

GROUNDWATER FLOODING

Reference: CS-37

The sustained wet weather for 3 months over the winter period of 2013/2014 has resulted in wide scale flooding, and in particular an unusually high risk of groundwater flooding in low-lying Chalk areas, on river gravel plains and in limestone valleys. Unlike surface water flooding, groundwater flooding usually involves much smaller flows of water, but these can be sustained for weeks or even months, rather than the more typical days of surface water inundation.

GWP Consultants LLP has more than 40 years of experience in assessing, developing and implementing groundwater flooding solutions, at household, communal and municipal scales, to the highest standards.



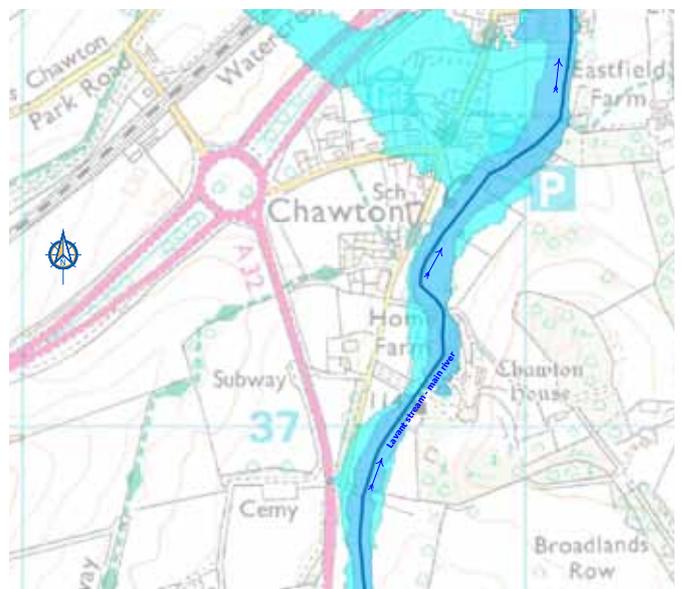
GWP Consultants provides solutions for all aspects of groundwater flood risk management. This experience ranges from single dwelling basement problems, to commercial sized infrastructure developments, to regional scale aquifer and river basin groundwater numerical modelling approaches enabling the magnitude and location of future groundwater flooding to be predicted. This work is undertaken by our team of hydrogeologists, geologists and hydrologists, backed up by experienced

surveyors, GIS specialists and geotechnical engineers.

We can undertake all aspects of groundwater flood risk management, from desk study and site investigation assessments, to predictive numerical modelling, and design and construction supervision of appropriate flood mitigation structures. Our multidisciplinary approach ensures that we can deliver projects from inception to completion.

Related expertise:

- Desk studies and scoping studies
- Groundwater flooding site investigations
- Groundwater monitoring
- Local and regional groundwater flooding numerical modelling
- Groundwater flooding frequency, location and elevation prediction
- Groundwater flood risk mapping
- Design of basement tanking solutions
- Design of groundwater level lowering, drainage and pumping measures
- Design of groundwater flow interception and cut-off structures
- Material and construction method specification
- Tender document preparation and evaluation
- Construction supervision and certification



Selected projects

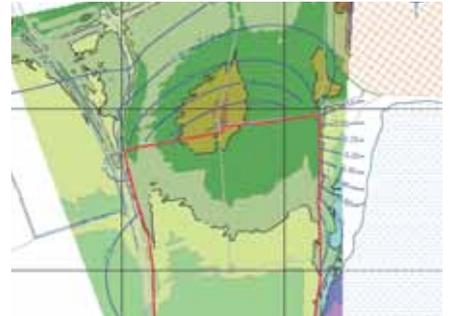
Case Study: Assessment of Groundwater Flood Levels in Chalk aquifers of Wiltshire, Hampshire, Cambridgeshire and Lincolnshire

Low lying Chalk terrains are especially vulnerable to groundwater flooding as the Chalk has little storage and exceptional seasonal groundwater level rises can exceed 15-20m. Assessment of the risks of extreme high groundwater levels to cause inundation, flooding and rupture bursts to commercial and industrial facility subterranean infrastructure, including: basements, utility service ducts, waste disposal containment liners systems and effluent disposal systems. Investigations included monitoring borehole installations, extreme rainfall analysis, ground properties testing and water quality analysis. Integrated groundwater interception walls - drainage perimeter trenches, internal and external wall lining/tanking systems and sump pumps were designed and installed as necessary.



Case Study: Groundwater Flood Risk Assessment and Mitigation Design for village in the Thames Valley

Low lying terrains are vulnerable to groundwater flood risk due to reductions in groundwater flow conveyance, associated with sustained periods of high river levels. A groundwater investigation was designed and implemented to characterise the groundwater regime in river floodplain sand and gravel aquifer beneath a historic Gloucestershire village. The results of the investigation were used to construct and calibrate a numerical groundwater model that enabled the simulation and prediction of the location and magnitude of groundwater flooding to be determined. A groundwater flood mitigation strategy was designed, having been successfully tested using the numerical model, consisting of a network of interception drains. The groundwater management scheme was approved by the Environment Agency.



Case Study: Groundwater Flooding Risk Assessment and Prevention for Cotswolds Town Council

The limestones of the Cotswolds are particularly vulnerable to groundwater flooding due to the perching of seasonal groundwater flows on low permeability clay beds within the limestone. During intense and prolonged rainfall periods, groundwater regularly floods household basements and other below ground infrastructure. GWP were asked to investigate, design and supervise construction of a groundwater management structure to prevent groundwater inundation of the new cemetery. A desk study and site investigation, including trial pitting and installation of monitoring boreholes, was undertaken to establish seasonal groundwater level maxima and flow rates. A groundwater control structure was designed consisting of a series of integrated cut-off wall trenches and drainage systems. Tender documentation was prepared and the construction works supervised. Post-construction monitoring confirmed the structure to be fully effective and to intercept all groundwater previously entering the site.



Case Study: Basement Groundwater Inflow Assessment and Engineering Control for a private property in Oxford

A developer wished to extend his dwelling by excavating a new basement beneath his property. A hydrogeological investigation of the underlying sandy strata using mini-monitoring boreholes, was designed and implemented to assess the risk of groundwater flooding of the proposed basement.

Groundwater levels and inflow rates were determined and flood mitigation measures consisting of a series of cut-off wall trenches and French drains were developed. The design included an integrated system to deal with both site groundwater and surface water flooding, including grey water re-use and drain re-sizing, to ensure site surface water run-off was not increased due to the groundwater discharge.



Case Study: Prediction of Rising Groundwater Levels in a Chalk Aquifer using a Regional Numerical Modelling

Development of a 3 dimensional numerical groundwater model of a regional Chalk aquifer, to establish the groundwater inflows and flooding risk to a large Chalk quarry.

The model was also used to predict the regional rise in groundwater levels and increases in spring, wetland and stream discharges on abandonment of the quarry and cessation of in-pit pumping activities.



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