF Trust Fund. The project follows the guidance from the 'Programming Paper for Funding the Implementation of NAPA projects under the LDC Trust Fund (GEF/LDCF 2006). The project focus is also aligned with the scope of expected interventions as articulated in the LDCF programming paper and decision 5/CP.9. As climate impacts fall disproportionately on the poor, the project recognizes the links between adaptation and poverty reduction (GEF/C.28/18, 1(b), 29).

2.4. Design principles and strategic considerations

Baseline projects and aligned initiatives

70. Rainwater harvesting will contribute to reducing water scarcity and stress on aquifers, however Yemeni water security cannot be achieved by these systems in isolation. Therefore, the project is part of the national response, which also includes irrigation efficiency and the promotion of drought resistant crops and varieties.

71. In 2004, MoWE prepared the **National Water Sector Strategy and Investment Programme** (NWSSIP I) for 2005–2009 as a strategy and action plan for the water sector. The NWSSIP was adopted in 2005 and preceded

the 2006 amendments to the Water Law. The programme promotes the decentralisation of water management to local level authorities such as Water User Associations (WUAs) and basin committees. In 2007, NWSSIP I was updated for the 2008–2015 investment period and is now under implementation as the NWSSIP II. The activities of the NWSIPP II focus on multiple water-related sectors, including: i) irrigation; ii) groundwater management; and iii) access to safe drinking water[23]. The programme has allocated a budget of US$340 million to develop the following sectors: i) urban water; ii) rural water; iii) Integrated Water Resource Management (IWRM); and iv) Irrigation. The Government of Germany has contributed US$154 million, the Government of the Netherlands US$64 million, the World Bank US$90 million, and the Government of Yemen US$32 million. In NWSSIP II, the Water Sector Supply Programme (WSSP) will improve domestic water supplies and develop institutional capacity for water resources management. The GoY has contributed over US$4 million to address the needs of IWRM under WSSP. The UNDP also supports the WSSP framework by providing US$3.4 million in funding to the NWRA's IWRM project. The IWRM project is aligned with the WSSP and aims to develop and initiate the implementation of two management plans covering two proposed water basins for Tuban-Abyan and Taiz. The proposed comprehensive sub-basin level management plans will be available to all sectorial and community water users.

72. The NWSSIP also includes the National Irrigation Programme (NIP) that supports the implementation of irrigation projects and water management. The NIP has an annual budget of US$10.6 million. Within the NIP, the two main programmes address surface water and groundwater, respectively. The NIP also supports the General Authority of Rural Water Supply Project (GARWSP) in establishing affordable and sustainable water supplies for rural areas in Yemen.

73. The **Rural Water Supply and Sanitation Project** (RWSSP) was funded by the World Bank and completed in 2010. The project focused on developing the capacity of local communities to plan and manage their own water systems in Ibb and Abyan Governorates. The outcomes of this project were assessed in the World Bank's review to be "moderately successful"[24]. One of the project's review findings was that WUAs require ongoing technical and financial support to for their activities to be sustained. In parallel with the RWSSP, the GoY implemented the General Authority of Rural Water Supply Project (GARWSP), which adopted a "decentralised, demand-responsive approach to rural water supply and sanitation"[25]. The LDCF-financed project will build on the lessons learned and capacity built by the RWSSP and GARWSP in the selected governorates[26] of the LDCF-financed project.

74. The **Groundwater and Soil Conservation Project** in Yemen (GSCP) receives funding from the World Bank. The GSCP was expected to be completed in 2012, however the implementation of some activities was delayed and the project was granted a period of extension. The objectives of the GSCP include: i) improve water use efficiency through water saving technologies; ii) increase surface and groundwater availability through rehabilitation of small to medium spate irrigation schemes, terrace rehabilitation, bank protection works and other water and soil conservation activities; and iii) support groundwater management frameworks and institutions. The Implementation Status and Results (ISR) ratings for achieving Project Development Objectives (PDO) and Implementation Progress (IP) for the GSCP was assessed to be satisfactory until its IP rating was downgraded in June 2011as a result of delays to implementation of some activities.

75. The **Sana'a Basin Water Management Project** (SBWMP) was funded by the World Bank and completed in 2010. The project's objective was to address the factors which contribute to the depletion of groundwater in the Sana'a Basin aquifer and to promote the adoption of efficient water use practices. The first component of the SBWMP focused on water savings and conservation in agriculture by increasing the efficiency of irrigation through: i) upgrading piped delivery systems; ii) converting open channels to piped delivery systems; iii) introducing pressurised irrigation; and iv) promoting local community participation. The second component aimed to accelerate groundwater recharge through: i) small conventional dams; ii) sub-surface dams; and iii) other structures. The third component of the SBWMP focused on: i) developing a regulatory framework;

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[23] The proportion of Yemenis without access to safe drinking water in rural areas is 53%. In urban areas, this proportion is 43%.

[24] The World Bank, Documents and Reports: Republic of Yemen, RWSSP. 2011. Available at: http://documents.worldbank.org/curated/en/2011/06/14767155/republic-yemen-rural-water-supply-sanitation-project. Accessed on 18 February 2014.

[25] Al-Derwish, A., Dottridge, J. 2013. Evaluation of user satisfaction or rural water supply in Yemen. Journal of Water, Sanitation and Hygiene for Development 03.3. p.322–331.

[26] These are the governorates of Sana'a, Taiz, Ibb, Dhamar, Raymah and Al Mahweet. The municipality of Al Mukalla – capital of Hadramout Governorate – was originally selected as well, but has been excluded because of security concerns. However, the LDCF-financed project will remain flexible and may re-include Al Mukalla as a target governorate should the situation become feasible.

ii) applying regulatory procedures for water rights management; and iii) ensuring the responsibility of NWRA for catchment-wide water resources investigation, regulation, and monitoring. The SBWMP also commissioned a hydrogeological and water resource study to analyse projected effects of dams and *wadi* structures on aquifer recharge and groundwater levels. This included: i) surveys; ii) laboratory testing; and iii) satellite imagery and aerial photography to quantify effects on crops and irrigated areas. The fourth, fifth and sixth components of the SBWMP, respectively: i) promoted public awareness; ii) established environmental management plans; and iii) supported project management activities.

76. IFAD is in the process of designing a project titled **Rural Adaptation in Yemen**. This project requesting US$10 million from GEF to fund the implementation of this project. The respective components of the Rural Adaptation Project target: i) community resilience through enhanced planning capacity, awareness, education, and risk management; ii) water resources, including water harvesting and water-use efficiency interventions; and iii) climate change downscaling, which will enable the EPA to create watershed scale climate change models. The expected outputs of the IFAD project complement the UNDP project strongly. The two projects have liaised during their respective design phases and will continue to do so during implementation. Once staff has been recruited for both projects, a workshop will be organised to introduce the respective teams and further clarify the projects' objectives, approaches, areas, and implementation strategies. With both projects planning implementations in Dhamar governorate, this area will be a focus of coordinated on-the-ground interventions. Email correspondence outlining the agreement of cooperation can be found in Annex 7. Additionally, Annex 8 contains a list of corresponding activities and recommendations for measures to maximise cooperative benefits.

77. The GEF-funded **Small Grants Programme** (SGP) has implemented revolving funds for water harvesting techniques to be administered through selected local NGOs. The funds are used as loans to support beneficiary farmers to implement rainwater harvesting techniques. The loans are repaid by farmers over a pre-agreed period. To date, three funds have been implemented since 2005. Of these three funds, one has been successful, one has achieved moderate success and one has failed. The relative success of a fund can be attributed to factors including: i) buy-in and ownership by local communities; ii) profitability of crops grown; and iii) effectiveness of management and administration within the local NGO administering the fund. The SGP has also implemented projects related to: i) introduction of rooftop water harvesting and providing training on masonry techniques to build cisterns; and ii) the rehabilitation of spate irrigation canals. The latter projects are implemented in participation with farmers, who contribute 5% of their income towards the maintenance of canals and diversion structures as part of the project's management arrangements.

78. The SFD has promoted terrace rehabilitation through the **Rain-fed Agriculture and Livestock Development Project** (RALDP) – taking place in Sana'a, Taiz, Lahj, Al Mahweet, and Hajja – and through the **Labour Intensive Works Project** (LIWP). Both projects have rehabilitated over 600,000 m^2 of terraces from 2010-2012. The MoAI, through the NASS, has also implemented terrace rehabilitation and allocated US$20 million towards this.

79. The **PPCR** for Yemen has four Investment phases. Phase IV is on Integrated Coastal Zone Management so has minimal relevance to the LDCF-financed project. However Phase I, II and III are, respectively: i) Climate Information Systems; ii) Improving the Climate-Resilience of the Water Sector; and iii) Improving Rural Livelihood through Adaptation in Rain-fed Agriculture. Phase I and IV are being implemented with Phase II and III to follow. The PPCR has a total budget of US$110 million from the World Bank, with additional co-financing amounts still to be determined from other government and multilateral sources, including the GEF.

80. GIZ's **Institutional Development of the Water Sector Programme** (WSP) was implemented in 2006 and is expected to be completed in 2017. The objective of the programme is to improve the implementation and steering capacity of relevant water institutions. This will be achieved through the development and support of water sector policies and strategies, the creation of financially viable structures to improve the management of water resources, and improving urban and peri-urban water supply and sanitation services. The programme's partners include the MoWE, NWRA, and urban water utilities and water basin committees.

Table 1. Co-financing Sources

Sources of Co-financing	Purpose	Amount (US$)
Ministry of Water and Environment – Environmental Protection Agency	To build off their experience and knowledge within the Climate Change Unit and achieve compliance with environmental legislation so that interventions have 'no regrets'.	2,000,000

Ministry of Water and Environment – National Water Resources Authority	To benefit from the NWRA's experience in managing water resources, executing NWSSIP and designing and implementing water basin management plans. NWRA is also responsible for project implementation.	12,000,000
Social Fund for Development	To use the SFD's experience of previous rainwater harvesting projects to inform design and coordinate the implementation of project activities. The SFD also has proven experience in targeting the most vulnerable and planning community-based development projects through participation.	14,200,000
UNDP	The UNDP Yemen country office has been supporting climate change, natural resource management and community development projects since 1966. The experience and outreach capacity from previous initiatives will be used to support the implementation of water harvesting structures and capacity-building activities under the LDCF-financed project.	600,596
Total co-financing		28,800,596

National and household benefits

81. The LDCF-financed project will benefit Yemen by increasing local communities' water security under predicted climate change scenarios and reducing the rate of aquifer depletion. This will be achieved through: i) reviving traditional water harvesting techniques, e.g. spate irrigation and terracing; and ii) introducing innovative water harvesting techniques e.g. artificial recharge and fog harvesting.

82. Without the project, local communities and their livelihoods will be at increasing risk from the effects of climate change on water availability. Furthermore, progress towards poverty reduction and economic development is likely to be hampered. The project will improve local communities' water security and reduce their reliance on groundwater resources, thereby enhancing communities' climate-resilience and slowing the rate of aquifer depletion. Water is integral to Yemen's economy and improving water security will strengthen and safeguard livelihood assets and household incomes against the effects of climate change. At least 1,000 households from a minimum of two villages in each of the six target governorates will benefit directly from LDCF resources. These households represent more than 6,000 people. The total land benefitting from improved rainwater harvesting techniques will be at least 5,000 hectares. The project will focus on communities that are the most vulnerable to water scarcity and will allow these communities to be more self-sufficient in their water requirements. Decentralised water harvesting systems are more efficient, sustainable and cost-effective in capturing and making available harvested water than centralised water supply systems. This decentralisation also limits the influence of negative political forces at both a local and national level.

83. The project will also increase awareness of the predicted effects of climate change on water security and the benefits of rainwater harvesting techniques amongst national and sub-national stakeholders. Although government institutions and international NGOs and CBOs are actively promoting such techniques, these programmes currently do not incorporate predicted climate change scenarios into their designs. The LDCF-financed project will "climate-proof" physical water harvesting interventions and water management strategies, policies and plans through the improving climate change assessment capacity in the MoAI, EPA, NWRA and SFD. Additionally, physical infrastructure – such as bridges, roads and water supply – as well as economic assets – such as agricultural land – will benefit from water harvesting through the reduction in flooding risk and erosion potential.

Comparative Advantage of UNDP

84. The LDCF-financed project is aligned with UNDP's comparative advantage, as articulated in the GEF matrix, in the area of capacity building, providing technical and policy support as well as expertise in project design

and implementation. Additionally UNDP has close links with the GoY, as well as a high level of experience managing other LDCF projects in the region, in particular those with an adaptation component.

85. Since water access problems assumed precedence in the country's development agenda, UNDP has been an active partner of the government in this sector. UNDP has supported the GoY in the formulation of the NAPA and has provided continuous support in the process of implementation of the key priorities. UNDP has proven in-house expertise in promoting integrated water resource management (IWRM) in Yemen and the broader region of Arab States. Since 2003, UNDP has been supporting the government in improving the conditions of water access and promoting water harvesting as a preferred solution to water shortages. The IWRM and Masila community-based water and sanitation projects are among the key UNDP-supported interventions in Yemen. With UNDP support, NWRA developed and initiated the implementation of two water basin management plans covering the basins of Tuban-Abyan and Taiz. UNDP has helped develop the Guidelines for Rooftop Rainwater Harvesting Systems that is being tested in partnership with NWRA in the governorate of Taiz. This is directly relevant to the LDCF-financed project. Additionally, UNDP provided support for mainstreaming climate change risks into key national policy documents such as NASS and made substantive contributions through targeted policy notes for NWSSIP. UNDP has been an active partner supporting the SFD. In the context of discussions on establishing the National Climate Fund, UNDP conducted an institutional and functional capacity assessment of the SFD.

86. In terms of agency capacity to support the project, the Country Office (CO) in Yemen currently manages a programme portfolio of total value of over US$70 million. It offers the following dedicated staff capacity for project implementation oversight support:

- Environment Analyst who oversees the implementation on a daily basis, including quality assurance and monitoring and evaluation[27].
- Climate Change Policy Advisor who leads on UNDP's programming and policy advice on climate change mitigation and adaptation, promotes policy dialogue on climate change with government and development partners, engages in climate change policy dialogue at national level with key partners and provides substantive inputs on national low-carbon, climate-resilient development strategies, and plans and review of sector policies.
- Environment Associate who assists with budget revisions, quarterly reporting, auditing and recruitment procedures.
- Finance Analyst who reviews the budgets and monitors project delivery status.
- Head of Operations Unit who assures compliance with overall fiduciary standards of UNDP.
- UNDP CO Country Director and Resident Representative, who liaises with the government and negotiates key policy and legislative changes proposed by the project.

87. The UNDP country office is also supported by Regional Technical Advisors at UNDP offices in Istanbul and Addis Ababa, as well as by policy, adaptation, economics and climate modelling experts in New York, Cape Town and Bangkok. A network of global Senior Technical Advisors provides additional technical oversight and leadership, helping to ensure that programs on the ground achieve maximum policy impact. There are other LDCF, SCCF and Adaptation Fund–financed projects within the region with similar objectives currently supported by UNDP, which means that there is substantial in-house technical expertise that can support the Government with project implementation. Also in Yemen, UNDP is uniquely positioned to exercise Results Based Management and leverage its extensive knowledge of the similarities and differences between countries at different stages of development, and to translate that into evidence-based insights for effective, adaptable development solutions.

2.5. Project Objective, Outcomes and Outputs/activities

2.5.1. Project objective

88. The project objective is **to re-introduce traditional and introduce innovative water harvesting techniques to improve water availability.** The beneficiaries will be rain-dependent farmers and pastoralists, and rural and urban poor households in the Yemeni governorates of Ibb, Taiz, Sana'a, Dhamar, Raymah and Al Mahweet.

89. The livelihoods and wellbeing of rural and urban communities in Yemen are negatively affected by the declining availability and quality of water for drinking, irrigation and domestic use. It is anticipated that the effects of

[27] This post is currently being advertised and will be filled in the near future.

climate change – including drought, rainfall variability, flooding and watershed degradation – will further exacerbate the existing constraints in Yemen's water sector. Vulnerable groups, particularly rain-dependent farmers, pastoralists and poor households, require technical and financial support to adapt to the increasing scarcity of water caused by climate change and aquifer depletion in Yemen.

90. The introduction of innovative water harvesting techniques[28], as well as the re-introduction of traditional water harvesting techniques, is a cost effective adaptation strategy identified in Yemen's NAPA. Although traditional water harvesting knowledge in Yemen was developed over centuries of water management, much of this traditional knowledge has been lost over the last century as communities increasingly adopted the use of groundwater resources and custodians of traditional knowledge migrated to other areas. Socio-economic surveys conducted as part of the site selection process will be collated and disseminated to inform subsequent rainwater harvesting projects. These surveys will provide baseline data that can be used to evaluate project interventions and will contribute to the growing body of evidence supporting rainwater harvesting as a viable, cost-effective and sustainable means of supplying water for domestic and agricultural uses.

91. This LDCF-financed project will use traditional knowledge as well as modern innovations to increase the effectiveness of the existing rainwater harvesting techniques. This knowledge will be disseminated to communities and water management institutions in Ibb, Taiz, Sana'a, Dhamar and Al Mahweet. Local communities will implement the improved techniques with guidance and technical input provided by the project. Additionally, water management methods that facilitate water availability will be introduced. The national and local institutions that are mandated with management of water resources – including national-level institutions within MoWE, as well as local-level entities such as WUAs and WUGs – will be provided with training, capacity building and institutional strengthening to support the implementation of the project's activities in the long-term. The demonstration of appropriate water-harvesting techniques and the development of technical and institutional capacity within Yemen's water sector will result in increased water availability for domestic and irrigation purposes from community-owned and maintained systems under conditions of climate change. The increase in water availability will result in positive effects on health[29] and income[30] for communities in the intervention areas and will increase the resilience of these communities to the predicted impacts of climate change.

92. The project will use LDCF resources to develop the technical capacity of national and local institutions to identify and implement sustainable, climate-resilient water harvesting techniques to increase the resilience of vulnerable communities to climate change. The project will design, implement and provide training on water harvesting technologies and develop community-based water harvesting management to improve quality and availability of water for vulnerable communities.

93. The outcomes of the LDCF-financed project will support vulnerable communities to access adequate water for domestic and productive purposes under conditions of climate change. The increased availability of water will support the development of Yemen's agricultural sector, which is a major contributor to the national economy and the most important livelihood in rural areas. The increased availability and improved quality of water for drinking and domestic use will reduce the burden of water collection on women and children and reduce the incidence of waterborne diseases. Therefore, increasing water availability through cost effective means will support social and economic development at the intervention sites and will reduce the negative impacts of climate change on vulnerable communities.

2.5.2. OUTCOME 1: TECHNICAL CAPACITY TO INTEGRATE COST-EFFECTIVE WATER HARVESTING TECHNIQUES STRENGTHENED AT NATIONAL AND LOCAL INSTITUTIONS AND IN LOCAL WATER MANAGEMENT ORGANISATIONS (WMOS) TO IMPROVE WATER SECURITY.

Co-financing amounts for Outcome 1: US$4,054,363
LDCF project grant requested: US$673,930

2.5.2.1. Without LDCF/SCCF Intervention (baseline):

[28] Water harvesting is defined as the collection of water for productive use, including human and livestock drinking water, as well as irrigation.
[29] Al-Derwish, A., Dottrigde, J. 2013. Evaluation of user satisfaction or rural water supply in Yemen. Journal of Water, Sanitation and Hygiene for Development 03.3. p.322–331
[30] Wiebelt, M., Breisinger, C., Ecker, O., Al-Riffai, P., Robertson R., Thiele, R., 2011 Climate Change and Floods in Yemen: Impacts on Food Security and Options for Adaptation. IFPRI Discussion Paper 01139. IFPRI Development Strategy and Governance Division.

National policies, strategies and plans related to water resource management

94. The rate of extraction of groundwater has resulted in aquifer depletion in all of Yemen's governorates[31]. The factors that contribute to the unsustainable rates of groundwater abstraction include: i) a national focus on groundwater extraction; ii) increased demand for irrigation and domestic water; iii) decreased rates of groundwater recharge; and iv) decreased use of traditional water harvesting techniques. The reasons for the decline in traditional water harvesting techniques are discussed in detail in the situation analysis section and under Component 2. In the mid-1990s, the GoY recognised that the use of groundwater was unsustainable and created legislation to protect water resources. However, there is a lack of coordination between institutional stakeholders related to water resource management and there is a need to update existing policies and strategies to promote sustainable practices for water resource management. For example, there is a lack of coherent national policies to promote artificial groundwater recharge, with the exception of the SBWMP.

95. There are examples of initiatives lead by NGOs, CBOs and government departments that include a focus on activities to promote traditional water harvesting techniques, including within the SFD, MoAI and NWRA. For example, the SFD promotes water harvesting techniques such as rainwater harvesting and terraces. However, at present there is no national policy to support a coordinated strategy to promote traditional water harvesting techniques. Discussions have been initiated between MoWE and SFD to develop such a policy, but this initiative has not progressed as a result of limited availability of funding.

96. In addition to the lack of resources and policies to promote traditional water harvesting techniques, the ongoing initiatives that do include a focus on water harvesting are currently being implemented without the benefit of long-term climate projections or cost-benefit analyses of water harvesting under various climate change scenarios. For example, in 2003 the GoY implemented the National Programme for Integrated Water Resource Management (NPIWRM), executed by NWRA. The programme improved water resource management by enhancing cooperation and cohesion between national and sub-national stakeholders and provided a basis for coordinating national and sub-national IWRM plans, but these plans did not include consideration of climate change and its resultant effects on water resources. An additional factor that has limited the development of water harvesting techniques is that harvested water is not reflected in the national water budget. In consequence, there is insufficient data and information available to decision makers in government departments such as the SFD and NWRA to effectively incorporate water harvesting into climate-resilient national water plans and policies.

GIS resources for climate-resilient water resource management

97. Yemen has GIS departments in the Water and Environment Centre (WEC) at the University of Sana'a and within various GoY agencies, such as: i) Yemen Remote Sensing and GIS Centre (YRSC); ii) Sana'a Water and Sanitation Local Corporation; iii) MoWE; iv) NWRA; v) MoAI; and vi) EPA. These GIS service providers enable the GoY to assess and manage water resources at national, governorate and catchment levels. GIS resources have been used to construct models to assist in water management. Studies assessing the vulnerability of water resources have been conducted in *Wadi* Abyan and *Wadi* Surdud[32]. A Rainfall-Runoff Model (RRM) has been applied to Sana'a basin to estimate daily run-off rates. Data exist to produce RRMs in almost all *wadis* of the western part of the country, including the Gulf of Aden and the Red Sea Basin[33], however the available data are highly variable in terms of the quality, density and temporal.

98. Consultations with GIS professionals[34] demonstrated a perception that the majority of GIS-related projects conducted in Yemen have failed to achieve their objectives. All the projects were reported to have insufficient budgets and 87% were not completed within the allotted timeframes[35]. The challenges encountered by these

[31] Van Steenbergen, F., Bamaga, O.A., Al-Weshali, A., 2011. Groundwater Security in Yemen – Who is Accountable to Whom? Law, Environment and Development Journal 7/2, p 167.
[32] These studies used four interacting models: i) a Rainfall-Runoff Model (RRM); ii) an Irrigation Simulation Model (ISM); iii) a Groundwater Simulation Model (GSM); and iv) an Economic Policy Model (EPM). See: Alderwish, A. & Al-Eryani, M. 1999. An approach for assessing the vulnerability of the water resources of Yemen to climate change. Climate Research 12, 85–89.
[33] Alderwish, A., Pers. Comm. 20 February 2014.
[34] Details on these professionals are unavailable, as respondents' identities are protected. All respondents are employed in the GIS sector in Yemen. See: Al-Waraqi, G. & Zahary, A. 2012. Critical factors of GIS projects' failure in Yemeni governmental agencies. The 13th International Arab Conference on Information Technology 2012. Available at: http://www.acit2k.org/ACIT/2012Proceedings/12894.pdf. Accessed on 7 March 2014.
[35] Al-Waraqi, G. & Zahary, A. 2012. Critical factors of GIS projects' failure in Yemeni governmental agencies. The 13th International Arab Conference on Information Technology 2012. Available at:

projects are primarily attributed to financial and technical constraints within these agencies, exacerbated by ongoing political uncertainty in the country.

Institutional structure and coordination

99. Yemen concluded the National Dialogue on political transition in January 2014. It is anticipated that the resolutions of this transitional process will result in increased political stability and security. Following the conclusion of the National Dialogue, Yemen is envisaged to become a federal republic with six sub-national regions. The restructuring of the republic is intended to increase the autonomy of the sub-national governance systems. However, the future role of national institutions in water management – such as NWRA, the EPA and SFD – is uncertain and the socio-economic factors that result in conflicts over water resources are unlikely to be resolved by this political restructuring alone. For example, it is anticipated that conflicts over access rights to communally shared water resources such as *wadis* and aquifers are likely to be continued as groundwater levels drop and individuals try to minimise their own loss at the expense of the common resource[36]. The effects of climate change are likely to exacerbate the problem of water scarcity and conflict between local communities, unless cooperative arrangements that are perceived to be fair are established and adhered to.

2.5.2.2. With LDCF/SCCF Intervention (adaptation alternative)

100. The LDCF-financed project under this outcome will: i) improve the capacity of technical staff within MoWE and other water management institutions to apply modern geo-spatial techniques and improved climate information for climate-resilient management of water resources; ii) improve the quality and geospatial coverage of biophysical, weather and climate information to support improved water resource management; iii) study the socio-economic benefits of rainwater harvesting and use the results of this research to inform proposed policy revisions; and iv) develop catchment-level plans for the governorates of Sana'a, Ibb, Taiz, Dhamar, Raymah and Al Mahweet. This outcome will strengthen the skills and decision-making capacity of institutions to promote water harvesting as a climate-resilient approach to increasing the availability of water.

101. The ongoing political restructuring in Yemen creates an opportunity for water harvesting to be incorporated into the regulations of the new states or governorates – such as the June 2014 diesel subsidy reform. While the institutional restructuring is still in progress, the LDCF-financed project will remain flexible to work with new structures as they are established. Yemen's political restructuring also provides the opportunity to integrate the promotion of water harvesting into relevant national and sub-national legislation, build the capacity of water officials and managers in newly created positions, and institutionalise sustained support for WUAs after project termination.

Output 1.1: The MoAI and NWRA assisted to produce rainfall-runoff models (RRM) based on GIS to simulate key parameters for selection of water harvesting, including artificial recharge techniques.

102. The identification of appropriate water harvesting techniques is context-dependent and is informed by factors such as: i) rainfall regime; ii) temperature and evaporation; iii) topography; iv) soil type and depth; iv) land use; and v) road access. Yemen is highly heterogeneous in terms of topography, aspect, climate and socio-economic context. Because of this environmental heterogeneity, there is a need for up-to-date, spatially explicit data to guide the selection and implementation of appropriate water harvesting techniques.

103. As previously described, the application of GIS techniques in projects related to water management has been met with mixed success. To address this, the LDCF-financed project's interventions will include specialised training for technical government staff on the application of GIS, remote sensing and improved climate information for management of water resources. In particular, training will include a focus on the application of these techniques for undertaking rainfall-runoff modelling. The improved capacity for application of geospatial technologies such as GIS and Remote Sensing will support the NWSSIP to undertake priority activities related to improving irrigation, groundwater management and drinking water supply, in addition to developing the capacity required to design and implement appropriate water harvesting interventions.

http://www.acit2k.org/ACIT/2012Proceedings/12894.pdf. Accessed on 7 March 2014.

[36] Moore, S. 2011. Parchedness, politics and power: the state hydraulic in Yemen. *Journal of Political Ecology* 18: 38–50.

104. Under Activity 1.1.2, existing biophysical and meteorological information and data will be compiled and collated to identify gaps and information needs within the target governorates. Additional data will be collected by consultants working with WMOs and local communities to address these gaps. The information and data collected will be used to: i) identify specific locations for water harvesting in Activity 1.1.4; ii) support research in Activity 1.2.2; iii) support climate change proposals for inclusion into policy in Activity 1.2.3; and iv) update basin level plans of IWRM to include harvested water under predicted climate change scenarios in Activity 1.3.2.

105. Although water harvesting is considered a beneficial practice overall, there are potentially negative consequences, such as: i) groundwater contamination in urban areas; and ii) erosion from defective design. Under Activity 1.1.5, the MoAI will be trained in RRM to assess pollution threats to groundwater in urban scenarios. Furthermore, this training will assist decision making for artificial recharge under Output 2.4. Training under Activity 1.1.5 will also strengthen the MoAI's capacity to assess larger systems such as spate irrigation diversion barriers to prevent possible erosion resulting from design flaws.

Activities

- Activity 1.1.1: Build technical capacity within NWSSIP for remote sensing and GIS to produce simulation models.
- Activity 1.1.2: Assemble biophysical and meteorological data from existing sources and identify gaps in target governorates.
- Activity 1.1.3: Collect field data to address gaps identified in Activity 1.1.2.
- Activity 1.1.4: Develop models that incorporate climate projections and land use changes to identify locations for water harvesting.
- Activity 1.1.5: Train the MoAI in RRM, incorporating erosion and run-off related pollution and an assessment of potential for groundwater pollution in artificial recharge techniques.

Output 1.2: Water harvesting regulations integrated into the Water Law of Yemen to include harvested water as part of the national water budget.

106. Under this output, the potential effects of water harvesting interventions on both rural and urban environments will be investigated and analysed. This study will include a focus on the internal rate of return on government investments in water harvesting and by quantifying the benefits generated by water harvesting measures, including consideration of current and predicted effects of climate change. The potential benefits of water harvesting which will be assessed include: i) increased agricultural productivity and food security as a result of increased availability of irrigation water; ii) reduced flood damage to public infrastructure; iii) improved community health and well-being; and iv) reduced investments in alternative water management approaches, such as the use of desalination to generate fresh water. The investigation will also include climate change projections and land use changes in predicted scenarios. The results of the study will support the GoY to determine appropriate strategies and techniques for water harvesting and will inform the development of proposed revisions to be made to the Water Law. All research and analysis on the potential benefits and effects of water harvesting will be made available to policymakers.

Activities

- Activity 1.2.1: Calculate the economic value of harvested rainwater, including future impacts of climate change and aquifer depletion, for domestic use and irrigation at a basin level. Disseminate the findings to relevant policymakers.
- Activity 1.2.2: Propose changes to policies and strategies to include potential climate change effects.
- Activity 1.2.3: Propose water harvesting regulations for inclusion into the Water Law.
- Activity 1.2.4: Facilitate implementation of water harvesting under new federal government institutions.

Output 1.3: Long term, climate-resilient water plans developed incorporating integrated water harvesting to facilitate groundwater recharge and supplement irrigation in the selected governorates.

107. Under this output, dialogue and communication will be promoted between local communities, WMOs, CBOs and government institutions – such as MoWE, MoAI, EPA, NRWA, SFD – to support cooperative management of water resources at national, sub-national and local community levels in Yemen. Under Activity 1.3.1, an online discussion forum hosted by NWRA will be established as a public platform for the dissemination of information generated under Activities 1.1.2, 1.1.3 and 1.1.4. The research and knowledge products generated by the project's activities – as described under Activity 1.3.3, Output 2.3 and Output 3.1 – will be hosted on the

NWRA's forum and will be made publicly available to support other ongoing and future water management initiatives. The forum will hold regular meetings and issue newsletters containing updated information and news related to water harvesting. WUA representatives will be invited to speak on and discuss their experiences.

108. Under Activity 1.3.2, discussions on updates to basin-level plans of IWRM and their relationship to national IWRM plans will be facilitated. The LDCF-financed project will propose interventions to build climate-resilience into both basin-level and national IWRM plans by facilitating discussions with relevant national and sub-national stakeholders. These discussions will be guided by information generated under complementary activities of Outcome 1. GIS information and RRMs generated in activities under Output 1.1 will enhance the efficacy of IWRM plans. The information generated on the costs and returns of investments in water harvesting generated under Activity 1.2.1 will be used as an evidence base to support increased investment in water harvesting.

109. The LDCF-financed project's interventions include undertaking an assessment study on the results of ongoing and past water harvesting programmes, under Activity 1.3.3. This assessment will also include lessons learned from initiatives in the Middle East and North Africa region, such as the water management experience of the South-South Cooperation Initiative in Tunisia. The information generated by this assessment study will be collated and used to inform the training activities under Output 2.3, Activity 2.6.1 and Output 3.1. The study will inform future water harvesting projects in Yemen. Opportunities and gaps for water harvesting projects will be identified and solutions to problems will be proposed.

Activities

- Activity 1.3.1: Create a discussion forum in NWRA to facilitate dialogue on water harvesting between national, sub-national and community stakeholders.
- Activity 1.3.2: Update IWRM basin-level plans to include harvested water under predicted climate change scenarios using models developed under Activity 1.1.4.
- Activity 1.3.3: Assess existing water harvesting programmes, projects and CBO initiatives in the six selected governorates. Collate lessons learned to inform future water harvesting programmes, projects and initiatives.

2.5.3. OUTCOME 2: WATER AVAILABILITY INCREASED THROUGH INTRODUCING ON-THE-GROUND MEASURES FOR WATER HARVESTING AND REHABILITATING TRADITIONAL WATER HARVESTING STRUCTURES.

Co-financing amounts for Outcome 2: US$18,400,703
LDCF project grant requested: US$3,173,838

2.5.3.1. Without LDCF/SCCF Intervention (baseline)

110. As described previously, there are well-established traditional systems for water management and water harvesting in Yemen. However, because of changing socio-economic contexts, the traditional approaches for harvesting, storing and sharing water resources are no longer practiced. For example, in Yemen's urban areas, population growth has resulted in increased demand for domestic water use. Since the introduction of mechanised pumping, the GoY has promoted the development of groundwater resources to supply homes in urban areas. However, the increased usage of groundwater is not limited to urban areas and the general trend across Yemen is that water for drinking, domestic use and productive uses (such as irrigated agriculture) is increasingly abstracted from groundwater aquifers. Natural aquifer recharge is insufficient to compensate for the current rate of extraction. Consequently, the widespread reliance on groundwater resources has resulted in a decline in all of Yemen's major aquifers. It is anticipated that the rate of aquifer depletion will increase because of climate change, both because of decreased rates of groundwater recharge as well as an increased demand for irrigation water.

Irrigated agriculture

111. Because of decades of investment in groundwater irrigation systems and the migration of labour from rural areas, traditional spate irrigation systems have fallen into decline in Yemen. Maintenance of the shared canal systems is the responsibility of the MoAI, however, the ministry is constrained by limited financial resources. As a result, barriers in *wadis* are often left unrepaired between floods and seasons. Many canals are partially or completely blocked because of uncontrolled vegetation growth, particularly the invasive *Prosopis juliflora*. In the case of farmers who are situated far from *wadis* and must maintain relatively long canals, the large costs required to repair and maintain spate irrigation systems are not justified by the low return from crops such as grains. The use of groundwater for irrigation is increasingly becoming economically unviable because of falling groundwater levels and the increasing input costs for fuel to operate borehole pumps. For example, the groundwater level of the Sandstone Aquifer in Sana'a basin dropped by 110 m between 1993 and 2007. As a result, farmers are obliged to either accept the increasing costs of groundwater use or alternatively invest in the re-establishment of spate systems. In some instances, farmers closest to the *wadi* have continued to use spate irrigation while farmers further downstream are reliant on groundwater. Conflicts between water users are common, particularly on issues related to rights of access and sharing of costs for rehabilitation of canals. The institutions that traditionally arbitrate these disputes are weak and do not have the capacity or mandate to enforce decisions.

Rooftop water harvesting for domestic water supply

112. Given the difficulty in supplying water to remote rural areas, many communities still rely on traditional water storage techniques such as *Al Kervan*, *Al Bearak* and *Al Karif*[37]. These water storage systems are built according to local conditions and available materials. For example, a resilient type of cement known as *Khadad*, made using an ancient method and locally available materials, is still the preferred method for sealing traditional cisterns. Traditionally, during the dry months water was sourced from hand-dug wells or springs. However, as a result of the ongoing depletion and reduced rate of recharge of aquifers, groundwater levels have fallen below the depth of existing springs and hand-dug wells. As a result, many rural communities have to travel significant distances to fetch water for drinking and domestic use. Women and children are generally responsible for fetching water, which sometimes results in the removal of children from school. Similarly, when fetching water is performed by women, it diverts them from other productive tasks. Therefore, there is a significant opportunity cost for households in collecting water from distant sources.

113. The potential of rainwater harvesting to supply domestic water and supplement rain-fed agriculture has been acknowledged and there are initiatives by both government and the international community to promote water harvesting as part of Yemen's response to predicted climate change and the growing challenge of water insecurity. A number of programmes include a focus on providing training and equipment for local communities to implement rainwater harvesting, such as the RWSSP, GEF SGP, SFD RALDP, GSCP and SBWMP. For example, the SFD provides training in rainwater harvesting structures, techniques and maintenance to local basin committees, as well as providing funds for the implementation of projects. These basin committees are elected by the community itself. The committees are responsible for collecting contributions from beneficiaries for maintaining projects beyond their implementation. The SFD's Water and Environment Unit has, between its creation in 1997 and until 10 December 2013, installed 39,389 rooftop rainwater cisterns. These had a total capacity of 1,967,049 m^3 that benefitted 419,519 people. The unit also installed 1004 public rainwater harvesting systems with a total capacity of 906,981 m^3 that benefitted 1,529,019 people.

114. The limitations to rooftop harvesting include the size of the collecting roof and the volume of the storage tank. As Yemen is predominantly semi-arid to arid and rainfall is strongly seasonal, rooftop systems cannot harvest enough water to meet the total water demands of the average household. However, rooftop harvesting systems are an effective method for providing supplementary water during the wet months. Rooftop water harvesting is particularly beneficial for farmers who are engaged with planting and weeding during the wet season and cannot afford to dedicate time or labour to water collection. Despite the increased awareness of the benefits of rooftop water harvesting systems and the capacity built by ongoing initiatives such as the SFD, there is a perception that communities do not have the capacity and resources to maintain procured infrastructure in the long term.

Other ongoing approaches to water harvesting

[37] A more comprehensive list and definitions of traditional storage systems is available in Annex 9.

115. In addition to the past and ongoing programmes that promote the use of rooftop water harvesting, there are examples of initiatives, which include a focus on the promotion of other water harvesting techniques. Various techniques for groundwater recharge have been demonstrated at a number of sites, particularly around Sana'a. For example, check dams are a series of low elevation barriers constructed progressively across the *wadi* bed, starting upstream with the placement of loose stones. In the lower reaches of the *wadi*, check dams are constructed with gabions to resist the water flow. Recent research in Sana'a governorate shows that check dams in upper-middle *wadis*, where alluvial deposits overlie particular geologies, offer more economical and effective aquifer recharge potential than gravity dams because of the rapid rate of recharge. This quick recharge minimises evaporation loss, which also reduces the concentration of minerals that have a negative effect on water quality. However, there is a lack of financial resources and technical capacity to replicate the successes achieved by these investments in check dams.

116. A pilot project, 'Fog and Rainwater Harvesting for Improved Coffee Production in Manakha', Sana'a Governorate', has been successfully implemented. This project, funded by the Water Governance Programme for Arab States (WGP-AS) and executed by the National Foundation for Watershed Management & Services (WAM) has received additional funding of US$50,000 for its continuation in 2014. Its achievements include: i) establishment of a coffee nursery; ii) installation of water harvesting structures that also minimise flooding and reduce erosion; iii) identification and documentation of a traditional water harvesting practice of stone piling for coffee; and iv) the successful demonstration of fog harvesters. The fog harvesters comprise 3 m x 2 m mesh screens that were able to condense enough fog to provide drinking water for a family of five. This is the first example of a successful fog harvesting initiative in the Western Highlands. Local communities now benefit from the provision of drinkable water and women and children are no longer required to travel to collect water during the dry months. However, previous initiatives related to fog harvesting have been implemented elsewhere in Yemen with mixed results. As a result, there is a need to demonstrate the benefits of fog harvesting as a climate-resilient approach to increasing water availability, both to policy- and decision-makers as well as to local communities.

117. In general, projects that undertake interventions at the household-level – for example, the SFD's rooftop rainwater harvesting and communal rainwater harvesting for domestic livestock projects – are considered relatively sustainable in the long-term because local communities have a sense of ownership of the project's activities. This sense of ownership results – in part – from the SFD's intervention ownership-sharing strategy, whereby the SFD covers 50% of implementation costs and the community is responsible for the remaining 50%. In comparison, project activities that are implemented at a wider geospatial level than individual households – *inter alia*, projects that focus on watershed management – are relatively more challenging to sustain in the long term. For example, in the case of projects which implement watershed management activities – such as rehabilitating terraces and building check dams – participating communities in the upstream areas do not perceive a direct benefit from recharging groundwater because the majority of the increased water flow provides benefits to communities in downstream areas. Therefore, projects, which are implemented on a broader scale than at a household level, should include a mechanism for operating and maintaining project interventions in the long term to ensure that investments are sustainable. There is a need to identify and promote mechanisms to encourage communities to maintain project interventions that will generate additional benefits for communities who are not necessarily participants in the project's interventions.

2.5.3.2. With LDCF Intervention (adaptation alternative)

118. To address the anticipated effects of climate change and aquifer depletion, the LDCF-financed project will implement a range of water harvesting techniques in the governorates of Sana'a, Taiz, Ibb, Dhamar, Raymah and Al Mahweet. Local communities will be trained in the construction and maintenance of various water harvesting techniques. In addition, awareness of the socio-economic benefits of water harvesting will be raised in the selected governorates. The introduction of alternative systems for distribution of water will reduce the extractive pressure on existing water resources and support improved water security under conditions of climate change. Traditional water management and harvesting techniques, such as terraces and spate irrigation, have shown their effectiveness over time and are well-established practices in Yemen. This infrastructure will be rehabilitated and improved to become resilient to climate change effects. New techniques, such as fog harvesting with a vertical mesh screen, will be introduced to provide additional water under uncertain climate change predictions.

119. The design of the LDCF-financed project builds on lessons learned from other initiatives that have water harvesting experience in Yemen. These initiatives include WAM, WASH, RALDP, the GSCP, the Community Livelihoods Project (CLP), the SGP and Progressio. The proposed adaptation interventions of the LDCF-financed project have been designed as a package of complementary activities that: i) incorporate traditional

and innovative water harvesting techniques; ii) require locally available or simple inputs; and iii) respond to the anticipated effects of climate change on women, youth and other vulnerable groups. The design of on-the-ground interventions will follow a participatory approach. Specifically, the LDCF-financed project will promote the involvement of local communities in selecting and prioritising interventions that are tailored to their specific conditions. This approach will promote local community 'buy-in' and ownership of the project's activities. Community buy-in has significantly contributed to the success of previous government and donor-funded water harvesting projects. The sustainability of the LDCF-financed project will be further enhanced by establishing collaborative relationships with relevant partners such as WUAs, MoAI extension officers and local CBOs.

120. The design of water harvesting techniques to be implemented will include considerations of simplicity and ease of maintenance[38]. Maintenance requirements form a significant factor in the sustainability of a system. Design aspects to be taken into account when minimising maintenance include: i) size of the system; ii) distance between the collection point and storage or use location; iii) distance of the system from the community or household; iv) potential energy and water speed; and v) required materials and tools. Wherever possible, techniques that are user-friendly and easy to maintain will be promoted in favour of complex and expensive systems such as pump-operated systems, which require some technical knowledge for maintenance and repairs.

121. The LDCF-financed project will coordinate closely with the SFD during project implementation, to maintain continuity and complementarity between project interventions and the SFD's rainwater harvesting initiatives throughout Yemen. This includes *inter alia* the SFD's intervention ownership-sharing strategy with local communities.

122. The implementation of project interventions described below is labour intensive and will create employment for a number of skilled and unskilled Yemeni. Activities under Output 2.4 will generate ~35,000 days of employment for local unskilled labour, while activities under Output 2.5 will generate ~40,000[39] days. In addition, a number of activities require the services of skilled specialists – particularly activities involving the training of local communities. This training will provide skills that have income generating potential as well as supporting project interventions – such as training communities in masonry. Output 2.3 will train selected community members in masonry techniques with these skills, creating employment opportunities beyond the project's implementation. Under Output 2.4, local communities will participate in establishing five nurseries in each of the target governorates. Community members will maintain ownership over these nurseries as a small-scale enterprise. Should the benefits to crop yields under Output 2.1 be demonstrated to justify the labour involved, this will catalyse farmers to invest in these methods themselves, thereby creating employment opportunities beyond project implementation.

Output 2.1: Five traditional water harvesting techniques re-introduced into the selected governorates. (1. Inter-row water harvesting; 2. Micro-catchment water harvesting; 3. Rooftop water harvesting; 4. Medium-sized catchment water harvesting; 5. Large catchment water harvesting)

123. Under this output, the LDCF-financed project will reintroduce rooftop harvesting to increase drinking water availability for vulnerable households in the targeted governorates. Rooftop harvesting is simple, cost-effective and does not contribute to the depletion of existing water resources. In addition, rainwater is generally of a superior quality for drinking than surface or ground water. However, there is potential for contamination of rainwater from the roof or storage tanks. Therefore, local communities will also be trained to clean their roofs of dust and debris prior to the wet season to prevent blockages and minimise opportunity for contamination. The design of storage tanks will include over-flow pipes and spillways that remove excess run-off water from exceptional rainfall events. Under such conditions, excess water will be diverted for productive use and to prevent erosion. For example, an overflow pipe irrigates a home garden or a grass-covered water-way serves to promote infiltration and counter erosion.

124. The size of the storage tanks will be determined according to the roof surface area and projected annual rainfall. Locally sourced materials and traditional construction techniques will be used wherever possible. For example, WAM's project in Manakha (discussed in paragraph 117) found that the community is using locally-sourced bamboo to build roofs for cisterns. This is a cost-effective method and has strong potential for buy-in because local communities have developed it. In places where bamboo is locally available, this method of cistern roof construction will be promoted through demonstration to increase replication in intervention sites.

[38] Spurlock, A., 2009.Case Studies for Terrace Rehabilitation in Yemen: Assessing local communities and household resilience to adapt to climate change in rain-fed areas of Yemen, Report for the SFD in collaboration with World Bank.
[39] Unskilled labour will be paid ~US$10 per day.

125. Another technique that will be demonstrated under this output is inter-row water harvesting to improve water infiltration. Inter-row systems are practicable on flat or terraced land, with a slope between 0–5%, and soil at least 1 m deep[40]. These systems consist of small contour ridges or bunds between rows of planted crops that increase the infiltration of water to by causing water to concentrate in the crop row. This technique has the dual effect of reducing evaporation from soils and promoting development of crop roots, thereby preventing heat damage to the shallow root system of a flat field. The specific catchment to cropping ratio (CCR), i.e. the ratio between the area of crop row and ridge, will be determined according to rainfall and slope. The benefits of mulching, using organic material or stones depending on local availability, will also be demonstrated as a technique to improve soil infiltrability and limit evaporation. Yemen's Agricultural Research and Extension Authority (AREA) will be approached to identify research fields where treatments such as drought resistant crops, irrigation scheduling and fertilisers have been implemented. The project will implement inter-row water harvesting in these fields to pilot and evaluate the benefits of integrating this technique with agricultural productivity enhancing treatments. The project will consult with AREA to benefit from their monitoring and evaluation practices. Inter-row harvesting will be implemented in 25% of a farmer's field, with the remainder serving as a control. This approach will serve to show the benefit of inter-row harvesting directly to the farmer. Thereafter, the farmer can further implement the technique to the remainder of his land.

126. Under this output, various scales of catchment harvesting systems will be demonstrated (at a micro-, medium- and macro-catchment scales). Micro-catchment harvesting systems will be demonstrated in sloped areas. Their function is to channel run-off towards crops and increase the rate of water infiltration. Sediment and organic material are also trapped to provide nutrients for crops. These harvesting systems will be demonstrated on rehabilitated terraces and in unterraced hillside fields. There are numerous approaches to micro-catchment harvesting, depending on the local topography and aspect, area of catchment, area of field, and total annual rainfall. A summary of potential techniques and requirements is presented in Annex 11.

127. Medium catchment water harvesting systems – including terracing – will be demonstrated in sloped catchments ranging in size from 0.1 ha – 200 hectares. These catchments will increase the infiltration of water into agricultural soils and will also be used to supply water storage tanks or cisterns such as *al karif* and *al majel*. Although the latter water storage structures have a long history of use in Yemen, they have become degraded in many cases. A contributing cause to the neglect of these traditional storage systems is the potential for water contamination and the resultant perception that these systems are unreliable for storing drinking water. The LDCF-financed project will support the restoration and upgrading of these cisterns by: i) building roofs from locally grown bamboo and an impermeable layer to reduce evaporation; ii) providing a lining for tanks to prevent contamination; and iii) introducing sediment traps to reduce sedimentation. Local communities will be trained in cleaning and maintaining cisterns, as well as advice on hygiene to minimise water contamination. The LDCF-financed project will also establish new and restore degraded terraces on slopes with a gradient between 10% and 35% at selected sites in target governorates.

128. Large or macro catchment water harvesting refers to systems whose catchments are many square kilometres in area. As they are large in scale, water often reaches defined *wadi* channels before being diverted to inundate fields. This technique is therefore often referred to as floodwater harvesting. It is discussed in detail under Output 2.5.

Activities

- Activity 2.1.1: Install rooftop harvesting systems according to predicted rainfall regime with planned overflow for exceptional events.
- Activity 2.1.2: Demonstrate inter-row, micro, medium- and large-catchment water harvesting techniques in pilot sites.
- Activity 2.1.3: Provide training, materials, tools and technical guidance in selected sites for inter-row, micro-catchment, medium- and large-catchment water harvesting.

Output 2.2: Fog harvesting technology introduced in Raymah

[40] Prinz, D., Malik, A.H., Runoff farming, Article prepared for WCA infoNET. Available at: http://www.plantstress.com/articles/drought_m/runoff_farming.pdf. Accessed on 21 February 2014.

129. Under this output, the LDCF-financed project will implement fog harvesting using mesh screens in Raymah. The participating communities will be selected based on criteria including: i) local water availability; ii) frequency of dry season fog; and iii) presence or potential to create a CBO to manage the initiative. Experts in this technique will train local community members in the construction and maintenance of fog harvesters and record keeping of harvesting results. Lessons learned during the WAM project in Manakha in the adjacent Sana'a governorate will be applied. For example, locating the screen according to ease of access by its owners is preferable to a site that would provide greater water yields but is harder to access.

Activities

- Activity 2.2.1: Develop a fog harvesting manual based on quantitative and qualitative data from previous fog-harvesting attempts in Yemen, including 'traditional' stone-piling and the 'modern' screen technique. This manual will be made available to relevant NGOs working in suitable areas in Yemen.
- Activity 2.2.2: Host workshops to disseminate the fog harvesting manual to local communities that have suitable socio-economic and biophysical conditions.
- Activity 2.2.3: Install 'screen' fog harvesting in selected sites using the fog harvesting manual.
- Activity 2.2.4: Train local communities in maintenance of fog harvesters and record keeping of water yields.
- Activity 2.2.5: Measure results of fog harvesting in providing water and effect on communities.

Output 2.3: Local community members (farmers, pastoralists and rural households) from the selected governorates trained in the construction and maintenance of water harvesting techniques.

130. Water harvesting is still practiced by many communities in the selected governorates. However, in other places, knowledge has been lost because of emigration, increased reliance on groundwater or limited finances and capacity to maintain water harvesting structures. The LDCF-financed project has selected intervention sites based on poverty indicators under the SFD's CLP. CBOs and WUGs in the pilot areas will be trained in water harvesting techniques and construction. Furthermore, local community members will be trained to relay this information in their communities to maximise the dissemination of knowledge. Masons will be trained in traditional techniques for building and maintaining tanks and cisterns[41]. Women, in particular, will be targeted, as they are more likely to stay in rural villages than men – who often migrate to urban centres in search of employment opportunities. Targeting women will ensure that knowledge and skills remain in the rural areas and will increase the opportunities for sharing knowledge and skills with other community members – especially the youth. Trainees will be selected from those villages where storage systems have either fallen into disrepair, or the materials and suitable sites are present but not being put into use. This training will be informed by the lessons learned from SGP masonry training projects. Local community discussion forums will be hosted to share lessons learned on water harvesting successes and failures. These lessons will also be collated to create material for use in other discussion forums.

131. Under this output, training will be based on the principles of water harvesting[42]. The rationale behind these principles is that there are no formulae or set of instructions for water harvesting. Rather, each location has its own unique circumstances that the farmer or household should apply the principles to in order to maximise water use. These principles are:
    - Begin with long and thoughtful observation.
    - Start at the top (highpoint) of the catchment and work downwards.
    - Start small and simple.
    - Slow, spread, and infiltrate the flow of water.
    - Always plan an overflow route and manage that overflow as a resource.
    - Maximise living and organic groundcover.
    - Maximise beneficial relationships and efficiency by "stacking functions".
    - Continually reassess the system: the "feedback loop".

132. These water harvesting principles are elaborated further in Annex 8.

Activities

- Activity 2.3.1: Train local communities on the principles of water harvesting.

[41] For example, *Khadad* stucco uses locally sourced material and has been shown to be durable and resilient.
[42] Lancaster, B. 2006. *Rainwater Harvesting for Drylands and Beyond, Volume 1.* Rainsource Press.

- Activity 2.3.2: Train CBOs to monitor and advise farmers, pastoralists and rural households on water harvesting techniques.
- Activity 2.3.3: Train CBOs and WUGs on forming WUAs according to lessons learned from Output 3.1.
- Activity 2.3.4: Train masons in selected local communities where material is available for their skill.
- Activity 2.3.5: Host local community discussion forums to share lessons learned on water harvesting experiences.

Output 2.4: Integrated groundwater recharge systems established

133. Groundwater recharge systems have a range of complexity. Simple techniques, such as those discussed under Output 2.1, include inter-row and micro-catchment water harvesting that promote infiltration of water into soil and shallow aquifers and do not require specialised skills and inputs to implement. Examples of more complex and technically challenging approaches to water harvesting include projects that require expert engineering and hydrogeological skills, such as mechanically pumping surface water into aquifers. Therefore, to complement the simple approaches demonstrated under other outputs, this output will demonstrate technologically complex approaches to water harvesting, including sand dams and check dams, collectively referred to as artificial recharge.

134. Under Output 2.4, local community nurseries will be established in selected sites to propagate agroforestry species, such as coffee, almonds and *Moringa oleifera*. Agroforestry benefits groundwater recharge through: i) promoting water infiltration; ii) reducing erosion; iii) reducing raindrop impacts; and iv) harvesting fog[43]. The local nurseries will offer the additional benefit of providing income for local community members. Farmers will be able to purchase these plants at discounted prices. They will be assisted in establishing agroforestry plots on their land. This training will include using water harvesting principles discussed under Activity 2.3.1 to promote growth in the agroforestry plots

135. The LDCF-financed project will install check dams and sand dams in *wadis*. Suitable locations will be determined through hydrogeological studies conducted by qualified experts. As groundwater is a shared resource, artificial recharge structures require a WUA to manage the resource beyond the project implementation phase. Local communities will be trained in establishing WUAs under Output 3.1. To support sustainability of check dams, local communities will be trained in the required maintenance. This includes the removal of silt, fine sand, clay and organic material to retain recharge rates. The training will also promote the use of the removed material as top dressing for agricultural fields.

Activities

- Activity 2.4.1: Educate farmers and water managers on techniques for increasing soil infiltration in agricultural fields using Activity 2.1.2 as demonstration sites.
- Activity 2.4.2: Conduct hydrogeological tests to determine specific locations for artificial recharge.
- Activity 2.4.3: Install check and sand dams at sites determined under Activity 2.4.2.
- Activity 2.4.4: Establish local community nurseries propagating agroforestry species to reforest upper catchments.
- Activity 2.4.5: Train local communities in the protection of these upper catchments.

Output 2.5: Floodwater harvesting systems introduced to support irrigation

136. The LDCF-financed project's interventions under this output include the rehabilitation of spate irrigation systems in selected *wadis*. Primary and secondary canals will be excavated, either manually or mechanically, depending on the size of the canal and the extent of degradation. The sediment cleared from the canals will be used to create inter-row ridges and micro-catchments in nearby fields to contribute to Output 2.1.

137. Traditional irrigation methods will be complemented by the adoption of modern irrigation techniques. For example, results from the models developed under Output 1.1 and Output 1.3 will be used to simulate flooding potential of *wadis* in the selected catchments. The results will be included in the design of the rehabilitation of

[43] Fog condenses on the leaves of trees and drips off to infiltrate soil. In high fog density and frequency areas, this creates cloud forests. This phenomenon has been witnessed to a lesser degree on the western escarpment. (Al Saghier, O. pers. comm. 17 February 2014.) Studies in Socotra estimate that up to two-thirds of available moisture in high-altitude areas is derived from fog. (Scholte, P., De Geest, P. 2010. The climate of Socotra Island (Yemen): A first-time assessment of the timing of the monsoon wind reversal and its influence on precipitation and vegetation patterns. Journal of Arid Environments 74: 1507–1515.)

the *wadi* diversion structure and canals. In *wadis* that are predicted to have increased flood peaks, *Ogma* bunds and *Al Masaqit* drop structures will be built into the spate irrigation system to prevent damage caused by extreme flooding.

138. The project's interventions will include planting trees along restored canals to: i) stabilise the banks; ii) provide shade to reduce evaporation; and iii) create a windbreak for the canal and adjacent field to reduce evapotranspiration. Agroforestry species will be selected according to the specific local agro-climatic conditions of the intervention sites[44]. These species will provide additional benefits such as the supply of fruit, forage for livestock and other NTFPs. Potential agroforestry species include *Moringa oleifera, Ficus sycamorus, F. wassa, F. palmate* and *Tamarix spp*. This activity will be prioritised in places where *Prosopis. juliflora* is found.

139. *P. juliflora* and other undesired alien species will be cleared from canals and adjacent banks according to best practices established during SGP projects. Farmers will be trained on managing alien vegetation in canals and *wadis*. This training will include managing the spread of alien vegetation and using removed vegetation for water harvesting. For example, there is potential to use removed vegetation to build: i) livestock exclusion barriers; ii) contour bunds on slopes; and iii) barriers in erosion gulleys to trap sediment. Additionally, training will include lessons on identifying priority areas for restoration, and on timing the removal of vegetation to according to seasonality and labour availability. For example, plants should be removed before they seed, or when the soil is soft from rain so that seedlings can be hand pulled without breaking roots.

140. The LDCF-financed project's activities include building and restoring sediment traps in spate irrigation canals according to best practices. Sediment traps will minimise the maintenance required to keep canals open during the wet season, when farmers are planting crops in the fields. The sediment traps allow farmers to remove sediment from the system more easily than if it was spread through the canals. Once the sediment is removed, it can be distributed to fields at a time of the farmer's choosing. A single large pile of sediment adjacent to a trap is also preferable to many small piles along the canal. A large pile is less susceptible to wind erosion because of the smaller surface area to volume ratio. Wind erosion will be further minimised by planting windbreaks using agroforestry species at the sediment traps. These species will be selected using the process adopted for the planting of the canal bank vegetation described in paragraph 139.

Activities

- Activity 2.5.1: Use hydrological modelling developed under Activity 1.1.4 to model floods and potential damage.
- Activity 2.5.2: Remove alien vegetation (e.g. P. juliflora) from channels and educate farmers on alien vegetation management.
- Activity 2.5.3: Vegetate canals with agroforestry species.
- Activity 2.5.4: Rehabilitate and install sediment traps to limit canal sedimentation.

Output 2.6: Awareness raising programme designed and implemented for all six selected governorates to promote socio-economic benefits of water harvesting

141. The LDCF-financed project's interventions under this output will focus on raising awareness of the benefits of water harvesting, using appropriate media that are easily accessible and understood by the intended audience. Data and information from pilot interventions and demonstration sites under Outputs 2.1 – 2.5 will be analysed and collated for dissemination to schools, media outlets, mosques and the public. Literacy levels in Yemen are low[45] and rural areas, which have greater water supply problems, have higher illiteracy levels than the urban areas[46]. Therefore, the awareness campaigns will account for the variable literacy rates by focusing on verbal and visual messages in areas where literacy levels are lower. Additionally, messages will be tailored towards the area where they are disseminated. For example, urban areas will focus on the benefits of rooftop harvesting and ensuring that harvested water is potable. Rural areas will include lessons to improve infiltration and prevent erosion. Lessons learned from other outputs will guide proposals to integrate water harvesting and water

[44] Species that are already found growing in proximity to the intervention sites will be prioritised.
[45] Approximately 65%, compared to the global average of ~84%. Approximately 82% of Yemeni men, aged 15 and above, are literate, compared to only ~49% of Yemeni women from the same cohort.
[46] CIA World Fact Book – Yemen. Available at: https://www.cia.gov/library/publications/the-world-factbook/geos/ym.html. Accessed on July 17 2014

resource education into the school syllabus. Additionally, water management will be promoted in secondary schools as a career option.

142. Signboards will be designed to disseminate current information on water resources. This will include boards with interchangeable numbers – similar to a scoreboard – to display rainfall, water table and dam levels, and the volume of water captured through local water harvesting initiatives. These will be implemented in urban areas to be accessible by a greater number of people.

143. In rural areas, awareness programmes on water harvesting will be broadcast on five local governorate-level radio stations as well as via medium wave transmission on stations such as Radio Sana'a and Radio Aden. Following this model, Equal Access' youth radio programme *Ma'an Leenkon Alafdal* (Let's Be the Best Together) has reached a national audience of ~4 million youths.

144. The LDCF-financed project will also implement grey water recycling and water harvesting in public buildings and mosques. The interventions are intended as demonstrations for public officials and clergy who would then be inclined to incorporate the benefits into their work – in the case of public officials – and use their social standing to further disseminate the benefits of water harvesting. These demonstrations will promote public awareness and interest in grey water recycling and water harvesting, as well as demonstrate the benefits of these to local communities.

Activities

- Activity 2.6.1: Analyse data from pilot interventions and collate the results for dissemination to schools, media and public institutions.
- Activity 2.6.2: Propose water harvesting and water resources education in the school syllabus and promote water management as a career option in secondary schools.
- Activity 2.6.3: Review current awareness in local communities and the effect of current awareness raising initiatives and use the results as a basis for 2.6.4.
- Activity 2.6.4: Use media, including radio and signboards to target specific audiences with appropriate water harvesting information.
- Activity 2.6.5: Promote water harvesting and grey water recycling in public buildings and mosques, including public displays of these techniques and their results.

2.5.4. OUTCOME 3: DECENTRALISED AND COMMUNITY-LED WATER MANAGEMENT SYSTEMS TO COPE WITH LONG-TERM EFFECTS OF CLIMATE CHANGE ON WATER AVAILABILITY.

Co-financing amounts for Outcome 3: US$4,905,500
LDCF project grant requested: US$840,000

2.5.4.1. Without LDCF/SCCF Intervention (baseline)

Traditional water governance

145. The Constitution of Yemen and Islamic law (*Sari'a*) form the basis for the Yemeni Civil Code and traditional water rights continue to determine water management. The traditional system consists of *Sari'a* and customary law (*'urf*). *Sari'a* governs water rules countrywide while *'urf* has many local specifications. There are, however, inherent contradictions within this framework. While the Yemeni constitution states that all natural resources belong to the GoY, the *Sari'a* claims that water cannot be owned unless it is contained, in a well or dam for example. This has caused uncertainty over water rights, and has led to increased groundwater extraction, as farmers attempt to legitimise their claims on a diminishing resource[47].

146. Traditional law operates at multiple levels ranging from the *harat* in rural areas or *'aqil* in urban areas at village level, to sheikhs and other traditional leaders at sub-national level. At a governorate level, the government appointed magistrate is referred to as *qadi*. The *harat* is elected by the local community. Their role is to arbitrate according to customary law, local knowledge and experience. The *harat's* decisions are usually accepted and it is rare for a case to be transferred to a higher level. The higher authority may either be within the traditional

[47] Lichtenthaeler, G. 2013. Water conflict and cooperation in Yemen. MER254: running dry. Available at: http://www.merip.org/mer/mer254/water-conflict-cooperation-yemen. Accessed on 11 March 2013.

system or the *qadi*. If the dispute refers to land or water the *qadi* usually refuse to deal with the case, deferring to the greater local knowledge and experience of the *harat.*

147. Water rights disputes can be resolved through the intervention of a respected elder, known as an *Al Moqadem*. The local community elects an *Al Moqadem* on the basis of his relationship with the farmers and knowledge of the farmland. Rather than arbitrating decisions and conferring rights, the *Al Moqadem* is engaged to negotiate seasonal and downstream water distribution rights amongst local community members.

148. Local communities usually honour regulations and decisions reached by consensus. In small homogeneous groups, a verbal agreement amongst people is usually sufficient to ensure compliance. In other conflicts over water resources, local communities increasingly resort to a written consensus-based form of regulation, known as a *marqoum*[48].

149. Traditional Yemeni systems of water management were developed centuries ago and their endurance is evidence of their efficacy. However, modern events including increased population, mechanised groundwater extraction and climate change have placed additional challenges on the country's water management institutions. Predictions of climate change, particularly increased rainfall variability, and aquifer depletion in Yemen will make these challenges more acute. Therefore, Yemen's WMOs and government institutions require increased capacity to provide sound water management for predicted scenarios.

150. Increased variability under climate change projections will place additional stress on water resources. Additionally, Yemen's heterogeneous landscape creates strong variation between areas.

2.5.4.2. With LDCF/SCCF Intervention (adaptation alternative)

151. A decentralised approach will allow local WMOs to make decisions based on their current local conditions. Access to short- and long-term weather data will assist management decisions. Future water shortages will require traditional dispute mediators to have increased authority and skills to manage a scarce resource and arbitrate conflict resulting from this scarcity. Formal establishment of WUAs will add further authority to WUGs. This formalisation will provide additional access to support from government institutions, such as NWRA and the SFD.

152. There is potential for successful collaboration and coordination with UNDP's Crisis Prevention and Recovery (CPR) unit. UNDP's CPR unit has implemented 35 projects in Yemen to date, including the Peace and Transition Support Project (PTSP) under UNDP's Governance portfolio. The overall objective of the PTSP is to support increasing citizen participation in peace and development planning and policy development, as well as to support the rebuilding of the social contract with marginalised groups, most importantly women and youth. The PTSP aims to address the causes of conflict in Yemen with a focus on the lack of development and access to basic social services. The LDCF-financed project will benefit from the CPR unit's experience as well as from lessons learned during the PTSP.

153. The LDCF-financed project will promote mechanisms for increasing investment into the water harvesting sector. Activities will provide finance for local communities to implement their own water harvesting infrastructure. Loans and grants will come in the form of materials and revolving funds. Public works projects will rehabilitate terraces using local labour. Additionally, private investment in water harvesting, as part of corporate social responsibility (CSR), will be promoted.

Output 3.1: Water user associations (WUAs) in the selected governorates provide customer-oriented water distribution and seasonal rationing services for communal harvested water, with full engagement of the community members and traditional Al Moqadem of the target communities.

154. Under Output 3.1, research on existing and former WUAs will be conducted to determine the reasons for their successes and failures. This study, under Activity 3.1.1, will inform the development of a manual for establishing and managing WUAs. This manual will emphasise on incorporating water harvesting techniques into WUA management. The study will also review the registration process and the experiences of those WUA representatives during this time. The information will be used to propose revisions to the registration process. These revisions will support WUGs in achieving WUA status. Under this Activity 3.1.2, representatives of the

[48] Lichtenthaeler, G. 2013. Water conflict and cooperation in Yemen. MER254: running dry. Available at: http://www.merip.org/mer/mer254/water-conflict-cooperation-yemen. Accessed on 11 March 2013.

Ministry of Social Affairs and Labour will also be trained in processing applications to make registration easier for WUGs.

155. Following the creation of the manual, WUAs will be trained to manage a limited supply of water. WUAs representatives must be respected in their local communities and have the required skills to ration water and manage disputes and conflicts. *Al Moqadem* have traditionally occupied this role but under predicted climate change scenarios and aquifer depletion additional training is needed.

156. *Al Moqadem* will also be trained on the potential effects of climate change. They will be informed on climate change predictions[49], potential effects on agriculture and measures that farmers can implement to build resilience[50]. Given that *Al Moqadem* are respected in their local community, information provided by them will have a significant effect.

157. In Yemen, water availability is seasonal and there is strong interannual variability. Water management therefore requires constant adaptability. To promote the transfer of information from water management institutions, the LDCF-financed project will establish discussion forums in the selected governorates. These forums will allow NWRA representatives to communicate drought or flood warnings to WUAs so that this information can be incorporated into their management decisions. The forums will also provide opportunities for WUAs to receive advice on water management and relay lessons learned on their problems and solutions. These lessons will be collated and made available to other WUAs to promote continual and widespread learning in water management. The benefits of this activity will be assessed, compiled and disseminated.

Activities

- Activity 3.1.1: Assemble data on existing and former WUAs in Yemen and collate this into a manual for their future establishment and management.
- Activity 3.1.2: Train representatives of the Ministry of Social Affairs and Labour to facilitate the WUA registration process.
- Activity 3.1.3: Train WUA representatives in: i) water budgets; ii) demand-side management; iii) criteria establishment for assessment of household water demand; and iv) conflict management.
- Activity 3.1.4: Train Al Moqadem in climate change effects and adaptation measures
- Activity 3.1.5: Establish discussion forums for WUAs in the selected governorates to facilitate information dissemination and discussion between WUAs and governorate water management institutions.

Output 3.2: Social Fund for Development Engineering Unit and extension services have the skills and capabilities to support range of water harvesting technology designs and maintenance requirements

158. The SFD was established in 1997 to reduce poverty and improve the standard of living of poor communities in Yemen through building capacity and empowering local communities and councils to implement development projects. From 1997–2010, the SFD implemented 10,768 projects, with a total cost of ~US$1.25 billion. The SFD has seven implementation units, namely:
    - education;
    - water and environment;
    - health and social protection;
    - training and organisational support;
    - small and micro enterprise development;
    - agriculture and rural development; and
    - cultural heritage.

159. In addition to these implementation units, the SFD has a database of engineers who provide consulting services for the design and supervision of projects. The SFD implementation units conduct technical reviews and studies, and ensures quality control – including conducting site visits to monitor project implementation and stakeholder commitment.

160. The UNDP project will provide SFD technical staff with additional training and capacity building to include considerations of mid- and long-term climate change projections in the design, implementation and

[49] Outcomes from Output 1.1 will be used as the basis of this.
[50] Climate-resilient farming practices include water harvesting techniques, such as inter-row harvesting, and a switch to waterwise crops, efficient irrigation and mulching.

maintenance of water harvesting projects. In addition, SFD staff will be provided with training and capacity building on various innovative approaches for the design, maintenance and implementation of both traditional and modern water harvesting technologies.

Activities

- Activity 3.2.1: Establish criteria for the selection of certain areas, districts or water user groups for rainwater harvesting practices, for example target poor, remote or flood prone areas.
- Activity 3.2.2: Establish and maintain a database for current sites and techniques of rainwater harvesting to use as a reference for establishing new sites.
- Activity 3.2.3: Train SFD-related staff and extension services on the principles of water harvesting under predicted climate changes, technique costing and local community-education methods.

Output 3.3: A set of incentives, such as concessional micro-loans, community grants and employment guarantees for construction and maintenance of water harvesting infrastructure introduced to stimulate community and private investment in water harvesting infrastructure, within target governorates.

161. The UNFCCC report on assessing the costs and benefits of adaptation options identified 'the creation of incentives' as an adaptation option that scored highly against UNEP's MCA4 climate criteria[51]. Therefore, under this output, financial mechanisms will be promoted to stimulate investment in water harvesting. The LDCF-financed project's interventions include a study of previous and current initiatives to establish the reasons for success and failure. The project will use the results of the study to establish criteria for selecting local communities where financial incentives are likely to be successful. The criteria will include: i) bio-physical conditions, including rainfall, elevation, relief and soil types; and ii) socio-economic conditions, including crop types, farming methods, access to markets and local community cohesiveness. Harvested water[52], and meeting the terms set out by the financing project will be used to evaluate success. The reasons for failure will be assessed and methods for overcoming these constraints will be proposed.

162. The SFD and Public Works Project[53] (PWP) are currently supervising a programme that is targeting Yemeni communities who are most vulnerable to poverty. Local councils provide details on potential target communities to the SFD and PWP for review. The programme provides employment opportunities through infrastructure development projects and wages are paid weekly for the provision of local labour and locally available materials, such as stone, gravel and sand. Typical examples of the SFD/PWP programme activities and interventions include: i) restoring terraces; ii) implementing rainwater harvesting; iii) constructing flood barriers; iv) improving and introducing micro-catchments; and v) building spate irrigation canals.

163. The LDCF-financed project will complement the SFD/PWP programme by restoring terraces using locally available labour to provide employment out of busy agricultural seasons. The SFD's LIWP will be used as a baseline project for this activity. Income from this seasonal employment will stimulate local economies. Additionally, advice will be given on how this income can be used by local communities to invest in additional water harvesting techniques.

164. Intervention sites will be selected in places where rehabilitated terraces are likely to be maintained. This includes an evaluation of the initial factors that led to their neglect. For example, temporary migration or alternative work opportunities, such as road construction, are possible reasons for a period of neglect. Rehabilitation costs are estimated at US$5 m^{-2}, which is considerably more than the cost of maintaining terraces. Rehabilitation also requires coordination between the respective owners of the terraced land. With the return of the migrant labour force, rehabilitation would not have been affected because the cost and the limited coordination[54]. Assessment of the situation will allow the project to select sites where rehabilitated terraces will be maintained beyond project implementation. In places where an existing or predicted decrease in rainfall is set to affect agricultural productivity, additional water harvesting infrastructure to supplement rainfall is to be integrated with rehabilitating terraces. For example, micro- or medium-catchment water harvesting are potential options to increase water availability for terraced crops.

[51] UNFCCC. 2011. Assessing the costs and benefits of adaptation options.
[52] Measured either by volume of water harvested, or by proxy, e.g. increase in crop yield.
[53] A GoY project established in 1996 to reduce the negative impacts of the Economic Reform Programme
[54] Spurlock, A., 2009, Case Studies for Terrace Rehabilitation in Yemen: Assessing local communities and household resilience to adapt to climate change in rain-fed areas of Yemen, Report for the SFD in collaboration with World Bank.

165. The SFD will be assisted in designing a set of incentives to attract private investment into water harvesting. CSR is a form of self-regulation integrated into companies to ensure compliance with ethical standards. In Yemen, industry only accounts for 3% of water use. Although there is potential for water harvesting to assist companies in lowering input costs through reduced water fees, targeting industry will not make a significant contribution to addressing the national water crisis. However, given the increasing attention that the water crisis is receiving, private companies will improve their public image through charitable investment in water harvesting.

166. Certain interventions, such as cement storage tanks and fog harvesters, are highly visible. There is potential to attract CSR investment because of this visibility. These interventions will attract attention from the general public while displaying the benefits of water harvesting and improving corporate image. This investment can either come in the form of materials from the companies that produce them, e.g. cement, PVC pipes, mesh cloths, steel bars, or in cash from companies with no direct involvement with materials used for water harvesting. In promoting CSR, companies will be advised that with climate change and Yemen's water crisis, experience in implementing water harvesting will be valuable given the potential for future growth in the sector.

167. The LDCF-financed project's interventions include the establishment of revolving funds in local communities. The project will use the experience of the SGP in similar schemes to select local communities where the funds will be sustainable. For example, local community buy-in and strong levels of trust between fund administrators and borrowers have been shown to be strong factors for determining sustainability[55]. Revolving funds will be targeted towards farmers able to use it for income generation, i.e. subsistence activities will not qualify. Local communities will determine the terms of payment for these funds.

168. As a result of the proposed interventions, local communities will have access to information and incentives to implement their own water harvesting to increase their resilience to the effects of climate change

Activities

- Activity 3.3.1: Establish criteria, including biophysical and socio-economic conditions, for directing loans and incentives to local communities who will yield maximum water harvesting benefits.
- Activity 3.3.2: Offer grants in the form of materials (not cash) accompanied with implementation guidelines.
- Activity 3.3.3: Rehabilitate terraces and other water harvesting infrastructure to provide non-agricultural income between cropping seasons.
- Activity 3.3.4: Design and promote rainwater harvesting projects for CSR.

2.6. Key indicators, risks and assumptions

2.6.1. Indicators

169. Indicators for the LDCF-financed project will be based on UNDP's Monitoring and Evaluation Framework for Climate Change Adaptation. A number of GEF initiatives under UNDP's Community-Based Adaptation Programme have adopted this approach. The project indicators are also aligned with the UNDP Adaptation Monitoring and Assessment Tool (AMAT). The Project Results Framework in Section 3 details indicators, baseline information, targets and sources of verification at the Objective and Outcome level. At the Project Objective-level, the indicators are as follows:
    - Number of people benefitting from increased availability of domestic water given existing and projected climate change [AMAT 1.2.3]
    - % of targeted groups adopting adaptation technologies by technology type (disaggregated by gender) [AMAT 2.2.2]

170. The Outcome-level indicators are:

Outcome 1: Technical capacity to integrate cost-effective water harvesting techniques at national and local institutions and in local Water Management Organisations (WMOs) to improve water security.

<u>Indicators</u>

[55] Al-Saghier, O. personal communications. 17 February 2014.

1. Number of staff trained on the use of modern technologies related to analysis of climate information and availability of water resources, disaggregated by gender
2. Number of national- and local-level policies, strategies and plans for water harvesting developed

Outcome 2. On the ground measures for the introduction of water harvesting and rehabilitation of traditional water harvesting structures.

Indicators

1. Number and type of water-harvesting techniques introduced to increase supply of irrigation water
2. Number of vulnerable communities trained on the use of water harvesting techniques for climate change adaptation

Outcome 3. Decentralised and local community-led water management systems developed to cope with long-term impacts of climate change on water availability.

Indicators

1. Number of WUAs in the target governorates trained in water management under changing climate scenarios
2. Area of terraces rehabilitated (m^2)

171. These indicators will be used to monitor progress towards achieving the LDCF-financed project's Outcomes and Objectives. For more information and for indicators at the Objective and Output level, refer to the Strategic Results Framework in Section 3. Baseline values for these indicators will be determined during the first six months of project implementation.

2.6.2. Risks and assumptions

Risks, mitigation/reduction measures and assumptions of the UNDP project are summarised in Annex 3, and assigned to indicators in the Project Results Framework (see Section 3).

Table 2. Risks, mitigation measures and assumptions

2.7. Cost-effectiveness

172. Rain water harvesting is considered to be more cost-effective than alternative interventions that address water scarcity, such as desalination and large dams[56]. Water harvesting requires less investment in constructing and maintaining infrastructure and provides greater water volume returns[57]. For example, the estimated cost of building a desalination plant is US$6 billion, while a large dam would cost in excess of US$100 million[58].

173. With Yemen's oil resources being depleted, the local price of diesel is increasing, increasing water transportation and pumping costs. This decreases the cost-effectiveness of centralised interventions that require distribution systems, either via canals, pipes or tanker trucks. For example, desalination is being explored as an option to supply Sana'a with domestic and industrial water. The estimated cost of delivering one cubic metre of desalinated water from the Red Sea to Sana'a is US$1.1[59]. The cost of the pipeline construction for this system is estimated at US$3 billion. Pumping costs will be dependent on global fuel prices, as Yemen's own oil resources run out. Under this desalination scheme, a further US$3 billion is proposed for solar power plants to offset the energy required for pumping.

[56] Srinivasan, V., Gorelick, S. M., & Goulder, L. 2010. Sustainable urban water supply in south India: desalination, efficiency improvement, or rainwater harvesting? *Water Resources Research* 46(10).
[57] Nagaraj, N., Pradhani, U., Chengappa, P.G., Basavaraj, G., & Kanwar, A. 2011. Cost effectiveness of rainwater harvesting for groundwater recharge in micro-watersheds of Koalr Districs of India: the case study of Thotli micro-watershed. *Agricultural Economics Research Review* 24: 217-223.
[58] The Hassan Dam, currently under implementation in Abyan governorate, will cost US$102 million, while the Alkared Dam in Sana'a cost US$182 million.
[59] Alderwish, A.M., 2011 Integrated Water Management for Small Catchments in Arid Mountainous Region – Yemen, International Journal of Energy and Environmental Engineering, Vol. 19, Issue 6, p. 709.

174. In Mocha, Taiz Governorate, water from the privately-owned desalination plant is sold for US$1.86 m^{-3}. Water is transported 109 km by tanker from the plant to Taiz City and is sold for US$5.58 m^{-3}[60]. A 104 km pipeline running from Mocha to Taiz is planned with an estimated cost of US$220 million.

175. In comparison, rain water harvesting requires less investment for a return on a given volume of water. For example, a study of groundwater recharge sites in Sana'a governorate estimated the most productive sites would recharge the aquifer the equivalent value of desalinated water (US$1.1 m^{-3}) within two years. The average for this study was 13.6 years. As well as being cost-effective to build and maintain, water harvesting interventions are decentralised, thereby reducing transportation and infrastructure costs. The use of locally available materials where possible will contribute to the cost-effectiveness of the project's interventions. As many of the techniques employed in this project are based on traditional knowledge, local materials are already inherent in their design.

176. As has been noted, the success and feasibility of particular water harvesting techniques are dependent on site specific biophysical and meteorological conditions. These conditions are spatially and temporally variable, so it is not possible to make general statements on their cost-effectiveness. However, numerous studies from Yemen and other countries make the case for the cost-effectiveness of water harvesting projects.

Rooftop rainwater harvesting in Sana'a

177. Rooftop rainwater harvesting systems can be implemented for an estimated US$1,684 per household[61]. This figure includes installation and maintenance costs for the operating period. It is estimated that rooftop harvesting will reduce annual water expenses for the residents of Sana'a by US$82 million, representing a potential water saving of 43.4% for households annually[62].

Micro-catchment harvesting in Kolar District, India

178. The feasibility of investment on water harvesting structures in micro-catchments was evaluated[63] using standard discount cash-flow techniques. In addition, the economic effect of groundwater recharge was analysed through the: i) reduction in the cost of groundwater irrigation; ii) amount of newly irrigated land; and iii) increase in net returns. As described in Table 3 and Table 4, the cost-benefit analysis of water harvesting structures indicates that investment is cost-effective and financially-viable. For every US$1 spent, the investment yielded on average US$1.21 over the economic life span of the watershed's assets.

Table 3. Investment analysis of water harvesting structures (average)

Technology	Returns/US$ invested (US$)	Cost/m^3 water impounded (/m^3)	Recharge benefit (m^3)
Farm Pond	1.80	1.33	1,350
Recharge Pit	1.78	1.67	720
Field Bund	1.39	3.01	5.6

Table 4. Summary of costs and returns

Technology	Total Costs (US$)	Returns (US$)	Returns to Cost ratio (US$)
Farm Pond (US$/unit)	35.54	64.26	1.80

[60] Middle East Electricity. 2010. Available at: http://www.middleeastelectricity.com/global/Middle_East_Electricity/pdf/Yementolaunchfirstdesalinationproject05Jul10YT.pdf. Accessed on 20 March 2014.
[61] Taher, T.M. 2014. Quantity and quality considerations of rooftop rainwater harvesting as a substantial resource to face water supply shortages. *International Journal of water Resources and Arid Environments* 3(1): 01-10.
[62] Taher, T.M. 2014. Quantity and quality considerations of rooftop rainwater harvesting as a substantial resource to face water supply shortages. *International Journal of water Resources and Arid Environments* 3(1): 01–10.
[63] Data drawn from: Nagaraj, N., Pradhani, U., Chengappa, P.G., Basavaraj, G., & Kanwar, A. 2011. Cost effectiveness of rainwater harvesting for groundwater recharge in micro-watersheds of Koalr Districs of India: the case study of Thotli micro-watershed. *Agricultural Economics Research Review* 24: 217–223

Recharge Pit (US$/unit)	166	295.68	1.78
Field Bund (US$/acre)	US$8.82	US$12.28	US$1.39

179. The internal rate of return (IRR) was 12%. Considering the lending rate of five per cent on long-term loans, a modest IRR of 12% is economically worthwhile. The IRR is a reasonable indication of the higher average earning power of investment on water harvesting structures. Only direct benefits were considered in the analysis of investment in the watershed. If indirect benefits were also included, the IRR would increase further.

Medium and macro-catchment water harvesting

180. Construction of medium and macro-catchment water harvesting structures, such as: i) *al qaid* (low earthen bunds); ii) *ogma* (high earthen bunds); iii) check dams; iv) terraces; and v) barriers to exclude livestock, will use alien vegetation removed under Activity 2.5.2. In doing so, the LDCF-financed project will have the dual benefit of preventing the negative effects of the alien vegetation, such as groundwater depletion, while promoting positive effects, such as erosion prevention and groundwater infiltration.

181. The MoWE and MoAI will assume responsibility for the implementation of the project, providing support to the project management unit and inputs for the implementation of project activities. The GoY, through the MoWE and EPA, will provide in kind co-financing for US$2 million.

182. The NWRA, in cooperation with the MoAI, will be responsible for the national execution of the project, mainly under components 2 and 3. The GoY will provide co-financing for US$12 million in the form of on-going activities implemented through the NWRA.

183. The SFD will provide key lessons to the project and will play a critical role in providing technical inputs for the design of water harvesting structures. The GoY will provide co-financing of US$14.2 million in the form of on-going activities implemented through the SFD.

184. The total co-financing for the LDCF-financed project is US$28 million

2.8. Sustainability

185. During the PPG phase, the project engaged with relevant national stakeholders and experts, in order to identify activities aligned with national priorities and development goals. The project has accordingly been designed to reflect the local context and address priorities identified by stakeholders. Security concerns experienced during the PPG phase prevented travel outside of Sana'a. Consequently, the project was not able to include all relevant stakeholders – such as representatives of rural communities who will be the project beneficiaries – during the initial consultation phase. Given this, the project will engage closely with participating communities during the implementation phase to identify priority activities and intervention sites. This approach will promote community ownership of project activities and increase the likelihood that the project's interventions will be sustained beyond the initial implementation phase.

186. The LDCF-financed project will introduce complementary measures to create an enabling environment for sustainable water resource management at a national level. For example, technical and institutional capacity for climate-resilient water management and water harvesting will be increased by providing training and awareness-raising at national, governorate and local levels, as described in Activity 1.2.3 and Activities 2.6.2 – 2.6.5. Under Activities 1.3.1 and 3.1.4, discussion forums will build linkages and promote information dissemination to strengthen coordination between different government levels. The project will also increase awareness and improve understanding of the risks posed by climate change and aquifer depletion by providing training to stakeholders such as policymakers, the SFD, WUA representatives, farmers, pastoralists and rural communities. As a result, the project will increase the willingness of stakeholders to sustain the proposed interventions beyond the project implementation period.

187. A feature of the project's design, which will support long-term sustainability of UNDP investments, is an evidence base for analysing the costs and benefits of water harvesting for agriculture, livestock and domestic use under Activity 1.2.1. This evidence base will support the creation of an enabling environment for policy- and decision-makers to invest in successful project activities beyond the implementation period.

188. A decentralised approach will be adopted by the LDCF-financed project for implementing interventions at a household level. This decentralised approach will support a sense of ownership towards the project's interventions. As a result, the investments in infrastructure made by the project are more likely to be maintained in good working condition by the project beneficiaries because the benefits are directly realised. There are certain interventions that can only be implemented at a community level, including terraces, communal cisterns, medium-sized catchment harvesting and spate irrigation canals. WUAs and CBOs will be established to operate and maintain these communal water harvesting interventions. Agreements will be established between members of these institutions to designate roles and responsibilities for the operation and maintenance of communal project investments. Lessons learned from past experiences in similar initiatives will form the basis for establishing these WUAs and CBOs.

189. Although the interventions will be designed to minimise maintenance and associated labour costs, water harvesting structures require continual input to remain viable. Indeed, in places where rehabilitation is to occur, maintenance requirements were perceived by local communities to be unjustifiable, hence the state of disrepair. The construction of physical interventions in Components 2 and 3 will occur in conjunction with training community members, WUAs and CBOs in operation and maintenance of water harvesting infrastructure.

190. The criteria used to select the proposed water harvesting technologies include ease of maintenance and minimal labour requirements. Design features to minimise labour will include *inter alia*: i) installation of filters and sediment traps in cisterns to prevent debris from entering; ii) installation of drains so that tanks can be dried and cleaned prior to the wet season; iii) provision of roofs and lids for open cisterns; iv) installation of fog harvesters close to homes for ease of maintenance; and v) tree planting on the banks of *wadi* canals to reduce soil erosion and sedimentation.

2.9. Replicability

191. Climate change is expected to exacerbate water scarcity in Yemen through: i) increased rainfall variability; ii) increased evapotranspiration; and iii) decreased groundwater infiltration. To address the challenge of increasing water scarcity, the LDCF-financed project's interventions include demonstrating multiple climate-resilient water harvesting techniques and water management practices. The demonstrations of water harvesting techniques in six selected governorates will be complemented by awareness-raising and training activities to increase the capacity of local, sub-national and national stakeholders to replicate the project's activities and respond to the negative effects of climate change in Yemen.

192. The interventions of the LDCF-financed project will support the identification of techniques and methods that can be transferred and replicated within the selected governorates, and extended to other governorates. The project will be implemented with the involvement of relevant government institutions, such as the EPA, NWRA and the SFD. As a result, the project will support the integration of improved water harvesting and water management practices directly into ongoing national planning processes, including the NWSSIP and NASS.

193. The project has been designed to respond to national strategies and priority activities related to national water resource management and climate change adaptation. The project will strengthen institutional and technical capacity while demonstrating cost-effective water harvesting and water management practices. During the project's implementation, lessons learned and best practices for replication and upscaling across Yemen will be developed and recorded for future water harvesting projects.

194. At a governorate level, the lessons learned, as well as techniques and methods developed under the LDCF-financed project, will be disseminated and implemented throughout Yemen. The project's interventions will work in parallel with the institutional country assistance mechanism and will integrate lessons learned and best practices directly into ongoing initiatives. At the local level, a public participation and stakeholder involvement approach will be adopted. Local communities will be equipped with the knowledge and skills to design and implement their own water harvesting techniques. Participating local communities will be provided with capacity-building and technical assistance to support the decentralisation of responsibility for maintenance and management of project interventions.

195. The project's interventions will increase the availability of data, information and planning tools related to climate-resilient water harvesting and water management. This will support future initiatives to replicate the project's activities. For example, GIS tools based on DEM, satellite imagery and meteorological data developed in Activity 1.1.4 will be used to plan and implement water harvesting techniques in various locations of the country,

outside of the project intervention sites. Similarly, the economic evaluation conducted under Activity 1.2.1 will form a basis for decision-making for future water harvesting projects. Under Output 3.1, data on successful WUAs will be assembled and used for Activities 2.3.3, 3.1.2 and 3.1.3. These data will be available for other institutions, such as the SGP and FAO, to use in similar initiatives. The UNDP has established collaborative relationships with several relevant institutions in Yemen that will support the process of replicating the project's activities and integrating best practices into other ongoing initiatives. The project's interventions include the provision of data and lessons learned for use within and beyond the region. The involvement of organisations such as the GEF, UNDP/FAO/IFAD and the World Bank, coupled with close cooperation with other international projects, will support the replication of the project's approach.

2.10. Stakeholder involvement plan

196. Stakeholders at all levels – national, district, sub-district and community – will be engaged during implementation of the LDCF-financed project. This process commenced during the PPG phase with the inception workshop (detailed in Annex 2). Because of security concerns in Yemen, the validation mission was cancelled in favour of disseminating the project document to stakeholders for comment. The stakeholder involvement plan was discussed and agreed upon during one-on-one meetings and *via* correspondence with relevant stakeholders.

Table 5. Relevant partners and stakeholders identified for engagement by project outcome/output.

Outcome	Output	Stakeholders	Key Responsibilities
Outcome 1. ***The technical capacity to integrate cost-effective water harvesting*** **techniques** ***at national and local institutions and in local WMOs to improve water security.***	**Output 1.1.** The MoAI and NWRA assisted to produce RRM based on GIS to simulate key parameters for selection of water harvesting, including artificial recharge techniques.	MoWE, MoAI, NWRA, SFD, WEC, YRSC	Develop and coordinate GIS training (WEC, YRSC). Participate in training sessions on RRM and remote sensing (MoAI, MoWE, NWRA, SFD). Integrate improved GIS data into NWSSIP and NASS (MoWE, MoAI, NWRA, SFD).
	Output 1.2. Water harvesting regulations integrated into Water Law of Yemen to include harvested water as part of the national water budget.	EPA, NWRA, SFD, MoWE, MoAI, IMCCC, MoPIC	Participate in workshops to offer input on proposed regulations. Incorporate water harvesting regulations into the Water Law and annual national budgets. Integrate climate change into national and sub-national policies and strategies. Facilitate implementation of water harvesting under new federal institutions.
	Output 1.3. Long-term, climate-resilient water plans developed incorporating integrated water harvesting to facilitate groundwater recharge and supplement irrigation in the selected governorates.	EPA, NWRA, SFD, MoWE, MoAI, SGP, WMOs	Provide input on lessons learned from existing water harvesting programmes and projects. Facilitate a discussion forum on water harvesting between national, sub-national and community stakeholders (NWRA). Participate in water harvesting discussion forum. Update IWRM basin-level plans to include proposals for water harvesting under predicted climate change scenarios (EPA, NWRA, MoWE, MoAI, WMOs).
Outcome 2. ***Water availability increased through introducing on-the-ground***	**Output 2.1.** Five traditional water harvesting techniques re-introduced into	EPA, NRWA, MoWE, MoAI, SFD	Pilot inter-row, micro-catchment, medium- and large-catchment water harvesting at selected sites.

measures for the introduction of water harvesting and rehabilitation of traditional water harvesting structures.	selected governorates (1. Inter-row water harvesting; 2. Micro-catchment water harvesting; 3. Rooftop water harvesting; 4. Medium-sized catchment water harvesting; 5. Large catchment water harvesting).		Provide training, material, tools and technical support to communities for inter-row, micro-catchment, medium- and large-catchment water harvesting. Provide training, material, tools and technical support to communities for rooftop harvesting (SFD, NWRA).
	Output 2.2. Fog harvesting technology introduced in Al Hadaydah.	WAM, NRWA, EPA	Develop a fog harvesting manual based on lessons learned from previous projects. Conduct workshops to disseminate fog harvesting manual to selected NGOs and communities. Install 'screen' fog harvesters in selected sites. (NWRA, EPA). Assess fog harvesting water yields and benefits to communities (NWRA, EPA). Train communities in maintenance and recording water yields (NWRA, EPA).
	Output 2.3. Local community members (farmers, pastoralists and rural households) from the selected governors trained in the construction and maintenance of water harvesting techniques.	NRWA, EPA, SFD, MoAI, MoWE, MoSAL, CBOs, WUGs	Provide training to CBOs and WUGs on water harvesting techniques, construction, and monitoring (NRWA, EPA, SFD, MoAI, MoWE). Provide training on establishing WUAs (MoSAL, NWRA, SFD). Participate in training sessions on establishing WUAs and water harvesting techniques, construction and monitoring (CBOs, WUGs). Train masons in selected communities (NRWA, EPA, SFD, MoAI, MoWE). Facilitate community discussion forums to share lessons learned on water harvesting (NRWA, EPA, SFD, MoAI, MoWE).
	Output 2.4. An integrated groundwater recharge system established.	NRWA, EPA, SFD, MoAI, MoWE	Conduct hydrogeological tests to determine specific locations for artificial recharge. Install check and sand dams at selected sites. Establish community nurseries propagating agroforestry species to reforest upper catchments. Train communities in upper catchment protection.
	Output 2.5. Floodwater harvesting systems introduced to support irrigation.	NRWA, EPA, SFD, MoAI, MoWE	Model floods and their potential impacts to guide the rehabilitation of *wadi* division structures and canals (NRWA, EPA, SFD, MoWE). Coordinate the removal of alien vegetation from channels and educate communities on alien vegetation management.

			Rehabilitate and install sediment traps to limit canal sedimentation.
	Output 2.6. Awareness raising programme designed and implemented for all six identified governorates to promote socio-economic benefits of water harvesting.	NRWA, EPA, SFD	Assess current awareness of water harvesting and efficacy of awareness raising initiatives. Analyse and collate data from pilot interventions for dissemination to schools, media and public institutions. Design and implement a media campaign to disseminate appropriate water harvesting information. Pilot grey water recycling and water harvesting at public buildings and mosques.
Outcome 3. ***Decentralised and local community-led water management systems developed to cope with long-term impacts of climate change on water availability.***	**Output 3.1.** WUAs in the selected governorates provide customer-oriented water distribution and seasonal rationing services for communal harvested water, with full engagement of the community members and traditional *Al Moqadem* of the target communities.	MoSAL, NRWA, EPA, SFD, WUAs	Develop and disseminate a manual on establishing and managing WUAs. Develop training on facilitating the WUA registration process. Participate in training on facilitating the WUA registration process (MoSAL). Provide training on water budgets, demand-side management, conflict management and assessing household water demand (MoSAL, NRWA, EPA, SFD). Participate in training on water budgets, demand-side management, conflict management and assessing household water demand (WUAs). Facilitate discussion forums for WUAs to disseminate information between associations and governorate water management institutions (NRWA). Train *Al Moqadem* on climate change effects and adaptation interventions.
	Output 3.2. SFD Engineering Unit and extension services have the skills and capabilities to support a range of water harvesting technology designs and maintenance requirements/	SFD, EPA, NRWA	Develop site selection criteria. Establish and maintain a database of current rainwater harvesting sites and techniques to guide site selection. Provide training on principles of water harvesting, technique costing and community-education methods (EPA, NRWA). Participate in training on the principles of water harvesting, technique costing and community-education methods (SFD).
	Output 3.3. A set of incentives, such as concessional micro-loans, community grants and employment guarantees for construction and maintenance of water harvesting infrastructure	SGP, SFD, NWRA, EPA	Establish criteria for directing loans and incentives to communities who will yield maximum water harvesting benefits. Provide material grants for water harvesting interventions accompanied by implementation guidelines.

	introduced to stimulate community and private investment in water harvesting infrastructure, within target governorates.		Design and promote rainwater harvesting projects for CSR (SFD). Implement terrace and other water harvesting infrastructure rehabilitation to provide non-agricultural income between cropping seasons.

2.11. Explain compliance with UNDP Safeguards Policies

197. The UNDP environmental and social safeguard requirements have been followed in the development of this LDCF project. As outlined below, the project is not expected to have any negative environmental or social impacts.

198. The LDCF-financed project does include activities that support upstream planning processes. However, the envisaged revisions that will be proposed to national policies and strategies are not likely to have any negative environmental or social impacts. To the contrary, the project will have positive environmental and social impacts through influencing policies and strategies for climate-resilient development planning.

199. The implementation of water harvesting structures – proposed under Outcomes 2 and 3 – will reduce vulnerability to the effects of climate change. These proposed interventions will not impact natural resources negatively. The interventions will not only make water available for domestic, livestock and irrigation use, but will also have additional effects such as reducing soil erosion and flooding potential. In addition, the LDCF-financed project will not increase pollution or greenhouse gas emissions. On the contrary, the increase in biomass as the result of re-vegetation of slopes and improved irrigation will reduce greenhouse gas emissions.

200. Although the project will benefit local communities it is not expected that this will lead to localised population increases. Rather, it is expected that the approaches used will be spread to surrounding communities. The use of a community-based approach that is cost-effective and does not require advanced infrastructure makes it easily replicable. It is therefore possible for the benefits in the project sites to be realised in surrounding communities. The benefits of the project interventions will also reduce the vulnerability of communities to natural disasters, such as droughts and floods, and have a positive effect on health through improved hydration and nutrition. Communities will have improved livelihoods and are expected to have increased income. Consequently, the project is expected to have positive socio-economic effects.

201. Gender equality and the use of a community-based approach are focus areas of the LDCF-financed project. Consequently, project interventions will promote social equity and equality. All social consequences of the project are expected to be positive. Through consultation with women's groups in communities, the interventions that are focused on women will be culturally appropriate. In addition, the majority of interventions planned are traditional methods. The innovative methods, such as fog harvesting, have been readily taken up in areas where they have been applied. All interventions that will be implemented will be approved by the community through consultation.

202. As the project is expected to have either "no negative effects" or "positive effects" on the environment and communities it is not necessary for a full environmental and social review.

3. Project Results Framework

This project will contribute to achieving the following Country Programme Outcome as defined in CPAP or CPD:

Local Balanced Development

Country Programme Outcome Indicators:

Number of Communities engaged in climate change adaptation

Primary Applicable Key Environment and Sustainable Development Key Result Area:

Promote climate change adaptation

Applicable SOF (e.g. GEF) Strategic Objective and Program:

Climate Change Adaptation Objective CCA-1

Reducing vulnerability: Reduce vulnerability to the adverse impacts of climate change, including variability, at local, national, regional and global level

Climate Change Adaptation Objective CCA-3

Disseminating technology: Promote transfer and adoption of adaptation technology

Applicable SOF (e.g. GEF) Expected Outcomes:

Outcome 1.2: Reduced vulnerability to climate change in development sector

Outcome 3.1: Successful demonstration, deployment and transfer of adaptation technology in targeted areas

Applicable SOF (e.g. GEF) Output Indicators:

Output 1.2.1: Vulnerable physical, natural and social assets strengthened in response to climate change impacts, including variability

Output 3.1.1: Relevant adaptation technology transferred to targeted groups

	Indicator	Baseline	Targets End of Project	Source of verification	Risks and Assumptions
Project Objective **To re-introduce traditional and innovative water harvesting techniques to improve water availability to rain-fed farmers and pastoralist who are highly vulnerable to climate change**	1. Number of people benefitting from increased availability of domestic water given existing and projected climate change [AMAT 1.2.3] 2. Percentage of targeted groups adopting adaptation technologies by technology type	Number of people without access to improved drinking water[64] to be confirmed once pilot sites have been selected during implementation. Governorate level estimates of the number of people without access to improved water resources are as follows:	At least 2,000 people across all selected governorates benefiting from rooftop water harvesting and minimum 300 people benefitting from fog-harvesting 60% of training session attendees adopting water harvesting technologies	Baseline, mid-term and terminal verification survey at household level Expenditure reports, mid-term and terminal evaluation reports Surveys and questionnaires for attendees of training sessions	**Assumptions:** • Increased awareness and capacity of local communities will support the sustained maintenance beyond project implementation • Training sessions will increase capacity of institutional staff • Increased capacity will be applied in the field • Recommendations will be included in policies, strategies and plans • Policies, strategies and plans will be adhered to

[64] Access to an improved water source refers to the percentage of the population using an improved drinking water source. The improved drinking water source includes piped water on premises (piped household water connection located inside the user's dwelling, plot or yard), and other improved drinking water sources (public taps or standpipes, tube wells or boreholes, protected dug wells, protected springs, and rainwater collection).

	(disaggregated by gender) [AMAT 3.1.1]	• Ibb: 1,219,950. • Taiz: 1,374,300. • Sana'a 1,554,750. • Dhamar: 763,650. • Raymah: 226,350. • Al Mahweet: 284,400 Limited knowledge or resources for planning, implementation and maintenance of water-harvesting technologies in EPA NWRA, SFD and MoSAL			• Increased capacity of government technical staff to provide extension services and training **Risks:** • Rooftop and fog harvesting systems will fall into disrepair because of limited funds • Water harvesting interventions in agricultural lands will not be maintained because of limited funds or labour • Training sessions will not increase capacity • Increased capacity will not be applied in the field • Staff turnover will cause capacity to be lost • Recommendations will not be included into policies, strategies and plans • Policies, strategies and plans will not be adhered to
Outcome 1 **The technical capacity to integrate cost-effective water harvesting techniques at national and local institutions and in local Water Management Organisations (WMOs) to improve water security.**	1. Number of staff trained on the use of modern technologies related to analysis of climate information and availability of water resources, disaggregated by gender 2. Number of national- and local-level policies, strategies and plans for water harvesting developed	MoAI and NWRA staff have general GIS skills, but are not trained in the analysis of climate information, such as rainfall run-off models and remote sensing Currently no sector policies, strategies and plans that explicitly include water harvesting into the national water budget	20 staff (50 percent split between gender) trained on the use of modern technologies related to analysis of climate information and availability of water resources Recommendations for at least 5 sector policies, strategies and plans that explicitly include water harvesting into the national water budget	Surveys and questionnaires for attendees of training sessions Review of recommendations for policies, strategies and plans	**Assumptions:** • Data will be available or obtainable to develop models • Technical staff will be willing to attend training sessions • Recommendations for policies, strategies and plans will be accepted and mainstreamed • IWRM plans will be accepted by decisions-makers and local communities • Baseline and target updated by baseline study **Risks:** • Data cannot be collected or is not comprehensive enough to produce a sufficiently accurate model • Technical staff are constrained from attending training seminars • Policies, strategies and plans are not accepted by decision-makers or local communities and cannot be enforced • IWRM plans are not accepted by local communities and cannot be enforced

Outcome 2 **Water availability increased through introducing on-the-ground measures for water harvesting and rehabilitating traditional water harvesting structures.**	1. Number and type of water-harvesting techniques introduced to increase supply of irrigation water 2. Number of vulnerable communities trained on the use of water harvesting techniques for climate change adaptation	The number of communities benefiting from water harvesting systems will be determined once pilot sites have been determined Community representatives to participate in training will be identified once pilot sites have been established	At least 4 water-harvesting techniques demonstrated at pilot sites in target governorates, including: i) rooftop water harvesting; ii) inter-row, micro-, medium, large catchment harvesting; and iii) artificial recharge to increase irrigation water Representatives of at least 40 communities trained on using additional water harvesting practices	Baseline, mid-term and terminal verification survey at household level Expenditure reports, mid-term and terminal evaluation reports	**Assumptions:** • Roofs are suitable for water harvesting. • Communities perceive harvested water for domestic use is potable • Water harvesting is able to improve crop yields • Water harvesting techniques are adoptable • Agroforestry plots have in excess of 60% survival rate • Sediment measurements between flood events are consistent enough to show difference before and after traps are rehabilitated or implemented **Risks:** • Rooftop systems cannot provide potable water • Water harvesting systems are not adopted and/or maintained by beneficiaries • Agroforestry plots are not maintained and revert to a degraded state
Outcome 3 **Decentralised and community-led water management systems developed to cope with long-term impacts of climate change on water availability**	1. Number of WUAs in the target governorates trained on water management under changing climate scenarios 2. Area of terraces rehabilitated (m^2)	WUAs have limited training and become non-functioning over the long-term The sites for terraces rehabilitation will be determined once pilot sites have been identified at implementation	25 WUA representatives trained in water management under changing climate scenarios 40,000 m^2 of terrace rehabilitated	Baseline, mid-term and terminal verification survey at household level Expenditure reports, mid-term and terminal evaluation reports Records of areas designated before and after rehabilitation, including photographs	**Assumptions:** • WUA representatives and staff will be willing to attend training and follow-up sessions • Financing options are viable in terms of loans being repayable through increased crop yields from water harvesting • Material grants create water harvesting benefits • Allocated funds are sufficient to rehabilitate targeted area of terraces **Risks:** • WUA representatives and staff are constrained from attending training and follow-up sessions • Financing schemes fail to be sustainable • Material grants are insufficient to create sustainable water harvesting yields

					• Allocated funds are insufficient to rehabilitate targeted area of terraces

4. Total budget and workplan

Award ID:	00082016	**Project ID(s):**	00091112
Award Title:	Integrated Water Harvesting Technologies		
Business Unit:	YEM10		
Project Title:	Yemen: Integrated Water Harvesting Technologies to Adapt to Climate Change Induced Water Shortage		
PIMS no.	4989		
Implementing Partner	NWRA		

SOF (e.g. GEF) Outcome/Atlas Activity	Responsible Party/ Implementing Agent	Fund ID	Donor Name	Atlas Budgetary Account Code	ATLAS Budget Description	Amount Year 1 (US$)	Amount Year 2 (US$)	Amount Year 3 (US$)	Amount Year 4 (US$)	Total (US$)	See Budget Note:
OUTCOME 1: Technical capacity to implement cost-effective water harvesting techniques integrated in national and local institutions and communities to reduce climate induced water insecurity.	**NWRA**	**62160**	**LDCF**	71200	International Consultants	35,000	58,000	66,000	35,000	**194,000**	1a
				71600	Travel	3,800	7,900	13,100	2,400	**27,200**	1b, 1c
				72200	Vehicle	4,000	4,000	4,000	4,000	**16,000**	1e
				71300	Local Consultants	56,800	15,400	83,400	30,600	**186,200**	1d, 4a
				72800	Information Technology Equipment	20,200	0	0	0	**20,200**	1f
				71400	Contractual Services-Individuals	30,000	0	0	0	**30,000**	1g
				75700	Training & Workshops	27,140	77,670	70,350	25,170	**200,330**	1h
					Sub-total GEF	**176,940**	**162,970**	**236,850**	**97,170**	**673,930**	
					Total Outcome 1	**199,080**	**181,699**	**270,655**	**111,494**	**762,928**	
OUTCOME 2: On the ground measures for the introduction of water harvesting and rehabilitation of	**NWRA**	**62160**	**LDCF**	71200	International Consultants	46,100	20,000	20,000	20,000	**106,100**	2a, 4c
				71600	Travel	2,000	0	0	0	**2,000**	2b, 2c
				72200	Vehicle	35,950	0	0	0	**35,950**	2e

traditional water harvesting structures.				71300	Local Consultants	82,320	51,920	19,520	19,520	**173,280**	2d
				71400	Contractual Services-Individuals	458,796	1,329,843	310,996	310,996	**2,410,631**	2f
				74200	Audio-visual & Print	0	1,200	0	0	**1,200**	2g
				75700	Training & Workshops	114,320	73,550	52,800	52,800	**293,470**	2h
				72200	Equipment & Furniture	140,600	5,000	5,000	0	**150,600**	2i
					Sub-total GEF	**880,086**	**1,481,513**	**408,316**	**403,316**	**3,173,231**	
					Total Outcome 2	**974,865**	**1,696,838**	**454,872**	**450,572**	**3,577,147**	
Outcome 3: Decentralised and community-led water management systems developed to cope with long-term impacts of climate change on water availability.	**NWRA**	**62160**	**LDCF)**	71200	International Consultants	8,000	4,000	4,000	8,000	**24,000**	3a
				71600	Travel	2,400	0	0	2,400	**4,800**	3b, 3c
				71300	Local Consultants	60,320	13,760	13,760	13,760	**101,600**	3d
				75700	Training & Workshops	189,360	50,650	50,650	50,650	**341,310**	3e
				72300	Materials & Goods	76,145	76,145	0	0	**152,290**	3f
				71400	Contractual Services-Individuals	50,000	50,000	50,000	40,000	**190,000**	3g
				74500	Miscellaneous	1,500	1,500	1,500	1,500	**6,000**	3h
				74200	Audio-visual & Print	0	10,000	0	10,000	**20,000**	3i
					Sub-total GEF	**387,725**	**206,055**	**119,910**	**126,310**	**840,000**	
					Total Outcome 3	**439,243**	**230,167**	**135,555**	**142,717**	**947,682**	
Project management unit	**NWRA**	**62160**	**LDCF**	71400	Contractual Services – Individual	10,000	10,000	10,000	10,000	**40,000**	4a
				75700	Training, Workshops & Conf.	4,000	0	0	0	**4,000**	4b

				71200	International Consultants	40,000	0	40,000	40,000	**120,000**	4c
				72800	Information Technology Equipment	10,800	0	0	0	**10,800**	4d
				72500	Supplies	4,300	4,300	4,300	4,300	**17,200**	4e
				74100	Professional Services	3,500	3,500	3,500	3,500	**14,000**	4f
				74599	UNDP Cost Recovery Charges – Bills	20,868	922	922	4127	**26,839**	4g
					Total Management	**93,468**	**18,722**	**58,722**	**61,927**	**232,839**	
					PROJECT TOTAL	**1,518,218**	**1,929,261**	**803,798**	**668,723**	**4,920,000**	

Summary of Funds:

	Amount Year 1 (US$)	Amount Year 2 (US$)	Amount Year 3 (US$)	Amount Year 4 (US$)	Total (US$)
LDCF	1,518,218	1,929,261	803,798	668,723	4,920,000
UNDP	168,167	258,256	96,095	78,077	600,595
Environmental Protection Agency	560,000	860,000	320,000	260,000	2,000,000
National Water Resources Authority	3,336,000	5,160,000	1,920,000	1,584,000	12,000,000
Social Development Fund	3,976,000	6,106,000	2,272,000	1,846,000	14,200,000
TOTAL	9,558,385	14,313,517	5,411,893	4,436,800	33,720,595

Budget Note	**Description of cost item**
1a, 1b, 1c	International Resource Economist for 60-day contract at US$500 per day with 30 days DSA at US$140 per day and 2 international flights at US$1,000 each. Transport will be provided and is discussed under note 1e. The position includes evaluating the economic benefits of water harvesting in both rural and urban settings. The results will be compiled into a report for presentation to policy-makers and will include proposals for policies to support water harvesting.
1a, 1b, 1c	International Water Law Specialist for 60-day contract at US$500 per day with 30 days DSA at US$140 per day and 2 international flights at US$1,000 each. This position will review the current water laws, including traditional and customary practices, and the new structures of national institutions in the federal system. The specialist will prepare a draft report detailing proposed policy recommendations to facilitate water harvesting under projected climate change scenarios. The report should be based on the findings of the water harvesting economics report in addition to international water law practices. The position will also conduct a weeklong workshop with relevant stakeholders to discuss the findings of the draft report and incorporate the outcomes of this workshop into a final report.
1a, 1b, 1c	International GIS Training Specialist for 60-day contract at US$400 per day with 40 days DSA at US$140 per day and 3 international flights at US$1,000 each. This position will train NWSSIP representatives in a weeklong training workshop on remote sensing and GIS to produce simulation models for water harvesting. The

	specialist will also conduct 3 separate weeklong training workshops for MoAI and NWRA representatives on Rainfall-runoff Models and set real-life exercises for attendees to complete in between workshops. In addition, the position will be responsible for the assessment of the MoAI and NWRA attendees.
1a, 1b, 1c	International Water Resources Management Specialist for 80-day contract at US$500 per day with 30 days DSA at US$140 per day and 2 international flights at US$1,000 each. The position will meet with water managers from the 6 respective governorates to discuss the priorities, opportunities and limitations for proposed IWRM plans. The position will also include addressing workshops on international standards for IWRM, and advise on and review basin level IWRM plans.
1d	National GIS Specialist for 160-day contract at US$160 per day. This position will assess current state of GIS resources of Yemen under Activity 1.1.2, including: i) data relevant for water harvesting; ii) data quality; iii) human resources; iv) tools and infrastructure; and v) data and capacity gaps that can be addressed. Additionally, they will be responsible for organising the workshops discussed under budget note 1h.
1d	National Resource Economist for 80-day contract at US$200 per day. This position will work closely with the International Resource Economist in conducting an economic evaluation of water harvesting, including possible impacts under predicted climate change, land use scenarios, and aquifer depletion. They will consult stakeholders to develop case studies of water harvesting projects. In addition, they will assist in compiling the final report and making policy proposals.
1d	National Water Law Specialist for 75-day contract at US$200 per day. This position will organise the workshops to receive stakeholder input for law and strategy proposals. In doing so, they will work closely with the International Water Law Specialist by reviewing: i) current water laws; ii) the new structures of national institutions in the federal system; and iii) the draft report on proposed policies to ensure feasibility in Yemen's legal framework. Responsibilities will also include organising the workshop for the discussion of this draft.
1d, 3d	National Information Management Specialist for 80-day contract at US$160 per day. This position will create an online discussion forum in NWRA to facilitate dialogue on water harvesting between national, sub-national and community stakeholders under Activity 1.3.1. To facilitate involvement in this forum, this position will also organise workshops as discussed under budget note 1h. Furthermore, a database of water harvesting techniques and sites will be maintained by this position. The establishment of the database will include a workshop with relevant stakeholders to receive input. This position will also assist the National WUA Specialist in establishing governorate discussion forums for Water User Associations.
1d	6 Governorate-level IWRM Specialists, each on 80-day contracts at US$200 per day. These positions will create basin-level IWRM plans to include water harvesting under predicted climate change scenarios under Activity 1.32. This is to be done using models developed under Activity 1.1.4. The International IWRM Specialist will assist with these activities. Stakeholder input will also be received from local water managers through workshops as discussed under budget note 1h.
1d, 2d, 3d	National Water Harvesting Specialist for 345-day contract at US$160 per day. This position will: i) assess existing water harvesting programmes, projects and initiatives; ii) oversee the implementation of pilot sites under Activity 2.1.2; iii) train contract teams and oversee their work; iv) present on water harvesting at governorate workshops and demonstration plots; v) develop criteria for selecting communities for water harvesting; vi) assist the National Information Management Specialist with their responsibilities; vii) train SFD-EU and extension services on the principles of water harvesting, technique costing and local community-education methods under Activity 3.2.3; and viii) assist the National Community Finance and CSR Specialist to establish criteria, including biophysical and socio-economic conditions, for directing loans and incentives to local communities under Activity 3.3.1.
1e	Vehicle (see budget note 2e) maintenance is budgeted at US$4,000 per year to provide transport for international and national consultants under Components 1 and 2. However, it is possible that the security situation will prevent them from travelling. In this case, this budget will be reallocated to providing public transport for stakeholders to travel to Sana'a.
1f	Budget is allocated to buy suitable GIS software for MoAI and NWRA representatives. If required, it can be put towards buying hardware that is sufficient to handle the RRM data.
1g	Pending the outcomes of the workshop under budget note 1h., a contract will be developed to hire a specialist to collect data to complete the modelling under Activity 1.1.4. Depending on the findings of this workshop, there may be a single contract created, or multiple contracts if there is a diversity of data sources and locations for it to be measured.
1h	Under Activity 1.1.1, a one-week workshop in Sanaa for 40 NWSSIP members to for training in remote sensing and GIS to produce simulation models. This workshop will be organised by the National GIS training Specialist. The total amount for the workshop is US$17,400, which includes venue hire, meals, stationary, and transport and accommodation for non-Sanaa residents.
1h	Under Activity 1.1.2, the National GIS training Specialist will organise a one-day workshop in Sanaa for 40 representatives from: i) WEC ii) YRSC); iii) Sana'a Water and Sanitation Local Corporation; iv) MoWE; and v) the SFD. This workshop will assess national data resources and identify data gaps for i) hydrogeological monitoring, ii) groundcover, iii) water supply and distribution; and iv) road networks. The total amount for the workshop is US$5,630, which includes venue hire, meals, stationary, and transport and accommodation for non-Sanaa residents.
1h	Under Activity 1.1.5, the National GIS training Specialist will organise three one-week workshops in Sanaa for 40 MoAI and NWRA representatives for training in Rainfall-run off modelling. Each workshop will cost, US$17,550, which includes venue hire, meals, stationary, and transport and accommodation for non-Sanaa residents.

1h	Under Activity 1.2.2 and 1.2.3, the National Water Law Specialist will organise six one-day workshops in Sanaa for 40 representatives from MoAI, MoWE, MoPIC and Ministry of Finance to propose changes to policies and strategies to include potential climate change effects. The total amount for the workshop is US$1,830, which includes venue hire, meals, stationary, and transport and accommodation for non-Sanaa residents.
1h	Under Activity 1.2.4, a one-week workshop in Sanaa for 40 representatives from NWRA, EPA, SFD, MoWE, MoAI, MoPIC and other institutions will be organised by the National Water Law Specialist to facilitate implementation of water harvesting under new federal government institutions. The total amount for the workshop is US$17,550, which includes venue hire, meals, stationary, and transport and accommodation for non-Sanaa residents.
1h	Under Activity 1.3.1, the National Information Management Specialist will organise four one-day workshops in Sanaa for 40 representatives from national and sub-national NWRA offices. This workshop will gather information for a discussion forum in NWRA to facilitate dialogue on water harvesting between national, regional and community stakeholders The total amount for each workshop is US$7,230, which includes venue hire, meals, stationary, and transport and accommodation for non-Sanaa residents.
1h	Under Activity 1.3.1, the National Information Management Specialist will organise annual one-day workshops in each of the six selected governorates for 40 representatives of NWRA, MoAI, MoWE, WUA and other institutions. These workshops will update information for the discussion forum as well as promote its benefits to members. The total amount for each workshop is US$2,380, which includes venue hire, meals, stationary, transport and accommodation.
1h	Under Activity 1.3.2, the Governorate IWRM Specialist will organise six one-day workshops in each of the selected governorates for 25 local water managers. These workshops will include harvested water under predicted climate change scenarios using models developed under Activity 1.1.4 as part of basin-level IWRM plans. The total amount for each workshop is US$1,680, which includes venue hire, meals, stationary, transport and accommodation.
2a, 2b, 2c	International Geohydrologist for 60-day contract at US$400 per day with 45 days DSA at US$140 per day and 2 international flights at US$1,000 each. This position will oversee the governorate geohydrologists in the selection of appropriate sites, planning and implementation for artificial recharge. This will include 1 trip during the selection and planning phase, and another trip during implementation.
2d	National Fog Harvesting Specialist for 65-day contract at US$160 per day. This position will: i) develop a fog harvesting manual based on past-Yemeni and international projects and techniques; ii) host workshops to disseminate the fog harvesting manual; iii) install “screen” fog harvesting in selected sites; iv) train local communities in maintenance of fog harvesters and record keeping; v) measure the impact of fog harvesting; and vi) present these findings to relevant institutions.
2d	Five Governorate Water Harvesting Specialists each for 116-day contracts at US$120 per day. This position will work in close collaboration with the national water harvesting expert and national WUA expert. Responsibilities include: i) implementing the demonstration plots; ii) providing technical oversight and assistance to local communities; iii) organising training workshops for local communities; iv) facilitating community discussion forums; and v) promoting water harvesting and grey water recycling.
2d	National Masonry Specialist for 78-day contract at US$160 per day. The position will organise workshops, select candidates to attend and train them. He will also conduct follow-up visits to report on the effect of the training. Transport will be provided for the follow-up visits.
2d	National Rangeland and Alien Vegetation Removal Specialist on 175-day contract at US$160 per day. This position will organise workshops discussed under budget note 2h. They will also be responsible for the removal of alien vegetation in canals. Furthermore, they will work in conjunction with national and governorate water harvesting experts to use vegetation as anti-erosion and water harvesting techniques, and exclusion barriers for agroforestry plots.
2d	National Hydrological Modelling Specialist for 30-day contract at US$200 per day. This position will coordinate the training for the MoAI, NWRA and NWSSIP. Furthermore, this position will develop the outcomes of the training into a report to be communicated to the national and Governorate Water Harvesting Specialists as well as the Governorate IWRM specialists.
2d	National Education and Information Specialist for 30-day contract at US$160 per day. This position will: i) work with the National Information Management Specialist to gather relevant information; ii) organise and host workshop with government representatives to verify and enhance information as well as receive input on information dissemination; iii) compile information into educational packages with specific target audiences; and iv) assist the National Media Campaign Specialist to present at governorate workshops.
2d	National Media Campaign Specialist for 125-day contract at US$160 per day. This position will: i) use the information gathered by the National Education and Information Management Specialist to design a print, radio and billboard campaign to raise awareness for the water crisis and proposed methods to address it; ii) organise and host 2-day workshops in each of the selected governorates, in conjunction with the National Education and Information Management Specialist, to present water harvesting information; and iii) follow-up on developments in the UNDP project and incorporate this into the media campaign.
2e	A vehicle will be bought for the project and used by international and national consultants who are required to travel to governorates to perform on their deliverables. The budget allocated to this is US$35,950 at the outset of the project.
2f	Rooftop water harvesting systems to the value of US$260,000. SFD guidelines suggest a maximum of US$130 spent per person. Therefore, this activity will benefit a minimum of 2,000 people.

2f	Demonstration plots will be implemented at selected sites. At a daily wage rate of US$10 per day, the project can make use of 35,000 labour days to demonstrate the value of micro-, medium and large catchment water harvesting.
2f	Fog harvesters have an approximate price of US$800 depending on site access. This price includes labour and material. The proposed project intends to implement a minimum of 60 across 12 communities.
2f	Three hydrogeological contracts with one in Sana'a governorate, one in either Ibb or Taiz, and the last in Dhamar or Al Mahweet. Each contract will be 60 days at US$160 per day. These contracts will be used to determine the preferred sites for 3 artificial recharge sites, with each implementation contract amounting to US$258,682.
2f	24 nurseries growing coffee and other agroforestry species will be established. The all-inclusive cost of each nursery is US$9,900 based on the WAM's procedure. This includes technical study of location in Year 1 (US$1,500), construction (US$5,000), supervision and follow-ups (US$1,000), beneficiary training (US$1,500), tools and seeds (US$900).
2f	Annual funding of US$100,000 is made available for the clearing of alien invasive species in canals and the replanting of canal banks with agroforestry species. At US$10 per labour day, 10,000 days of labour per year can be created for this activity.
2f	27 sediment traps will be constructed in selected canals that have been rehabilitated. Each costs US$7,400 to implement.
2f	US$54,000 is allocated to produce and broadcast a water harvesting campaign for radio.
2f	US$30,000 is allocated to design and install billboards on water harvesting.
2g	US$1,200 is allocated for the printing of the fog harvesting manual for dissemination to relevant NGOs
2h	Under Activities 2.1.2 and 2.4.1, 40 one-day community workshops will be held to discuss methods for improving infiltration followed by one day of field demonstrations. These will be hosted *in-situ* by the national and respective governorate water harvesting experts. Transport (under budget note 2e) and accommodation (US$80) will be provided for the national specialist to travel between communities. Tools and materials are contained under budget note 2i.
2h	Under Activities 2.1.3 and 2.3.1, 40 two-day community workshops will be held to train communities on the principles of water harvesting and methods for implementing inter-row, micro- and medium catchment water harvesting. Transport (under budget note 2e) and accommodation (US$80) will be provided for the national specialist to travel between communities. Tools and materials are contained under budget note 2i.
2h	Under Activities 2.2.2 and 2.2.4, six one-day community workshops will be held to train communities on fog harvesting principles, implementation, record keeping and maintenance. This will be followed by a five-day construction of the harvesters. Accommodation at US$80 per night will be provided.
2h	Under Activities 2.3.2 and 2.3.3, five two-day governorate workshops will be held to: i) train CBOs to monitor and advise farmers, pastoralists and rural households on water harvesting techniques; and ii) train both CBOs and WUGs on forming WUAs according to lessons learned from Output 3.1. Approximately 40 representatives will attend in each of the respective governorates. The total amount for the workshop is US$5,640, which includes venue hire, meals, stationary, transport and accommodation.
2h	Under Activity 2.3.4, five weeklong governorate workshops will be held to train selected candidates on masonry for water harvesting. Each workshop will host six candidates in a community selected by the National Masonry Specialist. Accommodation will be provided for the candidates. Materials are contained under budget note 2i. The cost of each workshop is US$3,000.
2h	Under Activity 2.3.5, four one-day workshops will be held each year in each governorate to discuss water harvesting interventions and give feedback on successes and failures. Approximately 40 representatives from WUGs will attend. The total amount for the workshop is US$2,480, which includes venue hire, meals, stationary, transport and accommodation.
2h	Under Activity 2.4.5, 40 one-day workshops will be held to train 40 local communities in the protection of upper catchments. This will be organised by the National Rangeland and Alien Vegetation Removal Specialist. Approximately 40 representatives will attend. The total amount for the workshop is US$100, which includes transport and accommodation for the national specialist. Materials are contained under budget note 2i.
2h	Under Activity 2.5.2, 40 two-day workshops will be held to train 40 local communities in the removal and control of alien vegetation. This will be organised by the National Rangeland and Alien Vegetation Removal Specialist. Approximately 40 representatives will attend from each community. The total amount for the workshop is US$100 that includes transport and accommodation for the national specialist. Materials are contained under budget note 2i.
2h	Under Activity 2.6.2, the National Education Specialist will organise a one-day workshop in Sanaa for 40 representatives from Ministry of Education, MoWE, NWRA, MoAI, NGOs. The total amount for the workshop is US$5,430, which includes venue hire, meals, stationary, and transport and accommodation for non-Sanaa residents.

2h	Under Activity 2.6.5, the National WUA Specialist will organise five two-day governorate workshops, one in each of the respective governorates, for 40 representatives from public buildings and mosques. The total amount for the workshop is US$2,904, which includes venue hire, meals, stationary, transport and accommodation.
2i	Tools and materials under Activities 2.1.2 and 2.1.3 are budgeted at US$88,000 initially with annual replacement budgets of US$4,000 in Years 2 and 3.
2i	Masonry tools under Activity 2.3.4 are budgeted at US$5,000.
2i	Tools and materials required under Activity 2.5.2 and 2.5.3 are allocated US$53,100. This includes annual replacement budgets of US$3,000 in Years 2 and 3.
2i	Outcome 2 will allocate US$500 for compact digital cameras for monitoring purposes.
3a, 3b, 3c	International Community Water Management Specialist for 60-day contract at US$400 per day with 20 days DSA at US$140 per day and four international flights at US$1,000 each. This position will assist the national WUA Specialist in creating protocols and structures for successful WUAs and training *Al Moqadem*.
3d	National Water User Association Specialist for a 195-day contract at US$160 per day. This position will assemble data on WUAs, train relevant parties, including current and prospective WUA representatives, government officials and *Al Moqadem*. This will be done in workshops (under budget note 3e). They will also establish the WUA discussion forums under Activity 3.1.5.
3d	National Community Financing and CSR Specialist for 150-day contract at US$160 per day. This position will: i) establish criteria for directing loans and grants to local communities; and ii) implement materials and tools grant programme to selected communities. They will also promote CSR investment into water harvesting.
3d	National Terrace Rehabilitation Specialist for 80-day contract at US$160 per day. This position will: i) select sites within the respective governorates; ii) select contractors based on proven experience in rehabilitation; and iii) provide oversight for terrace rehabilitation through ensuring the work is done to specification.
3e	Under Activity 3.1.2, six one-day governorate workshops will be held, one in each of the respective governorates, to train approximately five government representatives in assisting prospective WUAs for registration. The total amount for the workshop is US$400, which includes venue hire, meals, stationary, and transport and accommodation for the National WUA Specialist.
3e	Under Activity 3.1.3, six weeklong governorate workshops will be held, one in each of the respective governorates, to train approximately 25 WUA representatives in assisting prospective WUAs for registration. It will be organised by the National WUA Specialist. The total amount for the workshop is US$12,520, which includes venue hire, meals, stationary, transport and accommodation. In addition, one-day annual follow-up workshops will be held in years 2, 3 and 4. These workshops will cost US$5,640 each.
3e	Under Activity 3.1.4, six one-day governorate workshops will be held, one in each of the respective governorates, to train approximately 25 *Al Moqadem* in conflict resolution. It will be organised by the National WUA Specialist. The total amount for the workshop is US$5,640, which includes venue hire, meals, stationary, transport and accommodation.
3e	Under Activity 3.1.5, six two-day governorate workshops will be held, one in each of the respective governorates, with 40 WUA representatives, NWRA, MoAI, MoWE and other representatives to create discussion platforms for sharing water harvesting experiences. It will be organised by the National WUA Specialist. The total amount for the workshop is US$8,740, which includes venue hire, meals, stationary, transport and accommodation. In addition, seven one-day national bi-annual follow-up workshops will be held starting from the end of Year 1. These workshops will cost US$2,420 each.
3e	Under Activity 3.2.1, a one-day workshop will be held with 40 NWRA, MoAI, MoWE and other representatives in Sanaa to establish criteria for selecting target communities and areas. It will be organised by the National Water Harvesting Specialist. The total amount for the workshop is US$5,430, which includes venue hire, meals, stationary, and transport and accommodation for non-Sanaa residents.
3e	Under Activity 3.2.2, six one-day governorate workshops will be held, one in each of the respective governorates, with 20 NWRA, MoAI, MoWE and other representatives to establish and maintain a database for current water harvesting sites and techniques. It will be organised by the National Water Harvesting Specialist. The total amount for the workshop is US$1,330, which includes venue hire, meals, stationary, and transport and accommodation for the national specialist.
3e	Under Activity 3.2.3, six weeklong governorate workshops will be held, one in each of the respective governorates, to train 30 SFD, NWRA, MoAI and NGO representatives on the principles of water harvesting, technique costing and local community-education methods. It will be organised by the National Water Harvesting Specialist. The total amount for each workshop is US$13,600, which includes venue hire, meals, stationary, transport and accommodation. In addition, 3 annual follow-up workshops will be held starting from Year 2 to facilitate discussion on experiences in water harvesting implementations and projects. These workshops will cost US$1,980 each.
3f	Material for water harvesting to the value of US$152,290 will be purchased and distributed to communities based on the outcomes of the criteria development workshop under Activity 3.2.1. Materials will include: i) tools such as spades, picks, hoes, hammers and wheelbarrows which can be used to repair or build water harvesting structures; and ii) consumables for sealing cisterns, for example.

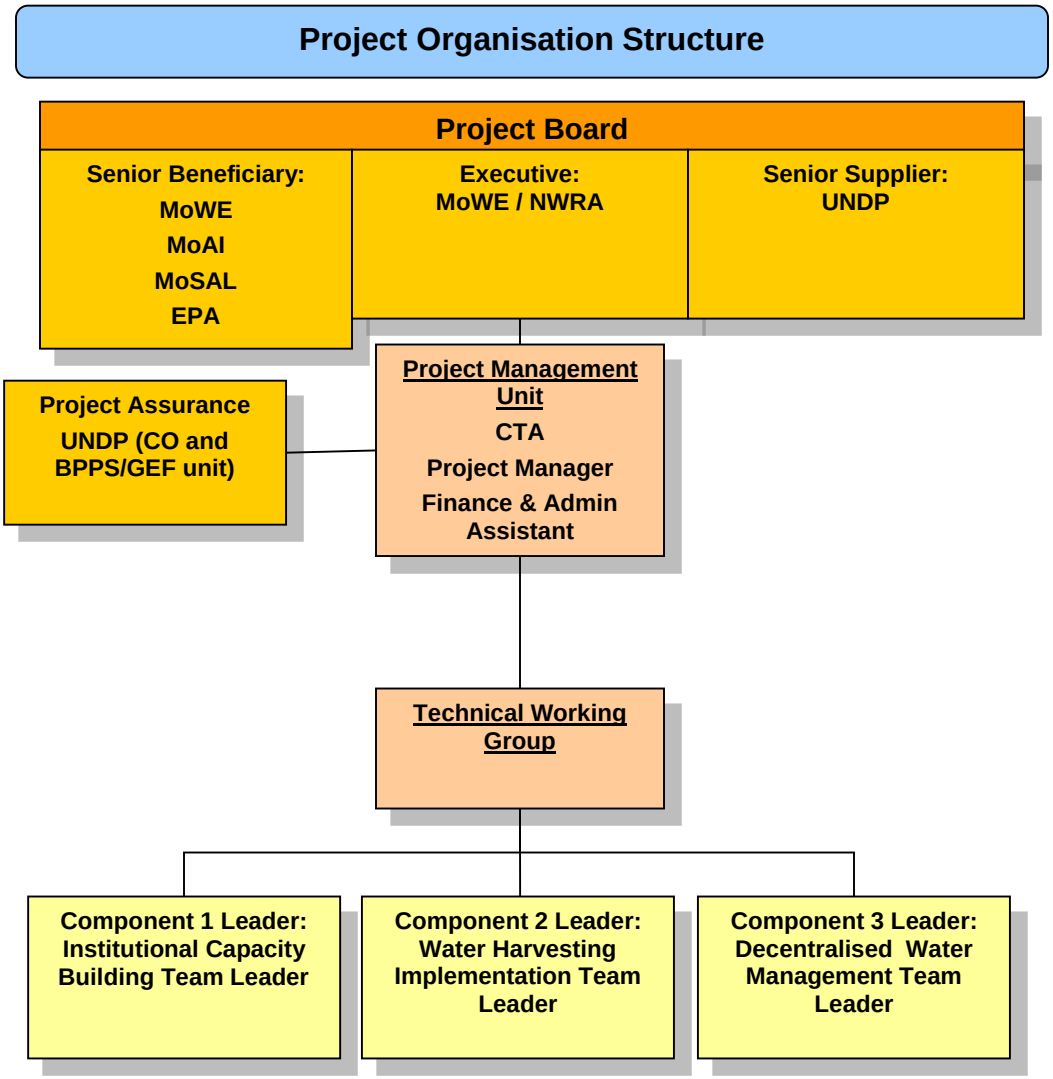
3h	US$190,000 is allocated to terrace rehabilitation. Using conservative costing, based on the GWSCP of US$6-8/m of terrace wall, this should be able to rehabilitate a minimum of 23.75 km of terrace wall.
3h	US$1,500 is allocated to the maintaining of the WUA discussion forum and the water harvesting database.
3i	US$10,000 is allocated to the printing of the manual on WUA protocols and procedures. US$10,000 is allocated to the printing and presentation of the LDCF-financed project document.
4a	Project Manager hired on a four-year contract at US$24,000 per year.
4b	Two-day Project Inception Workshop to be hosted in Sana'a with all relevant stakeholders.
4c	International Monitoring and Evaluation Specialist for baseline, mid-term and terminal evaluation.
4c	Chief Technical Advisor @ US$500 per day for 40 days in each year
4d	US$10,800 for computer equipment for project management in year one.
4e	General office supplies are budgeted @ US$4,300 per year.
4f	Annual audit @ US$3,500 per year.
4g	Estimated UNDP Direct Project Costs for project execution services to support the procurement of goods and services, recruitment, payments, etc. The services are charged on an item-by-item basis against UNDP's Universal Price List. The estimated breakdown is described below. • Staff selection and recruitment: 2 staff @ US$998.79 = US$1,997.58 • Staff HR & Benefits Administration & Management: 2 staff @ US$228.86 = US$457.72 • Issue IDs: 2 staff @ US$33.49 = US$66.98 • International consultant recruitment: 6 consultants @ US$365.53 = US$2,193.18 • National consultant recruitment: 29 consultants @ US$365.53 = US$10,600.37 • Payment process associated with consultants: 35 consultants x 2 payments each @ US$32.98 = US$2,308.60 • Low value procurement (Project Board meetings): 16 (4 per year) workshops @ US$202.01 = US$3,232.16 • High value procurement and disposal of equipment: 5 procurement and disposal processes[65] @ (US$786.37 + US$410.18) = US$5,982.75 • Total = US$26,839.34

[65] Based on one procurement and one disposal for each of the following groups of items: i) office computers; ii) office equipment/furniture; iii) digital cameras; iv) tools; and v) GIS software and computers.

5. Management Arrangements

The Project will be implemented through the National Implementation Modality (NIM) by the NWRA, under the MoWE. The NWRA is the GEF political focal point in Yemen and a completed capacity assessment of the NWRA is presented in Annex 5.2.

5.1 Project Structure



The **Project Board** is responsible for overall management and decision-making for the project, and will provide administrative support and guidance to the Project Manager. The Project Board will play a critical role in Monitoring and Evaluation (M&E) of the project's activities and will apply the results of M&E to inform an adaptive management approach, particularly with respect to project performance, improvement, accountability and learning. The Project Board is responsible for arbitration of any conflicts that emerge within the project, including the negotiation of mutually agreeable solutions to any problems or disputes with external bodies. In addition, the Board approves the appointment and responsibilities of the Project Manager and any delegation of its Project Assurance responsibilities. Based on the approved Annual Workplan, the Project Board can also consider and approve the quarterly plans – if applicable – and also approve any essential deviations from the original project design.

In order to support UNDP's ultimate accountability for the project's outcomes, Project Board decisions will be made in accordance with standards that will achieve cost-effectiveness, fairness, integrity, transparency and effective international competition. In case consensus cannot be reached within the Board, the final decision shall rest with the Chief Technical Advisor (CTA) or Project Manager, with the CTA having final authority.

Potential members of the Project Board are reviewed and recommended for approval during the PAC meeting. Representatives of other stakeholders can be included in the Board as appropriate. The members of the Board will fulfil four distinct roles, including:

1. **An Executive:** A senior representative of the NWRA will fulfil this role to represent the project and chair the Project Board.
2. **Senior Supplier:** An individual or group from the UNDP CO representing the interests of the donor (LDCF) as well as parties providing co-financing for specific cost-sharing projects and/or technical expertise to the project. The Senior Supplier's primary function within the Board is to provide guidance regarding the technical feasibility of the project.
3. **Senior Beneficiary:** An individual or group representing the interests of the local communities who will ultimately benefit from the project. The Senior Beneficiary's primary function within the Board is to ensure the realisation of project results from the perspective of project beneficiaries. A Senior Beneficiary is still to be selected for the project, but potential candidates include representatives of the SFD, NWRA, MoWE and MoAI.
4. **Project Assurance:** An individual that supports the Project Board Executive by carrying out objective and independent project oversight. The Project Manager and Project Assurance roles cannot be held by the same individual. The UNDP CO will select a representative from within its organisation to fulfil this role.

Project Manager: The Project Manager (PM) will run the project on a day-to-day basis on behalf of the Implementing Partner under the oversight of the Project Board. The PM is responsible for delivering the results and outcomes specified in the project document, to the required standard of quality and within the specified constraints of time and cost. The PM will report on a weekly basis to the TM and the CTA on the progress and challenges encountered on the ground during the execution of activities. In particular, the PM will: i) provide on-the-ground information for UNDP progress reports; ii) engage with stakeholders; iii) organise the PSC meetings; iv) provide technical support to the project, including measures to address challenges to project implementation; and v) participate in training activities, report writing and facilitation of consultant activities that are relevant to his/her area of expertise.

EPA: The EPA is the focal point of UNFCCC, and in charge of coordinating donor-finance climate change interventions. Moreover, EPA is the national agency in charge of oversight, and enforcement of Environmental law, and coordinating international environmental and climate change conventions. Therefore, the EPA which has a climate change is will be responsible for the coordination and oversight of Government's actions on climate change including this project. Furthermore, the project's Environmental Impacts Assessment (EIA) will be carried out in coordination with EPA.

A technical working group will be established to support the PM and will comprise three **Component Team Leaders** (CTL), including: i) Institutional Capacity Building Team Leader; ii) Water Harvesting Implementation Team Leader; and iii) Decentralised Water Management Team Leader. The responsibility of the CTLs will be to promote: i) the timely execution of activities and achievement of expected deliverables under the respective components of the project; ii) dialogue between stakeholders, particularly at a local level; and iii) participation of institutions and local communities in project activities. The CTLs will be selected from the National Consultants to be hired for the implementation of specific activities. Appendix 6 contains more details on the role of these consultant positions. The selection will be made depending on the relative skills of the applicants. The exception will be the Component 2 CTL who will be the National Water Harvesting Consultant. As this consultant position has a wide and extensive role, the appointee will have the requisite skills to provide the role of CTL. The various National Consultants required to implement

activities under Components 1 and 3 have more specific roles within those components. Therefore, the CTL for these components will be selected upon the review of the capacity of the National Consultants appointed within these respective components.

Project Support: The Project Support will be provided by the Finance and Administration Assistant position. The role of this position is to provide project administration and management support to the PM. An administrative assistant will be employed for the duration of the project.

5.2 Project Management

UNDP will engage NWRA to implement activities and budget lines based on Letters of Agreement signed between UNDP and the Ministries (see Annex 12). In order to receive funds and implement activities, implementing partners are required to have a satisfactory assessment (Annex 5.2) of their financial and management capacity, as well as open a bank account in the name of the project.

UNDP Direct Project Costs (DPCs) for project execution services include support for the procurement of:

- Staff selection and recruitment of two PM staff;
- HR & Benefits Administration & Management of the PM staff;
- Issuing IDs for the PM staff;
- International consultant recruitment;
- National consultant recruitment;
- Payment processes associated with consultants;
- Low value procurement (Quarterly Project Board meetings); and
- High value procurement and disposal of equipment.

The services are charged on an item-by-item basis against UNDP's Universal Price List. The estimated breakdown is described under budget note 4g in Section 4. The total DPC is US$26,839.34

Audit: Project audits are under the mandate of the UNDP Office of Audit and Investigation (OAI). The project audit regime is determined by the implementation modality. Expenditure incurred under the NIM modality may be subject to annual NIM audits, based on pre-determined risk and expenditure thresholds. The cost of audits will be included within the project budget. Results of audits will be shared with the Project Board.

6. Monitoring Framework and Evaluation

The project will be monitored through the following M&E activities. The M&E budget is provided in the table below.

Project start:
A Project Inception Workshop will be held <u>within the first 2 months</u> of project start with those with assigned roles in the project organisation structure, UNDP country office and where appropriate/feasible regional technical policy and programme advisors as well as other stakeholders. The Inception Workshop is important for building ownership for the project results and to plan the first year annual work plan.

The Inception Workshop should address a number of key issues including:

a) Assist all partners to fully understand and take ownership of the project. Detail the roles, support services and complementary responsibilities of UNDP CO and PMU staff vis à vis the project team. Discuss the roles, functions, and responsibilities within the project's decision-making structures, including reporting and communication lines, and conflict resolution mechanisms. The Terms of Reference for project staff will be discussed again as needed.
b) Based on the project results framework and the relevant SOF (e.g. GEF) Tracking Tool if appropriate, finalize the first annual work plan. Review and agree on the indicators, targets and their means of verification, and recheck assumptions and risks.

c) Provide a detailed overview of reporting, monitoring and evaluation (M&E) requirements. The Monitoring and Evaluation work plan and budget should be agreed and scheduled.
d) Discuss financial reporting procedures and obligations, and arrangements for annual audit.
e) Plan and schedule Project Board meetings. Roles and responsibilities of all project organisation structures should be clarified and meetings planned. The first Project Board meeting should be held within the first 12 months following the inception workshop.

An Inception Workshop report is a key reference document and must be prepared and shared with participants to formalize various agreements and plans decided during the meeting.

Quarterly:

- Progress made will be monitored in the UNDP Enhanced Results Based Management Platform.
- Based on the initial risk analysis submitted, the risk log shall be regularly updated in ATLAS. Risks become critical when the impact and probability are high. Note that for UNDP GEF projects, all financial risks associated with financial instruments such as revolving funds, micro-finance schemes, or capitalization of ESCOs are automatically classified as critical on the basis of their innovative nature (high impact and uncertainty due to no previous experience justifies classification as critical).
- Based on the information recorded in Atlas, a Project Progress Reports (PPR) can be generated in the Executive Snapshot.
- Other ATLAS logs can be used to monitor issues, lessons learned etc. The use of these functions is a key indicator in the UNDP Executive Balanced Scorecard.

Annually:

- Annual Project Review/Project Implementation Reports (APR/PIR): This key report is prepared to monitor progress made since project start and in particular for the previous reporting period (30 June to 1 July). The APR/PIR combines both UNDP and GEF reporting requirements.

  The APR/PIR includes, but is not limited to, reporting on the following:
  - Progress made toward project objective and project outcomes - each with indicators, baseline data and end-of-project targets (cumulative)
  - Project outputs delivered per project outcome (annual)
  - Lesson learned/good practice
  - AWP and other expenditure reports
  - Risk and adaptive management
  - ATLAS QPR
  - Portfolio level indicators (i.e. GEF focal area tracking tools) are used by most focal areas on an annual basis as well.

Periodic Monitoring through site visits:

UNDP CO and the PMU will conduct visits to project sites based on the agreed schedule in the project's Inception Report/Annual Work Plan to assess first hand project progress. Other members of the Project Board may also join these visits. A Field Visit Report/BTOR will be prepared by the CO and UNDP RCU and will be circulated no less than one month after the visit to the project team and Project Board members.

Mid-term of project cycle:

The project will undergo an independent Mid-Term Evaluation at the mid-point of project implementation (March 2017). The Mid-Term Evaluation will determine progress being made toward the achievement of outcomes and will identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; will highlight issues requiring decisions and actions; and will present initial lessons learned about project design, implementation and management. The findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term. The organisation, terms of reference and timing of the mid-term evaluation will be decided after consultation between the parties to the project document. The Terms of Reference for this Mid-Term Evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and

UNDP-EEG. The management response and the evaluation will be uploaded to UNDP corporate systems, in particular the UNDP Evaluation Office Evaluation Resource Center (ERC).

The relevant GEF Focal Area Tracking Tools will also be completed during the mid-term evaluation cycle.

End of Project:
An independent Final Terminal Evaluation will take place three months prior to the final Project Board meeting and will be undertaken in accordance with UNDP and GEF guidance. The final evaluation will focus on the delivery of the project's results as initially planned (and as corrected after the mid-term evaluation, if any such correction took place). The final evaluation will look at the impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental benefits/goals. The Terms of Reference for this evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-EEG.

The Final Terminal Evaluation should also provide recommendations for follow-up activities and requires a management response which should be uploaded to PIMS and to the UNDP Evaluation Office Evaluation Resource Centre (ERC).

The relevant GEF Focal Area Tracking Tools will also be completed during the final evaluation.

During the last three months, the project team will prepare the Project Terminal Report. This comprehensive report will summarize the results achieved (objectives, outcomes, outputs), lessons learned, problems met and areas where results may not have been achieved. It will also lay out recommendations for any further steps that may need to be taken to ensure sustainability and replicability of the project's results.

Learning and knowledge sharing:
Results from the project will be disseminated within and beyond the project intervention zone through existing information sharing networks and forums.
The project will identify and participate, as relevant and appropriate, in scientific, policy-based and/or any other networks, which may be of benefit to project implementation though lessons learned. The project will identify, analyse, and share lessons learned that might be beneficial in the design and implementation of similar future projects.
Finally, there will be a two-way flow of information between this project and other projects with a similar focus.

Communications and visibility requirements:
Full compliance is required with UNDP's Branding Guidelines. These can be accessed at http://intra.undp.org/coa/branding.shtml, and specific guidelines on UNDP logo use can be accessed at: http://intra.undp.org/branding/useOfLogo.html. Amongst other things, these guidelines describe when and how the UNDP logo needs to be used, as well as how the logos of donors to UNDP projects needs to be used. For the avoidance of any doubt, when logo use is required, the UNDP logo needs to be used alongside the GEF logo. The GEF logo can be accessed at: http://www.thegef.org/gef/GEF_logo. The UNDP logo can be accessed at http://intra.undp.org/coa/branding.shtml.
Full compliance is also required with the GEF's Communication and Visibility Guidelines (the "GEF Guidelines"). The GEF Guidelines can be accessed at: http://www.thegef.org/gef/sites/thegef.org/files/documents/C.40.08_Branding_the_GEF%20final_0.pdf.
Amongst other things, the GEF Guidelines describe when and how the GEF logo needs to be used in project publications, vehicles, supplies and other project equipment. The GEF Guidelines also describe other GEF promotional requirements regarding press releases, press conferences, press visits, visits by Government officials, productions and other promotional items.
Where other agencies and project partners have provided support through co-financing, their branding policies and requirements should be similarly applied.

M & E workplan and budget

Type of M&E activity	Responsible Parties	Budget US$ *Excluding project team staff time*	Time frame
Inception Workshop and Report	▪ Project Manager ▪ UNDP CO, UNDP CCA	Indicative cost: 10,000	Within first two months of project start up
Measurement of Means of Verification of project results.	▪ UNDP CCA RTA/Project Manager will oversee the hiring of specific studies and institutions, and delegate responsibilities to relevant team members.	To be finalized in Inception Phase and Workshop.	Start, mid and end of the project (during the evaluation cycle) and annually when required.
Measurement of Means of Verification for Project Progress on output and implementation	▪ Oversight by Project Manager ▪ Project team	To be determined as part of the Annual Work Plan's preparation.	Annually prior to ARR/PIR and to the definition of annual work plans
ARR/PIR	▪ Project manager and team ▪ UNDP CO ▪ UNDP RTA ▪ UNDP EEG	None	Annually
Periodic status/ progress reports	▪ Project manager and team	None	Quarterly
Mid-term Evaluation	▪ Project manager and team ▪ UNDP CO ▪ UNDP RCU ▪ External Consultants (i.e. evaluation team)	Indicative cost: 40,000	At the mid-point of project implementation.
Final Evaluation	▪ Project manager and team, ▪ UNDP CO ▪ UNDP RCU ▪ External Consultants (i.e. evaluation team)	Indicative cost: 40,000	At least three months before the end of project implementation
Project Terminal Report	▪ Project manager and team ▪ UNDP CO ▪ Local consultant	0	At least three months before the end of the project
Audit	▪ UNDP CO ▪ Project manager and team	Indicative cost per year: 3,000	Yearly
Visits to field sites	▪ UNDP CO ▪ UNDP RCU (as appropriate) ▪ Government representatives	For GEF supported projects, paid from IA fees and operational budget	Yearly
TOTAL indicative COST Excluding project team staff time and UNDP staff and travel expenses		US$102,000 (+/- 5% of total budget)	

7. Legal Context

This document together with the CPAP signed by the Government and UNDP, which is incorporated by reference, constitute together a Project Document as referred to in the SBAA [or other appropriate governing agreement] and all CPAP provisions apply to this document.

Consistent with Article III of the Standard Basic Assistance Agreement, the responsibility for the safety and security of the implementing partner and its personnel and property, and of UNDP's property in the implementing partner's custody, rests with the implementing partner.

The implementing partner shall:

1. put in place an appropriate security plan and maintain the security plan, taking into account the security situation in the country where the project is being carried; and

2. assume all risks and liabilities related to the implementing partner's security, and the full implementation of the security plan.

UNDP reserves the right to verify whether such a plan is in place, and to suggest modifications to the plan when necessary. Failure to maintain and implement an appropriate security plan as required hereunder shall be deemed a breach of this agreement.

The implementing partner agrees to undertake all reasonable efforts to ensure that none of the UNDP funds received pursuant to the Project Document are used to provide support to individuals or entities associated with terrorism and that the recipients of any amounts provided by UNDP hereunder do not appear on the list maintained by the Security Council Committee established pursuant to resolution 1267 (1999). The list can be accessed via http://www.un.org/Docs/sc/committees/1267/1267ListEng.htm. This provision must be included in all sub-contracts or sub-agreements entered into under this Project Document.

This project will be audited in accordance with UNDP Financial Regulations and Rules and applicable audit policies.

8. Annexes

Annex 1: Reference List

1. Noman, A.A. 2004. Indigenous knowledge for using and managing water harvesting techniques in Yemen. Civil Engineering Department, Water and Environment Center (WEC), Sana'a University, Sana'a, Yemen.

2. AFDB. 2008. Rainwater harvesting handbook: assessment of best practices and experience in water harvesting. African Development Bank. Available at http://www.rural-water-supply.net/en/resources/details/268 Accessed on 26 March 2014.

3. Al –Eshlah, A., Al-Rubaidi, H. & Al-Sabri, A. 2013. Agriculture's contribution to solving the water crisis. National Conference for the Management and Development of Water Resources in Yemen. Available at www.**yemenwater**.org/wp-content/uploads/2013/03/Paper-2-B.pdf Accessed on 26 March 2014.

4. Al-Derwish, A. & Dottridge, J. 2013. Evaluation of user satisfaction or rural water supply in Yemen. Journal of Water, Sanitation and Hygiene for Development 3(3): 322-331.

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Annex 2: Key Assessment Reports

1. Inception Workshop Report

Integrated Water Harvesting to Adapt to Climate Change in Yemen

Report from Inception Workshop

Held at the offices of the UNDP in Yemen on the 15 December 2013

The workshop began at 9:30 am. It was conducted in Arabic and translations to English were done through Abdulkareem Almakaleh.

Summary

This report will highlight the main outcomes, discussion points and follow-up actions resulting from the workshop. The main overarching outcomes of the workshop were to: i) notify potential stakeholders to the LDCF project, ii) initiate discussion on how to align and collaborate existing and planned projects with this one, iii) update stakeholders on the water resources situation in Yemen, iv) show selected examples of projects being implemented, v) begin to elaborate on Activities under predetermined outputs as outline in the PIF, vi) develop criteria for measuring their success on implementation. Outcomes i-iv are discussed in more detail under ***Presentations*** (Page 2). Outcomes v-vi are discussed in more detail under ***Group Discussions*** (Page 4).

Details on the attendees, schedule, and discussion groups, are contained in Annexes at the end of the report.

Introduction

There were 35 participants in attendance (see Annex 1). Participants were selected based on the in-country associates of the **UNDP Poverty and Sustainable Development Unit Team Leader, Fuad Ali Al-Kadasi, UNDP National Climate Change Policy Advisor**, **Walid Ali** and **National Consultant, Saif Alhakimi**.

It was debated whether an honorarium should be offered to participants who would have to travel long distances. It was decided against as it would complicate the already challenging circumstances, which are elaborated on in the below paragraph. Although this meant that the workshop was not attended by representatives from the targeted governorates and experts based outside of Sana'a, it did mean that those who were present were there of their own accord and this was displayed in the levels of enthusiasm shown during the workshop.

The workshop was also held under exceptional circumstances with regards to the security situation. The original intention was to host it at a conference facility. But, owing to recent criminal events, most importantly the coordinated car bombing and attack on the Ministry of Defence, it was decided that only the UNDP offices itself would be able to provide the required security. Also, the originally planned two-day format for the workshop was condensed into a single day. Additionally, the second **International Consultant, K.S. Viswanatham**, was not allowed to travel to Yemen to fulfil his contractual obligations. **International Consultant and Team Leader for the PPG**, **Anton Louw,** was fortunately already in country when the decision to stop incoming missions was taken. As such, he was able to attend the Inception Workshop. With the above in mind, risk mitigation measures for continuing the PPG phase effectively are being explored under the assumption that the present security arrangements will remain in place.

Presentations

The workshop was introduced by **Walid Ali, National Climate Change Policy Advisor, UNDP Yemen**. He noted that the problem the LDCF project was addressing is that Yemen is running out of the groundwater resources on which it has depended and many rural areas are already with inadequate water resources.

The proposed solution to this problem is to revive traditional water harvesting techniques and introduce new ones to access the country's rainwater resources.

Speakers:

(For a full schedule, please see Annex 4.2)

- *Welcoming Remarks:* **UNDP Deputy Director, Mr Sultan Hajiyev**
  Mr Hajiyev welcomed participants and noted the reasons for the exceptional hosting of the workshop, offered his condolences for recent events and reiterated the UNDP's resolution to addressing the challenges in Yemen. The role of water in addressing poverty as a method of undermining extremism was highlighted. It was because of this role, that the decision was made for the workshop to proceed. He thanked participants for their partnership and attendance.

- *NWRA Remarks:* **NWRA Chairman, Mr. Ali Al-Suraimi**
  Mr Al-Suraimi thanked God, the UNDP and all organisations present for showing an interest in one of the most important crises facing Yemen. He noted that poverty was the over-riding reason for recruitment to terrorism, that active measures are needed to redress this or risk further destabilisation in the country and region, and that the state and international community needs to prioritise the water resources to address poverty and livelihoods. He looked forward to meeting us all again under improved circumstances.

- (**EPA Chairman, Dr Khalid Alshibani**, was scheduled to speak, but was unfortunately delayed. He offered his apologies on arrival.)

- *Project objectives, proposed work plan and implementation modalities, activities, outcomes, outputs and Results Based Management (RBM) for the LDCF Project:* **PPG Team Leader, Anton Louw, C4 EcoSolutions.**

  Anton Louw spoke about the requirements and structure for a GEF-funded Adaptation Project. His presentation's main points were:
  - The clear distinction between climate change adaptation, climate change mitigation.
  - How adaptation is included in existing baseline projects as an 'additionality'.
  - The requisite participatory approach and its purpose in establishing ownership of the project for stakeholders.
  - The process for the development of a LDCF Full Size Project.
  - A brief overview of the project components.
  - The requirements for the current PPG phase of the project. This included: i) data and information to be collected; ii) stakeholder consultations; iii) monitoring and evaluation criteria to meet Results Based Management requirements
  - The project workplan and institutional arrangements

- *Water Resources Vulnerability and Adaptation to Climate Change in Yemen Republic: Evaluation and Planning System (WEAP) model for Water resources – Case Studies*: **National Consultant, Saif Alhakimi.**

  The main points in this presentation were:

  - Brief outcomes of previous studies on climate change impacts on water resources in Yemen, supported by GEF, NCAP (Netherlands) and others were discussed. This referred to the different case studies conducted in areas, like Wadi Abyan Delta, Sadah Basin, Sana'a Basin, Aden and Al-Hudaida (Wadi Surdod).
  - A number of basins studied are drying up in a few years (1 or 2 decades), based on modelling and calibrations of models.
  - This stressed the urgency of finding an alternate solution to the groundwater depletion, particularly in the cities of Sana'a and Taiz.

- The urgency for rainwater harvesting in Yemen, particularly in cities of larger populations, is therefore justified.
- Rooftop water harvesting has high potential in urban, and rural areas provided they are cost effective. Newly built residential compounds in cities, implemented by investment banks, are strong candidates for this in urban areas. Governmental offices, ministries, schools, universities and the like, can also use rooftop water harvesting, as an adaptation option.
- The current artificial groundwater recharge systems in the western and eastern parts of Sana'a city are inefficient, due to the limited drainage areas and such recharging areas not being monitored through neighbouring wells.
- For many years, the simple advice made by engineers and water researchers of not paving middles or islands of large streets was not heeded to by decision makers. Particularly, this was emphasized in 2004, while the speaker was acting as a consultant for the parliament.

- *Presentation on Traditional and Innovative Water Harvesting Techniques in Manakhah, Sana'a Governorate*: **Ahmed Yehia Ali, National Foundation for Watershed Management Services**

  - Manakhah has a scarcity of water and pollution issues. It is a very isolated area.
  - A pilot intervention project was supported by the UNDP Regional Water Governance Project for Arab States (WGP-AS) and implemented by the National Foundation for Watershed Management Services.
  - Terracing, rooftop harvesting and fog-harvesting are providing solutions for irrigation and drinking water.
  - Terracing: Traditional terracing methods have been enhanced by an innovative fog harvesting method. This consists of stone layering around coffee trees at a diameter of 2-3 m. Three sizes of stone layering are used. The most important aspect is this harvests the fog as it condenses on the stones. It also improves fertility of soil, limits weeds and retains soil moisture
  - Cisterns: This is a common system in Yemen. Some consist of digging shafts into rocks. This prevents water from pollution and limits evaporation. Another method uses bamboo to make roofs for open cisterns to limit evaporation. This is an example of using locally available materials to address local problems. These cisterns also have drains for cleaning. Pollution problems were solved by providing filters.
  - Innovative 'modern' fog harvesters: In this area, 6 months of fog occur outside of the rain season. The community showed initial scepticism, but recognized benefits quickly and uptake was then spontaneous. This method consists of a screen made from normal shade-cloth. 15-60 litres per day were being harvested from a screen that was 2 x 3 metres. This provided enough drinking water for a family of 5 for 3-4 months. It was the first time that the community had seen clear water. Previously, they prayed for the fog to go because of the danger of low visibility and moisture causing plant diseases. Now, they pray for fog to provide drinking water. Previous attempts at fog harvesting in Yemen have failed. The key is to keep them close to the homes for ease of access for maintenance ease.
  - A nursery for coffee was also built in order to replace water intensive *qat*.
  - Before they began these initiatives, they educated the community on the value of water and water resource management.

Group Discussions

The components of the LDCF project were discussed in a plenary session in further detail so that participants could select a group in which to engage in discussions. It was requested that representatives from the same agency should divide themselves between the discussion groups in order to spread institutional knowledge. The group breakdown, including the moderators, is contained in Annex 3.

The outputs, as outlined in the project description, are listed below, along with each component to facilitate links with activities and interventions suggested by participants.

The proposed amendments to outputs and interventions produced by each group by each group were as follows:

Component 1: Capacity and policies for traditional and innovative water harvesting developed.

Outputs:

Output 1.1. Environmental Protection and Water Resources Authorities, in conjunction with Sana'a University and National GIS centre, assisted to produce rainfall-runoff models based on GIS, using Digital Elevation Models (DEM) and satellite imageries, to simulate key parameters for selection of water harvesting (including, artificial recharge techniques) in various locations of the country.

Output 1.2. Water harvesting regulation integrated into the Water Law of Yemen to include harvested water as part of the national water budget.

Output 1.3. Long term, climate-resilient water plans that include, integrated water harvesting that facilitates ground water recharge and supplementary irrigation from the harvested flood waters have been prepared for six target governorates of Ibb, Taiz, Sana'a, Dhamar, Al Mahweet and Raymah.

Concerned parties:

1. Governmental: Ministry of Water and Environment (MoWE): National Water Resources Authority (NWRA), Environment Protection Authority (EPA), General Authority for Rural Water Supply (GARWS), Administrative offices and projects affiliated with the above.

2. Ministry of Agriculture and Irrigation (MoAI): National Programme for Irrigation (NIP) Food Security Project, Agricultural Research Extension Authority (AREA), Tihama Development Authority (TDA)

3. Ministry of Local Administration (MLA)

4. Other governmental parties: Social Fund for Development (SFD), Public Works Project (PWP), Economic Opportunities Project (EOP), Agricultural and Fisheries Production Enhancement Fund (AFPEF)

5. Civil Society Organisations (CSO): Water User Groups (WUG), Basins' Committees.

6. Academia: Sana'a University, Department of Earth and Environmental Science; Sana'a University, Faculty of Engineering.

Suggested interventions included supporting relevant policies and strategies, as indicated below:

1. National Water Sector Strategy and Investment Programme (NWSSIP) through: i) technical support and capacity building in the field of remote sensing and GIS for producing simulation models and; institutional support to implement the water law and its executive bylaws.

2. National Strategy for the Agriculture Sector through: i) supporting the third strategic goal pertaining to the implementation of the water harvesting programme by focusing on maintenance and rehabilitation of agricultural terraces and; ii) supporting the fifth strategic goal pertaining to the activities related to climate change, through maintenance and rehabilitation of agricultural terraces.

3. Making use of the guidelines on Integrated Water Resource Management (IWRM) in the field of decision-making and introducing policies in the water harvesting program.

4. Updating policies and strategies to include issues related to climate change.

5. Creating a mechanism of coordination, to include research parties, as part of the main tasks and responsibilities of the concerned parties.

6. Introducing water harvesting programmes and activities in the annual national budget of the concerned parties, based on the principle references, represented by Water Law and other strategies.

7. Updating plans of IWRM in the main administration offices on the level of basins, so that they include methods and activities of integrated water harvesting.

8. Making lawful and legislative inventories and evaluations of all activities and programmes concerned with the field of water harvesting, and updating them.

Component 2: On the ground measures for the introduction of water harvesting and rehabilitation of traditional water harvesting structures.

Outputs:

Output 2.1. Five traditional water harvesting technologies re-introduced in six identified governorates: i) inter-row water harvesting; ii) micro-catchment water harvesting; iii) rooftop water harvesting; iv) medium-sized catchment water harvesting; v) large catchment water harvesting.

Output 2.2. Fog harvesting technology introduced in one coastal and/or mountainous governorate (Raymah and Al Hadaydah).

Output 2.3. At least 900 community members (local farmers, pastoralists and rural households) from Ibb, Taiz, Sana'a, Dhamar, Al Mahweet and Raymah governorates have been trained in the construction and maintenance of water harvesting technologies.

Output 2.4. Integrated groundwater recharge systems established as part of the integrated water harvesting infrastructure.

Output 2.5. Supplementary irrigation from floodwater harvesting technique introduced.

Output 2.6. Awareness raising programme designed and implemented for all six identified governorates to promote socio-economic benefits of water harvesting.

The suggested activities and interventions were as follows:

Output 2.1: For (1) inter-row harvesting: i) added resilience through mulching was suggested as an activity to limit evaporation and encourage infiltration. This included stone and gravel, or organic material. For (3) rooftop harvesting past experience showed that household scale interventions, such as this method, were more successful than larger or communal scale interventions. Additional resilience activities include: ii) assessing the need for additional storage using predictive modelling in order to capture all available rainfall and; iii) an overflow pipe which could be used to irrigate a shade providing tree and/or a home garden. For (2) micro-, (4) medium- and (5) large catchment water harvesting: as mentioned above under rooftop harvesting, smaller scale and individually managed systems have had greater success in the past. For this reason, activities will include: iv) establishing assessments of the reasons why larger interventions are unsuccessful (e.g. internal community conflict); v) promoting strategies to overcome these reasons; and vi) implementing larger projects in areas, which are more conducive for success.

Output 2.2: As in Ahmed Yehia Ali's presentation, fog harvesting – both modern and traditional methods – shows potential. Activities for this will include: i) educating communities on the principles, providing the materials and methods for construction and maintenance; ii) gathering data from community operated pilot projects; iii) exploring the business potential for this technique; iv) promoting the experimentation of this method, e.g., using bamboo frames for construction, different rock size, shape and layout plans.

Output 2.3: Training in construction and maintenance: Based on the principles used in the SFD's successful Community-Led Total Sanitation programme, this output will not apply a prescriptive approach. Activities will include: i) training communities on the principles of water harvesting; ii) providing an inventory of

techniques; iii) monitoring individually designed and practiced interventions; iv) hosting community feedback sessions to share lessons learned amongst and between communities.

Output 2.4: Groundwater recharge systems: It was noted that failed past attempts resulted from the inadequate evaluation of the geohydrology in intervention sites. This is possibly because of sites being determined based on political affiliations. This refers to larger scale groundwater recharge system that divert flood waters into aquifers. However, there are smaller-scaled interventions that recharge shallow aquifers or soil water. These do not require engineering interventions or geohydrological surveys. As such, activities under this component will include: i) promoting small-scale groundwater recharge methods such as infiltration dams, swales, infiltration ditches; ii) promoting methods for increasing soil infiltration in agricultural fields; iii) evaluating the potential for groundwater recharge in urban areas, including the effects of pollution; iv) evaluating potential sites in rural areas based on hydrological and socio-economic conditions.

Output 2.5: Flood water harvesting was unfortunately not discussed in detail in the group discussion. It will therefore be emphasized in stakeholder consultations.

Output 2.6: Awareness raising programmes: It was noted that awareness to rainwater harvesting is already relatively high in rural areas because of the limited distribution networks and the role of agriculture in these communities. However, as migration towards urban areas increases, general awareness levels will decline. Although, domestic water use is a much smaller proportion of water used when compared to irrigation, its effect on well-being and health is far greater. Additionally, with existing urban groundwater supplies are set to run-out and the current trend of trucking rural groundwater into urban areas, education on water harvesting in urban areas will have a significant influence on national water resources in the future. Activities under this output include: i) including water harvesting and water resources education in the school syllabus; ii) promoting water management as a career option in secondary schools; iii) promoting water harvesting and grey water recycling in public buildings and mosques that includes public displays of the methods and impacts of this initiative, e.g. signs painted on tanks stating the purpose of the tank and how much water it collects and signs in public building gardens stating that it is irrigated with grey water and explaining what grey water is and; iv) billboards in towns noting the current initiatives and associated water savings, e.g. billboard with adjustable figures stating total surface area used for water harvesting, recent rainfall and amount of water saved.

Indicators to assess site selection were discussed. It was decided that the preferred indicator site selection, apart from the required bio-physical conditions related to certain interventions, was poverty. A poverty indicating tool suitable to the Yemeni context, such as the SFD's, will be selected. It was noted during discussions, that although the document is gender neutral, unless it specifically states that it will benefit women, this vulnerable group is overlooked and the intended gender sensitivity does not occur. For this reason, the poverty level indicator used will have a particular focus on benefitting women.

In selecting larger directly implemented interventions, the sustainability of the intervention will be assessed. This includes measuring the level of participation occurring and the capacity building focus of the initiative.

Regulations to promote water harvesting were also discussed. With the fragile state of Yemen currently, it was decided that applying prescriptive or restrictive policy measures would be met with resistance and would be difficult or costly to enforce. As such, the best regulations to promote would encourage an empathy amongst public officials at all levels and set an example for people to follow.

Component 3: Decentralized and community-led water management systems developed to cope with long-term impacts of climate change on water availability.

Outputs:

Output 3.1. At least 6 Water User Associations of the target governorates provide customer-oriented water distribution and seasonal rationing services for communal harvested water, with full engagement of the community members and traditional *Al Moqadem's* of the target communities.

Output 3.2. Social Fund for Development Engineering Unit and at least six extension services have the skills and capabilities to support range of water harvesting technology designs and maintenance requirements.

Output 3.3. Suite of incentives, such as concessional micro-loans, community grants, employment guarantee (for construction and maintenance) introduced to stimulate community and private investment in water harvesting infrastructure, benefiting 20,000 people of the target governorates.

The suggested activities to reach outputs were:

1. Identifying suitable geographical sites or places for harvesting rainwater in the six governorates, Sana'a. Taiz, Dhamar, Ibb, Al Mahweet and Raymah, using topographic maps, satellite images, geologic maps or other means.

2. Finding or selecting the appropriate harvesting techniques to carry out rainwater harvesting in the six governorates, benefiting from experiences gained by locals, engineers and traditional practitioners, or improving such techniques, if present at some governorates.

3. Finding or contacting the water user groups in the six governorates, if present, or establishing new ones with an adequate mechanism, agreed upon by locals.

4. Establishing a suitable mechanism for coordinating work among concerned institutional parties regarding rainwater harvesting, and building or enhancing institutional capacities (cadres, skilled workers, etc.), including strengthening the awareness program, monitoring and evaluation methodologies to ensure effectiveness and reliability of the techniques applied.

5. Capacity building in the main concerned administration unit (SFD Headquarter) and in the affiliated branches, or aligned units at other institutions.

6. Establishing a database for current sites and techniques of rainwater harvesting and incorporating in it any new sites and techniques.

7. Agreeing on using certain criteria to be used when selecting certain areas, districts or water user groups, for rainwater harvesting practices, for example, targeting 'unfortunate' and remote areas and areas inhabited by the powerless poor.

8. Establishing a suitable mechanism for directing loans and incentives to the deserved and needy individuals, with periodic monitoring and evaluation of accomplished work.

9. Offering loans in the form of material and supplies rather than cash means.

10. Directing loans to people producing agricultural crops and animal livestock that may contribute positively to food security.

Omissions

Because of time constraints, the workplan and institutional responsibilities were not discussed. This will be addressed by the consultants, the implementing partner and baseline partners in the coming weeks.

Conclusions

1. Despite challenges in organising the workshop, it was well attended and the level of enthusiasm and energy is encouraging for the development and implementation of the LDCF project.
2. The knowledge for implementations is mostly in existence in Yemen. However, it needs to be collated and made available to both implementing agencies and communities.

3. The role of women needs to be highlighted, not only to ensure gender equity, but to achieve a greater impact through implementations.
4. Site selection will be done using a poverty indicator.
5. The current instability needs to be factored into the management and design of the project. This will be addressed as part of the risk mitigation.

Recommended Action Plan

1. Organising a follow-up workshop to select suitable indicators in order to validate site selection. The omissions stated above will also be finalised at this workshop.
2. Contacting other stakeholders who were not present at workshop to bring them up-to-date.
3. Gathering data on existing projects and data that will complement and inform this project.
4. Formulating a clear plan for the completion of deliverables from stakeholders, including production of maps, building runoff models and coordinating data sharing.
5. Finalising activities, as well as detailing them for their implementation.
6. With the current security situation, the national consultant will require assistance in order to complete tasks that were to be performed by the international consultants.

Annex 2.1: Participants and contact details:

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Annex 2.2: Schedule

Time	Details	Speaker
9:00-9:30 am	Registration	
9:30-9:40 am	Welcoming remarks	UNDP Deputy Director-Programme, Mr. Sultan Hajiyev
9:40-9:50 am	EPA keynote address	EPA Chairman, Dr. Khalid Ashibani
9:50-10:00 am	NWRA keynote address	NWRA Chairman, Ali Al-Suraimi
10:00-10:15 am	Project objectives, proposed work plan and implementation modalities, activities, outcomes, outputs and Results Based Management (RBM) for the LDCF Project	PPG Team Leader (Anton Louw, C4 EcoSolutions)
10:15-10:25 am	Water Resources Vulnerability and Adaptation to Climate Change in Yemen Republic Evaluation and Planning System (WEAP) model for evaluation of Water resources - Case study	Saif, National PPG consultant (5 – 10 mins)
10:25-10:40	Coffee break	
10:40-1:00 am	*Discussions in four working groups:* *Tasks:* • *Propose activities to achieve outcomes, including interventions, regulations, education and awareness* • *Establish baseline and target criteria* • *Determine site selection criteria* • *Determine RBM and incentives* • *Determine first-year project work plan and key milestones* • *Propose laws regarding water harvesting, education and awareness* • *Review the Terms of Reference, roles and responsibilities for project staff* (Tasks will vary according to group)	Moderators: Fuad Ali Saif Alhakimi Walid Ali Anton Louw
1:00-1:30 pm	Facilitated discussion and feedback from the groups	Group presentations -Moderators
1:30-2:30	- Finalization of workplan, key milestones and modifications for the LDCF Project - Closing remarks	Anton Louw and Saif Alhakimi
2:30-3:00 pm	Lunch	

Annex 2.3: Groups for component discussions:

Component 1 Participants:
1. Dr. Gafar Shawtah
2. Eng. Mahmood Sultan
3. Eng. Munir Karhash
4. Eng. Anwar Abdulaziz
5. Dr. Abdulla Noaman
6. Eng. Mohamed Al-Emad
7. Eng. Sadek Al-Nabhany
8. Eng. Fahmy Ben Shebrak
9. Fuad Ali Al-Kadasi

Component 2 Participants:
1. Mr. Anton Louw (Moderator)
2. Eng. Abdullah Al-Thary
3. Dr. Wadie Saif Thabit Al-Ariqi
4. Dr. Husnia Al Kadri
5. Mohammed Alariqi
6. Abdulbaqi Ghailan
7. Hani Mohammed Saad
8. Ahmed M. Naser
9. Ali Kasem As sayagi
10. Anwar Noaman
11. Ahmed Yahia Ali
12. Dr. Omar Al-Sakaf
13. Dr Mohamed Fara

Component 3 Participants:
1. Eng. Ahmed Yehia Al-hassan
2. Eng. Maha Abdulatif Al-ban
3. Dr. Baseem Shaief Alkhirbash
4. Hani Mohamed Sa'ad
5. Dr. Hishm Mohamed Naji
6. Dr. Saif Ali Alhakimi (Moderator)
7. Eng. Hanan Al-Massany
8. Walid Ali (Moderator)

Annex 3: Risk Analysis

	Risk	Impact and Probability	Mitigation measure	Assumption
1	Technical staff and community leaders are constrained from attending training sessions.	I: 4 P: 2	Transport costs will be paid for trainees to attend training sessions.	Technical staff and community leaders will be willing to attend training sessions.
2	Attendance of training sessions does not result in the adoption of water harvesting.	I: 4 P: 2	Training will include climate change effects to emphasize benefits of water harvesting. Pre- and post-training assessments of capacity will be conducted.	Trainees leave training with improved capacity.
3	Local communities are sceptical about the reliability of water harvesting to satisfy their water needs and are not willing to commit their workforce in the proposed adaptation measure.	I: 4 P: 2	Meetings held with local stakeholders to explain project activities and enlist support. Evidence from successful projects will be presented. E.g. WAM fog harvesting project Local communities will be trained in selecting most beneficial techniques.	Local communities are aware of the benefits of water harvesting and, if not, will respond positively to evidence of success.
4	Reluctance of local institutions to change the status-quo of groundwater use and promote water harvesting.	I: 4 P: 2	Data of groundwater depletion and predicted outlooks will be presented to justify alternatives.	Local institutions are aware of the groundwater situation and realise that alternative water supplies are required.
5	Project focal points are unable to procure the necessary materials to implement community-level interventions for water harvesting.	I: 4 P: 3	Interventions will be designed to be as simple as possible.	Project focal points will be able to spend funds appropriately and timeously.

			Interventions will use locally available materials.	
6	Political unrest resulting in delays to project implementation.	I: 4 P: 4	The project manager and UNDP CO will continuously monitor the security situation. Community buy-in will contribute towards the safety of the project team and facilitate implementation.	The political situation is improving and local communities will recognise the project's benefits and avoid actions that might jeopardise it.
7	Uncertain climate change projections cause scepticism for water harvesting in policy and decision-makers	I: 3 P: 2	Presentation of evidence that water harvesting will be beneficial for soil and water resources regardless of the eventual climate change effects.	Water harvesting is a favoured option to provide domestic and irrigation water under the current water crisis in Yemen.
9	Antipathy for government prevents cooperation from local communities.	I: 4 P: 2	Meetings held with local stakeholders to explain project activities and enlist support.	Local communities will welcome projects that address their livelihood needs.
10	Communal harvested water becomes a source of conflict and dispute.	I: 3 P: 3	Implementations will be decentralised as much as possible. For those requiring communal management, community organisations will be trained in managing conflict. Dispute resolution mechanisms will be created.	Local communities have the incentive to create cooperative arrangements and methods of resolving disputes are strong enough to have binding decisions.
11	Suggested regulations and plans are unenforceable.	I: 3 P: 3	Meetings with local stakeholders to	Officials have the means and capacity to

			explain the benefits of cooperation.	enforce regulations and plans.

Annex 4: Terms of Reference

Annex 4.1: Key Project Positions

1. Project Manager (PM)

Scope of Work
The PM will lead the project team and provide overall operational management for the successful execution and implementation of the project. This includes the daily responsibility to manage, coordinate, and supervise the implementation of the project and the delivery of results in accordance with the project document and agreed work plans. Furthermore, the PM will be responsible for financial management and disbursements, with accountability to the government and UNDP. The PM will report to the CTA and the PSC.

Responsibilities:
- Oversee and manage project implementation, monitor work progress, and ensure timely delivery of outputs.
- Report to the CTA and the PSC regarding project progress.
- Develop and facilitate implementation of a comprehensive monitoring and reporting system.
- Ensure timely preparation of detailed AWPs and budgets for approval by PSC.
- Write ToRs with the CTA.
- Assist in the identification, selection and recruitment of staff, consultants and other experts as required.
- Supervise, coordinate and facilitate the work of the Technical Working Group, M&E specialist, national focal point and technical unit (including national and international consultants).
- Control expenditures and assure adequate management of resources.
- Provide a quarterly update of the expenses of the previous three months and the expenses expected for the next three months.
- Establish linkages and networks with the on-going activities of other government and non-government agencies.
- Provide input to management and technical reports and other documents as described in the M&E plan for the overall project. Reports should contain detailed assessments of progress in implementing activities, including reasons for delays, if any, and recommendations on necessary improvements.
- Inform the PSC, without delay, of any issue or risk which might jeopardise the success of the project.

Qualifications
- Master's degree in environment, natural resources management, water management, agriculture or a closely related field.
- A minimum of 10 years relevant work experience including at least 6 years' experience as a lead project manager in relevant sectors.
- Demonstrated solid knowledge of adaptation to climate change, ecological restoration and sustainable exploitation of natural resources.
- Experience in the public participation development process associated with the environment and sustainable development is an asset.
- Experience in working and collaborating within governments is an asset as well as experience in GEF projects.
- Fluent in English, including writing and communication skills.

Reporting
During the project implementation phase, the PM will be a staff member of the EPA and will report to the PSC. The PM will work closely with the PSC and CTA to provide information on progress and performance regarding the implementation of the project.

2. Chief Technical Adviser (CTA)

Scope of Work
The CTA will provide technical guidance on the implementation of the project to the NPC.

Responsibilities
- Provide quality assurance and technical review of project outputs.
- Undertake technical review of project outputs (e.g. studies and assessments).
- Write ToRs for technical consultancies with the PM (including policy revisions when necessary).
- Supervise the work of national and international consultants.
- Assist in monitoring the technical quality of project M&E systems (including AWPs, indicators and targets).
- Conduct the financial administrative reporting.
- Provide advice on best suitable approaches and methodologies for achieving project targets and objectives.
- Provide a technical supervisory function to the work carried out by NTAs, and national and international consultants hired by the project.
- Assist in knowledge management, communications and awareness-raising.
- Facilitate the development of strategic regional and international partnerships for the exchange of skills and information related to climate change adaptation.

Qualifications
- At least an advanced post-graduate at or above Master's level in climate change adaptation or a related discipline such as disaster risk reduction, environmental management, natural resources management, agriculture and water resources management.
- A minimum of 5 years' experience in a senior technical lead position with planning and management of environmental and/or natural resources management programmes in developing countries.
- A minimum of 5 years in a senior technical position involved in institutional strengthening and capacity building.
- Previous similar experiences in provision of technical support to complex projects.
- Experience from Middle-East region would be an advantage.
- Good communication and computer skills.
- Fluent in English, including writing and communication skills with knowledge of Arabic a distinct advantage.

Reporting

The CTA will report to the chair of the PSC. The CTA will cooperate with the PM to ensure the availability of information on progress and performance in the implementation of the project. In the performance of his/her duties, the CTA will work in close collaboration with TM, and update him/her on the project's progress. Additionally, in consultation with the TM, the CTA will take responsibility for decision-making and implementation of the project.

3. Finance and Administration Assistant

Scope of Work
The Project Assistant will undertake the administration of the day-to-day operations of the project office and be responsible for the reporting of project financing.

Responsibilities
- Set up and maintain all files and records of the project in both electronic and hard copies.
- Collect project related information and data.
- Establish document control procedures.
- Compile, copy and distribute all project reports.
- Provide logistical support to the international consultants in organising training events, workshops, and seminars.
- Draft necessary correspondence with local and international agencies and stakeholders.

- Standardise the finance and accounting systems of the project while maintaining compatibility with UNDP financial and accounting procedures.
- Assist in the preparation of the Annual Work Plan (AWP).
- Comply and verify budget and accounting data by researching files, calculating costs, and estimating anticipated expenditures from readily available information sources.
- Prepare financial status reports, progress reports and other required financial reports.
- Process all types of payment requests for settlement purpose, including quarterly advances to the partners.
- Prepare periodic accounting records by recording receipts and disbursements (ledgers, cash books, vouchers, etc.) and reconciling data for recurring or financial special reports and assist in preparation of the annual procurement plan.
- Assist in the timely issuance of contracts and assurance of other eligible entitlements of the project's personnel, experts, and consultants by preparing annual recruitment plans.
- Prepare and update inventories of expendable and non-expendable project equipment.

Qualifications
- University Degree in Commerce, Business Management, or other relevant discipline.
- At least 5 years of relevant administrative, financial or programme experience at the national or international level.
- Strong understanding of budgeting and the UN accounting system—candidates familiar with UNDP administrative, programme, and financial procedures preferred.
- Ability to use MS Office packages under the Windows XP Professional environment, particularly word processing and spreadsheets (MS Word, Excel, etc.).
- Initiative, sound judgment, and capacity to work independently.
- Knowledge of database packages and web-based management systems.
- Excellent inter-personal and communication skills.
- Excellent verbal and written skills in English.

4. Technical Working Group Component Team Leaders

Scope of Work
The CTLs will be responsible for executing the activities under their respective components. The selection will be made depending on the relative skills of the applicants. The exception will be the Component 2 CTL who will be the National Water Harvesting Consultant. As this consultant position has a wide and extensive role, the appointee will have the requisite skills to provide the role of CTL. The various National Consultants required to implement activities under Components 1 and 3 have more specific roles within those components. Therefore, the CTL for these components will be selected upon the review of the capacity of the National Consultants appointed within these respective components.

Responsibilities
- Timely execution of activities and achievement of expected deliverables under the respective components of the project.
- Dialogue between stakeholders, particularly at a local level.
- Participation of institutions and local communities in project activities.
- Establish linkages and networks with the on-going activities.
- Monthly reporting to the PM on project activity implementation.
- Liaise with other CTLs to exchange information on activity implementation.
- Assist National consultants with technical support where needed.
- Assist and provide oversight for workshops and training seminars.
- Ensure required equipment and materials are available for activities.
- Maintain expenditure oversight for the components.
- Ensure fluid and open communication between co-financiers and government partners.

Qualifications

- MSc degree in a relevant academic field.
- Minimum 5 years' experience in project implementation.
- Past experience in training and developing content for presentations.
- Excellent written and spoken English.
- Excellent inter-personal and communication skills.
- Excellent organisational and coordinating skills.

Annex 4.2: International Consultants

1. International Resource Economist

- 100 day contract over Year 1 and 2, with 75 days spent in country (55 in Year 1, 20 in Year 2). Transport will be provided while in-country.
- Conduct an economic evaluation of water harvesting, including possible impacts under predicted climate change, land use scenarios, and aquifer depletion.
- Study cases in urban and rural areas where water harvesting is used for domestic and irrigation purposes.
- Consult stakeholders for existing water harvesting implementations – both project and community driven – to establish case studies, including successful and unsuccessful examples.
- Compile a report of the findings for presentation to national policy decision makers, including policy proposals based on the findings.
- Liaise closely with other relevant International and National Consultants in the development of the report.

Requirements:

- PhD or MSc degree in Resource Economics.
- Minimum 5 years' experience in Resource Economics.
- Prior experience in water harvesting and/or agricultural economics an advantage.
- Excellent written and spoken English.
- Arabic and/or Prior experience in the Middle-East an advantage.

2. International Water Law Specialist

- 75 day contract over Years 2 – 4. 75 days in total. One 15-day trip annually.
- Review current water laws, including customary and traditional practices.
- Review structural changes in roles and mandates for institutions under the new federal system.
- Liaise with National Water Law Specialist to coordinate continual in-country research.
- Liaise with International Resource Economist on the findings of the water harvesting economics report.
- Prepare a draft report detailing proposed policy recommendations to facilitate water harvesting under projected climate change scenarios. The report should be based on the findings of the water harvesting economics report and international water law practices.
- Arrange a weeklong workshop in Year 4 to discuss the draft report, assimilate input for incorporation into a Final Report.

Requirements:

- PhD or MSc degree in Water Law and/or Policy.
- Minimum 5 years' international experience in Water Law and/or Policy.
- Prior experience in water harvesting an advantage.
- Excellent written and spoken English.
- Arabic and/or Prior experience in the Middle-East an advantage.

3. International GIS Training Specialist

- 60 day contract in Years 2 and 3. One 10 day trip in Year 2 and 2 trips of 30 days in total in Year 3.
- Conduct a weeklong training workshop for NWSSIP representatives in Year 2 on remote sensing and GIS to produce simulation models for water harvesting. Liaise with National GIS Specialist to develop content for this workshop.
- Conduct 3, separate weeklong training workshops for EPA representatives (one in Year 2, two in Year 3) on Rainfall-runoff Models. This should include training on erosion and run-off related pollution.
- Assess capacity of EPA representatives at start of first workshop and end of third workshop.
- In conjunction with the National GIS Specialist, develop tasks with real life application as exercises between workshops.

Requirements:

- MSc or Hons degree in Natural Sciences, Environment, Hydrology or related field.
- Minimum 10 years' experience in GIS or remote sensing.
- 2 Years' experience in GIS training, including course design.
- Prior experience in water harvesting an advantage.
- Excellent communication and presentation skills in English.
- Arabic and/or Prior experience in the Middle-East an advantage.

4. International Water Resources Management Specialist

- 120 day contract in Years 3 and 4. 95 days travel over two annual trips (70 days in Year 3 and 25 days in Year 4).
- Visit the 6 respective governorates each for 12 days. Meet with water managers to discuss priorities, opportunities and limitations for IWRM plans.
- Address governorate workshops on international standards for IWRM.
- Advise governorate IWRM specialists in creating basin level plans, including reviewing draft plans.

Requirements:

- PhD or MSc degree in Hydrology, Water Law, or Water Policy and Planning.
- Minimum 10 years' experience in IWRM.
- Prior experience in water harvesting an advantage.
- Excellent written and spoken English.
- Arabic and/or Prior experience in the Middle-East an advantage.

5. International Geohydrologist

- 60 day contract in Year 1 and 2 to provide oversight for hydrogeologist contractors. 45 days in country over 2 trips: trip one spending 5 days in each governorate with 5 days to coordinate and meet national stakeholders before and after field visits. 15 days follow-up visit to consult on implementation in Year 2.
- Provide impartial oversight for national contractors conducting tests for sand and check dam suitability.
- Review and advise on draft plans for implementation of artificial recharge sites.
- Provide oversight for implementation of artificial recharge interventions during the follow-up trip.

Requirements:

- PhD or MSc degree in Geohydrology or Civil engineering.
- Minimum 5 years' experience in artificial recharge.
- Prior experience in implementing artificial recharge projects in developing countries.
- Excellent written and spoken English.
- Arabic and/or Prior experience in the Middle-East an advantage.

6. International Specialist in Community-based water management

- 100 day contract with 40 days in Year 1, thereafter 20 days in Years 2 to 4.
- 4 trips across project duration with 30 days in-country in year 1 and 10 days in-country in each of the following years.
- Liaise with national water harvesting consultant.
- Review data gathered by National WUA consultant and determine criteria for establishing successful WUAs. Also include suggestions for overcoming barriers that prevent WUAs from forming and remaining functional.
- Provide proposals for WUA application and registration processes.
- Present at workshops, training representatives from the Ministry of Social Affairs and Labour, WUA representatives and *Al Moqadem*.

Requirements:

- MSc degree in water management.
- Minimum 5 years' experience in community-based water management in developing countries.
- Prior experience in developing and presenting training material.
- Experience in public administration an advantage.
- Excellent written and spoken English.
- Arabic and/or Prior experience in the Middle-East an advantage.

Annex 4.3: National Consultant ToRs

1. National GIS Specialist

- 160-day contract. 100 days in Year 1 and 30 days in each of Years 2 and 3.
- Assess current state of GIS resources of Yemen under Activity 1.1.2, including: i) data relevant for water harvesting; ii) data quality; iii) human resources; iv) tools and infrastructure; and v) data and capacity gaps that can be addressed.
- Organise and host a 1-day workshop to facilitate the above process.
- Provide oversight for the collection of outstanding or out-of-date field data under Activity 1.1.3.
- Organise weeklong workshop in Year 2 for NWSSIP representatives as described under Activity 1.1.1.
- Organise weeklong workshops in Years 2 and 3 for EPA representatives as described in Activity 1.1.5.
- Work in close conjunction with the International GIS specialist to develop content for the above workshops.
- In conjunction with the International GIS Specialist, provide oversight for the development of models under Activity 1.1.4.

Requirements:

- Yemeni National.
- MSc or Hons degree in Natural Sciences, Environment, Hydrology or related field.
- Minimum 5 years' experience in GIS and remote sensing.
- 2 Years' experience in GIS training, including course design.
- Prior experience in water harvesting an advantage.
- Excellent written and spoken English.
- Good organisational and coordinating skills.

2. National Resource Economist

- 80-day contract. 60 days in Year 1 and 20 days in Year 2.
- Assist the International Resource Economist in conducting an economic evaluation of water harvesting, including possible impacts under predicted climate change, land use scenarios, and aquifer depletion.
- Provide contact and access to national and local information resources.
- Consult stakeholders for existing water harvesting implementations – both project and community driven – to establish case studies, including successful and unsuccessful examples.
- Study cases in urban and rural areas where water harvesting is used for domestic and irrigation purposes.
- Assist in compiling a report of the findings for presentation to national policy decision makers, including policy proposals based on the findings.

Requirements:

- Yemeni National.
- MSc degree in Resource Economics.
- Minimum 10 years' experience in Resource Economics in Yemen.
- Established network of stakeholders.
- Prior experience in water harvesting and/or agricultural economics an advantage.
- Excellent written and spoken English.
- Good organisational and coordinating skills.

3. National Water Law Specialist

- 75-day contract with 25 days in each of Years 2, 3 and 4.

- Organise 3 1-day workshops in Years 2, 3 and 4 to receive stakeholder input for proposals on laws and strategies for the inclusion of climate change and water harvesting, under Activity 1.2.2 and 1.2.3.
- Assist the International Water Law Specialist in reviewing current water laws, including customary and traditional practices.
- Assist the International Water Law Specialist in reviewing structural changes in roles and mandates for institutions under the new federal system.
- Assist in the preparation of a draft report detailing proposed policy recommendations to facilitate water harvesting under projected climate change scenarios. The report should be based on the findings of the water harvesting economics report and international water law practices.
- Organise a weeklong workshop in Year 4 to discuss the draft report and assimilate input for incorporation into a Final Report.

Requirements:

- Yemeni National.
- PhD or MSc degree in Water Law and/or Policy.
- Minimum 5 years' experience in Water Law and/or Policy in Yemen.
- Prior experience in water harvesting an advantage.
- Excellent written and spoken English.
- Good organisational and coordinating skills.

4. National Information Management Specialist

- 80-day contract with 50 days in Year 1, followed by 10 days in each of Years 2, 3 and 4.
- Create an online discussion forum in NWRA to facilitate dialogue on water harvesting between national, sub-national and community stakeholders under Activity 1.3.1.
- Organise 4 annual national 1-day workshops to facilitate the initiation and subsequent uptake of the discussion forum.
- Establish and maintain a database for sites and techniques of rainwater harvesting to use as a reference for establishing new sites under Activity 3.2.2. This database should also include their current condition.
- Organise and host a 1-day workshop with NWRA, MoAI, MoWE and other representatives to inform them of the database, its purpose and receive their input.
- Collate and upload the findings of the workshops onto the discussion forum.
- Assist the National WUA Specialist in establishing governorate discussion forums for Water User Associations.

Requirements:

- Yemeni National.
- Honours degree in Information Management.
- Minimum 5 years' experience in Website design.
- Prior experience in water harvesting an advantage.
- Excellent written and spoken English.
- Good organisational and coordinating skills.

5. Governorate IWRM specialists (x 5)

- 80-day contracts, with 60 days in Year 3 and 20 days in Year 4.
- Create updated basin-level IWRM plans to include harvested water under predicted climate change scenarios under Activity 1.32. This is to be done using models developed under Activity 1.1.4.
- Work in conjunction with International IWRM Specialist in the creation of these plans.
- Organise 1-day workshop for local water managers and other stakeholders to receive their input on developing the plans.

Requirements:

- Yemeni National.
- MSc degree in Hydrology, Water Law, or Water Policy and Planning.
- Minimum 5 years' experience in IWRM.
- From and located in a selected governorate preferable.
- Prior experience in water harvesting an advantage.
- Excellent written and spoken English.
- Good organisational and coordinating skills.

6. National Water Harvesting Specialist

- 345-day contract with 226 days in Year 1 and 103 days in Year 2 and 8 days in Years 3 and 4.
- Assess existing water harvesting programmes, projects and CBO initiatives in the six selected governorates under Activity 1.3.3 in Year 1. Collate lessons learned to inform future water harvesting programmes, projects and initiatives.
- Oversee the implementation of pilot sites under Activity 2.1.2, including site and technique selection.
- Work in close conjunction with the governorate water harvesting specialists.
- Provide training for the contract teams under Activities 2.1.2, 2.3.1 and 2.4.1.
- Present at governorate workshops and at demonstration plots.
- Assist national masonry expert in the selection of candidates for masonry training.
- Develop criteria for selecting communities for water harvesting beyond the LDCF-financed project's implementation period.
- Assist the National Information Management Specialist in the establishment of the water harvesting discussion forum and database.
- Train SFD-EU and extension services on the principles of water harvesting, technique costing and local community-education methods under Activity 3.2.3.
- Assist the National Community Finance and CSR Specialist to establish criteria, including biophysical and socio-economic conditions, for directing loans and incentives to local communities, under Activity 3.3.1

Requirements:

- Yemeni National.
- PhD or MSc degree in Hydrology, Water Management or related field.
- Minimum 10 years' experience in water harvesting, preferably with the majority in Yemen.
- Proven experience in project implementation.
- Past experience in training and developing content for presentations.
- Excellent written and spoken English.
- Excellent organisational and coordinating skills.

7. National Fog Harvesting Specialist

- 65-day contract in Year 1.
- Develop a fog harvesting manual based on quantitative and qualitative data from previous fog-harvesting attempts in Yemen, including 'traditional' stone-piling and the 'modern' screen technique.
- Host workshops to disseminate the fog harvesting manual to local communities that have suitable socio-economic and biophysical conditions.
- Install 'screen' fog harvesting in selected sites.
- Train local communities in maintenance of fog harvesters and record keeping of water yields.
- Measure results of fog harvesting in providing water and effect on communities.
- Present the findings of this in a report and disseminate the report to relevant institutions. This should also be made available to the national water harvesting database.

Requirements:

- Yemeni National.

- Prior experience in fog harvesting (not necessarily in Yemen).
- Proven experience in project implementation.
- Excellent written and spoken English.
- Good organisational and coordinating skills.

8. Governorate Water Harvesting Specialist (x5)

- 116-day contract with 68 days in Year 1 and 16 days per year in Years 2, 3 and 4.
- Work in close collaboration with the national water harvesting expert and national WUA expert.
- Implement demonstration plots under Activity 2.1.2 (50 days).
- Provide technical oversight and assistance for local communities under Activity 2.1.3.
- Assist national masonry expert in site selection.
- Organise workshops to train local communities on the principles and implementation of water harvesting, under Activities 2.1.2, 2.1.3, 2.3.1 and 2.4.1.
- Facilitate biannual community discussion forums under Activity 2.3.5.
- Promote water harvesting and grey water recycling in public buildings and mosques, including public displays of these techniques and their results, under activity 2.6.5.

Requirements:
- Yemeni National.
- MSc degree in Hydrology, Water Management or related field.
- Minimum 5 years' experience in water harvesting, preferably with the majority in the selected governorate.
- Proven experience in project implementation.
- From and located in a selected governorate preferable.
- Excellent written and spoken English.
- Good organisational and coordinating skills.

9. National Masonry Specialist

- 80-day contract with 35 days in Year 1 and 15 days in each of Years 2, 3 and 4.
- Determine suitable sites to host governorate workshops.
- Select candidates for workshops in conjunction with national and governorate water harvesting specialists, and using data collected under 3.2.2. This should be based on the state of masonry water harvesting structures in local communities, the level of available knowledge, and/or the availability of material.
- Organise and host weeklong workshops in the selected governorates in Year 1.
- Conduct follow-up visits in Years 2, 3 and 4 to the communities of the attendees to inspect their work and give advice where required.
- Transport will be provided for follow-up visits.

Requirements:
- Yemeni National.
- Minimum 10 years' experience in masonry.
- Proven experience in disseminating masonry skills.
- Prior experience in water harvesting an advantage.
- Written and spoken English an advantage.
- Good organisational and coordinating skills.

10. National Rangeland and Alien Vegetation Removal Expert

- 175-day contract with 115 days in Year 1 and 20 days in each of Years 2, 3 and 4.
- Organise and host 1-day workshops in local communities on sustainable grazing methods, the impacts of overgrazing, and alien vegetation management under Activity 2.4.5.

- Remove alien vegetation along canals under Activity 2.5.2.
- Work in conjunction with national and governorate water harvesting experts to use vegetation as anti-erosion and water harvesting techniques.
- Use alien vegetation to build exclusion barriers under the agroforestry plots of Activity 2.4.4.

Requirements:

- Yemeni National.
- MSc or Hons degree in catchment management, livestock practice or alien vegetation management.
- Minimum 5 years' experience in implementing projects in one of the above fields.
- Proven experience in developing and presenting educational material.
- Prior experience in water harvesting an advantage.
- Excellent written and spoken English an advantage.
- Good organisational and coordinating skills.

11. National hydrological modelling specialist

- 30-day contract in Year 3.
- Coordinate EPA and NWSSIP staff trained in modelling under Activity 1.1.1 and 1.1.4 to develop flood prediction models for wadis in the selected governorates.
- Develop outcomes into a report and share with the national and governorate water harvesting specialists, IWRM specialists.

Requirements:

- Yemeni National.
- PhD or MSc degree in hydrological modelling.
- Minimum 5 years' experience in developing models.
- Prior experience in water harvesting an advantage.
- Excellent written and spoken English an advantage.
- Good organisational and coordinating skills.

12. National Education and Information Specialist

- 30-day contract in Year 2.
- Work with the National Information Management Specialist to gather relevant information on water harvesting.
- Organise and host workshop with representatives from the Ministry of Education, MoWE, NWRA, MoAI, NGOs and other representatives to verify and enhance information as well as receive input on information dissemination.
- Compile information into educational packages with specific target audiences, including public officials, clerics, and scholars. Additional target audiences should also be recommended by the successful candidate.
- Assist the National Media Campaign Specialist to present at governorate workshops.

Requirements:

- Yemeni National.
- Hons degree in Education or Information Management.
- Minimum 5 years' experience in developing educational material.
- Prior experience in water harvesting an advantage.
- Excellent written and spoken English an advantage.
- Good organisational and coordinating skills.

13. National Media Campaign Specialist

- 125-day contract with 65 days in Year 2 and 30 days in each of Years 3 and 4.

- Use the information gathered by the National Education and Information Management Specialist to design and print, radio and billboard campaign to raise awareness of the water crisis and proposed methods to address it. Other media channels, such as social, online or mobile channels, should also be recommended. This campaign should not be limited to adverts, but should also include content rich discussion programmes (radio) and articles (print).
- Approach journalists to use their media channels to further disseminate information.
- Organise and host 2-day workshops in each of the selected governorates, in conjunction with the National Education and Information Management Specialist, to present water harvesting information to public institutions and clerics. These workshops should also be used to receive input on the most relevant water related problems and how best to disseminate information to local communities in the respective governorates.
- Follow-up on developments in the UNDP project and incorporate this into the media campaign through Years 3 and 4. 30 days in these two years should be dedicated to updating and maintaining the media campaign.

Requirements:
- Yemeni National.
- Hons degree in Media studies.
- Minimum 5 years' experience in designing and executing media campaigns.
- Prior experience in water harvesting, agriculture or social projects an advantage.
- Excellent written and spoken English an advantage.
- Good organisational and coordinating skills.

14. National Water User Association Specialist

- 195-day contract with 111 days in Year 1 and 28 days in each of Years 2, 3 and 4.
- Assemble data on existing and former WUAs in Yemen and collate this into a manual for their future establishment and management under Activity 3.1.1.
- Train representatives of the Ministry of Social Affairs and Labour to facilitate the WUA registration process under Activity 3.1.2.
- Train WUA representatives in: i) water budgets; ii) demand-side management; iii) criteria establishment for assessment of household water demand; and iv) conflict management under Activity 3.1.3.
- Train *Al Moqadem* in climate change effects and adaptation measures under Activity 3.1.4.
- Organise and host the respective workshops for the above deliverables.
- With the assistance of the National Information Management Specialist, establish discussion forums for WUAs in the selected governorates to facilitate information dissemination and discussion between WUAs and governorate water management institutions under Activity 3.1.5.

Requirements:
- Yemeni National
- PhD or MSc degree in water management.
- Minimum 5 years' experience with community based organisations.
- In-depth knowledge of the Ministry of Social Affairs and Labour registration processes.
- Prior experience in water harvesting or social projects an advantage.
- Excellent written and spoken English an advantage.
- Good organisational and coordinating skills.

15. National Community Financing and CSR Specialist

- 240-day contract with 150 days in Year 1 and 30 days in each of Years 2, 3 and 4.
- Establish criteria, including biophysical and socio-economic conditions, for directing loans and incentives to local communities who will yield maximum water harvesting benefits. This will be done with the assistance of the National Water Harvesting Specialist.

- Use criteria to establish and implement a materials and tools grant programme to selected communities for water harvesting. Provide technical assistance to these communities.
- Use the results of this grant programme to promote CSR investment in water harvesting.
- Design CSR projects for potential investors to encourage investment.

Requirements:
- Yemeni National.
- MSc degree in micro-finance or social investment.
- Minimum 5 years' experience with community based organisations or CSR.
- Prior experience in water harvesting or social projects an advantage.
- Excellent written and spoken English an advantage.
- Excellent organisational and coordinating skills.

16. National Terrace Rehabilitation Specialist

- 80-day contract with 20 days in each of the four years.
- Select sites within respective governorates for terrace rehabilitation. This should be based on the current state of terraces, and the likelihood of them being maintained beyond project implementation under Activity 3.3.3.
- Select contractors to implement terrace rehabilitation.
- Provide oversight for the implementation of terrace rehabilitation.

Requirements:
- Yemeni National.
- Minimum 10 years' experience in project management.
- Minimum 5 years' experience in terrace rehabilitation.
- Prior experience in other water harvesting techniques or social projects an advantage.
- Excellent written and spoken English an advantage.
- Excellent organisational and coordinating skills.

Annex 5: Capacity Assessment

Annex 5.1: Capacity Assessment of EPA

I. EPA Experience in UNDP projects:

The Environment Protection Authority (EPA) has been the main national counterpart of UNDP in implementation of environmental projects since 1997. Currently there are three projects implemented by the EPA, namely:

1. Sustainable Natural Resources Management Programme (US$1,900,000)
2. National Capacity Self-Assessment Project (US$200,000)
3. Clean Development Mechanism Project (US$120,000)

All above projects are implemented under NEX implementation modality. Advances are provided for the first two projects while the third project is implemented with full UNDP support, as the project is (1) for a relatively short period (one year) and has a small budget, (2) as well as a full time project manager could not be identified and recruited to manage the project.

2005 and 2006 audits were conducted for the first project. The observations of the auditors were not major on cash position and asset and financial management of the programme. Upon field review and assessment of implementation of the auditors' recommendations, it was observed that the project is adequately following the recommendations of the auditors.

II. Facts about the new project:

The Second National Communication on Climate Change is a follow-up project to earlier two climate change projects that were implemented by EPA. The project was developed in 2006 and the management arrangement of the project states that the project will be implemented by EPA using the NEX implementation modality. Main features of the project are as follows:

1. The total budget of the project is US$405,000
2. Project duration is 2 years
3. There is no major procurement of goods
4. Main project activities are in the form of technical assistance including:
    - services of national consultants;
    - services of international consultants;
    - organisation of consultation workshops;
    - in country training;
    - abroad training; and
    - awareness raising activities.

III. Conclusion:

Until the HACT capacity assessment is conducted and considering the experience of the EPA in NEX implementation modality, risk involved and the audit observations of currently implemented project in EPA, it is recommended to:

1. Provide advance to the project to implement project activities at the national level.
2. Provide Country Office support to the project in the procurement of goods, abroad training and recruitment of international consultants.

Annex 5.2: Capacity Assessment for YEM/97/200 NWRA

Objective: to define the standards or capacities necessary to carry out specific tasks or assume certain functions in a certain manner, in order to successfully undertake a project and to ensure accountability for the effective use of funds. During our meeting with the project and NWRA personnel, we have covered the following areas:

1. **Administrative Capacity:**

The UNDP CO examined the following 2 areas:

i. **The ability to procure goods, services and works on a transparent and competitive basis. However, the following are the exact findings**:

- The "Procurement Unit" is headed by the Procurement Manager and assisted by two Assistants and one Storekeeper;
- The unit follows the Government rules & regulations pertaining to procurement. However, staff work manually and do not have a Procurement Plan. Furthermore, they are neither able to track commitments against budget, nor to enter into a contract. The unit lacks written procedures for identifying appropriate vendors, appropriate forms such as request for quotation, invitation to bid, etc.
- They do not have written authorisation of who can approve adjustments to commitment and purchase;
- They do not have a system for registration and reporting receipt of goods in a timely and accurate manner; and
- They do have a property ledger (inventory) to track important property.

Recommendations:

Few issues must be addressed in order for this unit to function well:

- Delegating the authority to the procurement manger to manage the unit.
- Provide the current staff with a proper training exposing them to the local/international procurement practices.
- Furnishing this unit with Computer hardware and software in order to automat the work process.
- Use the NEX manual in order to ensure transparency in procurement.
- UNDP support might be required when drafting the specifications & requirements for the purchasing of goods or services.

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ii. The ability to recruit and manage the best-qualified personnel on a transparent and competitive basis: under this area and after meeting with the HR Staff, it is found that:

- This Unit acts as a channel between their office and the Ministry of Labour;
- The current HR personnel are not in a position to draft the required job descriptions, recruit and manage the best qualified personnel;
- They do not have a monitoring system for ensuring adequate performance against the job requirement; and
- They have not got a system of investigating and verifying the background of candidates.

Recommendations

The current set up of this unit is very weak and cannot run the show on the next phase. Therefore, UNDP's support is highly required. Many staff members expressed low morale, which can be addressed by training and full utilization of resources.

2. Financial Capacity

iii. Ability to manage Projects' Financial Aspects: time was spent with the concerned person whereby the following were found:

- The unit consists of the Financial Officer, two accountants. Due to lack of funding, the Financial Officer has hired a secretary on his own expense.
- The current Finance Officer is in a position to express the project financials in accordance with the plan;
- The current Finance Section staff are not exposed to the project budget, therefore unaware of the planned expenditure which results in poor financial control;
- Finance staff are not able to manage the tracking of commitment against the project budget as they are not hooked to the WINFOAS and/or FIM;
- Financial files and records storage do not meet security standards;
- They do not have written procedure to govern processing payments except following up the general government rules and regulations;
- There is no coordination b/w the decision makers at NWRA and the current Finance Officer. This results in confusion when direct payments are issued without the knowledge of the Finance Officer; and
- The Finance Unit does not have the technology/system to check and verify funds in the project budget before commitments are made. This results in over-expenditure and other issues.

Recommendations:

For the finance unit to perform well in the next phase, we recommend the following:

- Recruitment of professional personnel.

Annex 5.3: Capacity Assessment for Social Fund for Development

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Policy Note

A Framework for Assessing Institutions to serve as Hosting Agency for National Climate Fund

June 2011

United Nations Development Programme

ENVIRONMENT AND ENERGY

A Framework for Assessing Institutions to serve as Hosting Agency for National Climate Fund

The case of the Social Fund for Development (SFD) in Yemen

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Executive summary:

Yemen is highly vulnerable to climate change-related impacts because of its fragile socio-economic development and inadequate adaptive capacity. Climate change is the defining human development issue of our generation. It has also increasingly becoming an emerging development issue in Yemen. The potential impact of climate change on the development in Yemen is expected to make the current sustainability challenges further complicated. Rural livelihoods are expected to decline due to decreasing water access and agriculture productivity, or even asset destruction. Yemen requires enormous adaptation investments to adjust for climate change impacts besides making transition towards low-emission economic development paths. However, as a Least Developed Country (LDC), Yemen has only limited resources and capacities while experiencing tremendous development challenges. It is unlikely for Yemen with the existing capacities and resources to build up adequate community resilience to project climate change impact without mobilizing funds for financing climate resilient measures and interventions. Instead, global climate finance has recently experienced dramatic increase, and Yemen can tap into such funds to support its national priorities on climate change. One of the possible instruments to access funds is a National Climate Fund (NCF). This policy-note article lies under UNDP efforts -through the Boots on the Grounds- to explore the potentiality of Social Fund for Development (SFD) as a national institutions candidate to host the NCF. It focuses on analysing

relevant aspects such as goals, capacity, and project management experience, to ensure longterm service delivery of the fund that ensures sustainability and address national climate priorities, current capacities, and needs. In addition, it analyse the development context in Yemen and spot some potential NCF's modality and structure that maximizes the development outcomes for which it has been established to deliver. This article also seeks to answer the question of why the Social Fund for Development (SFD) should host the NCF in Yemen. This article also seeks to contribute towards efforts made to establishing proper framework for characterizing NCF's host agencies.

INTRODUCTION

Yemen is highly vulnerable to climate change-related impacts because of its fragile socio-economic development and inadequate adaptive capacity. Climate change is the defining human development issues of our generation. It has also increasingly becoming an emerging development issue in Yemen. The potential impact of climate change on the development in Yemen is expected to make the current sustainability challenges further complicated. Rural livelihoods are expected to decline due to decreasing water access and agriculture productivity, or even asset destruction. Yemen requires enormous adaptation investments to adjust for climate change impacts besides making transition towards low-emission economic development paths. However, as a Least Developed Country (LDC), Yemen has only limited resources and capacities while experiencing tremendous development challenges. It is unlikely for Yemen with the existing capacities and resources to build up adequate community resilience to project climate change impact. Instead, global climate finance has recently experienced dramatic increase, that is for instance at COP 16 in Cancun, pledges reach up to $30 billion in "fast start" funding – as climate funds pledged between 2010 and 2012 – and up to $100 billion by 2020 on annual basis.

This increase in climate change funding opportunities is especially important as countries consider how to attract and leverage different types of climate change investment, including private sources. In addition, several global funds have been established through pledges by developed countries to assist LDS and other vulnerable communities to adapt to climate change. For instance, Adaptation Fund, LDCF, and Green Funds are among the funds created to provide climate finance to LDCs adaptation interventions. . Yemen can also tap into such funds to support its national priorities on climate change. One of the possible instruments to access funds is a National Climate Fund (NCF). NCFs are a mechanism through which climate finance are channelled to support national priorities in well-structured and coordinated manner. Nevertheless, complexity in accessing funds has dramatically increased along with the remarkable increase in opportunities to access climate finance. The processes and reporting formalities and requirements associated with the many funds can be challenging particularly for LDCs.

One of the challenges are how to identify which funds are appropriate for a particular country, and how interventions through such funds can be properly coordinated, monitored and evaluated for results. To do so, this policy-note article lies under UNDP efforts -through the Boots on the Grounds- to explore the potentiality of Social Fund for Development (SFD) as a national institutions candidate to host the NCF. It focuses on analysing relevant aspects such as goals, capacity, and project management experience, to ensure long-term service delivery of the fund that ensures sustainability and address national climate priorities, current capacities, and needs. In addition, it analyse the development context in Yemen and spot some potential NCF's modality

and structure that maximizes the development outcomes for which it has been established to deliver.

This article also seeks to answer the question of why the Social Fund for Development (SFD) should host the NCF in Yemen. This article can provide insights towards how national institutions could possibly be assessed for relevance to host NCF. By so doing, UNDP can promote options to create interests among possible national institutions as candidates to host NCF. This article has used official documentations, donor reports, and work experience, and consultations with concerned officers to support the analysis throughout this paper.

To facilitate discussion throughout this article, analysis will be organized using questions and concluding answers for a couple of questions developed for relevant criteria (i.e. mission, and delivery mechanism) through which the key question is answered. Criteria for assessment were set out based on gained understanding of national development context as well as UNDP climate change policies and articles particularly NCF publications. The assessment carried out has not intended to carry a comprehensive and comparative analysis for several national institutions and funds operating in Yemen, but rather to highlight some relevant key aspects of a well-known institution as major candidate to host the NCF.

1. Is the SFD's mission relevant?

According to the SFD's Manual of Operation, the fund was established in 1997 by Law No. 10 as an autonomous State organization under a Board of Directors chaired by the Prime Minister. The fund aim at *"contributing effectively to the implementation of the State's social and economic development plan through enabling individuals, households, micro-entrepreneurs and poor & low-income groups to get access to employment and production by providing services, facilities and lawful credits for contribution to the reduction of unemployment, alleviation of poverty and handling the impact of the Economic Reform Program and lessening the burden of its measures affecting limited-income people."1*

As stated in the SFD's Manual of Operation, (page 1), "since its establishment, SFD, with extensive and expanding support from the government and the donor community has become a significantly active institution of State, with operations throughout the country prioritizing poorer communities with investments in several sectors. These include education, health, water and sanitation, agriculture, rural feeder roads, cultural heritage, small and micro enterprise development, social protection, training, capacity building of partner institutions and workfare programs."

As clearly stated, among the fund's goals is to contribute to implementing the States development plans, alleviation of poverty, assisting the vulnerable groups to access services. Furthermore, the SFD works on several strategic and thematic priorities which include: Water, agriculture; Poverty alleviation; Social protection, capacity building. The aforementioned thematic areas are evidently very-well positioned within the context of climate change considerations. For instance, climate change impacts include posing further burdens on water accessibility for domestic and economic uses. Agriculture productivity is affected by climate change impact either through greater water stress or longer warm seasons. Water and agricultures is among the critical thematic areas purposely to be addressed using funds channeled through the proposed NCF.

Social protection is expected to become more complicated under climate change as more people particularly the vulnerable certainly needs extra social protection in order to adapt to the projected impact of changing climate.
Social protection particularly the most vulnerable is among the services the NCF is expected to deliver. As an LDC,

[1] Manual of Operations, SFD (2010)

Yemen lacks adequate institutional and financial capacity to adapt to climate change. In this sense, capacity building is certainly being one of the priority areas of interventions NCF is expected to deliver.

To spell this out from different perspective, climate change is an emerging environmental and development issue in Yemen. Climate change is expected to affect water availability and agriculture productivity in Yemen. Possible climate change impacts, such as more violent and less predictable rainfall and a hotter and possibly drier climate would place Yemen's people and economy under further stress. Climate change and variability impacts on the water balance are projected to further reduce water availability. In addition, climate change makes the development challenges in poverty reduction more complicated.

The poor are the most vulnerable to the climate change impacts. The potential impact of climate change on the development and achievements of MDGs in Yemen is expected to turn the current challenges further complicated. It will have significant impacts on the economic growth, poverty alleviation and the achievement of the MDGs. Accounting for climate change potential impacts, the livelihood security challenges are increasingly becoming more complicated and pushing poverty to higher levels. As such, climate change impacts have clear links to the environmental and poverty reduction interventions under the SFD's portfolio. Therefore, climate change underlies within the context of the SFD's aim from environmental, developmental, and poverty reduction perspectives.

Additionally, as mentioned earlier, climate change is an emerging environmental and development issue in Yemen. As clearly pointed out in the SFD's Manual of Operation, (page 6) while addressing its major features indicated as continuous development and flexibility, the following is quoted:

"SFD is adjusting its organizational setup and operational policies and practices in line with lessons learned and based on emerging issues."

It can be deduced that the SFD executive manual plausibly institutionalized to accommodate climate change as an emerging development issue in Yemen through the indicated organizationally flexible setup. Following this understanding, apparently there should be no internal rules and regulations place constrains on carrying out any initiative to host the proposed NCF by the SFD.

2. Is the SFD's delivery mechanism conducive to host the NCF?

Before going further, it is useful to reach a common understanding regarding the basic common structures and functions of NCF using lessons learned from UNDP experience in designing and administering over 750 funds around the world. According to a publication[66] by the UNDP (2011) that, through stakeholder consultations, a country must identify specific and necessary functions of the NCF such as goal setting, strategic programming, capitalization, partnership management, project approval, policy assurance, financial control and performance measurement in order to ensure achieving its goals and progress toward low-emissions, climate-resilient development. The publication further added that "a national trust fund must be carefully designed to align with national objectives and capacities on climate change .To accomplish this, the design and administration of an NCF can demand extensive time, effort and resources". Appropriate and effective NCF structure is critical to ensure maximum delivery of climate finance to support national-driven climate priorities. The general NCF's structure models include funding sources, governing bodies, a trustee, and implementers. In general, UNDP lessons learned from existing NCFs points out to the following key considerations to ensure a successful delivery of climate finance that support the national priorities:

- Clearly defined NFC's functions
- Practical are well-defined objectives and
- Realistic expectations of capitalization
- Streamlined project cycle's design
- Stakeholder's consultation
- Clear appraisal and performance criteria
- System of fiduciary standards
- Flexible and evolving NCF's design elements
- Capacity development

Departing from the development context in Yemen, and the aforementioned strict requirements, and processes, obviously it is complicated and not easy task to ensure effective and efficient NCF setup for the delivery of climate finance because of the lack to nationwide adequate institutional capacity and credibility. Credibility is among the most critical and hard parts to ensure. According to the International Transparency report, Yemen scored 2.1 and ranked 154 in 2009. As such, Yemen is classified among the countries with lowest transparency points. Since NCFs are dedicated to raise and administer funds particularly from global funds, it is not easy to attract adequate capital flows particularly from international donors whose requirements are very strict, besides putting very tough procedures ensure funds are being utilized to deliver the results for funds are given.

Nevertheless, unlike to most of the national insinuations and funds in Yemen, Public Works Project (PWP) and SFD' records in terms of efficiency, effectiveness are relatively better off. This has been recognized by several international organizations and donors (UNDP, WorldBank, FAO, UNICEF, WHO) operating in Yemen. Although PWP and SFD apparently have relatively encouraging achievements, low fund leaking, and higher credibility records, the later is more appropriate to host the NCF because of closely relevant development and communitybased development experience than the earlier.

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[66] National Climate Funds: A Guidebook for Decision-makers, UNDP (2011)

The SFD is a community driven programme improving the infrastructure for education, health, water supply, etc., while the PWP is intended employment opportunities attempting to maintain the assets created by the SFD. Comparatively, the SFD employs a participatory approach for planning and implementation of community-based development projects besides working with the private sector (SMEs) which fits very well under the climate finance methodology of building up community resilience. This has insightful bearing into proposing the SFD as hosting agency since it has proven experience in targeting the poor, who are in fact the most vulnerable to the impacts of climate change. According to the poverty assessment report (2005), about 70% of the SFD resources go to the poorest three deciles. As a candidate institution to host the NCF, the SFD's capacities, and delivery mechanism are highlighted.

On this regard, donors' reports have also recognized the capacity of the SFD in mobilizing and delivering developmental results. For instance, the poverty assessment report (2005) published by Ministry of Planning and International Cooperation (MoPIC) in collaboration with, the UNDP, and the World Banks clearly acknowledge the credibility of the SFD. UNDP experience with the SFD also was positive through hosting microcredit network project for a transitional period of time until the maturity phase after which the project has been independently operating. During its consecutive phases, the SFD has gained good reputation in delivering developmental services in Yemen.

The SFD has operated in three phases to date. The first phase (1997-2000) had a total investment of US$90 million, and the Second Phase (2001 – 2003) amounted to US$75 million. The SFD now is in its Third Phase (20042008). The Fourth Phase will run for 5 years from 2011 to 2015. According to the poverty assessment report (2005), the SFD's project created about 11.3 million job opportunities, with six thousand full-time jobs. During the period 2001 – 2005, the SFD completed 3,888 projects at a total cost of US$343.5 million. Educational projects represent the largest share of the SFD's total investment commitment (54%), followed by water projects (11%), health projects (7.5%) and roads (7.6%). Environment and roads have the highest number of beneficiaries per project. Health and water often target women and hence benefit the highest proportion of women. Direct beneficiaries account for 71% of the total beneficiaries. Education, health, roads and water projects generate 73% of all direct beneficiaries. The SFD has directly benefited an estimated 7.1 million people, around half of which are women.

Donors such as World Bank put in their funds directly to support the SFD plans relying on the capacity of the fund to deliver results for which funds have been given. As mentioned earlier, the SFD is an autonomous State's institution designed and established in 1997 to efficiently deliver services to the poor in remote communities across several sectors which include education, health, water and sanitation, agriculture, rural feeder roads, cultural heritage, small and micro enterprise development, social protection, training, capacity building of partner institutions and workfare programme. Programmes and projects are the delivery mechanism of the SFD. According to SFD's Water and Environment team leader, the projects scales implemented by the SFD are not limited to specific size and scale, but rather ranges from small to large scale project. In addition, there is no regulations that put constrains on the size of projects to be managed by the SFD. This in turns clearly indicate the possibility of handling and operationalising even large-scale interventions under the proposed NCF. The SFD employs a participatory approach for planning and implementation of projects.

Structurally, the SFD has three main levels: the Board of Directors, the HQ and the Branch Offices. The Board of
Directors is chaired by the Prime Minister, approves the main policies and orientations of SFD, Annual Work Plan (AWP) and reviews the progress made by SFD on a regular basis. The HQ is in charge of overall operations. It carries out its duties through Procedural Policy Committee (PPC), Projects Approval Committee (PAC), supporting units and technical units in addition to the Labour Intensive Works Program (LIWP). The technical units are the Education, the Water & Environment, the Health & Social Protection, the Training & Organizational Support, the Small & Micro Enterprise Development, the Agriculture & Rural Development and Cultural Heritage. Amongst the different support units, there are the Programming, the Monitoring and Evaluation, the Finance and Administrative, the Procurement, the Technical, the Information Technology, the Internal Audit, Research and Development and Human Resources Units.

At the regional level, SFD is represented by its nine Branch Offices (BOs), each covering one or more governorates and responsible for the preparation, implementation and monitoring of SFD activities in that governorate(s). The organizational setup of the SFD is also clearly characterized by its specialised programmatic, and support function units. Roles and responsibilities are also clearly established. SFD Board of Directors is structured in such a way that the participation of the government, the private sector and the civil society is ensured for policy setting and guidance of SFD activities. The Executive body of SFD is headed by a Managing Director (MD) who has full authority to manage the fund's operations. The Procedural Policies Committee (PPC) works towards reaching collective decision-making process based on synergy and exchange of experiences. The Project Approval Committee (PAC) reviews project proposals submitted by the Units or Branch Offices in light of the general SFD polices and relevant criteria, and makes a decision based on clear justifications, and ensures proper coordination and synergies among the different projects.

Among the key supporting units are: Monitoring and Evaluation Unit; Procurement Unit; Programming Unit; and the Internal auditing units. The programming unit roles is to ensure adequate alignment of SFD's contribution to the national development plans, and coordinate, harmonize and monitor progress of annual plans preparation and implementation. The Monitoring and Evaluation unit ensures proper project monitoring mechanism and carries out impact studies for SFD projects and programs, and disseminate information, results and lessons from SFD activities through quarterly newsletters, annual reports and through the SFD website. The Procurement unit ensures that procedures for project's procurement are applied according to the binding procedures. The Internal Auditing Unit ensures efficiency and effectiveness of making use of material, human, financial resources available for the SFD through proper auditing exercise to address and remedy any weakness or incompleteness.

The SFD is also equipped with a pool of engineers and consultants. The SFD's Engineering Unit carries technical and engineering review and studies, submit proper designs, and ensures quality control, including conducting visits to the projects to follow up on the quality of implementation and testing them and to assure commitment of all involved parties. The SFD is also equipped with a Financial Unit to manage the fund's financial assets and transactions. From a delivery mechanism perspective, and based on the aforementioned analysis, it can be concluded that the SFD has relatively adequate institutional, managerial, organizational, and technical capacity, and experience to host the NCF through which climate financed can be raised and channelled to support national priorities on climate change in a relatively efficient, effective, participatory, and transparent manner if climate fund capacity is built up.

To put the aforementioned discussion into a perspective, it can be deduced that the delivery mechanism of the SFD is conducive for hosting the proposed NCF. The major goal of NCF is funding-raising and coordinating national climate actions which require credible institutions to perform such tasks. The SFD has the indicated record of credibility that facilitates funds flow to support national climate priorities. Furthermore, the programme and project management experience further strengthen the position of the SFD to administer the NCF capitals as long as the capacity is adequate. Besides the community approach employed, the internal auditing, and procurement, evaluation and monitoring, engineering and programming frameworks and capacities also provides further competence to the SFD to host the NCF. Such enabling conditions will allow the proposed NCF to gain sufficient capacity, grow and succeed very well until the maturity phase upon which the mature climate fund can become an independent national body in charge of coordinating and administering actions based on national climate priorities in Yemen. In this sense, NCF will be strengthening national ownership, besides using national systems and procedures, and accountability through nationally managed climate funds.

3. What are the implications of having SFD as a host agency for the NCF in Yemen?

The SFD is a social fund. But, the proposed NCF is a climate fund. As indicated, the SFD is a national agency equipped with relatively adequate capacities and conducive delivery mechanism to host the NCF until the maturity phase. This implies that the SFD as a social fund can serve as a host agency for the NCF; that is another fund. Nevertheless, the possibility that NCF can be hosted by another national ***FUND*** should be looked at. This need to be scrutinized through proper characterization of the host agencies, and if so, appropriate structures for the proposed NCF should be explored and put forward to have the climate fund hosted under another social fund.

4. Does the SFD have relevant experience in implementing climate change interventions?

The SFD has been actively engaged in supporting local communities, and contributed towards implementing environmental project in Yemen such as provision of adequate infrastructure, to enable sustainable access and use of water and sanitations particularly in rural areas. Additionally, the SFD is currently involved in contributing towards promoting rainwater harvesting as a proper interventions to secure extra water sources for domestic and agricultural uses particularly in rain-fed areas. In partnership with the World Bank, the SFD was approached to be involved in taking over the management of some components of Pilot Project for Climate Resilience (PPCR) in Yemen. The SFD also was engaged in promoting local clean renewable energy pilot initiatives across pilot areas in some parts of the rural Yemen. Although the aforementioned relevant experience in climate change interventions is relatively slight, such endeavours carries insightful bearings towards the basis upon which the SFD's interest to host the NCF can be further built up.

5. WHAT CHALLENGES ARE EXPECTED TO BE ENCOUNTERED WHILE MAKING EFFORTS TO FACILITATE DEVELOPMENT AND HOSTING OF THE NCF BY THE SFD

The following challenges are identified as posing potential risks for the development of the NCF, or create barriers for hosting the NCF by the SFD:

1. ***Lack of interest by the SFD:*** Although it is becoming increasingly clearer -through discussions and consultations- that the SFD is interested to host the NCF, some obstacles may arise in the way forward. However, such risks can be possibly mitigated through consultations, discussions, and build up mutual understanding, sharing of knowledge. The SFD has expressed its genuine interest to host the NCF because of their deep concerns over the development in Yemen under the projected climate change impacts and therefore taking action to support climate agenda in Yemen.

2. ***Lack of SFD's commitment:*** This may raise the risk of changing attitudes towards the national climate agenda or slightly diversion to the original agenda of the SFD and hence leaving the newly established NCF without adequate support due to huge portfolio under administration. However, such risks can be reduced through building adequate capacities to handle the growing demand for staff, administrative, financial implications, and technical capacities under the NCF. Furthermore, partnership with UNDP will be further enhanced, and advisory services will be provided. Knowledge sharing regarding climate change policies will be ensured, and facilitations will be provided

6. WHAT ARE THE EXPECTED ROLES ASSUMED BY MAJOR PARTNERS (SFD, EPA, AND UNDP) OF THE NCF

It is useful to clearly identify the roles of partners in relation to the NCF's development and administration. There are many partners will be involved in the development of NCF in Yemen. However, the roles of major partners such as SFD, Environmental Protection Authority (EPA), and UNDP will be highlighted.

SFD:

The SFD is proposed to represent the Government capacity to access and coordinate climate action in Yemen. The direct access modality can be enforced in the presence of such a fund. The roles will not be limited to but include:

- Propose proper arrangements to host the NCF
- Facilitate consultations with relevant stakeholder to develop the NCF
- Provide backstopping for administering the NCF
- Catalyze the establishment of the NCF
- Oversee the implementation of the fund
- Provide nursery service for the NCF until maturity phase

EPA:

Although the EPA is the climate focal point in Yemen, and has engaged in promoting climate agenda in Yemen, and participated in climate negotiations, and defend Yemen's interests and positions, the SFD to host the NCF was advocated by the EPA. On the other hand, The EPA will be one of the beneficiaries of the funds. As such, to avoid a conflict of interest, the EPA has not been advisable to host the NCF. On this regard, the EPA chairman recommended a collective approach to lobbying for promoting the SFD to host the NCF. Nevertheless, the EPA's role will not be limited but includes the following:

- Provide technical advice on climate finance opportunities and facilitates channelling funds to the NCF
- Propose appropriate polices to attract flow of private capital to the NCF
- Ensure proper measures are mainstreamed into the projects funded under the NCF in a way that maintain synergies with other environmental commitments and environmental polices

UNDP's roles include:

According UNDP' publication (2011), the UNDP provides the advisory services for the NCF which includes:

- ***NCF Design:*** helps to develop detailed term sheets that consolidate the decisions emerging from the design process
- ***Capitalization:*** supports to establish regulatory frameworks for identifying and collecting resources
- ***Trustee or Administrative Agent:*** provides transparent and accountable fund management services to enhance coherence, effectiveness and efficiency
- ***Capacity Development to strengthen institutions and readiness for national implementation:*** ensure that any national fund strengthens the capacity of governing bodies, implementers, recipients and other stakeholders, enhancing their ability to manage the operations of the fund and to support delivery of projects
- ***Implementation of climate change projects and programming:*** provides implementation services at the national, regional, and global levels, and can support the implementation of NCF programmes in different capacities

7. CONCLUSION

The relatively conducive delivery mechanism, capacity, credibility, and the community-based approach for delivery development results, and partnership with private sector are among the major competent that makes the SFD as the most appropriate option to serve as the hosting agency of the NCF in Yemen. However, the underlying implication of hosting a NCF by the SFD requires further scrutiny. Nevertheless, proper internal arrangements can be perused to propose alternative structures to host the fund as long as the interest and commitments remain relatively sufficient. With regards to the proposed framework for assessing national NCF's hosting agencies options, the mission, capacity, relevance, and the delivery mechanism are among the critical building blocks of the framework. Further scrutiny is required, and internally appropriate arrangements should be proposed to facilitate hosting the NCF by the SFD if any discrepancy may have identified. Based on the aforementioned policy implication, this article may suggests that proper characterization of the NCF's hosting agencies for future endeavours needs to be further explored. The article further suggests that UNDP to dedicate a chapter for proper characterization of NCF's hosting agencies through one of its forthcoming NCF publications.

ACKNOWLEDGMENT

The authors would like to express thanks and appreciation to UNDP Yemen CO senior management for advice and support, the Boots on the Ground's regional advisor based in Cairo, Marwan Owaygen for continuous advise, support, valuable discussions, consultations, and knowledge sharing, and the Boots on the Ground's team (particularly Isabel Kreisler, Rebecca Carman, and Pia Treichel) in HQ for continuous support, facilitation, and knowledge sharing. The authors would like also to express thanks to the Environment Protection Authority (EPA, Yemen) and the SFD for valuable consultations and discussions, facilitations, and knowledge sharing.

Annex 6: Letters of Co-financing

بسم الله الرحمن الرحيم

الجمهورية اليمنية

REPUBLIC OF YEMEN

Ministry of Water and Environment

Environment Protection Authority

وزارة المياه والبيئة

الهيئة العامة لحماية البيئة

No/Ref: EPA - 425

Date: 26-06-2014

No.of Pages:

الرقم / المرجع :

التاريخ :

عدد المرفقات :

Date: 26 – 06 – 2014

To: **Mikiko Tanaka**
Country Director
United Nations Development Programme - UNDP
Sana'a, Yemen

Subject: Co-financing commitment for the project entitled as "Integrated water harvesting technologies to adapt to climate induced water shortages"

Dear Mikiko,

With reference to the request for letter of co-financing, I am pleased to confirm co-financing from worth about US$ 2,000,000 towards the implementation of the above mentioned project throughout its life time from 2014-2020. The aforementioned project is well aligned with the National Adaptation Programme of Action (NAPA). The co-financing is committed through the implementation of the project known as Pilot Project for Climate Resilience (PPCR) with a total funding of about US$ 58 million secured from the World Bank. The PPCR project is expected to be completed in 2020.

The PPCR for Yemen has three strategic interventions which includes i) Climate Information System and PPCR Coordination Project; ii) Improving the Climate Resilience of Rural Communities; and iii) Climate Resilient Integrated Coastal Zone Management.

Therefore, this letter serves to confirm Environmental protection Authority's (EPA) commitment of co-financing which includes information sharing and collaboration to respond more cohesively to the increasing climate change impacts in Yemen particularly the water sector.

We look forward to your continuous cooperation.

Yours Sincerely,

Khaled Saeed Al-Shaibani

Chairman,
Environment Protection Authority

صنعاء - ص.ب : (١٩٧١٩) - هاتف : ٢٠٧٨١٧ - فاكس : ٢٠٧٣٢٧ بريد إلكتروني : epa-yemen@yemen.net.ye

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الموقع الإلكتروني : **www.yemenenvironment.org**

بسم الله الرحمن الرحيم

﴿وجعلنا من الماء كل شيء حي﴾

REPUBLIC OF YEMEN
Ministry of Water & Environment
National Water Resources Authority
Offic Head

الجمهورية اليمنية
وزارة المياه والبيئة
الهيئة العامة للموارد المائية
مكتب الرئيس

وزارة المياه والبيئة
الهيئة العامة للموارد المائية
السكرتارية
صادر
التاريخ: ١٥/٧/٢٠١٤
الرقم: ٦٧٣/٢٠١٤

Ref : ..... الرقم: .....

Date: ..... التاريخ: .....

Date:15/7/2014

To: Mikiko Tanaka
Country Director
United Nations Development Programme
Sana'a, Yemen

Subject: Co-financing commitment for the project entitled as "Integrated water harvesting technologies to adapt to climate induced water shortages"

Dear Mikiko,

With reference to the request for letter of co-financing, I am pleased to confirm co-financing from worth about US$ 12,000,000 towards the implementation of the above mentioned project throughout its life time from 2014-2017. The aforementioned project is well aligned with the National Water Sector Strategy and Action Plan, Phase II (NWSSIP). The co-financing is committed through the implementation of the projects such as Water Sector Support Program (WSSP) project with a total funding of about US$ 57,900,000 secured from the World Bank.

Therefore, this letter serves to confirm National Water Resource Authority's (NWRA) commitment of co-financing which includes information sharing and collaboration to respond more cohesively to climate induced water shortages in the country.

We look forward to your continuous cooperation.

Best regards

Ali Al-Suraimi
Chairman of NWRA

ص.ب: (٨٩٤٤) تليفون: ( ) فاكس: ( )
E-mail: NWRA-HQ@y.net.ye NWRAHQ@yem.net.ye

United Nations Development Programme

25 September 2014

Subject: Co-financing for the "Integrated water harvesting technologies to adapt to climate induced water shortages" project

Dear Adriana,

We are very happy to see progress in the formulation of the aforementioned project with expected GEF LDCF financing of US$ 4,920,000. Consultations have been undertaken with local stakeholders over the course of the formulation with the active involvement of the GEF RCU.

This project will respond to a critical need in Yemen facing severe water shortage that is sharply aggravating every year. UNDP has been an active partner of the Government in this sector, in integrated water resources management, natural resource management, biodiversity conservation, community development and climate change adaptation. UNDP has supported Yemen in the formulation and implementation of the NAPA. The experience and outreach capacity from previous initiatives will be used to support the implementation of water harvesting structures and capacity-building under the new project.

With reference to the PIF of the project, I am pleased to confirm UNDP co-financing of US$ 600,596 towards the implementation of the project throughout its life time from 2014-2018. We will also endeavor to mobilize additional resources.

We are grateful for your support and hope to move this project forward as quickly as possible.

Yours sincerely

Mikiko Tanaka
Country Director

Ms. Adriana Dinu
Executive Coordinator a.i
UNDP-GEF
304, E 45th Street • New York, NY 10017, USA

P.O Box 551 Sana'a, Republic of Yemen Tel : 967-1- 448805/8 Fax 967-1 - 448841 www.undp.org.ye

بسم الله الرحمن الرحيم

Republic of Yemen | الجمهوريـــــة اليمنيـــــة
Presidency of the Council of Ministers | رئاســـة مجلس الـــوزراء
Social Fund for Development | الصندوق الاجتماعي للتنمية

Date: 14/09/2014
Ref.: 299 / 14

To: Mikiko Tanaka
Country Director
United Nation Development Programme
Sana'a, Yemen

Subject: Co-financing Letter for the project entitled "Integrated Water Harvesting Technologies to Adapt to Climate Change Induced Water Shortage"

With reference to your request for the provision of a letter of baseline co-financing for the purpose of securing GEF funding for the above mentioned project, we would like to inform you that the Social Fund for Development's (SFD) ongoing and pipeline water related projects provide relevant baseline for the above mentioned LDCF project. Specifically, the SFD's baseline under implementation and pipeline projects are worth more than M14.2US$ including rainwater harvesting and watershed management activities. The LDCF project is well aligned with the SFD strategic investment program, Phase IV (2011-2015).

Therefore, this letter serves to confirm SFD's commitment in terms of information sharing and collaboration to respond more cohesively to the increasing climate change impacts in Yemen particularly the water sector. However, we would like to emphasize the importance of harmonizing policies and mechanisms of implementation between various players in this area.
We look forward to your continuous cooperation.
Best regards

Yours Sincerely,
Abdullah Al-Dailami
Managing Director

SOCIAL FUND FOR DEVELOPMENT
الصندوق الاجتماعي للتنمية

الصندوق الاجتماعي للتنمية – فج عطان – صنعاء – الجمهورية اليمنية – ص.ب (15485) – هاتف (449669) – فاكس (449670)
Social Fund for Development Faj Attan, Sana'a, Yemen, P.O Box 15485, Tel: 449669, Fax: 449670
www.sfd-yemen.org - E-mail: sfd@sfd-yemen.org

Annex 7: Agreements for cooperation between related UNDP and IFAD initiatives in Yemen

Subject: Intention of cooperation between IFAD "Rural Adaptation in Yemen Project" and the UNDP "Integrated water harvesting technologies to adapt to climate induced water shortages Project"

Email correspondence between national offices of IFAD and UNDP, following meetings held in Saa'na in January 2015:

Dear Dr. Fathia,

It was great pleasure for us to have you this morning for a coordination meeting regarding the two IFAD and UNDP GEF/LDCF projects which will be implemented in Yemen- the two project are known respectively as: "Rural Adaptation in Yemen"; and "Integrated Water Harvesting Technologies".

With reference to the consultations of today, I would like to reiterate that we have concluded fruitful meetings with you in the morning, and a follow-up discussion later in the day with Mr. Abdulla Al-Dukail, the Project Manager of IFAD's Rural Growth Project (RGP) in Yemen under which the IFAD GEF/LDCF Rural Adaptation Project in Yemen will be managed.

As discussed, we find that both projects will benefit from each other during the implementation. Moreover, as agreed, further coordination through relevant means including regular meetings, and information sharing will be further perused in at the implementation management the field level so that the interventions of both projects in the Governorate of Dhamar will be complementing each other but with clear differentiation.

In addition, the Integrated Water Harvesting Technologies Project will build on the already existing facilities of IFAD in the Governorate of Dhamar so that synergies are maximized. Furthermore, the coordination at the implementation levels will also provide a useful platform for sharing lessons drawn from accumulated experiences not only in Dhamar but also across other Governorates in the case when relevant best practices could be shared to accelerate delivery of results.

With the above brief summary, I would like to attached above the matrix which we have already shared and discussed with you and Mr. A-Dukail. The matrix outlines the proposed coordination activities between the two projects.

Once again, we would like to thank you for your support and look forward to collaborating with you and your team on such very strategic resilience building initiatives.

Walid Ali
Climate Change Policy Advisor

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Email: walid.ali@undp.org

Dear Walid,

Many thanks for your message and your initiative to coordinate the interventions of the two programmes (RGP and UNDP programme). I think that both programmes will benefit from this coordination. I expect that the proposed framework/matrix you gave us this morning needs to be updated when the AWPBs of the two programmes are prepared.

As we agreed this morning, there will be regular meetings between the two programs managers during the implementation process.

I suggest, once the two projects finalize the recruitment of staff, to hold a small workshop for further clarification about the two programmes. On the other hand, a start-up workshop will be held for the Rural Growth Project(RGP) after few weeks. Definitely you and your team will be invited to participate and to understand more about the programme's objectives, approach, project areas, targeting, co-financiers, and mechanisms.

Thanks again and best regards,
Fathia

Fathia Bahran, PhD,
Country Programme Officer
Near East, North Africa and Europe Division, PMD
IFAD, *Sana'a,* ***YEMEN.***

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Annex 8: Coordinating Actions between the UNDP and IFAD projects

Table 8.1 contains corresponding outputs across the respective IFAD and UNDP projects in Columns 1 and 2, with the intended coordinating action in Column 3.

Table 8.1

IFAD "Rural Adaptation in Yemen" Project Outputs	UNDP "Integrated water harvesting technologies" Project Outputs or Activities	Intended coordination action
1.1.1 Adaptation capacity building programme for the new PMUs designed and implemented involving transfer of knowledge from existing PMUs		
1.1.2 Full, gender-balanced adaptation capacity building programme designed through participatory process led by existing PMUs		
1.1.3 At least 500 community association members undergo 4 annual training sessions on climate, adaptation and natural resource management	Activity 3.1.4: Train Al Moqadem in climate change effects and adaptation measures	
1.1.4 A study tour is organised for local women to learn about local success story of women-led microenterprises, adaptation and restoration work. 1.1.5 Four regional study tours (10 people each) organised to learn existing best practices in adaptation	Activity 2.6.3: Review current awareness in local communities and the effect of current awareness raising initiatives and use the results as a basis for 2.6.4. Activity 2.6.4: Use media, including radio and signboards to target specific audiences with appropriate water harvesting information.	The study tours will be used as a means to gauge awareness in communities and its findings can be used as a basis for newspaper and radio articles. The tours can be presented in episode format to tell a narrative, rather than factual presentations.
1.2.1 Decision makers and community leaders trained on climate proofing development policies (6 sessions).	Activity 3.1.2: Train representatives of the Ministry of Social Affairs and Labour to facilitate the WUA registration process. Activity 3.1.3: Train WUA representatives in: i) water budgets; ii) demand-side management; iii) criteria establishment for assessment of household water demand; and iv) conflict management.	The reasons for and importance of climate proofing will be conveyed to trainees under the UNDP project to motivate them to apply the training they receive. Where appropriate, training material will be shared between the two projects.

1.3.1 At least 500 households in each target watershed are targeted by adaptation and risk management awareness raising campaign and empowered to enhance their resilience.	Activity 3.3.1: Establish criteria, including biophysical and socio-economic conditions, for directing loans and incentives to local communities who will yield maximum water harvesting benefits. Activity 3.3.2: Offer grants in the form of materials (not cash) accompanied with implementation guidelines.	Households that receive training under IFAD Output 1.3.1 can also be targeted for grants under Activity 3.3.2 in addition to those criteria established under Activity 3.3.1.
1.4.1 At least 50% of all the students and 10% of youth in each target watershed are reached by the project's education programme.		
1.4.2 Training materials on adaptation to climate change is produced for both literate and illiterate audiences.		
2.1.1 Community Action Plans designed and finalised for four pilot watersheds with the full participation of community associations and under the leadership of the PMUs.	1.3: Long term, climate-resilient water plans developed incorporating integrated water harvesting to facilitate groundwater recharge and supplement irrigation in the selected governorates.	Depending on the location of the community action plans, they can be incorporated or upscaled into the wider governorate water plans.

2.2.1 Traditional knowledge on water harvesting and storage compiled through rural appraisal process in target watersheds 2.2.2 Set of innovative and traditional water harvesting and storage techniques addressing rain, run-off and fog collection selected and put in practice in the framework of the watershed management plans.	2.1: Five traditional water harvesting techniques re-introduced into the selected governorates. (1. Inter-row water harvesting; 2. Micro-catchment water harvesting; 3. Rooftop water harvesting; 4. Medium-sized catchment water harvesting; 5. Large catchment water harvesting) 2.2: Fog harvesting technology introduced in Raymah 2.3: Local community members (farmers, pastoralists and rural households) from the selected governorates trained in the construction and maintenance of water harvesting techniques. 2.4: Integrated groundwater recharge systems established 2.5: Floodwater harvesting systems introduced to support irrigation	Data and information gathered on traditional and innovative techniques will be shared between projects. The implementation sites should also be discussed so that there is no overlap and the areas and number of people benefitting are maximised.
2.2.3 20% increase in the surface treated for water harvesting in all target watersheds.		
2.2.4 Water harvesting and storage increased by 30% in all target watersheds.		
2.3.1 20% increase in water efficiency for combined domestic and agriculture use compared to baseline situation in all target watersheds		
2.4.1 120 hectares of degraded terraces are restored in each target watershed	Activity 3.3.3: Rehabilitate terraces and other water harvesting infrastructure to provide non-agricultural income between cropping seasons.	The implementation sites should also be discussed so that there is no overlap and the areas and number of people benefitting are maximised.
2.5.1 At least 25% of each watershed is under integrated agriculture, rangeland and forest management	Activity 2.4.4: Establish local community nurseries propagating agroforestry species to reforest upper catchments.	The IFAD Output 2.5.1 will complement the training provided by the UNDP Activity 2.4.5. The UNDP project can also focus its Activity 2.4.4 in catchments where IFAD is implement this Output.

	Activity 2.4.5: Train local communities in the protection of these upper catchments.	
2.5.2 Innovative actions integrating agriculture production, sustainable resource management and restoration of the four watershed management plans are selected and implemented by the local communities, with a special focus on women and unemployed youth.	Output 1.3: Long term, climate-resilient water plans developed incorporating integrated water harvesting to facilitate groundwater recharge and supplement irrigation in the selected governorates.	Plans developed under IFAD Output 2.5.2 to be integrated into the broader governorate plans of UNDP Output 1.3
3.1.1 The Climate Change Unit of the EPA becomes the recognised focal point and clearinghouse for the collection and dissemination of meteorological data and information		
3.1.2 The Climate Change Unit of EPA is adequately staffed and its capacity built to perform its new tasks.		
3.2.1 Climate change downscaling models developed and disseminated in all target watersheds. 3.2.2 Base maps/sensitivity maps for climate hazards developed to guide implementation	Output 1.1: The MoAI and NWRA assisted to produce rainfall-runoff models (RRM) based on GIS to simulate key parameters for selection of water harvesting, including artificial recharge techniques.	Data collection to be discussed so that synergies are achieved, overlap is avoided and a richer data set is achieved to be used by both projects and housed across institutions indicated in the respective projects. Models developed by the respective projects will also be designed so their results can be used as inputs into models built by the other project.
3.3.1 Modalities developed and implemented within at least 2 Governorates for the provision of climate data to users		

Annex 9: Traditional water harvesting methods

- *Al kervan*: A natural or fabricated depuration in clay-loam soil.
- *Al bearak, Al asadiah*: A water pond built from stone masonry and clay.
- *Al karif*: A cistern typical of mountainous areas.
- *Al jeroof*: A tank made between two boulders and built from two sides only.
- *Al moujil*: An open tank dug in rocky areas.
- *Al seegayat*: A stone and concrete masonry system mainly collecting water from a household roof.
- Village tank: A communal system used within or outside the village and serving the whole community for drinking, livestock and household uses.

Traditional flood diversionary structures

- *Al Qaid* (deflectors): A low earthen bund, protected with brushwood and stones from the wadi, that extends partially across the wadi at an acute angle to the bank. This structure diverts water from the main wadi to fields in quantities proportional to the irrigated area and the size of the flood.
- *Ubar*: A large diversionary structure that supplies a network of canals. Occasionally, the walls of these banks are buttressed when the canal is long and crosses
- *Ogma* (high earthen bunds): Wadi bed material is piled across the low-flow channel of the wadi, with the object of diverting the entire low stage of the spate flow to their fields. During a large spate, as there is no provision for a spillway, the *Ogma* is either breached deliberately or it is over-topped and breaches naturally as the flood rises.
- *Al Masaqit* (drop structures): A stone structure built in spate canals when a channel has a steep gradient to reduce flow rate, or for transferring water from a high channel to lower one. The structure is built on a foundation of dry stone, occasionally mixed with a little concrete. The remaining part of the structure is constructed with stone interlocked properly, the gaps filled with smaller stone.
- *Al Masakhil* (spillways): The purpose of these structures is to control the quantities of water which enter the main spate canal. *Al Masakhil* is usually built on the earth embankment of the canals from medium-sized stones. The frame of the structure on both sides of the embankments extends to the foundation, so the supporting soil has no direct contact with the water.

Annex 10: The eight principles of successful water harvesting

1. Begin with long and thoughtful observation.
Use all your senses to see where the water flows and how. What is working, what is not? Build on what works.

2. Start at the top (highpoint) of your watershed and work your way down.
Water travels downhill, so collect water at your high points for more immediate infiltration and easy gravity-fed distribution. Start at the top where there is less volume and velocity of water.

3. Start small and simple.
Work at the human scale so you can build and repair everything. Many small strategies are far more effective than one big one when you are trying to infiltrate water into the soil.

4. Slow, spread, and infiltrate the flow of water.
Rather than having water run erosively off the land's surface, encourage it to stick around, "walk" around, and infiltrate into the soil. Slow it, spread it, sink it.

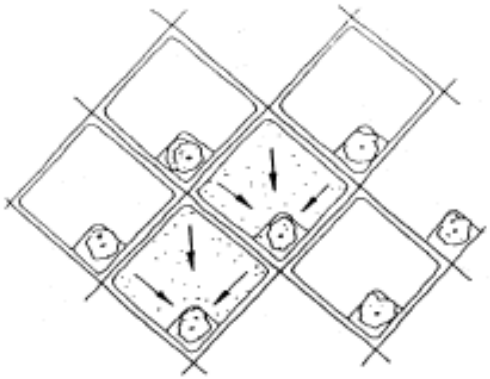
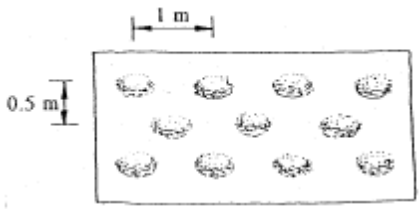
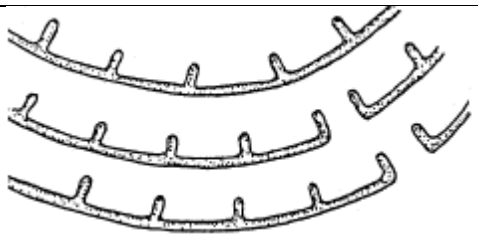
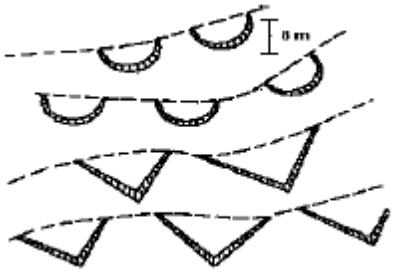
5. Always plan an overflow route, and manage that overflow as a resource.
Always have an overflow route for the water in times of extra heavy rains, and where possible, use the overflow as a resource.

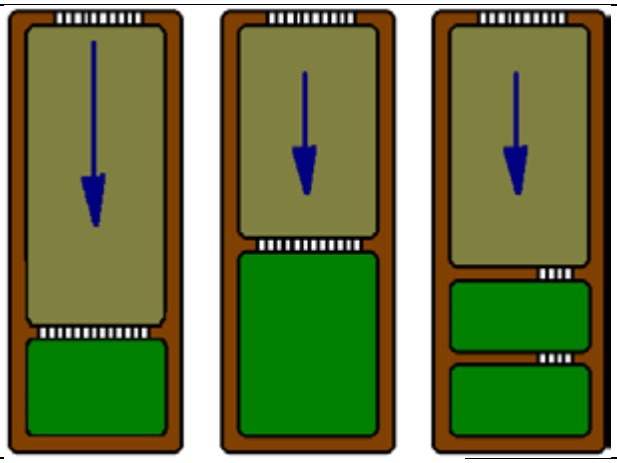
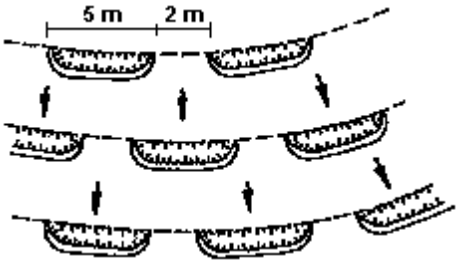
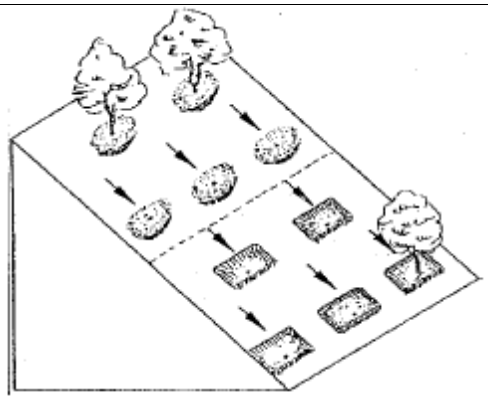
6. Maximize living and organic groundcover.
Create a living sponge so the harvested water is used to create more resources, while the soil's ability to infiltrate and hold water steadily improves.

7. Maximize beneficial relationships and efficiency by "stacking functions."
Get your water harvesting strategies to do more than hold water. Berms can double as high-and-dry raised paths. Plantings can be placed to cool buildings in summer. Vegetation can be selected to provide food.

8. Continually reassess your system: the "feedback loop."
Observe how your work affects the site, beginning again with the first principle. Make any needed changes, using the principles to guide you.

Annex 11: Micro-catchment Water Harvesting Systems

Type	Illustration	Parameters	Remarks and References
Negarin		CA: 3-250 CR: 1-10 CCR: 3:1-25:1 PREC: 150-600 SL: 1-20	Ben-Asher 1988
Pitting		CA: 0.25 CR: 0.08 CCR: 3:1 PREC: 350 - 600 SL: 0-5	"Zay system" (West Africa), "Kitui Pitting", "Katumani Pitting" (Kenya) Buritz et al. 1986 Gichangi et al. 1989
Contour ridges		CA: 100 CR: 20 CCR: 5:1 PREC: 300-600 SL: 5-25	Critchley 1987
Semi-circular hoops (demilunes); Triangular bunds		CA: 24-226 CR: 6-57 CCR: 4:1 PREC: 300-600 SL: 2-20	MoALD 1984

Meskat-type		CA: 500 CR: 250 CCR: 2:1 PREC: 200-600 SL: 2-15	El Amami 1983
Vallerani Type (fully mechanized)		CA: ~ 15 CR: ~ 2.4 CCR: 6:1 PREC: 100-600 SL: 20-50	400 MC/ha = 960m 2 CR/ha Preparation by "wavy dolphin plough"
Eye brow terraces; Hillslope Micro-catchments		CA: 5-50 CR: 1-5 CCR: 3:1-20:1 PREC: 100-600 SL: 1-50	100,000 trees programme in the Negev/Israel Ben-Asher 1988

Key: CA: Catchment size (m^2); PREC: Annual Precipitation (mm); CR = Cropping area (m^2); CCR = Catchment cropping ratio, SL = Slope (%)

Source: Prinz, D. 1996, Water Harvesting: Past and Future. In: Pereira, L. S. (ed.), Sustainability of Irrigated Agriculture. Proceedings, NATO Advanced Research Workshop, Vimeiro, 21-26.03.1994, Balkema, Rotterdam, 135-144

Annex 10: Letter of Agreement between the Government of Yemen and United Nations Development Programme on National Implementation Management (Draft)

STANDARD LETTER OF AGREEMENT BETWEEN
THE GOVERNMENT OF THE REPUBLIC OF YEMEN
AND A UNITED NATIONS AGENCY UNDER NATIONAL EXECUTION DURING THE PERIOD OF THE TRANSITIONAL PERIOD 2012 - 2014
TILL APPROVAL OF NEXT COUNTRY PROGRAMME

Dear Mr. Paolo Lembo,

1. Reference is made to consultations between officials of the National Water Resources Authority (hereinafter referred to as "NWRA ") and officials of the United Nations Development Programme (hereinafter referred to as "UNDP ") with respect to the UNDP support to programme/project with Atlas Award ID: 00082016 and title as “Integrated Water Harvesting Technologies to Adapt to Climate Induced Water Shortages”, to be managed by the Government. The latter shall be represented for the purpose of such management by the designated institution; National Water Resources Authority.

2. The designated institution recognises that UNDP enjoys privileges and immunities under the Convention on the Privileges and Immunities of the Specialised Agencies, to which the Government of Yemen became a signatory on 21 February 1996

3. In accordance with the programme support document or project document and with the following terms and conditions, we confirm our acceptance of the services to be provided by the United Nations agency towards this programme or project. Close consultations will be held between the United Nations agency and the designated institution on all aspects of the services to be rendered as described in Attachment 1: Description of services of this letter of agreement.

4. The United Nations agency shall provide the services and facilities described in Attachment 1: Description of services of this letter of agreement.

5. The designated institution shall retain overall responsibility for the UNDP support to the programme/project and shall designate a programme/project coordinator as National Project Manage.

6. The personnel assigned by the United Nations agency to the programme/project, and under contract with the United Nations agency shall work under the supervision of the programme/project coordinator. The supervisory arrangements shall be determined in mutual consultation and described in the relevant terms of reference of the personnel. This personnel shall remain accountable to the United Nations agency for the manner in which assigned functions are discharged.

7. In the event of disagreement between the programme/project coordinator and the programme/project personnel of the United Nations agency, the programme/project coordinator shall refer the matter under dispute to the United Nations agency for the purpose of finding a satisfactory solution. In the interim, the decisions of the programme/project coordinator shall prevail.

8. Upon signature of this letter of agreement and pursuant to the budget of the programme support document/project document and the work plan, the designated institution agrees that UNDP headquarters will advance funds to the United Nations agency, according to the schedule of payments specified in Attachment 2: Schedule of services, facilities and payments.

9. The United Nations agency shall submit a cumulative statement of expenditure each quarter (31 March, 30 June, 30 September and 31 December). The statement will be submitted to the designated institution through the UNDP resident representative within 30 days following those

dates. The format will follow the standard expenditure report of the United Nations agency, unless otherwise agreed to between the parties. The designated institution will include the expenditure reported by the United Nations agency in the financial report.

10. The United Nations agency shall recost and rephase the schedule of services and facilities described in Attachment 2, as necessary, when submitting the statement of expenditure to the designated institution. The United Nations agency may incur expenditures that exceed its assigned annual budget by four percent or by US$20,000.00, whichever is higher, in order to cover differences between actual and pro-forma costs. The designated institution shall adjust its financial records and confirm the revision submitted by the United Nations agency.

11. The United Nations agency shall submit such reports relating to the programme/project as may reasonably be required by the programme/project coordinator in the exercise of his or her duties.

12. The United Nations agency shall provide the designated institution with an annual report of non-expendable equipment purchased by the United Nations agency for the programme/project. The report shall be submitted within 30 days following 31 December, and shall be included by the Government designated institution in the main inventory for the programme/project.

13. The United Nations agency shall submit job descriptions and candidates for the posts foreseen in section 1 of Attachment 2 and obtain clearance of the Government designated institution for the personnel to be assigned to the programme/project.

14. Any changes to the programme support document or project document which would affect the work being performed by the United Nations agency in accordance with Attachment 1 shall be recommended only after consultation with the United Nations agency. Any changes to these arrangements shall be effected by mutual agreement through an amendment to this letter of agreement.

15. The arrangements described in this agreement will remain in effect until the end of the programme/project, or the completion of activities of the United Nations agency according to Attachment 2, or until terminated in writing by either party. The schedule of payments specified in Attachment 2 remains in effect based on continued performance by the United Nations agency unless UNDP receives written indication to the contrary by the designated institution.

16. For any matters not specifically covered by this agreement, the appropriate provisions of the programme support document/project document and revisions thereof and the appropriate provisions of the financial regulations and rules of the United Nations agency shall apply.

17. All further correspondence regarding this agreement, other than signed letters of agreement or amendments thereto should be addressed to NWRA (insert address)

18. The designated institution and the United Nations agency shall keep the UNDP Resident Representative fully informed of all actions undertaken by them in carrying out this agreement.

19. Except as provided in paragraph 6 above, any dispute between the designated institution and the United Nations agency arising out of or relating to this letter which is not settled by negotiation or other agreed node of settlement, shall, at the request of either party, be submitted to a Tribunal of three arbitrators. Each party shall appoint one arbitrator, and the two arbitrators so appointed a third arbitrator, who shall be the chairperson of the Tribunal. If, within 15 days of the appointment of two arbitrators, the third arbitrator has not been appointed, either party may request the President of the international Court of Justice to appoint the arbitrator referred to. The Tribunal shall determine its own procedures, provided that any two arbitrators shall constitute a quorum for all purposes, and all decisions shall require the agreement of any two arbitrators. The expenses of the Tribunal shall be borne by the Parties as assessed by the Tribunal. The arbitral award shall contain a statement of the reasons on which it is based and shall be final and binding on the parties.

20. The designated institution shall handle and be responsible for any third-party claim or dispute arising from operations under this agreement against UNDP or the United Nations agency, their officials or other persons performing services on their behalf, and shall hold them harmless in respect of such claims or disputes. The foregoing provision shall not apply where the parties agree that a claim or dispute arises from the gross negligence or willful misconduct of the above-mentioned individuals.

If you are in agreement with the provisions set forth above, please sign and return to this office two copies of this letter. Your acceptance shall thereby constitute the basis for your organisation's participation in the programme/project.

Yours sincerely,
Dr Mohammed Al-Saadi
Minister of Planning and International Coordination

Agreed by:
Name/Title: Abdul Salam Razaz / Minister of Water and Environment
Date: 29 October 2014
Signature:

Agreed by: United Nations Development Programme (UNDP)
Name/Title: Paolo Lembo/ Resident Representative
Date: 29 October 2014
Signature:

Attachment 1

DESCRIPTION OF SERVICES

Programme/project number: 00082016
Programme/project title: Integrated Water Harvesting Technologies to Adapt to Climate Induced Water Shortages.

Work to be performed by the UNDP:

The UNDP shall approves the project and activities work plan, ensures appropriate project appraisal and capacity assessment, coordinates auditing process, monitoring, evaluation and validation, and ensures financial and substantive oversight of the project in consultation with NWRA. It will also play a key role in donor coordination and resource mobilization activities. In case of non-resolution of any issues or disputes, the decision of UNDP shall be final.

Description of services:

Provide a detailed description of the programme/projects inputs by component. This may include identifying candidates for programme/project posts based on terms of reference provided by the Government-designated institution or recruiting already identified candidates.

Annexes:

Key Project Positions

1. Project Manager (PM)

Scope of Work
The PM will lead the project team and provide overall operational management for the successful execution and implementation of the project. This includes the daily responsibility to manage, coordinate, and supervise the implementation of the project and the delivery of results in accordance with the project document and agreed work plans. Furthermore, the PM will be responsible for financial management and disbursements, with accountability to the government and UNDP. The PM will report to the CTA and the PSC.

Responsibilities:
- Oversee and manage project implementation, monitor work progress, and ensure timely delivery of outputs.
- Report to the CTA and the PSC regarding project progress.
- Develop and facilitate implementation of a comprehensive monitoring and reporting system.
- Ensure timely preparation of detailed AWPs and budgets for approval by PSC.
- Write ToRs with the CTA.
- Assist in the identification, selection and recruitment of staff, consultants and other experts as required.
- Supervise, coordinate and facilitate the work of the Technical Working Group, M&E specialist, national focal point and technical unit (including national and international consultants).
- Control expenditures and assure adequate management of resources.
- Provide a quarterly update of the expenses of the previous three months and the expenses expected for the next three months.
- Establish linkages and networks with the on-going activities of other government and non-government agencies.
- Provide input to management and technical reports and other documents as described in the M&E plan for the overall project. Reports should contain detailed assessments of progress in implementing activities, including reasons for delays, if any, and recommendations on necessary improvements.
- Inform the PSC, without delay, of any issue or risk which might jeopardise the success of the project.

Qualifications
- Master's degree in environment, natural resources management, water management, agriculture or a closely related field.
- A minimum of 10 years relevant work experience including at least 6 years' experience as a lead project manager in relevant sectors.
- Demonstrated solid knowledge of adaptation to climate change, ecological restoration and sustainable exploitation of natural resources.
- Experience in the public participation development process associated with the environment and sustainable development is an asset.
- Experience in working and collaborating within governments is an asset as well as experience in GEF projects.
- Fluent in English, including writing and communication skills.

Reporting
During the project implementation phase, the PM will be a staff member of the EPA and will report to the PSC. The PM will work closely with the PSC and CTA to provide information on progress and performance regarding the implementation of the project.

2. Chief Technical Adviser (CTA)

Scope of Work

The CTA will provide technical guidance on the implementation of the project to the NPC.

Responsibilities
- Provide quality assurance and technical review of project outputs.
- Undertake technical review of project outputs (e.g. studies and assessments).
- Write ToRs for technical consultancies with the PM (including policy revisions when necessary).
- Supervise the work of national and international consultants.
- Assist in monitoring the technical quality of project M&E systems (including AWPs, indicators and targets).
- Conduct the financial administrative reporting.
- Provide advice on best suitable approaches and methodologies for achieving project targets and objectives.
- Provide a technical supervisory function to the work carried out by NTAs, and national and international consultants hired by the project.
- Assist in knowledge management, communications and awareness-raising.
- Facilitate the development of strategic regional and international partnerships for the exchange of skills and information related to climate change adaptation.

Qualifications
- At least an advanced post-graduate at or above Master's level in climate change adaptation or a related discipline such as disaster risk reduction, environmental management, natural resources management, agriculture and water resources management.
- A minimum of 5 years' experience in a senior technical lead position with planning and management of environmental and/or natural resources management programmes in developing countries.
- A minimum of 5 years in a senior technical position involved in institutional strengthening and capacity building.
- Previous similar experiences in provision of technical support to complex projects.
- Experience from Middle-East region would be an advantage.
- Good communication and computer skills.
- Fluent in English, including writing and communication skills with knowledge of Arabic a distinct advantage.

Reporting

The CTA will report to the chair of the PSC. The CTA will cooperate with the PM to ensure the availability of information on progress and performance in the implementation of the project. In the performance of his/her duties, the CTA will work in close collaboration with TM, and update him/her on the project's progress. Additionally, in consultation with the TM, the CTA will take responsibility for decision-making and implementation of the project.

3. Finance and Administration Assistant

Scope of Work
The Project Assistant will undertake the administration of the day-to-day operations of the project office and be responsible for the reporting of project financing.

Responsibilities
- Set up and maintain all files and records of the project in both electronic and hard copies.
- Collect project related information and data.
- Establish document control procedures.
- Compile, copy and distribute all project reports.
- Provide logistical support to the international consultants in organising training events, workshops, and seminars.
- Draft necessary correspondence with local and international agencies and stakeholders.

- Standardise the finance and accounting systems of the project while maintaining compatibility with UNDP financial and accounting procedures.
- Assist in the preparation of the Annual Work Plan (AWP).
- Comply and verify budget and accounting data by researching files, calculating costs, and estimating anticipated expenditures from readily available information sources.
- Prepare financial status reports, progress reports and other required financial reports.
- Process all types of payment requests for settlement purpose, including quarterly advances to the partners.
- Prepare periodic accounting records by recording receipts and disbursements (ledgers, cash books, vouchers, etc.) and reconciling data for recurring or financial special reports and assist in preparation of the annual procurement plan.
- Assist in the timely issuance of contracts and assurance of other eligible entitlements of the project's personnel, experts, and consultants by preparing annual recruitment plans.
- Prepare and update inventories of expendable and non-expendable project equipment.

Qualifications
- University Degree in Commerce, Business Management, or other relevant discipline.
- At least 5 years of relevant administrative, financial or programme experience at the national or international level.
- Strong understanding of budgeting and the UN accounting system—candidates familiar with UNDP administrative, programme, and financial procedures preferred.
- Ability to use MS Office packages under the Windows XP Professional environment, particularly word processing and spreadsheets (MS Word, Excel, etc.).
- Initiative, sound judgment, and capacity to work independently.
- Knowledge of database packages and web-based management systems.
- Excellent inter-personal and communication skills.
- Excellent verbal and written skills in English.

4. Technical Working Group Component Team Leaders

Scope of Work
The CTLs will be responsible for executing the activities under their respective components. The selection will be made depending on the relative skills of the applicants. The exception will be the Component 2 CTL who will be the National Water Harvesting Consultant. As this consultant position has a wide and extensive role, the appointee will have the requisite skills to provide the role of CTL. The various National Consultants required implementing activities under Components 1 and 3 have more specific roles within those components. Therefore, the CTL for these components will be selected upon the review of the capacity of the National Consultants appointed within these respective components.

Responsibilities
- Timely execution of activities and achievement of expected deliverables under the respective components of the project.
- Dialogue between stakeholders, particularly at a local level.
- Participation of institutions and local communities in project activities.
- Establish linkages and networks with the on-going activities.
- Monthly reporting to the PM on project activity implementation.
- Liaise with other CTLs to exchange information on activity implementation.
- Assist National consultants with technical support where needed.
- Assist and provide oversight for workshops and training seminars.
- Ensure required equipment and materials are available for activities.
- Maintain expenditure oversight for the components.
- Ensure fluid and open communication between co-financiers and government partners.

Qualifications
- MSc degree in a relevant academic field.
- Minimum 5 years' experience in project implementation.

- Past experience in training and developing content for presentations.
- Excellent written and spoken English.
- Excellent inter-personal and communication skills.
- Excellent organisational and coordinating skills.

Attachment 2

SCHEDULE OF SERVICES, FACILITIES AND PAYMENTS

				Estimated expenditure by year				Schedule of payments			
Section	Budget line	Work months	Total costs	Year 1	Year 2	Year 3	Year 4	Year 1	Year 2	Year 3	Year 4
Section 1: Personnel											
Section 2: Contracts											
Section 3: Training											
Section 4: Equipment											
Section 5: Miscellaneous											
Section 6: Micro-capital grants											
Total											

Total

Note:

- Expenditures for personnel services may be limited to salary, allowances and other entitlements, including the reimbursement of income taxes due and travel costs on appointment to the programme/project, duty travel within the programme country or region and repatriation costs.
- The designated institution shall be responsible for providing miscellaneous services such as secretarial assistance; postage and cable services and transportation as may be required by the United Nations agency personnel in carrying out their assignment.
- Adjustments within each of the sections may be made in consultation between the designated institution and the United Nations agency. Such adjustments may be made if they are in keeping with the provisions of the programme support document or project document and if they are found to be in the best interest of the programme or project.

Annex 11: Letter of Agreement between the Government of Yemen and United Nations Development Programme for the Provision of Support Services

STANDARD LETTER OF AGREEMENT BETWEEN UNDP AND THE GOVERNMENT FOR THE PROVISION OF SUPPORT SERVICES

Excellency,

1. Reference is made to consultations between officials of the Government of Yemen (hereinafter referred to as "the Government") and officials of UNDP with respect to the provision of support services by the UNDP country office for nationally managed "Integrated Water Harvesting Technologies to Adapt to Climate Induced Water Shortages" Project ID 00082016. UNDP and the Government hereby agree that the UNDP country office may provide such support services at the request of the Government through its institution National Water Resources Authority (NWRA) under the Ministry of Water and Environment (MoWE) designated in the relevant programme support document or project document, as described below.

2. The UNDP country office may provide support services for assistance with reporting requirements and direct payment. In providing such support services, the UNDP country office shall ensure that the capacity of the Government-designated institution the National Water Resources Authority is strengthened to enable it to carry out such activities directly. The costs incurred by the UNDP country office in providing such support services shall be recovered from the administrative budget of the office.

3. The UNDP country office may provide, at the request of the designated institution, the following support services covered by the Direct Project Costs, for the activities of the programme/project:

i. Staff selection and recruitment of two PM staff;
ii. HR & Benefits Administration & Management of the PM staff;
iii. Issuing IDs for the PM staff;
iv. International consultant recruitment;
v. National consultant recruitment;
vi. Payment processes associated with consultants;
vii. Low value procurement (Quarterly Project Board meetings); and
viii. High value procurement and disposal of equipment.

4. The procurement of goods and services and the recruitment of project and programme personnel by the UNDP country office shall be in accordance with the UNDP regulations, rules, policies and procedures. Support services described in paragraphs 3 above shall be detailed in an annex to the programme support document or project document, in the form provided in the attachment hereto. If the requirements for support services by the country office change during the life of a programme or project, the annex and related section in the programme support document or project document is revised with the mutual agreement of the UNDP resident representative and the designated institution.

5. The relevant provisions of the Standard Basic Assistance Agreement with the Government (the "SBAA") dated 10 February 1986, including the provisions on liability and privileges and immunities, shall apply to the provision of such support services. The Government shall retain overall responsibility for the nationally managed programme or project through its designated institution the National Water Resources

Authority. The responsibility of the UNDP country office for the provision of the support services described herein shall be limited to the provision of such support services detailed in the annex to the programme support document or project document.

6. Any claim or dispute arising under or in connection with the provision of support services by the UNDP country office in accordance with this letter shall be handled pursuant to the relevant provisions of the SBAA.

7. The manner and method of cost-recovery by the UNDP country office in providing the support services described in paragraphs 3 & 4 above shall be specified in the annex to the programme support document or project document.

8. The UNDP country office shall submit progress reports on the support services provided and shall report on the costs reimbursed in providing such services, as may be required.

9. Any modification of the present arrangements shall be effected by mutual written agreement of the parties hereto.

10. If you are in agreement with the provisions set forth above, please sign and return to this office two signed copies of this letter. Upon your signature, this letter shall constitute an agreement between your Government and UNDP on the terms and conditions for the provision of support services by the UNDP country office for nationally managed programmes and projects.

Yours sincerely,

_____

Signed on behalf of UNDP
Paolo Lembo
Resident Representative

_____

For the Government
Name/title: H.E. Mr. Abdul Salam Razaz, Minister of Water and Environment
Date:

DESCRIPTION OF UNDP COUNTRY OFFICE SUPPORT SERVICES

1. Reference is made to consultations between the Ministry of Water and Environment and National Water Resources Authority (NWRA), the institution designated by the Government of Yemen and officials of UNDP with respect to the provision of support services by the UNDP country office for the nationally managed programme or project ID "00082016 "Integrated Water Harvesting Technologies to Adapt to Climate Induced Water Shortages", the "project".

2. In accordance with the provisions of the letter of agreement signed on month year and the programme support document *or project document*, the UNDP country office shall provide support services for the Programme or Project ID 00082016 as described below.

3. Support services to be provided:

Support services	Schedule for the provision of the support services	Cost to UNDP of providing such support services based on UNDP Universal Price List (UPL)	Method of reimbursement of UNDP (Annually)
1. Staff selection and recruitment: 2 staff	Project Duration: 48 Months (from Jan 2015 through Dec 2018	US$1,997.58	GLJE
2. Staff HR&Benefits Administration& Management: 2 staff	Project Duration: 48 Months (from Jan 2015 through Dec 2018	US$457.72	GLJE
3. Issue IDs: 2 staff	Project Duration: 48 Months (from Jan 2015 through Dec 2018	US$66.98	GLJE
4. International consultant recruitment: 6 consultants	Project Duration: 48 Months (from Jan 2015 through Dec 2018	US$2,193.18	GLJE
5. National consultant recruitment: 29 consultants	Project Duration: 48 Months (from Jan 2015 through Dec 2018	US$10,600.37	GLJE
6. Payment process associated with consultants: 35 consultants x 2 payments each	Project Duration: 48 Months (from Jan 2015 through Dec 2018	US$2,308.60	GLJE
7. Low value procurement (Project Board	Project Duration: 48 Months (from Jan 2015 through Dec 2018	US$3,232.16	GLJE

meetings): 16 (4 per year) workshops			
8. High value procurement and disposal of equipment: 5 procurement and disposal processes	Project Duration: 48 Months (from Jan 2015 through Dec 2018	US$5,982.75	GLJE
Total		US$ 26,839.34	