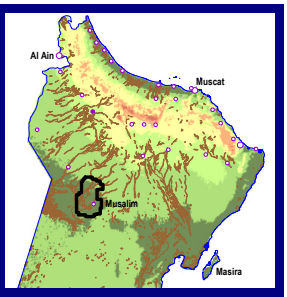
WRA Bulletin 32

October 2012

OVERSEAS WORK

Khazzan Gas Field, Oman

WRA has been assisting BP and their consultants with the design of flood protection facilities for a new gas field in the Khazzan area of Central Oman, around Mussalim. The study has involved a site visit followed by an initial report on the flood risk of various structures, roads, pipeline wadi-crossings and works compounds, to design appropriate scour protection.



Left image: Wadi Umayri delta, showing lighter coloured mixture of chalky limestone and gypcrete taken from a recent trial pit. Right image: Map of Northern Oman and location of the project area.

The area is characterised by a flat plain sloping gently from north-east to south-west, the Batinah, where drainage enters the Wadi Umayri delta, a large salt pan, or sabkha, close to the border with Saudi Arabia. Elevations fall from 120 m above sea level in the north to some 60 m over the sabkha.

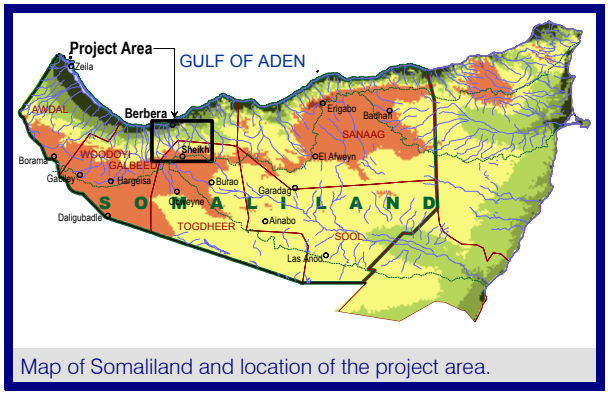
The area is not however uniformly flat, being dissected in places by wadis flowing towards the south west and by three to five metre high 'escarpments' forming the previous coastline of a large inland sea.

Left image: Wadi Umayri showing channel deeply incised into surrounding gypcrete formation. Right image: relic shoreline 'escarpments' with the higher Batinah plain and the relic lake bed forming the lower level

There are limited rainfall data and no records of flow within the region, although good records exist for the wetter regions further north. Estimation of flood hydrographs therefore required a considerable degree of judgement in order to make best use of the limited data available. The task was challenging as the client is risk-averse and required flood estimates up to the 10,000 year event with sparse data. A range of design flood estimates and hydrographs were provided for the gas production site and related facilities.

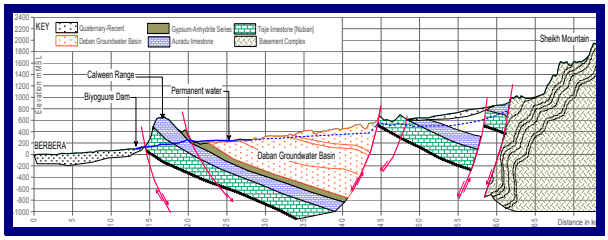
Berbera Water Supply, Somaliland

The original Berbera water supply came from a spring at Dubar, which fell into disrepair and does not have the capacity to support a growing port. The population is expected to grow to 165000, and livestock numbers will exceed 1.3 million by 2022. The Abu Dhabi Fund is aiming to develop a new water supply to meet these needs, and WRA-CONSER has been investigating groundwater and dam sites in the area south-east of Berbera. After a preliminary review study, the project focused on developing the resources of Tug Biyoguure and the Daban groundwater basin.



Map of Somaliland and location of the project area.

The Tug Biyoguure catchment has a surface area of 645 km^2 and elevation range of 1570 m, and provides perennial flow across the coastal plain. Tug Biyoguure baseflow is derived from the Daban down-faulted block, which lies between the coastal range and Sheikh Mountain covering an estimated area of 790 km^2.



Tug Biyoguure has eroded along a fault through the Calween Range lowering the Daban Basin surface, and producing a natural "line-sink" for groundwater trapped behind the impermeable Taleh Series.

It is expected that geohydrological monitoring and further reconnaissance will be carried out to confirm the magnitude and variation of tug baseflow.

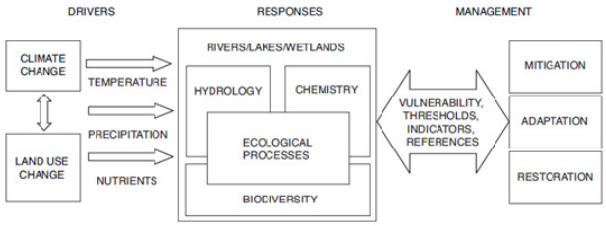
UK WORK

EU REFRESH Project

The project is a 14 million Euro project coordinated by UCL London and involves 20 partner organisations across the EU. WRA is a sub-contractor on the project with the task of leading a demonstration test catchment study of the River Thames, in the hands of Jill Crossman and Professor Paul Whitehead.

River Thames and Catchment Map
www.refresh.ucl.ac.uk

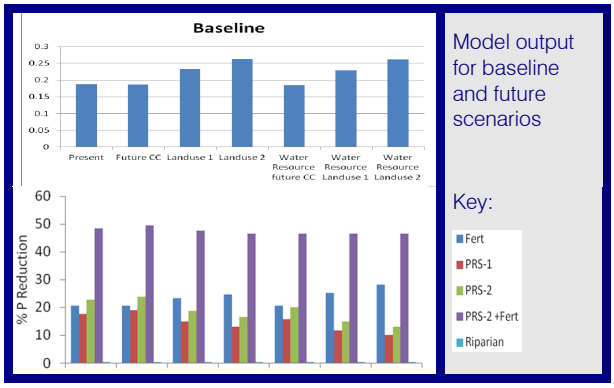
The work has involved setting up the INCA N and INCA P models for flow, water quality and ecology for the whole of the River Thames system, using data from a wide range of sources including Environment Agency, Thames Water, Met Office and DEFRA. The objective of the study has been to assess the impacts of climate change and land use change on the Thames River flows, water quality and ecology with the aim of investigating how the drivers of change and the responses can be controlled or mitigated by management action, as indicated below.



The models have been calibrated and validated for extensive records of data and a set of scenarios and mitigation measures evaluated for the following eight current and future conditions:

- Future climate for the period 2030-2060
- Future climate plus a future land use (LU1) under a Global Food Security scenario such that arable land is increased from the current 35.5% to 50%.
- Future climate and a more extreme projection of future land use (LU2) which assumes a Global Food Security scenario such that arable land is increased from the current 35.5% to 60%
- Thames Water Resource Strategy with the construction of a new reservoir at Abingdon under Future Climate for the period 2030-2060
- Thames Water Resource Strategy with the construction of a new reservoir under future climate plus the future land use (LU1)
- Thames Water Resource Strategy with the construction of a new reservoir under future climate plus the future land use (LU2)
- For climate change the KNMI atmospheric regional climate model (RACMO) has been used with the model being driven by the general circulation model (GCM) to project future climate variables.
- The set of mitigation measures considered have been reduced P fertiliser usage, the use of riparian buffer strips or wetlands and the treatment of effluents in STWs to remove phosphorus to 2 different standards (PR1 and PR2).

The model suggests that future P concentrations under changed climate and changed land use will be worse, although it is the land use change that will have the most significant effect, due to increased agriculture and enhanced use of P fertilisers.



In assessing the impact of mitigation strategies, it was found that the best approach to reducing river-P is to combine a strategy of 20% reduced P fertiliser applications and a high standard of P removal at wastewater treatment plant. This would reduce P concentrations down to the 0.12 mg/l level which is required for the Water Framework Directive.

WRA Director/Associate News

Dr Richard F Wright joins WRA as Associate, following a career in the USA and at the Norwegian Institute for Water Research. Dick is an international expert on land use, acid deposition, climate change and their effects on terrestrial and aquatic ecosystems, developing the MAGIC model for soil and water acidification.

WRA Board Meeting

18 January 2013, Wallingford

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 Paul Holmes: pach@watres.com

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