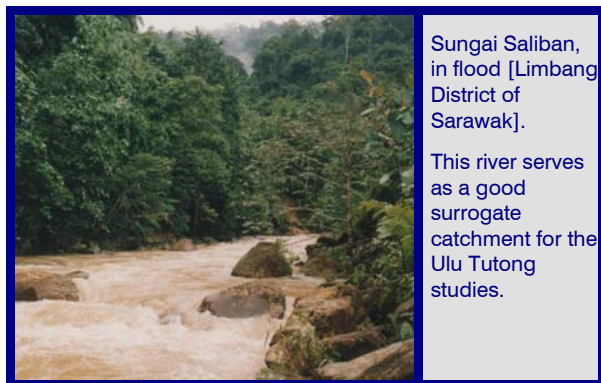
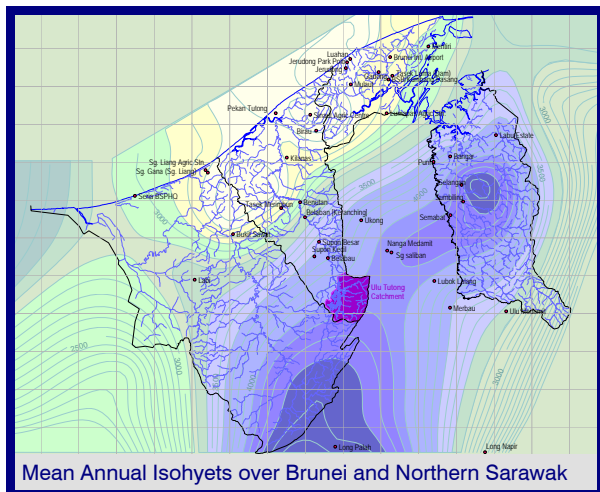


OVERSEAS WORK

Negara Brunei Darussalam

The hydrological design for Ulu Tutong Dam was carried out in 1996/97 as part of the water resources development projects for the Seventh National Plan. In January 2010, SinoHydro signed a contract with the Ministry of Development and started construction of the access road and diversion tunnel. At the same time, the contractor began monitoring rainfall at the dam construction site, where rainfalls were apparently recorded of 1740 mm in September 2010, and 7730 mm in a nine-month period [Aug 2010 - Apr 2011]. WRA was commissioned to review the rainfall data and potential impact on construction stage flood risk.

The Ulu Tutong dam is being built in a belt of high rainfall which extends from Long Jegan in Sarawak to Medamit and Semabat in Temburong. However, rainfall in Sep 2010 in this zone did not exceed 732 mm. Double mass analysis and an investigation of the measurement methods showed that the Ulu Tutong rain gauge is over-reading by a factor of 2.2, as a result of poor installation and bad hydrometric practice.

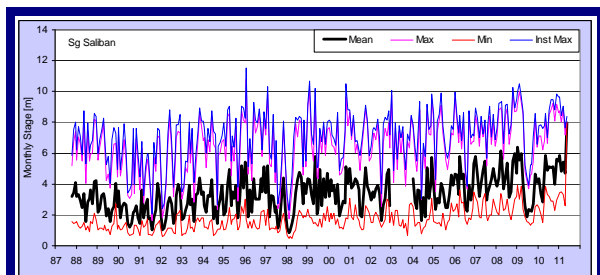


Sungai Saliban, in flood [Limbang District of Sarawak].
This river serves as a good surrogate catchment for the Ulu Tutong studies.

Data obtained by David Plinston from the Tropical Rainfall Measuring Mission (TRMM) showed that an annual total of 4329 mm would be a representative catchment rainfall for the Ulu Tutong in 2010. Using the Brunei and Sarawak raingauge network, mean annual rainfall for the Ulu Tutong catchment was revised at 4131 mm and mean annual runoff of 1900 mm for the 107.6 km² catchment. In a wet year, mean annual rainfall may reach 5000 to 6500 mm.

JPS / Sarawak and the Brunei Agriculture Department have kindly provided hydrological data for use in validating the rainfall and river flows. It was found that the 2010-2011 period has been wetter-than-average, but there is no evidence to suggest that the rainfall has been record-breaking. Over the past decade mean rainfall and runoff has been increasing in this region, seen in the Sg Saliban record.

Regional flood estimation methods were used to predict a mean annual flood of 150 m³/s, which agrees well with the bank-full discharge measured at the dam. A range of methods were used to calculate the 100 yr flood peak of 375 m³/s, and WMO PMP of 242 mm/hr for storm duration of three hours was used to estimate Probable Maximum Flood of 2600 m³/s.



Increasing trend in Sg Saliban minimum and mean stage
Data Source: JPS / Sarawak

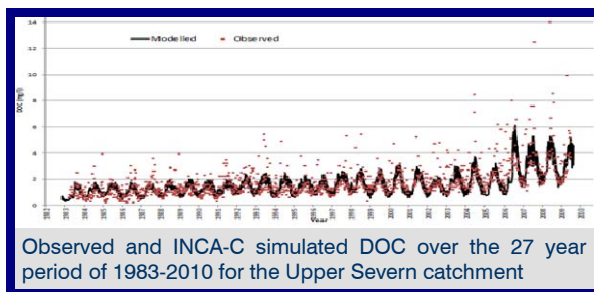


Sungai Tutong at Mapol.
Long-boat travelling up-river to Supon besra and Belabau settlements in the Ulu Tutong area

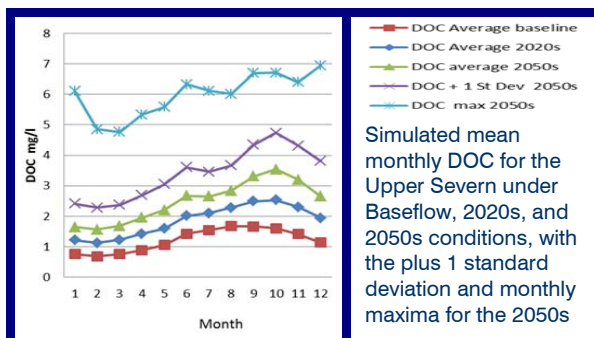
UK WORK

Climate Change & Drinking Water Supplies

As part of an UKWIR project looking at “Future Problems and Adaptation Measures”, Paul Whitehead and Martyn Futter have prepared a set of case studies using INCA software to assess potential impacts on nitrogen, phosphorus, sediments, dissolved organic carbon [DOC] and colour. DOC is becoming a serious issue in upland areas, and the Acid Waters Monitoring Network has shown significant rises at a wide range of sites across the UK. In order to assess potential future increases in DOC and water colour, the carbon version of INCA has been applied to the upper Severn catchment at Plynlimon, using a long run of data from 1983-2010, to help calibrate the model. The catchment in the upper Severn has peaty soils and there are rising trends in the data and a strong seasonal component. The model performs well, and simulates the seasonal and trend patterns of DOC over the past 27 years.

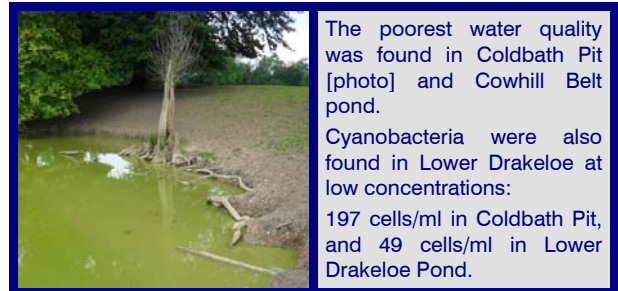


The INCA-C model has been used to assess potential changes in DOC using the UKCP09 2020s and 2050s climate change predictions. Significant DOC increases were identified in October and September when soils become saturated and flushing DOC. The model shows an average increase of 47% and 108% and increase in maxima of 95% and 245% for the 2020s and the 2050s respectively. Such increases in DOC are of real interest to the water companies because of the implications for the high cost of water treatment required to maintain water supplies from upland catchments. The uplands supply major conurbations including Manchester and Birmingham, so this is a question of strategic and economic importance.



Algal Bloom in the Woburn Lakes

The exceptionally dry spring resulted in early growth of algae in certain parts of the Woburn deer park, reaching a peak in early June. Luckily, wind and rain dispersed the concentrations in the main lakes, but smaller watering holes remain in poor condition. Samples were taken to determine algal species and the degree of hazard.

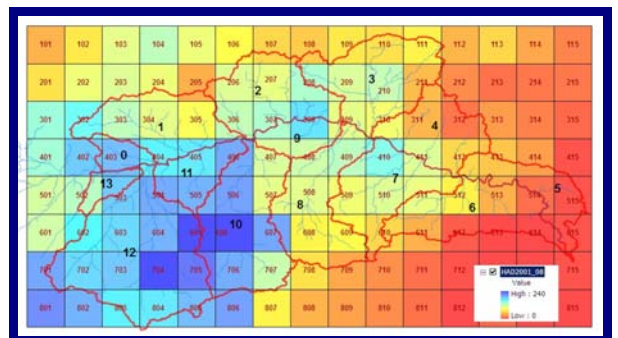


The problem of water quality was diagnosed by WRA in 2009, as the multiple use of water in Woburn lakes requires a long-term solution to the nutrient-overload. During summer, deer tend to congregate in the Coldbath catchment, which has comparatively few watering holes. Construction of additional ponds in this secluded area, combined with fenced-off reed corridors for removal of nutrients, would reduce the tendency for deer to use the main lakes.



TRMM: Tropical Rainfall Measuring Mission

David Plinston has processed a complete set of daily TRMM data, available for the period 1998 to present, for the whole globe between the 50 degree latitudes. The 0.25° data-cells were used recently on the Wadi Hadramaut Al Masilah in Yemen, providing a valuable new capability for water resource projects.



WRA Board Meetings

3rd October 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 Paul Holmes: pach@watres.com

Water Resource Associates Ltd, PO Box 838, Wallingford, Oxon OX10 9XA. Tel: +44[0] 1491 838 190, www.watres.com