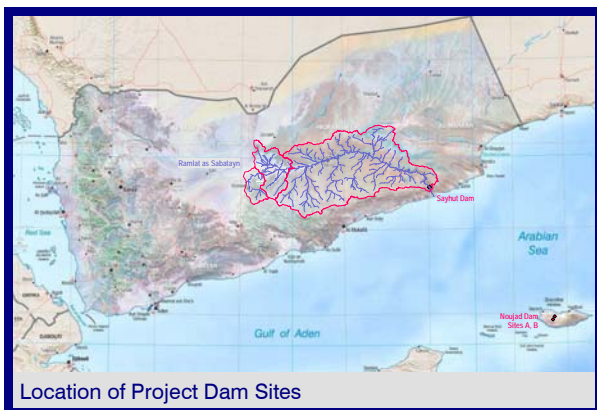


OVERSEAS WORK

Yemen

During the first quarter of the year, a WRA team working with Reservoir Safety Services, completed pre-feasibility studies for two dams in Yemen at Sayhut on the mainland and Noujad on Socotra Island.

Unfortunately, unrest in the country affected travel to the proposed dam sites, so the project was completed remotely, demonstrating how much can be achieved with present-day technology.



Location of Project Dam Sites

Sayhut dam on Wadi Al Masilah will provide six Mm³/year irrigation for 900 ha of the coastal plain. This wadi has a perennial discharge to the sea, from groundwater in the Mukallah Sandstone aquifer.

Although the area west of Ramlat as Sabatayn contributes groundwater to the Hadramaut Al Masilah drainage basin, there is no surface water contribution. Hydrological assessment focused on the lower basin, an area of 46,306 km² with length of 484 kms.

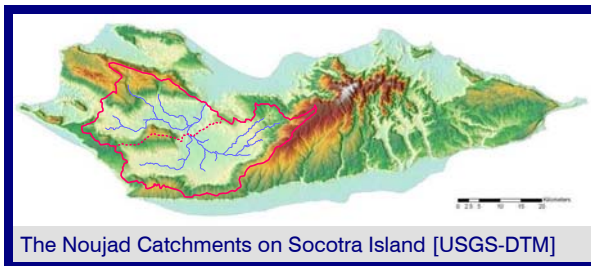
The wadi is separated into two distinct “wet” units by a Badlands sector, usually dry and unsettled. Only the largest floods from the Hadramaut valley pass through the Badlands to reach the Al Masilah and coastal plain.

A potential annual runoff of 287 Mm³ was calculated for the whole basin using TRMM data: however, due to losses through the Badlands, a yield of 28 Mm³/year was estimated for the proposed dam.

The primary purpose of the Socotra scheme is to recharge groundwater in the coastal plain where water supplies are currently obtained from wells and karifs. The Wadi Amrur catchment of 891km² above Noujad Dam comprises a block-faulted limestone plateau with two large gravel plains.

Most of the islanders in the Noujad catchment and also in the northern coastal plain are primarily engaged in

livestock rearing, supplemented in the coastal villages by fishing. Droughts in the past have severely affected livestock, and so the provision of water to help animals on the island survive prolonged dry periods will be a prime objective of the Noujad scheme, as well as enhancing supplies for domestic use.



The Noujad Catchments on Socotra Island [USGS-DTM]

Careful consideration needs to be given to the identification of wadi flows lost to the sea that could be stored for later release, to ensure that existing supplies will not deteriorate from dam construction. It is envisaged that staged development would be most appropriate, due to uncertainties such as karsticity and watertightness of the reservoir basins and the likely future use and needs of the system.

Catchment mapping for the project was based on 90m resolution USGS digital terrain model [DTM] tiles, covering the Yemen mainland and Socotra. Analysis of the DTM using ArcGIS then allowed the definition of both catchment boundaries and wadi flow-paths, checked against satellite imagery and soviet mapping.

Philippines

WRA has been reviewing for Crown Agents a large flood forecasting and warning project for the Bicol River. The river is the eighth largest in the Philippines in terms of drainage basin size with an estimated catchment area of 3,770 km². The river drains the south-western part of the island of Luzon.

The river passes through Lake Bato, which is only six meters above sea level, and then flows 94 kilometers to its estuarine mouth in San Miguel Bay. The Bicol valley is essentially a vast elongated coastal floodplain, with the Mayon volcano on the far SE boundary.



The Bicol River Basin

UK WORK

Headon Camp

In recent months, Dr Sean Burke carried out a risk assessment for redeveloping part of an industrial estate near Retford in Nottinghamshire.



The site was undeveloped agricultural land until World War II, when buildings were erected for use as a prisoner-of-war camp. A nearby quarry was used until 1975 and subsequently infilled. In the 1970s the derelict land was redeveloped for industrial use, which continues to the present day, and some of the activities could have left degrees of contamination. The local geology is the Mercia Mudstone, classified as a secondary aquifer, so groundwater and surface water bodies potentially at risk were reviewed in the study.

It was recommended that a phase 2 investigation be carried out, involving drilling and testing.

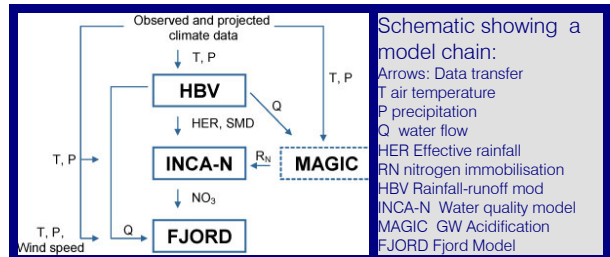
REFRESH Project

[Adaptive Strategies to Mitigate the Impacts of Climate Change on European Freshwater Ecosystems]



WRA is involved in water quality modelling for the River Thames as part of the EU-REFRESH project, which builds on the earlier EUROLIMPACS work. It was recognised that the measures that need to be taken to restore freshwater ecosystems to good ecological health or to sustain priority species, should be designed either to adapt to future climate change or to mitigate the effects of climate. Generating the scientific understanding that enables such measures to

be implemented successfully is the main focus of the new work, which started in February 2010. The River Thames is one of eight demonstration catchments, aiming to develop new catchment-scale models that not only simulate the transport of nutrients and organic matter to surface waters but also predict the ecological response, especially with respect to ecological functioning, biodiversity and thresholds.



Most critically the models will, for the first time, provide managers with a sophisticated tool to assess the effectiveness of adaptive management measures, and will extend existing science in the following areas:

- Development of chained river-lake-wetland models
- Simulating the interactions and feedbacks between ecological response and the chemical and physical environment of freshwaters
- Providing a capability for making assessments of management options for improving water quality and freshwater ecology at the European scale

A J Wade, P G Whitehead, and D Butterfield: The Integrated Catchments model of Phosphorus dynamics (INCA-P), a new approach for multiple source assessment in heterogeneous river systems: model structure and equations. *Hydrol. Earth Syst. Sci.*, 6, 583-606, 2002.

WRA Software News

The HYSIM-CC program and manual [Hydrological Simulation Model for Climate Change] can now be downloaded from the website: www.climatedata.info

WRA Director/Associate News

Dr Sean Burke joins WRA as Associate based in Rotherham. His expertise lies in water quality, hydrochemistry and resource protection through catchment management. His research interests have focused on the interdisciplinary catchment science needed for effective water resource management. Sean developed Demonstration Test Catchments [DTC], a DEFRA Environment Agency initiative in 2008-10, and lectures on Integrated Catchment Management at the University of Newcastle-upon-Tyne and Lancaster University



WRA Board Meeting

18th July 2011, Marlow

The **WRA Bulletin** is a quarterly publication, and relies on contributions submitted by Directors, Associates and Consultants. The document is circulated by email, and published on the WRA web-site, aiming to keep the WRA network, up-to-date with respect to current activities. Please email contributions for future issues to pach@watres.com

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