

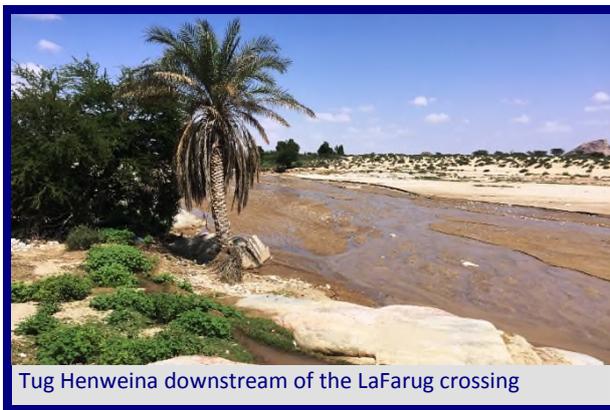
# WRA Bulletin 51

January 2019

## OVERSEAS WORK

### Somaliland wadi crossings

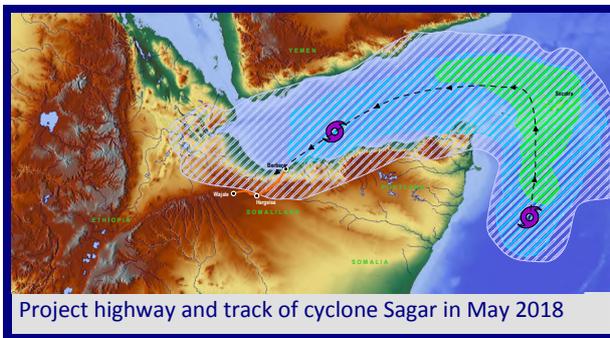
WRA continues to work widely in Somaliland and has supported CONSER in the design and reinstatement of wadi crossings [toggas] along the 250 km highway from the port of Berbera to the Ethiopian border town of Wajale, which passes through the capital city of Hargeisa.



Tug Henweina downstream of the LaFarug crossing

The work has involved hydrological and hydraulic modelling of 15 of the largest toggas by a team lead by Partner Paul Holmes, including Associates David Plinston, Julian Smith and Peter Baur.

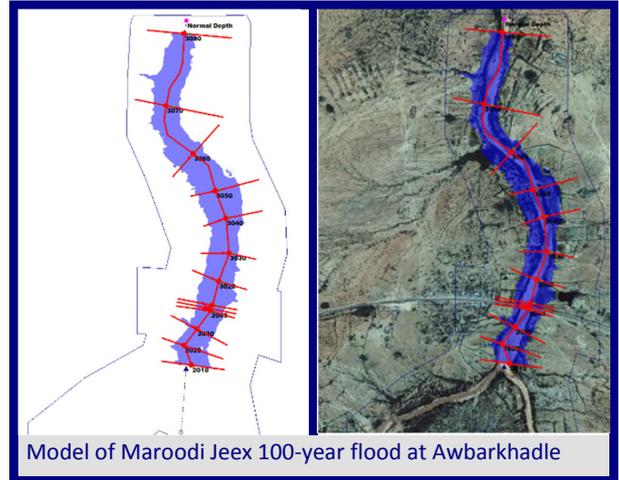
There are three large catchments over 300 km<sup>2</sup> in area, and three small catchments of less than 10 km<sup>2</sup>, three toggas draining the plateau farming area west of Hargeisa, and the remainder are moderate size toggas associated with drainage of the Assa Range of hills and Auradu escarpment between Awbarkhadle and Mandera. TRMM-GPM rainfall data were used to supplement ground data, and an analysis was made of the recent cyclone Sagar.



Project highway and track of cyclone Sagar in May 2018

InfoWorks RS v16 was used for hydraulic models which were calibrated against observed flood levels at selected sites. Many of the large crossings were built as Irish bridges which will be replaced with clear-span

bridges, while smaller crossings have multi-barrel culverts. Models were configured using high-resolution satellite imagery to produce a 1m-DTM and valley and channel cross-sections.



Model of Maroodi Jeex 100-year flood at Awbarkhadle

## UK WORK

### Fairford groundwater levels

Fairford, in Gloucestershire, historically suffered many flooding incidents from the River Coln which were also exacerbated by groundwater and surface water. A river flood alleviation scheme was introduced by the Environment Agency in 2013.

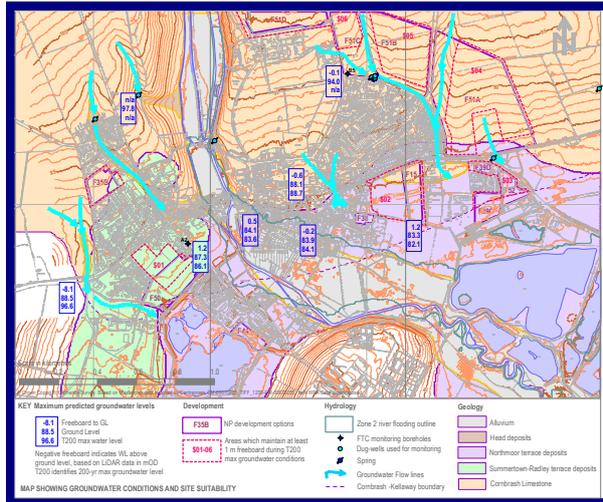


Drilling borehole A2 in the snow at Fairford Rugby Club

Paul Holmes and Partner Frank Farquharson assisted Fairford Town Council in 2018 in the preparation of their Neighbourhood Development Plan, by providing hard evidence to support the strategy for future housing development. The WRA assignment focused on groundwater so that future development could be sited in appropriate places which are not subject to high groundwater levels in the Cornbrash limestone and river alluvium.

This involved both an inventory of old wells in the town area, and drilling of three new observation boreholes which were equipped with loggers. Drilling was done by GMD and CCGI under the supervision of Andy Dixon. The wells and boreholes were then monitored for six months.

Groundwater hydrographs were modelled with reference to the national index site at Ampney Crucis, and other long-term monitoring sites, to predict 200-year return period maximum groundwater levels across the town area.



### Upper Lliw Reservoir in South Wales

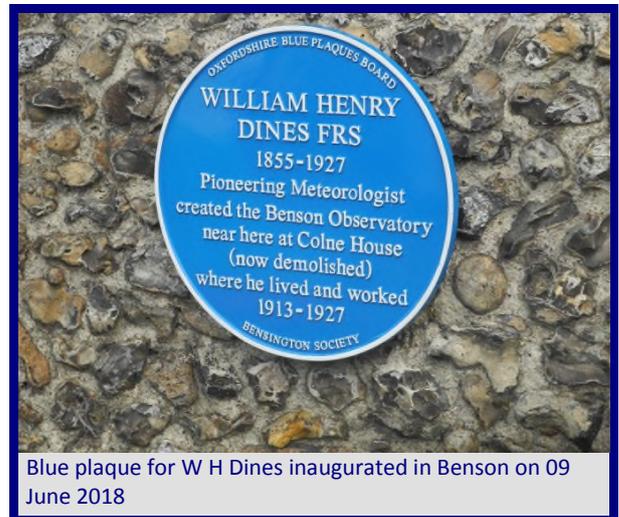
Paul Holmes assisted Stillwater Associates in their reservoir safety work for Welsh Water, providing groundwater expertise for investigation of seepage in the Upper Lliw drawoff tunnel. The work involved geological mapping and chemical testing of seepage water and sediment, to trace the origin of tunnel resurgence.



Inspection team (with staff from WRA, Stillwater Associates, and Welsh Water) entering Upper Lliw Reservoir drawoff tunnel

### Commemoration of William Dines

Frank Farquharson and Associate Nick Mandeville attended the unveiling of a blue plaque in Benson on 09 June 2018 to honour William Dines, the famous amateur experimental meteorologist.



Most UK hydrologists will be familiar with the Dines tipping bucket rain gauge, but for meteorologists he invented a pressure tube anemometer, which could measure wind direction and velocity with much greater accuracy than previously, an instrument widely used subsequently for almost a century. He was also a pioneer in the use of balloons and large box kites to measure upper air temperatures and pressures. One of Dines' associates at Benson from 1919 was Lewis F Richardson, the father of analytical weather forecasting.

On the day Frank Law, from CEH, recounted Dines' many inventions ([www.oxfordshireblueplaques.org.uk/plaques/dines.html](http://www.oxfordshireblueplaques.org.uk/plaques/dines.html)), and former TV weather man Bill Giles gave an amusing speech about the hazards of making early weather forecasts.

### New Associate



Peter Baur has recently joined WRA as an Associate. He has a strong background in international development and hydrology in Africa, the Caribbean and Latin America, and brings technical skills in diverse areas of hydrology, hydrogeology and water quality, with a particular focus on the mining industry and due diligence.

### Next WRA Board Meeting

Friday 26<sup>th</sup> April 2019, Benson

The WRA Bulletin is a quarterly publication, and relies on contributions submitted by Partners, 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 Nick Mandeville: [nick@watres.com](mailto:nick@watres.com)

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