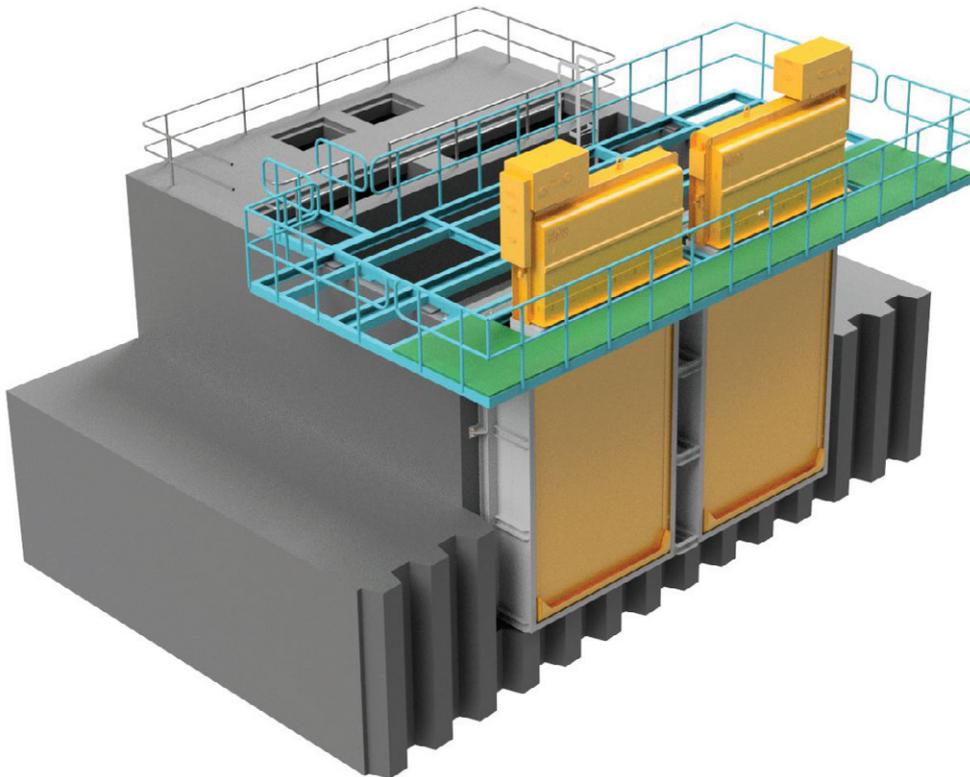


Southern Water Eel Screens Programme

18-site programme of work to protect the brook lamprey must meet stringent regulatory dates

by Tom Ross IMechE BEng (Hons) Msc & Ashton Dewey

The Eels Regulations 2009 require an eel screen to be installed within a diversion structure capable of allowing at least 20m³ of abstraction in a 24-hour period. The focus of this programme is to protect a threatened species of fish, brook lamprey (*Lampetra planeri*). This eel-like ancient fish is rare in the UK and ranges from 10-15cm in length; its primary habitat is in rivers, streams and canals and generally feeds close to the river or canal bed. BTU Utilities (a joint venture of Barhale Ltd and Trant Engineering) have been appointed to deliver a programme of eel screen installations for Southern Water across the South of England. The programme is being delivered under BTU Utilities' LCDR (Low Complexity Delivery Route) Framework with Southern Water. The framework covers capital project delivery for non-infrastructure projects across the entire Southern Water region for AMP7, expiring in 2025. The contract also consists of a unique innovation partnership with Southern Water to ensure all opportunities for innovation and R&D are fed into projects.



Rendering of Hardham abstraction intake - Courtesy of BTU Utilities

The programme

In total there are 18 abstraction sites in the Southern Water region in this programme, all of which must meet stringent regulatory dates. BTU Utilities are currently in the detailed design and modelling phase of two of the most complex sites (Otterbourne and Hardham) within the programme and are working on the next batch of three sites.

Otterbourne SWA (surface water abstraction) and Hardham SWA currently have a regulatory output date of 31 March 2021. There are many complex challenges in delivering these schemes, from ensuring the fish and their habitat is protected to working safely whilst over water as well as designing and installing a precise and intricate mechanical installation.

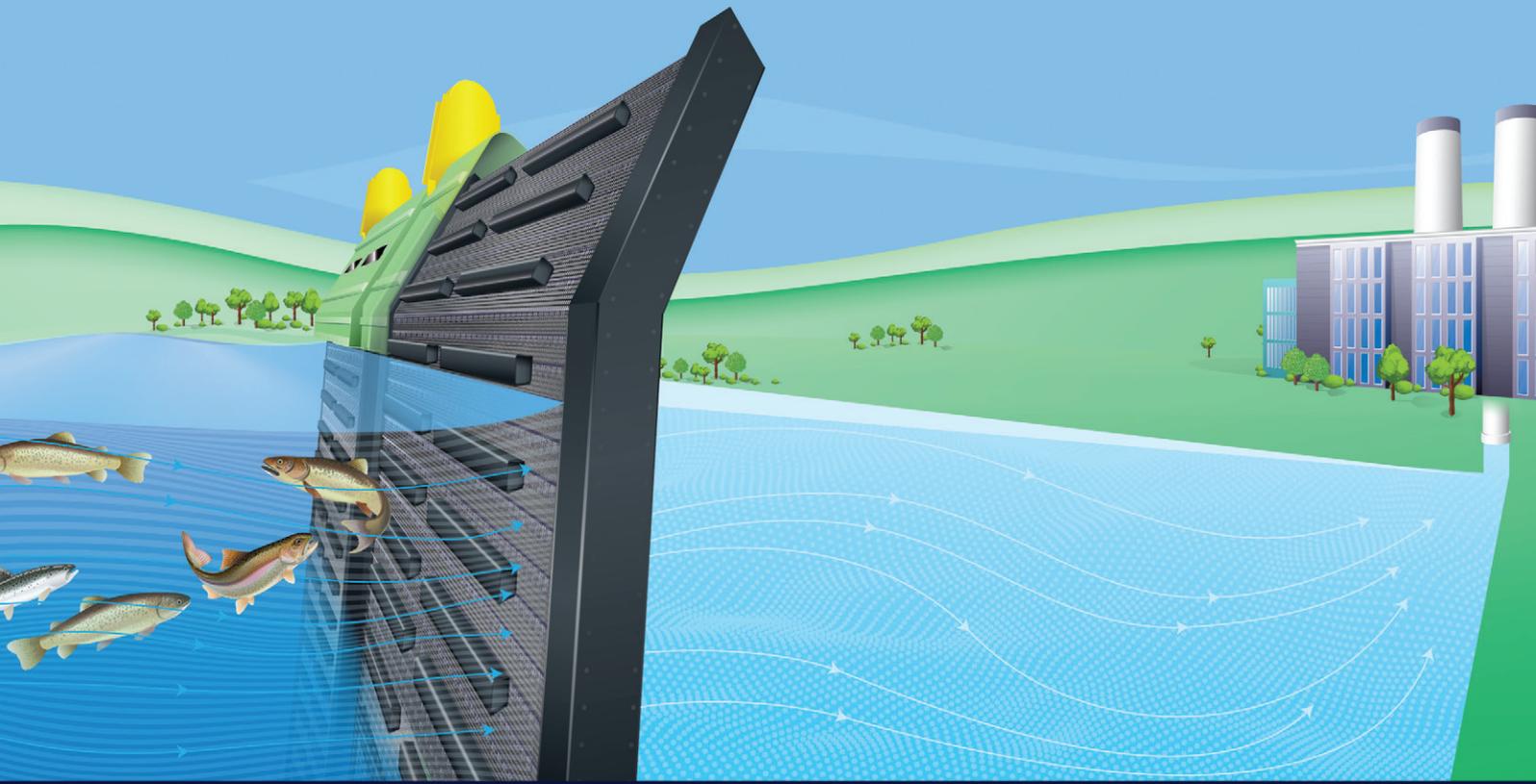
Otterbourne and Hardham present unique environmental challenges requiring innovative solutions. Otterbourne (SWA)

is located alongside the River Itchen in Hampshire and has a maximum abstraction of 45 MI/d, it is within 300m of the associated water supply works and is located within a site of special scientific interest (SSSI).

Hardham (SWA) is located alongside the River Rother in West Sussex and has a maximum abstraction of 75 MI/d. Adjacent to Hardham Supply Works (SWS), it is located within a flood plain.

Existing intakes

Both intakes consist of a debris deflector upstream of the intake structure to divert floating debris from the intake. Within each intake there is currently a coarse bar screen which is mechanically raked - flow passes through here into two further chambers containing self-cleaning band screens. The flow carries on to a common outlet chamber and pumping station wet well, where it is then pumped to the water supply works (WSW).



SOLUTIONS FOR COMPLIANCE **WITH EELS REGULATIONS**



- Compliant with The Eels (England and Wales) Regulations 2009
- Greatly reduces injury, impingement, and mortality
- Verified by independent testing as the best technology available on the market
- Identified by the Environment Agency as a solution for glass eels, elivera, and adult yellow/silver eels
- Can be equipped with or without a proven recovery and return system
- Reduced maintenance, lowest total cost of ownership, and industry-leading warranties



Silt curtain in place and dive works underway - Courtesy of BTU Utilities



Electro-fishing to safely remove the fish - Courtesy of BTU Utilities

Debris from the river is flushed from the band screens and is returned into the river downstream of the intake via a trough. River water is used for launder flushing and screen cleaning via a submersible pump which feeds a wash water booster set. The current screening arrangements do not meet the requirements of the Eels Regulations and as such the screening equipment must be upgraded to ensure compliance.

No disruption

While works are being carried out, there must be no disruption to the existing abstraction process to ensure customers' water supply is maintained. Close engagement with key stakeholders - the Environment Agency (EA) and Natural England - ensures construction methods take into consideration the impact on the environment within the river and the surrounding habitat. This has required frequent liaison with both parties on a step-by-step basis to ensure they are informed and to provide acceptance of the proposed works. As a result of the sensitivity of these areas, employment of specialised subcontractors has been required to mitigate disturbance in the river.

Specialist requirements for the dive survey works are shown in the photos above which consist of a silt curtain around the working area and electro-fishing to safely move the fish from within the silt curtain to ensure the works has little impact on the river or its inhabitants. BTU Utilities produced a detailed construction methodology plan which was reviewed and approved by all stakeholders. This helped to assist with the Flood Risk Assessment Permit (FRAP) required in order to carry out the main construction works in the river.

Scope of works

The scope of works is to provide two new S1800 vertical self-cleaning, travelling belt screens. They must have a mesh aperture of 1-2mm and operate to a safe working approach velocity to ensure that brook lamprey cannot become trapped and can safely swim away if in close proximity.

These screens will replace the existing coarse bar and the band screens entirely and will be housed within a new bespoke steelwork access platform. New mechanical and electrical equipment to control the operation of the new screens has also been designed.

BTU Utilities was provided with an initial outline design by Southern Water and this has been fully developed into a detailed design, build and commission package. The detailed design has been completed by Atkins on behalf of BTU Utilities for the mechanical, electrical and civil elements; steelwork access platforms were designed by the specialist installation team. As with all contracts, BTU Utilities have been appointed as the principal contractor and the principal designer throughout the duration of the programme.

Eel Screens Programme: Supply chain - key participants

- **Programme delivery:** BTU Utilities
- **Detailed designers:** Atkins
- **Secondary steelwork:** Global Energy Group
- **Eel screens:** Hydrolox
- **Wash water pumps:** Xylem Water Solutions UK
- **MCCs and system Integration:** Safronics
- **MCCs and system Integration:** MCS Control Systems
- **Fish Recovery:** APEM
- **Dive works:** Red7
- **River Booms:** Bolina Ltd

Designs

A 3D model was generated for both schemes and is being used across the design team, resolving any design issues before moving into fabrication. The model also provides certainty of avoidance of any cross-disciplines clashes, assists with access and maintenance

issues during Access, Lifting and Maintenance (ALM) reviews and provides a step-by-step constructability sequence guide.

The model has significantly aided the development of the overall programme and most importantly provided a clear indication of the number of events in the river requiring consultation with the EA, with openness and transparency from the outset.

The whole project has deployed DfMA throughout, allowing site works to be kept to a minimum by building and assembling offsite. This limits the amount of work and modifications required in or by the river and most importantly providing certainty that it will fit first time. The screens are installed into a cassette frame meaning there are no fixing requirements when installing them, again reducing intrusive river works, these simply slot in and stay in place due to their complementary design with the secondary steelwork.

Programme

The design has sufficiently progressed to complete the ALM and HAZOP meetings – again supported by the 3D models. Following this, works on the fabrication of the steelwork and the screens will commence. To reduce the programme time, BTU Utilities and Southern Water liaised with the Environment Agency on the screen selection. The proposed Hydrolox screens were agreed and accepted by the EA as the most suitable equipment to meet the Eel Regulations 2009 for these two particular sites.

As there was the potential for uncertainties on site, and a fixed regulatory date, a lot of the design work was done ahead of the main construction works, allowing an early methodology submission for the main construction works. This enabled the FRAP application to be processed, which generally takes up to 10 weeks.

With the support of Southern Water's environmental team, BTU Utilities has also been able to meet the requirements of all

stakeholders in a timely manner to ensure that the construction works are not delayed.

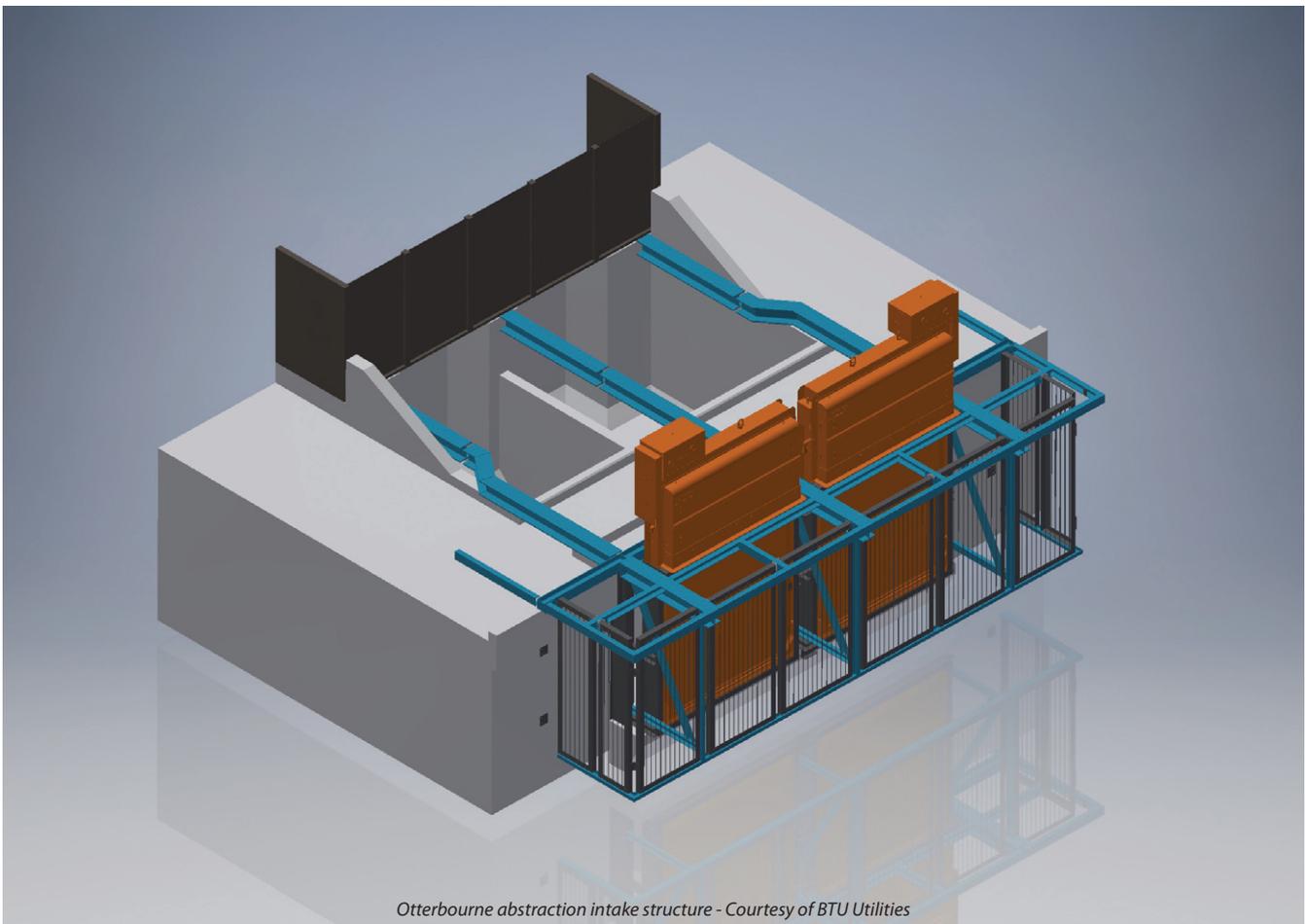
The main construction works take place from late summer 2020 to allow the river works to be done in the optimum ecological window in the river. This has proved challenging, with regulatory and operational constraints dictating the start date and the completion date requiring the team to manage the works sequence very closely. The ability to provide pre-assembled steelwork and early engagement with all stakeholders provided an achievable working window to build and commission.

Measures have been taken to avoid hindering water production from the surface water intake by means of the steelwork being installed in three progressive stages. Also, the screens will be installed once all the mechanical and electrical services are present, allowing the screen to be in operation within 24 hours of installation. These considerations have been built into commissioning phase two; only one screen will be installed at a time, should issues arise from the new equipment. There will also be a proving period agreed to ensure reliability is obtained before moving onto the second screen install.

Looking ahead

With these being the first two eel screen projects of a much larger programme, many lessons learnt have been captured already which going forward will allow future projects to be delivered in a more efficient manner. This will result in programme savings and opportunities to innovate – maximising performance regardless of the obstacles presented.

The editor and publishers would like to thank Tom Ross, LCDR Framework Manager, and Ashton Dewey, Innovations and Business Development Manager, both with BTU Utilities LLP, for preparing the above article for publication.



Otterbourne abstraction intake structure - Courtesy of BTU Utilities