

HYDROPOWER

Reference: CS-33

Abstraction for small hydropower generation is becoming increasingly widespread, providing an efficient and sustainable energy source. GWP Consultants LLP provides hydrological, geomorphological, geotechnical and surveying expertise to clients across the UK and overseas, supporting the assessment and design of hydropower development schemes.

GWP has direct experience working with micro hydropower developers, operators and land owners, primarily associated with the provision of geomorphological environmental impact assessment and environmentally sensitive hydraulic weir design.



GWP has expertise over a range of disciplines relevant for hydropower development, covering all aspects of hydrology, flood risk management, hydraulic design, geotechnical investigation, construction specification and supervision.

This work is undertaken by our water resources team and geotechnical engineers backed up by experienced



surveyors, GIS specialists and trained AutoCAD technicians. Our multidisciplinary approach ensures that we can deliver projects from conception to completion.

Our in-house team routinely utilise external associates to provide additional expertise related to power generation, electrical/mechanical engineering, financial modelling, civil construction and ecology.

Related expertise:

- Design of hydraulic structures
- Hydraulic modelling and flood water elevation prediction
- Rainfall probability analysis
- Flood Estimation Handbook techniques
- Rainfall runoff modelling
- Hydrological catchment modelling and flood routing
- Geomorphological EIA
- Detailed topographic surveying
- Geographic information systems (GIS) and catchment characterisation
- Flood risk mapping
- Geotechnical design and assessment of embankments, dams and abutments
- Construction specification and supervision

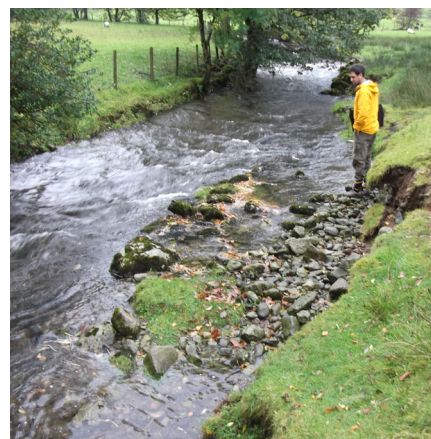
Selected projects

Case Study: Geomorphological Environmental Impact Assessment (EIA) and Offtake Hydraulic Weir Design

GWP Consultants LLP has worked on more than 12 micro hydropower schemes across Cumbria and Wales, providing both qualitative and quantitative geomorphological impact assessments.

Flow estimation and Flood Estimation Handbook (FEH) techniques were utilized in the ungauged catchments to enable an assessment of flow derogation across a range of flow magnitudes. Geomorphological site surveys, sediment sampling and channel dimension surveys provide an assessment of the geomorphological impact of flow derogation, relating to sediment mobilisation and transport.

GWP Consultants has revised the approach to weir design for high head hydropower intake structures, with the aim to enhance sediment transport downstream, mitigating the geomorphological impact in order to meet the objectives of the Water Framework Directive (WFD).



Case Study: Catchment runoff modelling and dam design

Modelling and characterisation of ungauged catchments to develop inflow hydrographs for reservoir design. One dimensional flow models were developed to determine optimum design of storage dams and reservoirs, overflow spillways, embankments, offtakes and outflow pipelines.

Works included catchment characterization involving detailed topographical interrogation of LIDAR and Aerial Drone survey data, rainfall-runoff modelling, construction of automatic rain gauges, two-dimensional hydraulic modelling of the catchment and conveyance analysis of transmission pipelines. The detailed design of 2 No. 5m high retention dams and reservoirs (with a combined storage of 845,561m³) was undertaken, including the specification of dam spillways and required geotechnical investigations.



Case Study: Strategic Catchment characterisation

Regional catchment characterisation in Trinidad, forming a strategic environmental impact assessment (SEIA). A topographic LIDAR survey was undertaken across 200km² of the country, providing large scale detailed topographic data. GIS, terrain analysis and catchment analysis enabled catchment comparisons based on factors such as gradient, land use and sensitive environmental receptors to identify areas of preferred sustainable development.



Case Study: Geotechnical assessment of dam abutments

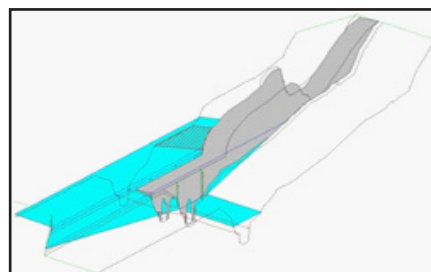
Stability assessment of the right abutment to the main Hatta Dam above the centre line of the asphalt core (then under construction). A detailed structural geological survey was undertaken of the right abutment, highlighting the possibility of mass slope movements from un-restricted excavation. Design controls to ensure undercutting of critical joint and fault surfaces were put in place. Detailed slope design assessed the consequences of injecting grouts into the potential failure surfaces.

The slope designs ensured the hazards were successfully removed in a controlled manner ahead of raising the dam. The dam was successfully completed.



Case Study: Hydrological modelling and reservoir storage optimisation

An unsteady-state one-dimensional hydraulic model was developed to determine reservoir inflows and appropriate outflow design for the specification of a flow retention structure, including the controlled releases at specified flow rates.



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