ARRIYADH STORMWATER MASTERPLAN REVIEW (ASMR)
RIYADH, SAUDI ARABIA

In 2010, the Riyadh Municipality commissioned local engineering consultants to assess the baseline stormwater infrastructure for the city of Riyadh, and to propose a masterplan to upgrade and extend the storm drainage network to serve the rapidly expanding city’s urban development. The masterplan that was prepared included proposals to increase the urban area served by the existing stormwater network from 27% in 2010 to 72% by 2021. In November 2013, at the same time as the masterplan was being finalised, the city experienced the heaviest rainfall in more than 25 years. This caused severe and devastating flooding, resulting in the loss of life and bringing the city to a standstill.

Such tragic events are rare in this region, but highlighted the lack of infrastructure in place to cope with intense rainfall events. As a result, the Governor of Riyadh instructed the Arriyadh Development Authority (ADA) to undertake a comprehensive review of the emerging masterplan to ensure that it was appropriate and fit for purpose. Of particular concern to the city authorities at that time was the potential flood risk to Riyadh’s new Metro system that was under design at the time of the flood event, with construction about to commence.

In early 2014 the ADA appointed BuroHappold Engineering to conduct a comprehensive and independent technical review of all aspects of the stormwater masterplan, and requested a detailed action plan with recommendations and solutions to deal with any potential shortcomings found.

We undertook a thorough review of hydrology using our extensive knowledge of the Riyadh area, including a comprehensive hydrological review of the Wadi Hanifah and Wadi Sulay catchments that receive both urban stormwater discharge, and runoff from the rural catchments beyond the city limits. Looking at how storm profiles develop specifically in Riyadh, rather than applying standard profiles for the whole of the Kingdom, is a significantly different approach to take and, together with HR Wallingford, we demonstrated with an appreciable evidence base that this was the most appropriate approach for this review.

CLIENT
Arriyadh Development Authority (ADA)

SUB-CONSULTANTS
HR Wallingford

DURATION
2014 - 2015

SERVICES PROVIDED BY BUROHAPPOLD
Stormwater masterplanning, hydrology, 1D stormwater network and 2D overland flood analysis, infrastructure asset management, flood risk assessment, project management.
BuroHappold utilised a Geographic Information System (GIS) to interrogate data and analyse the storm drainage network, the LiDAR topography data, the overland stream flow routes and the urban development plans for the city. With HR Wallingford, we undertook both 1D network modelling of the current and proposed storm network, as well as 2D modelling of overland flows across all urban areas of the city of Riyadh, under conditions where the capacity of the storm network is overwhelmed. By modelling targeted areas of the stormwater network, we then assessed the existing system against the masterplan proposals and were able to demonstrate that future works should be directed to specific priority areas, such as the trunk mains that carry the highest flows of water away from the city.

BuroHappold’s review included the presentation of key findings and key recommendations for the Municipality and major stakeholders, including the need for a comprehensive masterplan with a longer-term planning horizon (rather than the seven year timeframe adopted), the need for a consistent and higher design standard than proposed, the adoption of a Water Sensitive Urban Design approach to water resource management, the need for a comprehensive asset database of all stormwater infrastructure, the benefits of a co-ordinated 1D (in pipe) and 2D (overland) flood model for the city, and the preservation and incorporation of existing wadi and sub-wadi water management capacity (attenuation/infiltration) rather than conventional ‘end of pipe’ solutions.

BuroHappold’s commission also included the preparation of over 80 site-specific Flood Risk Assessments for all the below-ground Metro stations and tunnels as well as for 22 other sites that had been identified as being vulnerable to flooding. In addition, we used a GIS-based flood risk vulnerability analysis to identify further sites at risk.

This assessment looked at significant vulnerability categories such as hospitals, schools, highways and underpasses, and where these were clustered, which, for the first time, allowed a prioritisation of investment in flood risk management and mitigation.

Our innovative approach to this review has laid the foundations for proactively managing the stormwater assets in Riyadh both now and into the future, demonstrating the effectiveness behind the proposals, and highlighting how evidence-based prioritisation can inform effective infrastructure investment decisions.