Work has recently been completed on a temporary arena and cross country course for the London 2012 Olympics Equestrian event in Greenwich Park that will take place during July and August of this year.

The Environmental Protection Group (EPG) was engaged to provide a sustainable water management system by Andrews Bowen Ltd, the contractor responsible for the supply and installation of all equestrian footings (performance surfacing) for the scheme. The design remit for this prestige project was complex and very demanding due to the temporary nature of the development, the unique constraints associated with the Royal Park’s heritage and environmental setting, combined with exacting performance requirements of the surfacing and construction tolerances to meet international equestrian eventing standards.

Major elements of the sustainable water management design are constructed within steel structural platforms provided by The Structures Group (TSG). Over the past 18 months several substantial test events have been undertaken by the client to assess all aspects of the system and this has enabled TSG’s structural design team and EPG to develop an integrated, complimentary water management design to manage the surface water run-off from the platforms, which includes water harvesting to be re-used for the environmental conditioning of the equestrian footings system. The footings comprise a unique high performance sand and fibre mixture manufactured by Andrews Bowen, which requires a specific moisture content to achieve optimum performance. The water management elements have been installed for Andrews Bowen by SEL Environmental Ltd, a specialist environmental contractor.

Some of the key design challenges were as follows:

- No excavations whatsoever were allowed within the Park
- Existing ground levels varied significantly with gradients up to 6% in areas of the proposed arenas and training areas, whereas international standards require maximum gradients of 1% for equestrian performance areas
- Numerous protected trees exist in and around proposed performance areas that required suitable root protection provision
- The water management system must comply with current best practice source control SUDS guidance
- The performance surfaces must manage a 100 year storm event with zero discharge to existing sewers
- Water supply for irrigation of the performance surfaces is limited
- Truck cycles had to be kept to a minimum to avoid congestion and minimize environmental impact
- Wherever possible construction materials must be manufactured from recycled materials, be recyclable and reusable

The solution developed by EPG incorporated the Permavoid Equaflow system and involved the following innovative features:

- As all performance areas including the training facilities and the main arena had to be constructed to a 1% gradient; surface water run-off needed to be managed on a slope to prevent point loading to the existing grassed areas and avoid erosion issues and overland flooding to downslope structures and features. The run-off also needed to be harvested for irrigation of the overlying sand
and fibre performance surfaces. To achieve this EPG designed a system whereby the surface runoff is immediately collected within a Permavoid Equaflow modular high strength drainage/attenuation layer (supplied by Andrews Bowen) which receives and conveys the surface water directly beneath the sand and fibre surfacing. However, to prevent the water migrating entirely to the low end of the platforms; a series of regular 'check dams' have been created using welded robust membrane that will capture and control the level of the water at regular intervals. An arrangement of hydrophilic (wicking) geotextiles installed throughout the Equaflow layer transfers water 'on demand' into the underlying sand and fibre surface. An overflow arrangement will collect excess surface water into an underlying rainwater harvesting system that incorporates wet risers at the edge of the platforms to facilitate recovery via suction pumps mounted on the plant that will be used for routine surface maintenance during the event. A secondary overflow arrangement conveys further excess volumes to a series of perforated drains beneath the platforms to allow gravity controlled diffuse infiltration to the existing park surfaces; in effect, mimicking the natural rainfall management cycle. The system is designed to wholly manage the 100 year event + 10% allowance for climate change within the platform attenuation layer with final discharges to the diffuse soakaways limited to Green Field Run-Off Rates, in compliance with SUDS best practice.

- There are two types of structural platform incorporated into the above drainage design; two are steel and timber platforms designed by TSG; a further seven platforms are constructed using Permavoid as lightweight upfill system. The Permavoid, comprises modular high strength plastic structural 'blocks' that have a high tensile lateral interlocking tie arrangement to create a structurally competent raft. The modules are 150mm thick and have been assembled into varying cumulative thickness along contours predetermined from detailed topographical land surveys at each platform location. Thin layers (averaging no greater than 75mm) of imported granular material has been used to regulate construction formation levels. The gravel will be laid on a robust separation/filtration geotextile. This design ensures there is no long term damage to the existing grassed areas and prevents any high loads from overlying construction and maintenance plant from impacting on existing tree roots i.e. the system also provides root protection.

- The introduction of the Permavoid, lightweight modular upfill in lieu of conventional granular fill provides in excess of a 20-fold reduction in truck cycles.

- All of the Permavoid materials incorporated in the upfill and drainage systems are manufactured from recycled materials and/or are recyclable and reusable.

- Key figures (approximate):
  - Equaflow units – 250,000 nr
  - Platform Areas (Steel/timber) – 12,200 sq.m
  - Upfilled Platforms – 18,000 sq.m
  - Lightweight upfill – 6500 cu.m
  - Modular attenuation (additional to fill) – 3600 cu.m
  - Rainwater Harvesting – 100 cu.m
  - Equestrian Surfacing – 12,000 tonnes
  - Reduction in number of 20t truck loads - 700
  - Construction period – 11 weeks
  - Deconstruction period – 7 weeks

The whole system has been installed under a strict construction quality assurance (CQA) protocol and the completed system has been subjected to rigorous performance testing by a specialist academic team appointed by Andrews Bowen, which comprises an amalgamation of equestrian experts from Anglia Ruskin University, The University of Central Lancashire and Myerscough College.
Installation photographs during May 2012

Lightweight upfill being installed to contours on one of the platforms. Upfill varies in height up to 1.5m.

Water management arrangement at check dam position showing valve detail that controls attenuation and diffuse discharge. The pipes run through the whole system and have perforated walls with openings sized to ensure even distribution of discharge water. The white elements are the hydrophilic wicking geotextile that runs above and beneath the upper attention layer that is separated from the lower lightweight upfill by a robust welded waterproof membrane.

Rainwater harvesting tanks under construction beneath main arena platform.