RURAL FOCUS LTD.
Engineering and Development Consultants

UNIVERSITY OF OXFORD

SMART WATER SYSTEMS PHASE II

Progress Report, Year 1

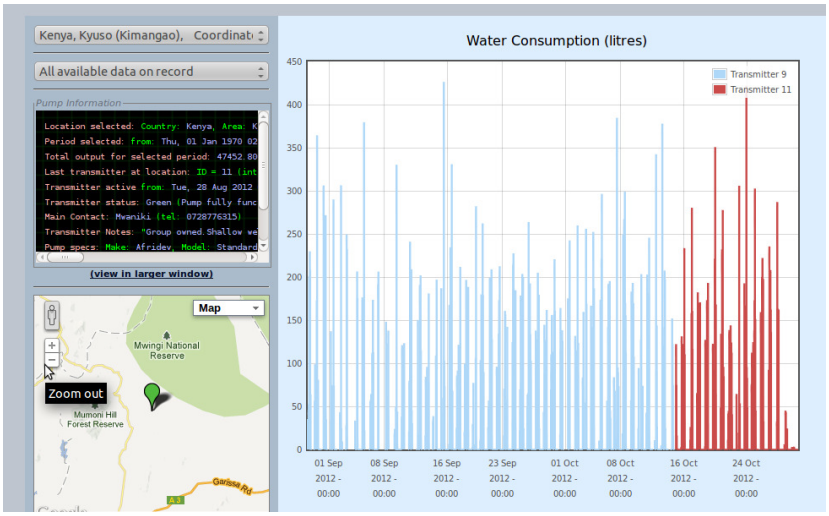
November 2012

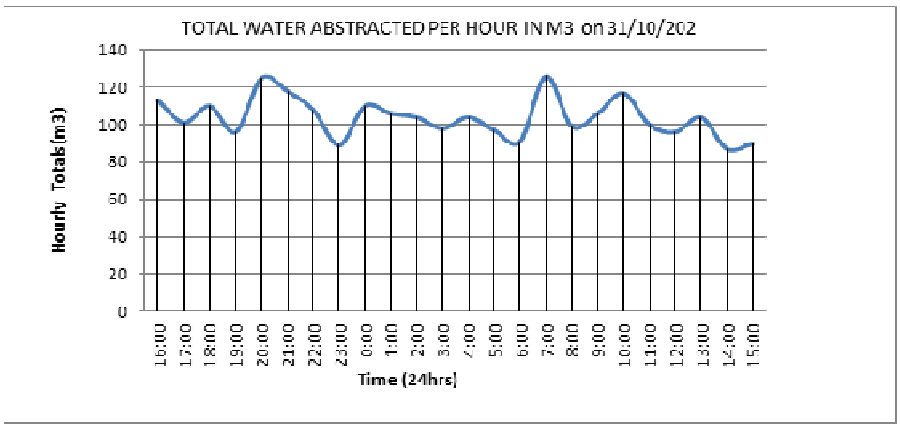
Project R5737

1 EXECUTIVE SUMMARY

Major goals have been achieved in installing and generating the first automated mobile data from a Smart River and a Smart Handpump in Kenya. The figures below reflect, to our knowledge, the first automatic GSM transmission of data on river water abstraction and handpump use in Africa. The implications are several and significant for poverty reduction. First are the opportunities to exploit a new, expanding and low-cost information architecture to develop sustainable systems for water security at scale. Low-cost and reliable data that is automatically and comprehensively generated at scale reduces the costs and increases the performance and accountability of institutions for delivery of services to the poor. Second, smart rivers that cater for productive and domestic uses may be designed to balance increasingly difficult choices in allocating water between low-income communities, commercial interests and ecosystems. Third, smart handpumps can reduce environmental, operational and governance risks. Smart handpumps can be monitored and repaired at lower cost and risk to water users with new maintenance models at scale which hold service providers and remote donors to account. The successful evolution of these initiatives has important implications in shaping the effective delivery and monitoring of the MDGs and SDGs to address the enduring nature of water insecurity in Africa. The research has been communicated with a global audience through BBC online news, radio and television, conference presentations, the project website, open-access reports and peer-reviewed articles.

Figure 1. Automatically-generated mobile data from a Smart Handpump (above) and a Smart River meter (below) in Kenya





2 Smart Handpumps

2.1 Key progress by project activities

- First 'smart handpump' installed and operational in Kenya (August 2012, A2.2.5);
- User interface designed and functioning (A2.2.6, A2.2.8);
- MOU agreed with District Water Officer who are cooperating and supporting the project. Handpump mechanics trained and operational. Performance metrics on all aspects of this work are designed and being monitored (A2.2.4);
- Baseline survey with handpump users conducted, including Choice Experiment exploring scalar maintenance models (A2.2.7);
- Oxford University (Fell Fund) awarded additional funds for installing and testing a handpump in Oxford for advanced signal process engineering research (Nov12-May13).

2.2 Challenges to date

- Several delays and negotiations with Kenyan Customs for clearing some of the technical equipment; this has delayed the full deployment of smart handpumps but is being resolved. By end of project (Sept 13), there is likely to have been a 9 month trial period rather than the planned 12 month trial.

Table 1: Timetable for Smart Handpumps Activities

Activities	2011	2012				2013		
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
	Sept-Nov	Dec-Feb	Mar-May	Jun-Aug	Sept-Nov	Dec-Feb	Mar-May	June-Aug
2.2.1 Inception								
2.2.2 Data needs								
2.2.3 Baseline data								
2.2.4 Train/hire mechanic								
2.2.5 WDT hardware								
2.2.6 WDT software								
2.2.7 Community engage								
2.2.8 Monitoring								
2.2.9Evaluation tools								
2.2.10 Community evaluation								
2.2.11 Workshop								
2.2.12 Final report								

3 Smart Rivers

3.1 Key progress by project activities

- Visioning workshop with Community Water Project Committees (CWPC) to improve understanding and support for the project and the smart meter installation;
- Monthly Burguret Water Users Association meeting with local project partner (RFL), CWPCs, other major water uers and the Water Resources Management Authority (competent government institute) to discuss project development was agreed;
- MOU signed with the Government of Kenya Water Resources Management Authority and all major water abstractors who confirm their support for the installation and protection of the smart meters;
- First smart meter has been installed and is operational at the Burguret Community Water Project (A2.1.5);

- Technical assessments have been conducted in all Community Water Projects (A2.1.2); assessments have conducted at the major commercial water use (Tambuzi) and productive discussions with Ol Pejeta Conservancy, a major tourist destination and confluence of the Burguret River and the Ewaso N'giro;
- Ol Pejeta Conservancy wishes to support the location and implementation of a gauging station though this has yet to be installed (A2.1.5);
- The user interface for the Smart Rivers System is operational and needs to be linked to the river gauging data;
- Completion of updating of water permit records and historical water rights for Burguret River (A2.1.7);
- Women's Focus Group Discussion Report completed for five Community Water Projects (A2.1.2);
- Map of Burguret River completed.

3.2 Challenges to date

- Delays occurred in smart meters being sourced to specification and passing through Kenyan Customs;
- Water abstraction remains a highly political issue and the project has been sensitive to the concerns of all community, business, conservation and government parties in the introduction of the technology – the pace of progress reflects a sustained engagement;
- Physical installation of the river gauge is complicated by the geomorphology of the confluence with Ol Pejeta where a wetland system means either installing a dynamic floating (expensive) river gauging system or a traditional system robust to high and low flows. Seasonal windows for installation have narrowed installation options.
- Concrete security boxes for existing meters offer good protection but diminish the mobile signal strength. Technical modifications have been required in discussion with the UK supplier (Bell Flow Systems).

Table 2: Timetable for Smart River Activities

Activities	2011	2012				2013		
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
	Sept-Nov	Dec-Feb	Mar-May	Jun-Aug	Sept-Nov	Dec-Feb	Mar-May	June-Aug
2.1.1 Inception								
2.1.2 Data needs								
2.1.3 Baseline data								
2.1.4 Identify SWS								
2.1.5 Gauging station								
2.1.6 Launch SWS								
2.1.7 Permit data								
2.1.8 Community pilot								
2.1.9 Poverty impacts								
2.1.10 Workshop								
2.1.11 Final Report								

4 Study sites

The Smart River project is located in Burguret River sub-catchment within the Ewaso N'giro River Basin which flows west from Mount Kenya to the Laikipia plateau. Total river abstractions doubled due to increasing community water project and agricultural demand over the last 10 years. There is increasing tensions between all water users and significant water shortages in dry periods that result

in many community water projects and water-based enterprises without sufficient causing economic loss and social hardship. Such challenges are being experienced across Kenya compounded by increased frequency of climate extremes that make resource management increasingly difficult leading to wider poverty impacts. A Smart River System will be designed to automatically measure abstraction on daily time-steps to determine current water use patterns, to explore new allocation systems and to protect environmental flow allocations. The project aligns with Government of Kenya policy (2002 Water Act) on resource conservation, poverty reduction and community investment. Improved water resource management will lower water risk and enhance water security to benefit the poor who are more vulnerable to water supply failure.

Kyuso District is the proposed study site for the Smart Handpump pilot. Kyuso District is located in Eastern Province falling in the lower arc of the Horn of Africa. The intensity and severity of droughts have increased over the last 10 years with the District recovering from the recent Horn of Africa drought event. 95% of the District population live in rural areas with 60% of the population falling below the income poverty threshold. Over one in six handpumps do not function with repair times often high (months vs. weeks). Most households rely on unimproved water often greater than 30 minutes away with associated economic and health implications. A sample of handpumps will be fitted with Waterpoint Data Transmitters which will measure and transmit handpump use in real-time over the mobile network to trigger maintenance alerts and to evaluate new maintenance models at scale.

Appendices *(available on request)*

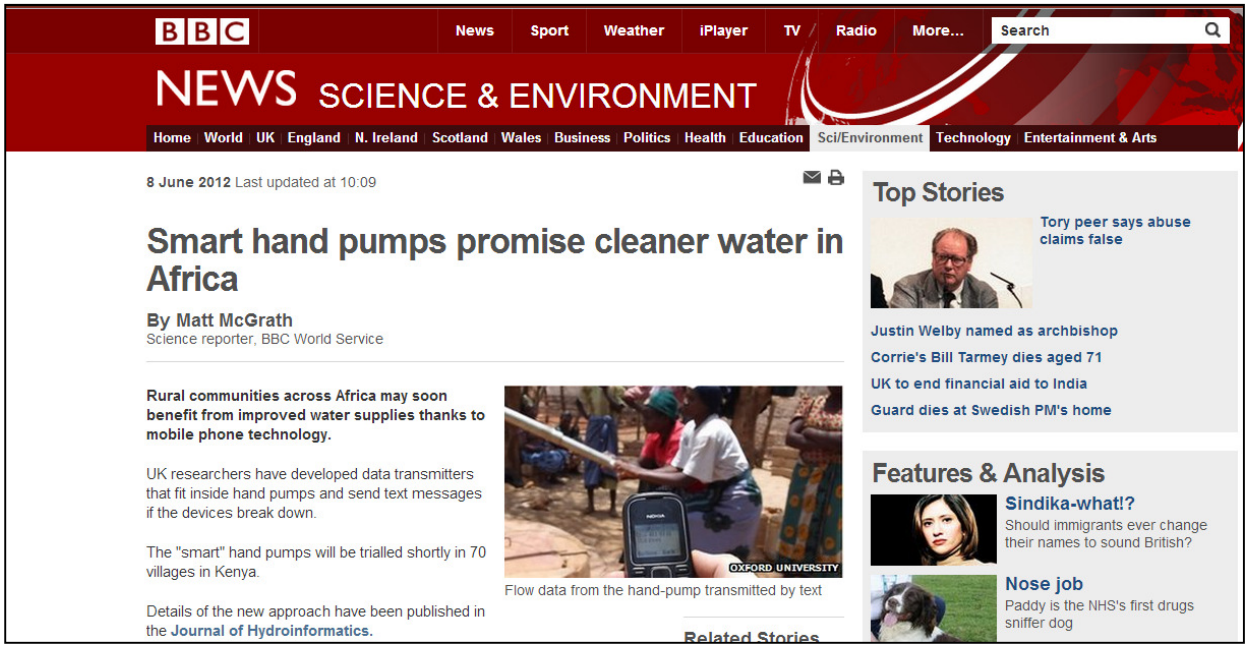
1. Smart River (Burguret) Reports
    a. Women's Focus Group Discussions
    b. Community Water Project Technical Assessment
    c. Permit licences and permits for Burguret River abstractions
    d. Map of study site
2. Smart Handpump (Kyuso) Reports
    a. Handpump User Evaluation (in progress)
    b. Map of study site
3. Presentations
    a. Water Security, Risk and Society conference, Oxford, April 2012
    b. Mobile Tech workshop, DFID, London, November 2012

Peer-reviewed publications

1. Hope, R.A., Foster, T. and Thomson, P. (2012) Reducing Risks to Rural Water Security in Africa, Ambio, DOI: 10.1007/s13280-012-0337-7.
2. Hope, R.A., Foster, T., Money, R. and Rouse, M. (2012). Harnessing mobile communications innovations for water security. Global Policy. DOI:10.1111/j.1758-5899.2011.00164.x
3. Thomson, P., Hope, R., and Foster, T. (2012) GSM-enabled remote monitoring of rural handpumps: a proof-of-concept study. Journal of Hydroinformatics, 14 (4), 29–39.
4. Thomson, P. Hope, R. and Foster, T. (2012) Is Silence Golden? Of mobiles, monitoring and rural water supplies. Waterlines. DOI:

Communication Strategy

1. Television (BBC CLICK: http://oxwater.co.uk/#/smart-handpumps-bbc-click/4569839456)
2. Online
    a. BBC news online, front page (April 8th 2012) At: http://www.bbc.co.uk/news/science-environment-18358766, see below)
    b. Project website (http://oxwater.co.uk)
3. Briefing Notes
    a. http://www.eci.ox.ac.uk/watersecurity/downloads/briefs/4-hope-2012.pdf
4. Blog
    a. Hope, Rob (2012) Mobile Water for Development and Growth. Global Policy. At: http://www.globalpolicyjournal.com/blog/23/03/2012/mobile-water-development-and-growth-1



Project Contact Information

Rob Hope, Oxford University, UK (robert.hope@ouce.ox.ac.uk)

Mike Thomas, Rural Focus Ltd, Kenya (mike@ruralfocus.com)