WRA Bulletin 40

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WRA Arid Zone Hydrology

WRA partners and associates have a wealth of experience addressing the problems of hydrology and water resources in arid areas where the lack of water is a constant challenge to everyday life. A recent study in the United Arab Emirates considered the meteorology, hydrology and hydrogeology of the Wadi Sha'am basin located in the mountainous north of the country. One of the methods used to provide water for domestic and agricultural purposes is the use of recharge dams to capture the surface runoff from the steep rocky terrain following infrequent but intense rainfalls (Figure 1). The storage of water then allows infiltration to groundwater to provide a source for abstraction rather than the rapid conveyance of the floodwaters into the sea.

Figure 1 Recharge dam in the Wadi sha'am

The building of recharge dams has encouraged more settlement in the downstream areas, thus increasing the population at risk of flooding if the dams were to be overtopped. The WRA study estimated the 1 in 100 year flood for the Wadi Sha'am and made use of the Modified Single Flow model developed at Zurich University to predict the areas at risk of flooding should the dam fail (Figure 2). Another component of the study considered the impact of sedimentation in the dam and used the US Department of Agriculture GLEAMS model (Groundwater Loading Effects of Agricultural Management Systems) to estimate the annual sediment load.

Figure 2. MSF model output showing flooded areas in blue downstream of the dam (orange).

The GLEAMS model estimated the annual average sediment load for different combinations of slope, land cover and geology, which were mapped on a grid cell basis using Arc GIS software. The slope was derived from a digital terrain model supplied by the client. The model simulations used daily rainfall data as an input and calculations based on the universal soil loss equation. Average annual sediment loads of up to 33kg/ha were predicted which were used to develop a management programme for removing sediment from the dam.

Milton Keynes

WRA recently undertook a hydrology survey on behalf of Milton Keynes Council in the grounds of a primarly school in order to find the location of a former pond and swimming pool on the site. The work included two components, a desk based study which made use of historical maps, aerial photographs and GIS to identify flow pathways and low lying areas of the terrain; and field work using CAT scanning and hand augering to pin-point any remaining infrastructure or hydrological features associated with these locations. The fieldwork confirmed the location of pipes around the former swimming pool and identified a low lying area in woodland along the school boundary where standing water had been present during wet periods.

This corresponded to the route of flow pathways mapped using GIS (Figure 3) and the site of the pond as marked on 19th Century Ordnance Survey maps. The use of GIS, detailed aerial photos and a high resolution digital terrain model provided quality background information so the fieldwork could focus on likley areas rather than having to undertake a full inspection of the site.

Figure 3. Flow pathways and pond location at Milton Keynes.

Sofware News

WRA has made use of GIS (geographical information systems) software for many years as a means of mapping and visualising spatial data and the associated attribute information. A recent acquisition has been the 3-D Analyst extension for the ArcGIS software package. This allows a 3-D representation of landscapes with the ability of the user to view from any angle and orientation. It also has a vertical enhancement so that minor but critical changes in the terrain can be made to stand out. In hydrology this has practical uses to provide a visual verification of surface features such as flow pathways, flood plains, sinks, and areas of raised ground. The software is also a powerful tool for presentations and can provide an audience who may be unfamiliar with features displayed in 2-d on maps with a proper visualisation of the ground surface.

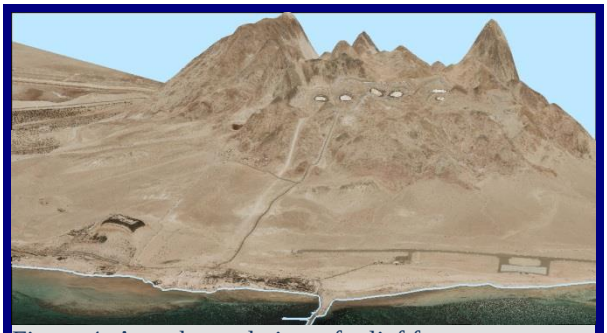

Figure 4. An enhanced view of relief features provided by the 3-D Analyst software.

WRA Partner/Associate News

Flood Studies Team Reunion

WRA Partner Nick Mandeville (shown 4th from the right in Figure 5 below) was one of a number of former staff from the Institute of Hydrology who attended the Flood Studies Team reunion in Wallingford this October. The event was instigated by WRA associate and former director, Mike Lowing (far left), and marked 40 years since the completion of the Flood Studies Report in 1974 (although it was not published until May 1975). Other Team members from WRA were David Plinston (WRA Associate, and second from right) and Partner Frank Farquharson who was unable to attend the reunion.

Figure 5. The Flood Studies Team reunion outside the original office location in Wallingford (photo: Max Beran).

Next WRA Board Meeting

9th January 2015, Benson

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 Harvey Rodda: harvey@watres.com

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