



GLENFIELD INVICTA PROVIDE INSTALLATION ACCURACY FOR UK MAJOR RESERVOIR

Glenfield Invicta completes turnkey design and installation of large 5m-wide stainless steel penstock on one of the largest reservoirs in the UK.

All reservoirs have drawdown facilities in place to quickly reduce water levels in the event of an emergency. A water company should be able to reduce the water level in any of its reservoir stock by one metre over a 24-hour period. The need for such facilities was thrown into the public spotlight by the Whaley Bridge dam crisis in August 2019.

The challenge at the reservoir which is the subject of this case study was to design and install a penstock in order to create a contact tank within the reservoir's spillway. Once the need for the drawdown had passed, the water in the tank would then be returned to the reservoir.

At the design stage, Glenfield Invicta's experienced engineers, Alex Philo and Stuart Montgomery, had to ensure that any penstock design they proposed was strong enough to withstand the huge water pressures that would act on the gate. Not only were they asked to consider a 2.4m static head, but also a surge flow of 19 m³/s. To make sure this was accurately assessed, Alex and Stuart employed Finite Element Analysis (FEA) during the design process:

*'Finite Element Analysis (FEA) is the process of simulating the behaviour of a part or assembly under given conditions. These simulations... allow engineers to locate potential problems in a design.'**

An added complexity was that the walls of the spillway were not vertical; they tapered, effectively creating a trapezoidal shape in combination with the spillway floor. The solution proposed by Alex and Stuart was to design tapered wall brackets with the sides

of the penstock itself remaining vertical; the penstock measured 5m wide x 2.5m high. The design also incorporated baffle boards at either side of the spillway upstream of the penstock.

The role of the baffle boards is to streamline the flow, diffuse the energy in the flow, and to prevent the accumulation of debris.

Glenfield Invicta is a member of the AVK UK Group of companies. Orbinox, another AVK Group company, was chosen to build the penstock. Glenfield Invicta Services were entrusted with the installation supported by members of the Orbinox team.

Jason Dunk was the Glenfield Invicta Services Engineer in charge of the penstock installation:

'As with any penstock installation, success is achieved by focussing on installation accuracy. This ensures smooth operation and optimal leakage performance.'

For more information on this project or Glenfield Invicta's Solutions please contact:

STUART MONTGOMERY
Business Development Manager
E: stuart.montgomery@avkukprojects.co.uk
T: 07876 798775

www.glenfieldinvicta.co.uk





The accuracy of installation on this particular project was even more critical due to the sheer size and weight of the penstock. We were fortunate that a visitors' car park was located close to the installation site. However, a 60-ton crane was still required to lift the penstock over some large trees that sheltered the car park from the reservoir.

Prior to the lift we pre-installed brackets to the spillway walls, and fitted the first of the channels in which the penstock sits. We clamped the penstock in place and then installed the second series of channels.'

The penstock uses a bespoke 90mm diameter spindle fabricated from solid stainless steel bar. The spindle also had sufficient thread to achieve a stroke of 3.5m, enough to lift the gate completely clear of the spillway when fully open. A typical design would have located the actuator on the top of the penstock frame. However, in this case expensive walkways and platforms would have been required to access the actuator had it been located in this position.

To resolve this challenge, a twin-bevel gearbox drive system was mounted to the penstock frame which allowed the actuator to be positioned on the existing masonry alongside the penstock at ground level. To further aid ease of maintenance, and eliminate the need for special access arrangements, stainless steel grease lines were provided on the penstock that allow the spindle to be easily lubricated from the same location as the actuator.

The entire installation was completed within a week largely due to the huge amount of preparatory work undertaken by Glenfield Invicta prior to arriving on site.



**For more information on this project or
Glenfield Invicta's Solutions please contact:**

STUART MONTGOMERY
Business Development Manager
E: stuart.montgomery@avkukprojects.co.uk
T: 07876 798775

www.glenfieldinvicta.co.uk

