WATER FROM SAND RIVERS

WATER FROM SAND RIVERS

Guidelines for abstraction

Stephen W. Hussey

Water, Engineering and Development Centre
Loughborough University
2007

Water, Engineering and Development Centre
The John Pickford Building
Loughborough University
Leicestershire
LE11 3TU
UK

t: +44 (0) 1509 222885 f: +44 (0) 1509 211079
e: wedc@lboro.ac.uk http://www.lboro.ac.uk/wedc/

© Stephen W. Hussey, 2007

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise without the prior permission of the publisher.

Hussey, S.W. (2007)
Water From Sand Rivers: Guidelines for abstraction
WEDC, Loughborough University, UK.

ISBN Paperback 978 1 84380 126 9

Dabane Trust

Produced in association with
Dabane Trust, Zimbabwe and WETT, UK

WETT

Designed by Rod Shaw and Kay Davey

Illustrations by Ken Chatterton

Cover painting by Rod Shaw

The cover illustration represents a sand-abstraction pump under development with Dabane Trust

All photographs were taken by the author unless otherwise stated.

Please note: The views expressed in this publication are not necessarily those of WEDC, Loughborough University

About the author

Stephen Hussey is the Director of Dabane Trust and has been involved with the development of basic methods of water storage and sand-abstraction for more than 30 years. He has undertaken an extensive research and development programme to demonstrate the benefits of the water resource that is held in sand river aquifers in dryland marginal areas. This work ultimately led to the award of Ph.D. from Loughborough University. In the course of both his work and research a number of simple methods of sand-abstraction have been developed. In this book he shares his experience and ideas in the hope that they will inspire development workers in dryland areas to review their water supplies and to consider alternative, low-cost options.

Dabane Trust

Dabane Trust is a non-governmental organization based in Zimbabwe. It has been developing basic forms of sand-abstraction for use by rural communities since 1990 and has installed more than 100 simple abstraction systems to provide clean water for household use and for small-scale irrigation and livestock water schemes. The basic technology is a simple and sustainable method of water abstraction that can be operated and managed by rural communities with low technical capabilities. Systems sited in areas where the nutritional status is low have been providing surrounding communities with vast quantities of fresh vegetables and have been in independent operation for over 15 years.

WETT

The Sustainable Water Extraction Technology Trust (WETT) is a British registered charity which supports the development of low-cost, sustainable water supply programmes. Their particular focus is remote dryland areas where the strategy is to assist rural communities to upgrade their traditional water supplies and install, operate and manage this themselves. WETT is interested in identifying interested organizations and in training personnel in the development of alternative water supply systems. It is also involved in research activities which will identify potential water supply locations and lead to wider usage of sustainable small-scale water supply systems.

Acknowledgements

I am most grateful to the assistance provided by WEDC staff, especially Bob Elson, Rod Shaw, Kay Davey and Tricia Jackson and to Ken Chatterton for the production of many of the illustrations. Thanks must also go to the trustees and staff of Dabane Trust especially Melusi Mafu, Florence Ndlovu, Thelma Ntini, Thembalani Tshuma, Douglas Nleya and Ekron Nyoni. The book is sponsored jointly by Dabane Trust and WETT and has been funded by Action for World Solidarity (AWS), Tudor Trust and the Department for International Development (DFID).

My most sincere thanks go to my family, Inez Hussey, Juliet Campbell, Joseph Hussey and Colin Campbell for their input, their encouragement and their patience; and also to Richard Cansdale, Richard Knottenbelt, Frances Chinemana and Tom Hill.

I also thank Eric Nissen-Petersen of ASAL Consultants Ltd, Nairobi, Kenya, for the references to hydro-dynamic wells he has pioneered; ALIN – Arid Lands Information Network-Eastern Africa, Nairobi, Kenya, for the use of the cartoon featured on page 124 and to Johnson Screens for their representation of a naturally developed sand filter featured on page 39; to FAO Publications for Table 7.1; to Brian Skinner of WEDC for use of the sand dam diagram featured on page 58; to World Water – Faversham House Group for the data contained in Table 7.3 and to Vernon Gibberd for his contribution on hafirs.

Foreword

The scene for this book can be drawn from amaNdebele folklore describing the traditional belief of the people of the semi-arid area of western Zimbabwe.

> *In the very beginning the World was dry, flat and featureless – devoid of life. God was not at all impressed, so he decided to send his Son to Earth. He gave him a bow and arrow and told him that if he wanted to call God, he should stamp on the ground.*
>
> *At first the Son did not know what to do in this arid, barren World. He then remembered God's instruction, to stamp on the earth. He looked around for something to stamp on and finally, after much searching, he found a small stone – a tiny pebble. He stamped on this and immediately mighty rocks sprang up out of the ground. Thus the Matopo Hills were formed. The skies darkened and a huge cloud formed overhead. The Son was frightened and took his bow and shot an arrow into the cloud. Immediately lightning flashed and torrential rain poured down and cascaded off the rocks. The Son saw that God and the water were one.*
>
> *The Son then took a needle and sewed the rocks together; the thread formed the rivers that flowed between the rocks. Life started in the valleys and people came. Thus the Son saw that God was the water and the water was the people and that the people were the water and were God.*

Through this traditional belief amaNdebele people conceptualize the interdependence of water and religion. The communication with ancestral spirits, with a divine creator and with the all-pervading need for water in an arid and harsh environment are omnipresent.

Throughout the world, water is perhaps the resource most taken for granted. In arid and semi-arid areas, however, this is far from true and providing a family with sufficient clean water can be a formidable task. In dryland areas of Zimbabwe, for example, distances of up to 9 kilometres have been recorded from permanent homes to water-points and in both South Africa and Zimbabwe homes have been recorded at altitudes of up to 500 metres above a reliable water-point. In remote areas of Mozambique, women are known to walk for up to 10 hours in one direction to collect water. To carry a weight of 20 kilograms in such situations is a Herculean

task and one that ultimately yields only 20 litres of water, the absolute minimum requirement for just two people.

Even where there is infrastructure to abstract or store water there may well be severe limitations. The systems to maintain or repair pumps are often woefully inadequate resulting in numerous water-points which are non-operational. Water may be too deep to draw using a simple handpump and dams too full of silt to maintain permanent water supplies.

In such situations every conceivable type of water supply must be considered and alternative water supplies, that might at first appear inadequate, need to be reviewed. Sand-abstraction – the abstraction of water from unconsolidated sand aquifers, particularly sand river aquifers – is a basic water supply system that has its origins rooted in traditional practices and can be suitable in many situations. Although it is highly-appreciated and sustainable, the technology has not attracted the attention of the mainstream water development industry even though the materials of the deep groundwater industry are used.

As a result, there is a particular dearth of practical information for project managers and fieldworkers concerning basic, low-level technologies for sand-abstraction. It is this which this book sets out to redress. It provides an overview of the conditions in which sand-abstraction is an option. It enables practical people to understand the technology and the technical and sociological factors required to make it sustainable.

The book is also aimed at providing decision-makers in the water industry, commercial, government and non-governmental organizations with an overview of an alternative, appropriate water supply solution that is particularly suitable for use by poor communities in dryland areas where water is scarce.

Stephen Hussey
Zimbabwe, 2007

Contents

Figures

Photographs

Tables