Terms of Reference

Improving Water Security for Poor People Research (IWSP Research)

Contents

Introduction

1. The Department for International Development (DFID) leads the UK government's fight against world poverty. We run long-term programmes to help address the underlying causes of poverty and respond to humanitarian emergencies. This Terms of Reference (TOR) sets out DFID's requirement for the supplier to establish and manage a new seven year research programme. The programme aims to answer the overarching question of how water security can be achieved sustainably at different scales in varying geographic environments for the benefit of the poor, focussing on Sub-Saharan Africa and South Asia. The programme will take a holistic approach focussing on the whole water system and bringing together a spectrum of different disciplines to address these challenges.

The Objective

2. The supplier is required to manage a major new research programme which responds to the challenges of achieving water security at scale in different geographic contexts and for the benefit of the poorest. The programme will help to deliver the knowledge and information needed to plan, implement and deliver water management and, where appropriate, distribution systems that enhance water security in developing countries in Sub-Saharan Africa and South Asia. In addition it will provide information to help measure and monitor water security and the costs/benefits of investments in water resources management.

3. The expected impact will be that efficient and sustainably managed water systems will support increased water security for between 2.5 - 5 million poor people, whilst helping sustain and preserve water resources. It is intended that the programme will deliver robust and accessible evidence on how to ensure sustainable water services for multiple users in developing countries at scale - evidence presented in a way that municipalities, rural water suppliers, governments, DFID and other investment/policy decision-makers can use to improve water security for poor people, and to better understand the costs-benefits and trade-offs associated with investment decisions.

4. The result will be that as key policies and investment decisions (for example: urban planning in Bangladesh and DRC; agriculture expansion in Ethiopia; or rural water supply in Sierra Leone) are developed; they better take into account the water resources available and any impacts

these decisions may have on other users. The programme is expected to deliver five main outputs across a number of research areas or themes.

- Improved evidence on the biophysical, institutional, political economy, social and economic challenges and opportunities in achieving sustainable water security at scale (e.g. evidence of how to maintain and adapt service delivery models to meet the challenges of future stresses (e.g. population growth, increased demand, climate change, pollution));
- Improved evidence on the constraints and opportunities to ensure poor people, including women and those most marginalised, benefit from initiatives to improve water security (e.g. evidence of how women, children and other marginalised groups can be targeted most effectively);
- Improved metrics and tools to monitor and evaluate the effectiveness of investment in water security (e.g. evidence of cost effective models for service delivery at scale; cost effective approaches, technologies and systems for delivering water security in fragile states at reduced unit costs);
- Improved capacity of researchers and policy makers to develop, access and interpret evidence (e.g. urban planners for an Ethiopian municipality are able to use the tools and evidence to assess the impacts of alternative city development plans).

The Recipient

5. The principal recipient for this programme is the Climate and Environment Team (CET) in the Research and Evidence Division (RED) in DFID. Research outputs from the programme, including learning on water resources investment decisions, will be made publicly available. Since the focus of the programme is to support research into sustainably managed water systems for poor people, they will be the ultimate beneficiaries.

The Scope

6. This contract covers the design, establishment and implementation of a seven year global research programme focussing on an integrated approach to water security, with priority research taking place on/in fragile states initially. Given the focus on integrated research that breaks down traditional silos and the broad range of skills/expertise relevant to water security, DFID would envisage that a consortium of organisations will be the best way of delivering the programme requirements.

7. The research programme will have three underlying principles at its core – understanding the system as whole, sustainability and issues of water management at different scales. The research will be conducted round a series of specific research themes or windows (up to 4) that will consider these elements in specific contexts. The initial theme will be fragile states. Subsequent themes will be commissioned competitively by the supplier and informed by detailed baseline studies during an inception phase. Potential themes are rural and urban. Research will not focus on agriculture but all proposals will be expected to draw in research from agricultural focussed programmes and ensure relevant linkages are made.

8. The scope of work includes:

- Designing, establishing and managing an international research programme on water security;
- Commissioning research in a transparent manner through competitive calls;
- Delivering high quality peer reviewed research products and outputs;

- Developing and implementing a compelling research into use strategy hardwired into the commissioning and reporting processes;
- Building capacity with stakeholders and southern research partners
- Monitoring and evaluating the programme, including research impacts, to track and continually improve value for money.

9. With increasing demands for water, competition between different user groups for the limited resource increases potential of conflict and results in water security for the poorest and the most marginalised being put most at risk. There is a lack of rigorous research on how best to address the challenge of meeting all needs in an equitable and sustainable manner. The programme's intended areas of focus are:

    - **Understanding the system as a whole** with the water cycle providing a "system of services". Some of these water services are of direct human benefit (such as water for households and farmers). Others provide indirect benefits through maintaining the natural environment and ecosystems vital to life and many economic activities. Delivering water security in the developing world requires a better understanding of the challenges and opportunities in the different parts of system, where to prioritise investment and how to manage trade-offs.

    - **Understanding sustainability** with projections suggesting that by 2050, over 40% of the world's population are likely to be living in river basins under severe water stress. Water demand is projected to increase by 55% globally between 2000 and 2050. Climate change represents a particular threat in many regions, with impacts likely to be reflected through changing precipitation patterns and increased demand for water from agriculture and power generation as temperatures rise. Other drivers of increasing demand will include land use change, population growth, urbanisation, and changing consumption patterns. Research is needed to provide clearer evidence on current and future drivers and stressors on the water system, as well as how water systems can be delivered in a way that is financially and institutionally sustainable and inclusive.

    - **Understanding issues of water security at scale**, including evidence on what scale water security interventions are best delivered at. This does not necessarily mean development and construction of large-scale infrastructure, but a better picture of the institutional scale (which grouping of actors etc can be mandated to provide and maintain what services) as well as the physical scale that water resources should be managed at (community level, river basin level, national/regional level etc). User scale is also crucial, particularly to provide economies of scale – for example how can local community initiatives be linked together to bring about larger scale impact? In all cases the most appropriate scale will be determined by the context, and this will be addressed through the different themes.

    - **How to measure water security.** Whilst there are many definitions of water security, how to measure it – when it's achieved, when different dimensions are achieved, what is needed for different groups (women, elderly etc) remains a key challenge.

The Requirements

10. The supplier will provide:

    - A nominated Programme Director, with a track record in research management and in directing large, complex, multi-stakeholder research programmes.

- A group of individuals or representatives from a group of organisations to provide overall strategic direction, organisation and management for the programme.
- A clear partner/resource to undertake and lead work on monitoring and evaluation, quality assurance and Research into Use activities.
- A well-developed Terms of Reference for commissioning or carrying out research on the Fragile States theme, plus a well-defined work programme and schedule for this process
- In-house multi-disciplinary research capacity and a track record in high quality research to deliver a significant proportion of the programme output.

11. The supplier will provide a strong management capability for the programme, but given the need to maintain coherence and keep admin costs down, a significant proportion of the research will also be carried out in-house. The proportion of programme funds used to sub-contract additional research, either to fill gaps or for specific themes, will be 30% of the total contract value (see Contract section 4, paragraph 15). The supplier will have capacity and experience carry out competitive research calls in accordance with best procurement practice. During Inception, the supplier will work with DFID to agree whether and how to establish an independent advisory panel(s)

12. Crucial to success will be the supplier's ability to deliver:

    - **Research excellence** underpinned by an in-depth knowledge of water security in developing countries (including biophysical, institutional, political, social/behavioural and economic aspects), with a tailored approach for this programme based on integrated and multidisciplinary research.

    - **Effective consultation** to develop a strong 'problem statement' around which the programme of research can be developed, incorporating issues of equity and gender. This must include consultation with the demand side / end users and the programme should therefore be inclusive of poor consumers in the process, as well as the outputs.

    - **Innovative and flexible methodology** to ensure that the focus of research and/or resources can be moved to areas where demand is greatest either thematically or geographically, allowing the programme to evolve as research delivers results. The methodology and management approach will deliver strong oversight and integration to ensure that the programme adds up to more than a set of individual projects.

    - **Maximum impact and outcomes for poor people** set out in a clear research uptake strategy, ensuring the programme embodies a value-for-money approach in delivering results on the ground. All research must include a monitoring and evaluation component. The supplier will work with DFID in developing a strategy that enables costs and benefits to be tracked and evidence of research impacts and outcomes to be captured.

    - **Global presence** – issues of scale are central to the programme. Some research will be best conducted and/or applied locally, nationally, regionally or internationally in different geographic contexts. The supplier will have the ability to do all of these (in time) as the need arises.

    - **Meaningful partnerships with developing country researchers** including capacity building of partner institutions. Success criteria will be agreed with the supplier during the design phase but is likely to include an increasing proportion of research publications or communications coming from institutions and researchers in developing countries over the course of the programme**.**

13. The contract will be implemented in two stages: (1) Inception and (2) Implementation. DFID must be content with the inception prior to commencing implementation. During the inception phase (6 months), the supplier will be expected to:

    - In consultation with DFID, finalise a list of core research questions which will be used to steer initial research;
    - Develop a conceptual framework which addresses the research and which can be used by all research projects to ensure coherence across the programme;
    - Develop an M&E, RIU and Gender strategy for the programme overall, with a clear line of sight to how it might be implemented by an individual projects or organisations (the RIU strategy should be developed with end-user involvement to inform and improve uptake opportunities)
    - Finalise the TORs for the fragile states research theme and competitively commission it as required;
    - Prepare and submit a detailed inception report and revised logframe as appropriate;
    - Undertake some initial research to inform the baseline – including on existing policies and regulatory frameworks in place which affect water security (eg. industrial, agricultural etc).
    - Agree specific milestones (dates and targets) included in the logframe, including a schedule of payments tied to these.

14. The main outcomes expected by the end of 2022 (to be finalised during inception phase) include:

    - At least 60 high quality knowledge products (e.g. tools, models, published papers, etc.), all open access, at least 60% peer reviewed, and at least 10 focused specifically on women and other marginalised groups.
    - At least 2 globally useful models/metrics for monitoring water security, adopted widely.
    - At least one relevant policy or major investment decision (e.g. in urban planning, agriculture expansion, etc.) in five target countries (e.g. Ethiopia, Bangladesh, Pakistan, DRC, Sierra Leone) incorporating the findings of this research.

Reporting

15. Deadlines will be confirmed with the supplier, but we anticipate three formal reporting requirements, on which payment milestones will be based, during the inception phase:

    - Approximately one month after contract award date: a short written project plan for the inception phase, presented to the DFID project team, including what will be addressed; by when; what/how consultations will take place; risks to delivery; etc.
    - Mid-way through the inception phase: a written report, presented to the DFID project team describing key results and developments so far.
    - End of inception phase: full inception report and written programme plan for implementation phase over the duration of the programme, presented to the DFID project team, including details as specified in the requirements section of this ToR.

16. The programme's results framework (finalised in the inception phase) will include a reporting schedule and milestones for the key outputs, including proposed competitive research calls. Payment milestones will be linked to these deliverables.

17. Standard reporting requirements will be:

    - Financial forecasts due one month prior to milestone due date
    - Short quarterly progress reports to the DFID project team
    - Full Annual Report, including assessment of progress on logframe milestones, to meet requirements for DFID annual review process (Annual Reviews will be led by a DFID team, but will require engagement with the supplier and possible site visits)
    - Annual Audited statement of accounts disclosing DFID funding

Timeframe

18. This is a seven year programme running from late 2015 to late 2022. The contract will be for 88 months in total, including the Inception phase.

19. The timeframe for launching this programme is detailed below. However a finalised timeframe will be agreed upon during the design phase:

    - Design phase: early 2015
    - Implementation phase: 2015 to 2018
    - Mid-term review: 2018
    - 2nd Implementation phase: 2018 to 2022
    - Project completion and evaluation phase: 2022

Background

This is a new and innovative type of research programme. Research in water has traditionally been silo-based (e.g. water supply for domestic use, water resources management for environmental outcomes). We will support a new approach to water research – looking at the impacts of water use in one area on water availability and benefits in another. This research programme will respond directly to a number of the proposed goals in the recent High Level Report on the Post 2015 Framework. These include Goal 5 (Food Security and Nutrition), Goal 4 (Ensure Healthy Lives) and Goal 2 (Empower Girls and Women and Achieve Gender Equality). In particular it will support implementation of Goal 6 (Achieve Universal Access to Water and Sanitation) especially proposed indicator c) *bring freshwater withdrawals in line with supply and increase water efficiency in agriculture by x%, industry by y% and urban areas by z%.* One of the underlying messages in the post 2015 High Level Panel report[1] captures the main essence of this research programme:

> *Better water resource management can ensure there will be enough water to meet competing demands. Distribution of water among industry, energy, agriculture, cities and households should be managed fairly and efficiently, with attention to protecting the quality of drinking water. To accomplish this, we need to establish good management practices, responsible regulation and proper pricing.*

This is an innovative approach to research, but also one which is considered vital to better inform water resources management in the future. Current research is primarily silo based and doesn't contribute to the vision outlined above of a fair and efficient distribution between different areas. Changing this

[1] UN (2013) *A New Global Partnership: eradicate poverty and transform economies through sustainable development. The report of the High Level Panel of Eminent Persons on the Post-2015 Development Agenda*

requires a flexible set up to enable integrated research – and also to enable control to move funding between different areas depending on performance and demand. A competitive process to bring together a strong mix of researchers and practitioners to deliver this innovative and flexible programme will help ensure high quality research which maintains and delivers against this vision.

The need for a system wide approach to water resources research and management, is also being called for by other leading think tanks and international groups such as the US National Science Federation[2] and ODI[3] who call for 'a holistic view of the water sector' to support implementation of the Post-2015 framework. The concept has been presented to the UK Water Research and Innovation Partnership (UKWRIP – a grouping of UK researchers, government departments and private sector – such as Thames Water and British Water – chaired by the UK Chief Scientist) who have expressed interest in exploring it further.

Why is UK support required?

Water security is commonly understood to be the process of ensuring sufficient quantity and quality of water for health, productive uses and the environment, with an acceptable level of water-related risks to people, environments and economies[4]. Delivering water security in the developing world requires understanding the water system as a whole, the challenges and opportunities in the different parts of the system, where to prioritise investment and how to manage trade-offs. The provision of water supply, sanitation and wastewater services generates substantial benefits for public health, the economy and the environment and is a crucial factor in ensuring desirable human, social, environmental and economic development outcomes. It is projected that by 2050, 3.9 billion people, over 40% of the world's population, are likely to be living in river basins under severe water stress. Water demand is projected to increase by 55% globally between 2000 and 2050

Benefits from the provision of basic water supply and sanitation services such as those implied by the Millennium Development Goals are massive and far outstrip costs. The High Level Report on the post-2015 frameworks reiterates this point and maintains a focus on provision of water and sanitation, as well as an equitable approach to water distribution and management of use for industries such as agriculture. Benefit-to-cost ratios have been reported to be as high as 7 to 1 for basic water and sanitation services in developing countries[5]. On the other hand wastewater treatment interventions can generate significant benefits for public health, the environment and for certain economic sectors such as fisheries and tourism.

Water supply and management in future years will become more challenging because of a number of converging issues such as climate change, pollution, population growth and movement, and competing demands from users. It is therefore important that future interventions are planned carefully to take into account these factors and that robust evidence is generated to inform such planning.

Water research has traditionally been undertaken in siloes. Research is needed to understand the implications of decisions made along the whole water system. The current approach results in unforeseen and potentially negative impacts further along the water system. Women and children are particularly vulnerable. Understanding how to measure water security – what does it look like at

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[2] (http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503452) NSF Research Programme on Water and Climate change calls for proposals which 'are expected to study water systems in their entirety and to enable a new interdisciplinary paradigm in water research'

[3] Doczi, Julian, Tobias Dorr, Nathaniel Mason and Andrew Scott. (2013). The post-2015 delivery of universal and sustainable access to infrastructure services. ODI Working Paper. Overseas Development Institute, London.

[4] Grey & Sadoff (2007) *Sink or Swim? Water security for growth and development.* Water Policy **Vol 9 No 6 pp 545–571**

[5] OECD (2011), *Benefits of Investing in Water and Sanitation: An OECD Perspective*, OECD Publishing.

different scales and for different people – and what costs and benefits of investments in water security is not well researched. There is limited evidence on the policies, regulations and other approaches needed to deliver water security at different levels (community, household, national etc). Finally, understanding how to ensure that the poor can benefit from water security investments, policies and regulations is key to maximising the benefits for those who are most vulnerable and marginalised.

What will we do to tackle the problem?

We will establish a new research consortium which focuses specifically on an integrated approach to water security research. We will look for innovation in delivery to enable flexibility to move resources to those areas where demand is greatest (both thematically and potentially geographically) and to bring together different disciplines across the physical, natural and social sciences. We will actively link this new programme to existing and related programmes which are focused on individual areas of the water security agenda. We will look for practitioners to be part of the delivery model, aiming to link researchers with field practitioners and to help build the capacity of practitioners, government officials and other end users to understand and utilise high quality research in their areas. Finally, we will fund research which will specifically focus on the challenges and opportunities of delivering water security in fragile states where water supply is most off-track.

What is the problem we are trying to address?

Water security is commonly understood to be the process of ensuring sufficient quantity and quality of water for health, productive uses and ecosystems, with an acceptable level of water-related risks to people, environments and economies. Water security is most commonly applied to overall water resources, but equally applies to sectoral use of water. In all cases to be meaningful discussions of water security must include both economic and physical water security. It is projected that by 2050, 3.9 billion people, over 40% of the world's population, are likely to be living in river basins under severe water stress. Water demand is projected to increase by 55% globally between 2000 and 2050[6].

Whilst there is evidence about the relationship between water and different sectors (such as water and agriculture, water and energy etc), there is little evidence which brings together the different demands and uses of water in a given area (country, region, community) and outlines how these competing demands can be managed sustainably, in a way which meets the needs of the poorest as well as the broader economy and environment, and which can respond to future drivers and stressors such as population growth.

What <u>do</u> we know?

In terms of productive uses, there is a strong relationship between effective management of water resources and economic growth. For example, the 2010 GLAAS report [7]indicated that improved access to water and sanitation produces economic benefits that range from US$ 3 – 34 for every dollar invested – increasing GDP by an estimated 2- 7%. In addition to water security for domestic use, water security for livelihoods, economic sectors and a healthy environment is also key. For example, agriculture uses between 70 – 90% of a nation's water[8] and agriculture represents approximately 20% of Africa's GDP[9].

There are also water related risks. Studies have shown that the variability of rainfall experienced by most poor countries in the South has a strong relationship to GDP in terms of both undermining economic growth and damage incurred by water related disasters (eg. droughts and floods)[10]. In the

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[6] Leflaive, X et al (2012) Chapter 5 – Water; in OECD Environmental Outlook to 2050 (OECD 2012)
[7] *WHO and UN Water (2010) GLAAS 2010 UN-Water Global Annual Assessment of Sanitation and Drinking Water*
[8] *World Water Development Report (2012)*
[9] *Jean-Marc Faurès and Guido Santini (eds) (2008) Water and the Rural Poor: Interventions for improving livelihoods in sub-Saharan Africa. IFAD and FAO.*
[10] *Grey D & Sadoff CW. 2007. Sink or Swim? Water security for growth and development. Water Policy, **9**: 545-571. /Brown C & Lall U. 2006. Water and economic development: the role of variability and a framework for resilience. Natural Resources Forum, **30**: 306-317.*

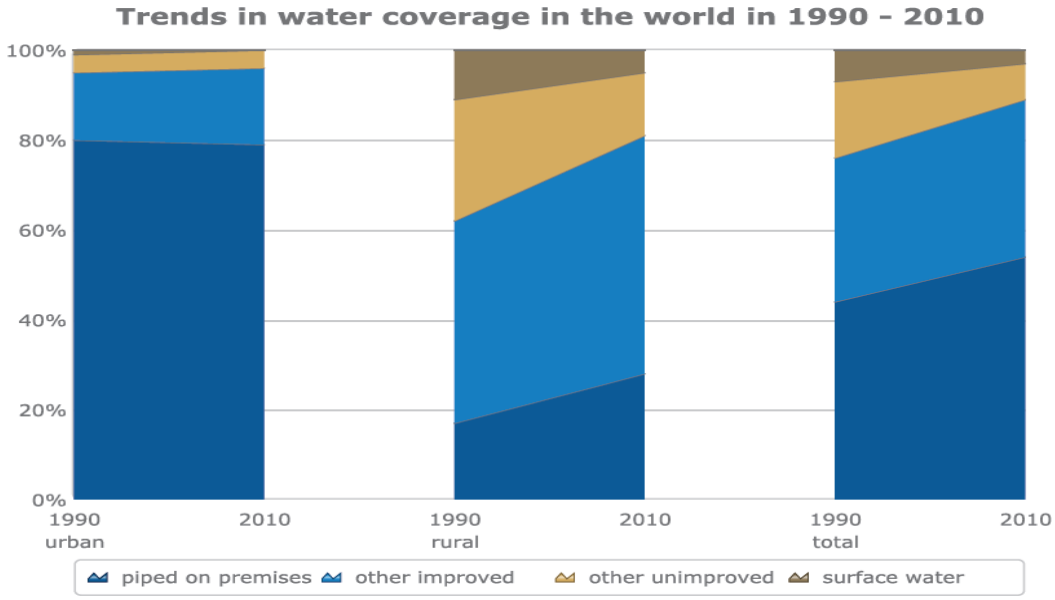
case of Ethiopia, for instance, it is suggested that poor water management and inadequate storage causes GDP to be one-third less than its estimated potential[11]. Floods in Kenya in 1997-98 led to losses equivalent to 11% of GDP for the year, and drought in 1998-2000, the equivalent of 16% of GDP for each year[12] with losses incurred across a range of productive and social sectors. Loss of life, livelihoods and economic damage from flooding and drought continue to be felt throughout the developing world, as witnessed by the 2010 and 2011 floods in Pakistan and the drought in the Horn of Africa.

Why is water security important for the poor?

Water is a basic necessity for life and for people's livelihoods. The poor face acute challenges in meeting these needs and therefore being "water secure" is critical to poverty alleviation. Water insecurity manifests itself in multiple ways for the poor:

- **Lack of access to adequate and safe water to meet basic drinking and sanitation needs:** Poor water, sanitation and hygiene are the cause of almost 90% of all diarrhoea cases globally, which is the third leading cause of death in children under 5[13]. According to statistics from the Joint Monitoring Programme (JMP), the world has now met the MDG Target for improved access to drinking water[14] but this does not take into account that many of the people with 'access' use water supplies that are contaminated, unreliable or where the source of water is vulnerable to future climate changes.

  The level of service achieved through access to an improved source is relatively low and still places a large burden, primarily, on women and girls to collect water[15]. So, even though the MDG target has been met, there remain many hundreds of millions of people who will still lack access to an improved water supply and many of these are harder to reach populations where new and more innovative approaches are likely to be needed, including mobilising private sector resources.



Source: JMP Statistics 2012

[11] *World Bank. 2006. Managing water resources to maximize sustainable growth: a country water resources assistance strategy for Ethiopia. World Bank, Washington, DC*
[12] *DFID. 2010. Water storage and hydropower: supporting growth, resilience, adaptation and mitigation. A DFID evidence into action paper*
[13] *WHO (2005). The World Health Report 2005 - make every mother and child count. WHO, Geneva.*
[14] *WHO & UNICEF (2012) Progress on Drinking Water and Sanitation: 2012 Update. World Health Organization, Geneva.*
[15] *WHO and UN Water (2010) GLAAS 2010 UN-Water Global Annual Assessment of Sanitation and Drinking Water*

In addition, water insecurity[16] can violate some of the basic principles of social justice, including:

- Equal citizenship – every person being entitled to an equal set of civil, political and social rights, including the opportunity to exercise these effectively;
- The social minimum – everyone should have access to resources sufficient to meet their basic needs and live a dignified life;
- Equality of opportunity – for example, as a result of children having to take time from school to collect water;
- Fair distribution.

- **Lack of access to water to meet livelihoods needs and economic opportunities:**

Water is central to the livelihoods of most poor people(agriculture, livestock farming, economic opportunities etc)as well as to most small and large-scale manufacturing processes. Globally about 70% of water is used in agriculture, but this increases to up to 90% in many developing countries[17]. Water is essential in power generation and service industries such as tourism and in sustaining ecosystems which harbour environmentally and economically important biodiversity [18].

- ***Exposure to Current and future risks and stresses***

Current estimates suggest that 1.2 billion people already live in river basins facing physical water scarcity, with 1.5 billion living in areas affected by economic water scarcity[19]. Recent analysis suggests 80% of the global population is exposed to threats to water security[20]. Loss of life, livelihoods and economic assets due to flooding and drought continue to be felt throughout the developing world, as witnessed by the 2010 and 2011 floods in Pakistan and the drought in the Horn of Africa[21]. For example, it has been estimated that in Zambia, variability of rainfall lowers the country's agricultural growth by one percentage point each year and will cost the country $4.3 billion in lost GDP over 10 years[22] and the drought in the Horn of Africa left more than 13 million people at risk according to UNICEF statistics[23].

Water scarcity and stress is likely to increase as a result of multiple factors[24]. Climate change represents a particular threat as the majority of its impacts will be felt through water in terms of changing precipitation patterns and increasing demands from agriculture and power generation as temperatures rise[25]. Other stressors include land use change, population growth, urbanisation and changing consumption patterns.

In summary, poor people face multiple water security challenges:

- **Lack of access** – The WHO/UNICEF Joint Monitoring Programme estimates that 780m lack safe drinking water[26]. The majority of which are in low-income and fragile countries. Lack of access for livelihood opportunities (eg. for agriculture) is also an issue.
- **Uncertain quality** – Even where access rates are improving, there may still be quality issues. Quality may be an issue of man-made pollution resulting from agriculture, urbanisation, and improper waste disposal among other causes.

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[16] UNDP (2006) Beyond Scarcity: Power, poverty and the Global Water crisis. Human Development report 2006.
[17] Molden D (ed). 2007. *Water for Food, Water for Life: A Comprehensive Assessment of Water Management in Agriculture*. Earthscan: London and International Water Management Institute: Colombo.
[18] Vörösmarty et al (2010) Global Threats to Human Water Security. Nature, September 2010
[19] Molden, D, Defraiture, C and Rijisberman, F (2007) *Water Scarcity: The Food Factor*. Published in Issues in Science and Technology Summer 2007 (http://www.issues.org/23.4/molden.html) .
[20] Vörösmarty et al 2010 (op cit)
[21] See – for a good graphic - http://www.grida.no/publications/vg/africa/page/3109.aspx
[22] http://www.infrastructureafrica.org/key-msg/sector/africa%E2%80%99s-economic-development-held-back-episodes-extreme-drought-and-flooding-hydro-c
[23] http://www.unicefusa.org/work/emergencies/horn-of-africa
[24] *UNDP (2006) Human Development Report 2006 Beyond scarcity: Power, poverty and the global water crisis*
[25] Bates BC, Kundzewicz ZW, Wu S & Palutikof JP (Eds). 2008. *Climate Change and Water*. Technical Paper of the Intergovernmental Panel on Climate Change. Geneva, IPCC Secretariat.
[26] WHO/UNICEF *Progress on Drinking Water and Sanitation: 2012 Update* (2012)

- **Affordability** – The poor pay more and more than they can afford. In Uganda water payments represent as much as 22% of the average income of urban households in the poorest 20% of the population[27].
- **High risk exposure** –The risk of being killed by a cyclone or flood is lower today than it was 20 years ago, except for those who live in a country with low GDP and weak governance[28]. Drought is still a hidden risk and locally its social and economic impacts are disproportionately concentrated on poor rural households.
- **Exclusion and Marginalisation[29] –** this may be exclusion from accessing existing water services or ground water resources, or in decision-making or governance of those water resources. Minority or marginalised groups (e.g. women, elderly landless, ethnic minorities,) are often particularly excluded and with limited or no voice in decision making[30].

Addressing the challenge

We recognise that with increasing demands for water the competition between different user groups for this limited resource is enhancing the potential for conflict in many areas. It is also recognised that as competition between users increases the poorest and the most marginalised are most at risk. ***However, what isn't known is how we can best address the challenge of meeting all needs in an equitable and sustainable manner.*** To address this challenge we are proposing a research programme which will have the principles of 'whole system', 'at scale', and 'sustainability' at its core. These principles will underpin all research funded through this programme. Research itself will look at these principles through different lenses – such as a focus on water systems in fragile states:

- **Understanding the *system as a whole***

The water system can be regarded as a "system of services created by the natural flux of water from precipitation to the sea (the water cycle). A simplified diagram of this system is set out in Figure 1 below. Some of these water services are of direct human benefit (such as water for households and farmers). Others benefit humankind indirectly through maintaining the natural environment and ecosystems vital to life and many economic activities"[31]. Delivering water security in the developing world requires understanding the water system as a whole, the challenges and opportunities in the different parts of system, where to prioritise investment and how to manage trade-offs.

[27] Uganda, Government of. 2004. "Poverty Eradication Action Plan (2004/5–2007/8)." Ministry of Finance, Planning and Economic Development, Kampala. In UNHDR 2006.
[28] UNISDR Global Assessment Report on Disaster Risk Reduction (2011)
[29] WaterAid (2010) Equity and Inclusion – A Rights Based Approach.
[30] WaterAid (2009) Women: Water, Sanitation and Hygiene. Water Drops 12 (Jan – Mar 2009)
UNDP (2007) Water Governance Strategy
[31] PEAKS Report to DFID (2012): **THE SUPPLY OF WATER SERVICES TO SCALE**

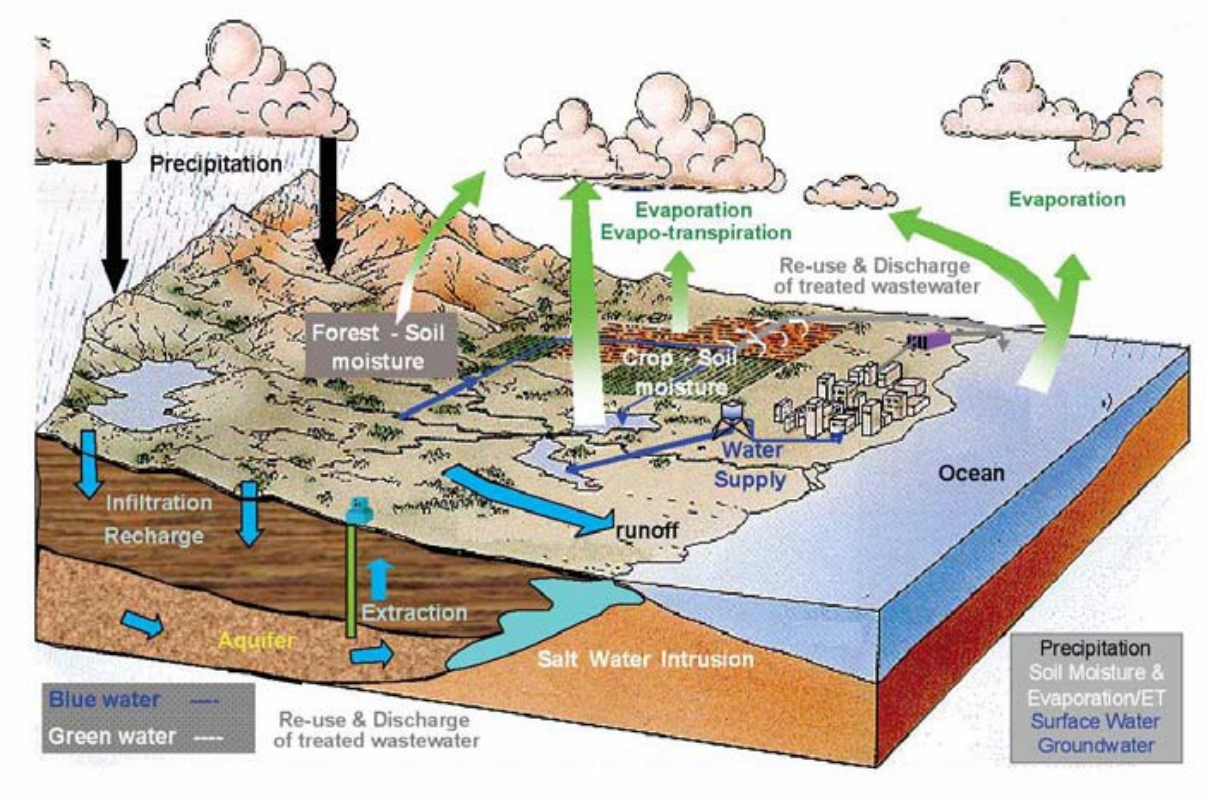


Figure 1 – Schematic of the hydrologic cycle components in present-day setting (see - http://webworld.unesco.org/water/wwap/wwdr/wwdr2/pdf/wwdr2_ch_4.pdf)

Challenges and opportunities can be seen across the system from catchment and management of the resource in aquifers or surface water, access and human use and finally treatment of wastewater and examples are given below. Decisions made in different parts of the system can have major implications for other parts, for example diversion or pollution of water upstream can affect the amount and quality available for human use and the environment downstream. Frequently, decisions about different parts of the system are made in isolation by different groups, for example government Ministries, private companies and farmers, without consideration of the implications. Research also tends to reinforce these sectoral silos, focusing on particular components of the system.

Integrated Water Resources Management (IWRM) is one approach which has been used to address water and river basin management. It is defined by the Global Water Partnership (GWP) as '*a process which promotes the coordinated development and management of water, land and related resources in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital eco-systems*'[32]. Although the approach has been implemented for the past few decades, a DFID funded systematic review indicates that there is little evidence which focuses on how and why the mechanisms have worked (including institutional mechanisms) and how these processes have been linked to poverty related outcomes[33].

There is remains limited evidence on how best to understand and tackle these issues in a holistic way which brings benefits to the poor as well as the environment. Some of the challenges and opportunities which are presented at different parts along the water system value chain are outlined below. These

[32] Source - http://www.gwptoolbox.org/index.php?option=com_content&view=article&id=8&Itemid=3

[33] **HEPWORTH ET AL** (IN PRESS) *WHAT FACTORS DETERMINE THE PERFORMANCE OF INSTITUTIONAL MECHANISMS FOR WATER RESOURCES MANAGEMENT IN DEVELOPING COUNTRIES IN TERMS OF DELIVERING PRO-POOR OUTCOMES, AND SUPPORTING SUSTAINABLE ECONOMIC GROWTH?. Draft DFID Systematic Review – to be published.*

include some of the better known examples of evidence on costs and benefits related to water system management, however the general level of robust evidence remains low:

Catchment and resource management – ecosystems as water 'infrastructure'
Managing water resources in terms of catchment protection and broader ecosystems is critical to the supply of water to users, both in terms of quantity and quality. Activities in other parts of the system such as over-abstraction and pollution can have detrimental effects on the water resource. There is growing evidence that water management at source can save much costlier work downstream, as well as having benefits *in situ.*

- In a well-publicised case in **New York State**, a programme for watershed protection, including the encouragement of farmers in the upper catchment area to convert to more environmentally-friendly cultivation practices, is expected to save $4.5 to $6.5 billion dollars (in present value) compared with the cost of a new downstream water filtration plant for New York City's population[34]. Data from other US cities (Portland Oregon, Portland Maine and Seattle) also confirm the extremely high financial savings from watershed protection, compared with the cost of building new water treatment and filtration systems[35].
- The **Nakivubo Swamp in Uganda** runs through the capital city Kampala and has a key role in assuring urban water quality. A large amount of untreated household sewage and the effluent of the city's sewage works enters the swamp prior to passing into Lake Victoria close to the intake of the water works supplying the city with drinking water. The swamp provides a natural filtration and purification of the wastewater. The physical infrastructure required to provide a similar level of wastewater treatment would cost up to $2 million per year.

Human use – domestic and WASH
As set out previously there are a range of benefits from enabling poor people to have access to safe and reliable water supplies. The economic benefits are captured in Box 1 below.

Box 1 Overall global benefits from meeting the MDGs for water supply and sanitation

Type of Benefits	**Breakdown**	**Monetised benefits (US $)**
Time savings from improved water supply and sanitation	20 billion working days per year	$63 billion per year
Productivity savings	320 million productive days gained in the 15-59 age group 272 million school attendance days per year 1.5 billion healthy days for children under 5	$9.9 billion p.a. in total for the 3 categories
Health care savings		$7 billion per year for health agencies $340 million for individuals
Value of premature deaths averted, based on discounted future earnings		$3.6 billion per year
Total benefits		**$84 billion per year**

OECD 2011

[34] OECD (2011) *Benefits of Investing in Water and Sanitation: an OECD Perspective*
[35] Emerton L & R Bos*, (*2004) *Value: counting ecosystems as water infrastructure* IUCN, Gland

Multiple challenges exist in delivering safe and reliable water supplies for poor people in developing countries; these include how to fund the cost of infrastructure, water storage, and the maintenance of systems, and how to prevent the diversion of water resources to other uses and water pollution.

In addition to providing economic benefits, the access to water has been judged to be a fundamental human right[36].

Human use - economic sectors

In addition to water security for domestic use, water security is crucial for a number of economic sectors such as agriculture, which uses between 70 – 90% of a nation's water and represents approximately 20% of Africa's GDP. Many industries depend on water as an essential element in their production process. Some require water in large quantities (thermal and hydro power generation, cooling, paper, food processing, etc.) others need it to be of high quality (e.g. electronics, specialty food, brewing). Where water does not satisfy industrial requirements, users turn to alternative supplies or greater use of internal treatment and recycling. Tourism is also sensitive to water: hotels and restaurants need sufficient water to cater to their visitors, while there are many cases of losses incurred where beaches and lakes are closed to tourists due to an outbreak of water-related disease, or to the onset of algal bloom.

Waste water – collection, treatment, disposal and re-use

Wastewater from domestic and industrial uses often reaches the environment untreated or insufficiently treated, resulting in major impacts on surface waters and associated ecosystems, as well as economic activity that depend on these resources. Safe disposal of wastewaters helps to improve the quality of surface waters with benefits for the environment (e.g. ecosystems; biodiversity), economic sectors that depend on water as a resource (e.g. fishing, agriculture, tourism) and public health. Wastewater treatment at source prevents extra costs for downstream users that would arise from the need to treat this water before use, or even develop alternative water supplies. Water pollution from untreated wastewater can also pose significant economic costs through its impact on health and environmental quality as well as industrial and commercial sectors.

The public health costs of water pollution in the **Sebou Basin of Morocco** were estimated to be US$97 million (in present value terms for total costs over a 25 year period, in 1996 prices)[37]. These were due to the cost of treatment and losses in productivity from diarrhoea, cholera and typhoid. The environment and livelihoods are also at risk of impact from the improper disposal of waste water. For example, fisheries, and therefore those who depend on them for their livelihoods are also seriously impacted by water pollution: the loss of fish from stretches of the **Bogota River** due to pollution has been estimated to be approximately $1 million[38].

- **Understanding sustainability** – ***what are current and future drivers and stressors on the water system and how can water systems be delivered in a way that is financially and institutionally sustainable and inclusive.***

It is projected that by 2050, 3.9 billion people, over 40% of the world's population, are likely to be living in river basins under severe water stress. Water demand is projected to increase by 55% globally between 2000 and 2050[39]. Water scarcity and stress are likely to increase as a result of multiple stresses[40]. Climate change represents a particular threat in many regions as the majority of its impacts will be felt through water in terms of changing precipitation patterns and resulting increase in demands from agriculture and power generation as temperatures rise (although in some regions, climate change

[36] http://www.un.org/waterforlifedecade/human_right_to_water.shtml
[37] *The price of dirty water: pollution costs in the Sebou Basin* by Claudia Sadoff. World Bank, June 1996
[38] OECD (2011) *Benefits of Investing in Water and Sanitation: an OECD Perspective*
[39] Leflaive, X et al (2012) Chapter 5 – Water; in OECD Environmental Outlook to 2050 (OECD 2012)

[40] *UNDP (2006) Human Development Report 2006 Beyond scarcity: Power, poverty and the global water crisis*

make act as an opportunity brining improvements in water availability)[41]. Other drivers of increasing demand include land use change, population growth, urbanisation, and changing consumption patterns.

The 2009 McKinseys report 'Charting our Water Future' highlights clearly some of the water security challenges which will be faced going forward, in particular related to sustainability:

"…., *agriculture accounts for approximately 3,100 billion m^3 or 71 % of global water withdrawals today, and without efficiency gains will increase to 4,500 billion m3 by 2030 (a slight decline to 65% of global water withdrawals)[42]. Demand for water for domestic use will decrease as a percentage of total from 14 % today to 12 % in 2030, although it will grow in specific basins, especially in emerging markets*.

While the gap between supply and demand will be closed, the question is how. Given the patterns of improvement of the past, ***will the water sector land on an efficient solution that is environmentally sustainable and economically viable****?...The annual rate of efficiency improvement in agricultural water use between 1990 and 2004 was approximately 1 % across both rain-fed and irrigated areas. A similar rate of improvement occurred in industry. Were agriculture and industry to sustain this rate to 2030, improvements in water efficiency would address only 20 % of the supply-demand gap…*

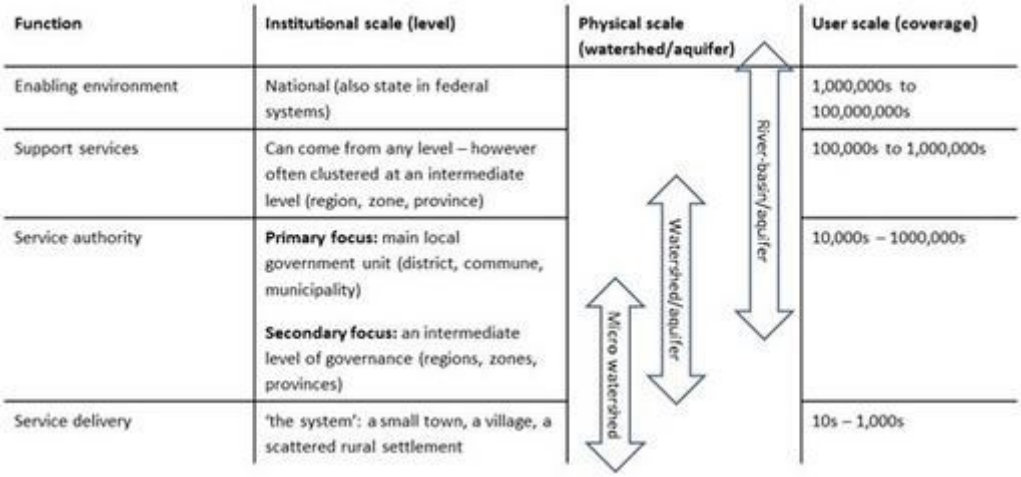
Closing the remaining gap through ***traditional supply measures would be costly****: these face a steep marginal cost curve in many parts of the world, with many of the supply measures required to close the 2030 gap bearing a cost of more than $0.10/m3, against current costs in most cases, of under $0.10 /m3. Without a new, balanced approach, these figures imply additional annual investment in upstream water infrastructure of up to $200 billion over and above current levels—more than four times current expenditure. This picture is complicated by the fact that there is no single water crisis.* ***Different countries, even in the same region, face very different problems***."

- **Understanding issues of water security at scale**

Evidence is needed on what scale water security interventions are best delivered at. This does not necessarily mean development and construction of large-scale infrastructure. By 'scale' we need to consider the **institutional scale** (which grouping of actors etc can be mandated to provide and maintain what services) as well as the **physical scale** that water resources should be managed at (should it be community level, river basin level, national/regional level etc). **User scale** is also crucial, particularly to provide economies of scale – including what the opportunities are to join together existing smaller / community scale interventions which work. The most appropriate scale will be determined by the context.

[41] Bates BC, Kundzewicz ZW, Wu S & Palutikof JP (Eds). 2008. *Climate Change and Water*. Technical Paper of the Intergovernmental Panel on Climate Change. Geneva, IPCC Secretariat.
[42] McKinseys 2009 Charting our Water Future

Figure 2: Different scales of intervention for sustainable water service provision (Triple S: www.waterservicesthat last.org)



Different contexts will require different solutions. For example, wastewater services may need to be provided at a certain minimum scale in order to achieve their purpose as well as to attain economies of scale. Providing them piecemeal in different situations may allow the continuation of serious public health and environmental risks. Also, sewerage and wastewater treatment is a costly and capital-intensive process requiring minimum levels of throughput and a broad user base to generate the required revenues.

There are major knowledge gaps on how to deliver at scale. Focusing only on utilities and infrastructure for example, a recent paper by Carvalho, Marques and Berg[43] provides a summary of the worldwide literature on water utility benchmarking, specifically that relating to economies of scope and scale in the provision of water services. They note that historically there has been a dearth of water sector studies focused on measuring performance and identifying factors affecting costs. The authors conclude that there is no consensus in the literature regarding (1) the optimal scale of water utilities and (2) the existence of scope economies between different types of services (e.g. water and wastewater services). Nor do they find any consensus regarding economies of vertical integration (i.e. economies between the various stages of the production chain).

There is also a lack of understanding of how to scale up existing successful small-scale interventions. Davis and Iyer[44] highlight several potential blockages between the pilot and the scaling up:

- Resistance from beneficiaries who do not want the proposed service or think they could not afford it on the terms proposed.
- Resource constraints (finance, people, weak supply chains, organisational capacity, etc.), not helped by the common situation that pilots use "gold plated" solutions. As Sinclair states, "Experience has shown that many projects implemented on a small scale require a level of financial and human resources that makes them completely impracticable on a larger scale".[45]
- Lack of a "shared understanding" amongst key stakeholders of the aims and components of a scaled up programme.
- Resistance from officials and others whose role is diminished by the scale-up, and the need to have a credible champion for change.

[43] Carvalho P, RC Marques, S Berg "A Meta-Regression Analysis of Benchmarking Studies on Water Utilities Market Structure" August 2011
[44] Davis J and I Param (Oct 2004) "Taking sustainable rural water supply services to scale: where are the bottlenecks?" *WaterLines* Vol 23, no 2
[45] Peter Sinclair, "Scaling up water supply – a WaterAid perspective", *WaterLines* Vol 23 No 2, 2004

- Untypical pilot conditions. Pilot sites are often selected because they seem favourable for the project in question. They may not be typical of the wider community.

Finally, there is a **limited understanding of how to measure water security**. Whilst there are many definitions of water security, how to measure it – when it's achieved, when different dimensions are achieved, what is needed for different groups (women, elderly etc) remains a key challenge. This issue was highlighted in a recent ODI report to DFID on developing metrics to measure water security as part of a contribution to the post 2015 MDG discussion and has been reiterated by DFID country advisers during consultation[46].

How will DFID respond – the proposed approach

The proposed programme seeks to respond to the challenges outlined above. The programme will fund research that delivers research excellence with development impact, bringing together researchers from across the spectrum of disciplines needed to address these water security challenges – including anthropologists, environmental scientists, hydrologists and economists.

We will openly commission a major new research programme which will focus on research underpinned by the three main principles:

- **A focus on the whole system**
  The above section outlines some of the challenges and opportunities in looking at water systems as a whole and the need to explore the interlinkages and incentives along the whole value chain.

- **A Focus on sustainability**
  We will require all research to consider sustainability – environmental, economic/financial, institutional and so on. This requires consideration of current and future drivers/stressors such as climate change, population growth and changing patterns of migration and how to foster system resilience.

- **A Focus on what works at scale**
  We do not expect a focus on large scale infrastructure but rather an investigation of the various issues related to scale – for example, what's the scale and nature of intervention needed to improve water security for different stakeholders; how can local community initiatives be linked together to bring about larger scale impact?

The research should aim to answer the following overarching question: '*is how can sustainable water security be achieved at different scales and how can the poor and most marginalised be part of the process'.*

Examples of possible more detailed questions that the research may address include:

*What does water security look like **practically** at different scales?(metrics and measurements)*

- What does water security look like for specific groups (rural, urban, women, elderly, men etc) and what metrics can be developed and tested to monitor the costs and benefits?
- How do global trends and the decisions/incentives inherent within them (eg. global food production, garment production) affect water security for the poor?
- At what level of GDP can countries deliver sustainable water systems at scale?

How can you achieve it at different scales? (institutions, policies, regulations)

[46] Mason, N and Calow, R (2012) *Water security: from abstract concept to meaningful metrics: An initial overview of options*. ODI Working Paper; available at http://www.odi.org.uk/publications/6811-framing-water-security-meaningful-metrics-post-2015-aspirations

- What are the institutional, financial and capacity requirements to deliver water security to large numbers of poor people? How do you involve stakeholders in decisions and planning along the value chain (from local to national/regional)?
- What role is there for ecosystems management to support water security outcomes for the poor?
- How can water security interventions be made more resilient to future shocks/drivers?
- How cost effective are different approaches to delivering sustainable water systems at scale for multiple uses?

How can the poor benefit and be part of the process?

- How can water security be delivered to those who are most vulnerable (women, children, disabled etc) and how can their voices be heard?
- Where are the examples of policies, regulations where the poor have been included and water security achieved at some scale?