Birdlip STW

construction upgrade encompassing the installation of new RBC and aerated reed beds in Gloucestershire

by Danny Begley BEng (Hons)

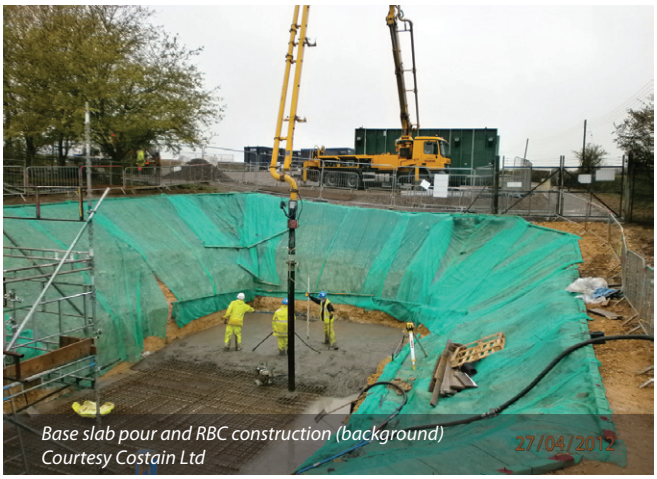
Birdlip is a small village situated at the top of Shaab Hill on the outskirts of Gloucester in the Cotswold countryside. The village consists of mainly residential properties, a school and a public house, with a few small business in the catchment. The existing works consisted of 2 (No.) primary settlement tanks, a small rotary filter bed and humus tank connected to a soak-away. A descriptive consent was in place for the works before the upgrade. A design solution for the works was created between Severn Trent Water and CostainMWH to fulfil the current design population equivalent (PE) of 394 and a 2026 PE of 424 (9% growth), with a consented flow of 4.7l/s (407m^3/d) with 40mg/l BOD, 60mg/l SS and 5mg/l Ammonia-N.

Completed Reed Beds No. 1 (left) & No. 2 (right) - Courtesy of Costain Ltd

Design template

The template design created was to construct a new rotating biological contactor and 2 (No.) aerated reed beds, encompassing the following activities.

- Construction and Installation of a new rotating biological contactor (RBC).
- Construction of 2 (No.) new aerated reed beds.
- Concrete flow measurement chamber (and stilling chamber).
- Construction of new storm overflow chamber (including installation of new *Copasac* unit).
- Construction of new reed bed distribution chamber.
- Construction of 2 (No.) new reed bed level control chambers (inclusive of new decanting arm).
- Construction of final outlet sampling chamber.
- Installation of new duct routes from the RBC and associated chambers to the existing site building.
- Associated panel and blower plinths.
- All associated below ground pipework.
- Installation of type B telemetry outstation, and associated BT cable.
- Installation of new UWWTD flowmeter (*WaterMaster* 80mm) and storm event flowmeter (*WaterMaster* 150mm).
- Renewal of site access track and extension to the yard area.
- Extension of existing site soak-away.



Base slab pour and RBC construction (background)
Courtesy Costain Ltd

Precast concrete walls used as shutters for liner mass fill concrete
Courtesy of Costain Ltd


Rotor/media pack installation (aerated reed bed 1 foreground)
Courtesy of Costain Ltd

RBC construction - Courtesy of Costain Ltd

Construction constraints

The construction programme at Birdlip was tight due to the consent that had been placed by the EA. The site in its very nature is remote and has a very small footprint. The new process footprint completely fills the site, so during the early stages of planning Costain decided to rent adjacent space from the farm next door.

Early contact was made with the village community especially the local school. In order to help the construction process and alleviate any interruption to the community a diversion was created to send construction traffic around the village to the farm where a haulage road was constructed to the new compound. This haul road was then kept by the farmer who has since erected a barn in the old compound area. The road was left in place and donated free of charge. Furthermore the existing access track was upgraded for STW and some new stock fencing was installed to keep the curious farm horses at bay.

Due to the special constraints of the footprint of the existing site and necessity of the existing process to remain operational throughout the works, the construction programme was put together in order to build the new assets off line in parallel to the works in operation.

As stated, the footprint of the site is now completely utilised so extra entrances were created in order for STW Service Delivery to maintain the existing works, and Costain to build the reed beds and RBC in tandem. This reduced the duration and any residual impact to the community was minimised as a result.

Construction of the RBC

The RBC provided by Tuke & Bell was excavated to a depth of 5m below the existing ground level on site through the underlying limestone. Excavation was hard going with the use of a rock wheel attachment placed on a 20t excavator.

A 300mm thick concrete base was cast. The RBC (built on site due to the tight nature of the rural roads around the location) was then lowered into position and fixed.

Precast concrete walls were then used as permanent shutters to allow a mass fill surround to the GRP Liner in place, saving valuable time and effort in reinforcement fixing and single sided shutter designs, making the process more efficient and removing the complicated temporary works of the shutters.

Once the mass fill concrete was placed in 670mm layers (internally with FE to balance provided by STW) as prescribed to prevent the tank from damage, the internal arrangement of the RBC was installed, followed by the rotor/media pack.

Running concurrently to the construction of the RBC was the formation and installation of two brand new aerated reed beds,

Reed Bed 1 aeration grid - Courtesy of Costain Ltd

the first of their kind within STW. The system provided by ARM Ltd includes an aeration grid at the base of the bed to treat storm flows.

Reed bed construction

Due to the original site lay out and phasing of the construction works two reed beds were formed with a combined treatment area of 460m^2 (with Reed Bed No. 1 sized 156m^2 and the larger Reed Bed No. 2 encompassing 306m^2). Both reed beds were supplied with duty and standby blowers, each controlled by a local control panel.

Timers can be set to control the aeration to each bed; this was originally set up to cover two hours of peak flow both morning and early evening. In the event of a storm condition the system runs for 48 hours continuously to help treat the storm overflow from the RBC. Storm condition was set to 4.7l/s which was connected to the MCERTS flowmeter (FFT) to trigger the process.

Construction of reed beds face their own particular problems. Again due the Cotswold limestone, excavation was prolonged and difficult. Both reed beds were formed and then lined with sand to ensure the profiled sides were maintained before the liner (supplied by PAG)placed and the media installed. The general construction of the reed beds was based on the standard drawings of the template design by STW.

The aeration grid and manifold piping was installed by hand by ARM Ltd. The grid doubles back on itself to prevent any issue with blockage in the lines and a constant flow of air is then passed through from both directions.

Some 230m^3 of 14mm well rounded stone was installed by excavator on top of the aeration pipes. Reeds were then planted at a rate of four per square metre in line with the STW design template. The reed type Phragmites australis was selected due to their hardy root composition to deal with the air flows.

The final piece of the puzzle was the re-conditioning of the existing soak-away on site. The original soak-away top was stripped back and a new soak-away 3m deep (average) x 26m x 18m (in plan) was dug out in order to allow the flows to collate in a storm condition. Percolation tests were performed and the results indicated that the stone excavated could be turned and returned to the excavation, this reduces the risks for future maintenance of the soak-away as a large open hole was no longer present.

Commissioning

As the construction works came to a successful completion, the seeding of the RBC was initiated and with it commissioning of the new works. With the help of STW and Costain commissioning staff, the incoming flow was introduced with a tanker of humus sludge to the RBC, in order to accelerate the biological process. The incoming flow was diverted by the use of weir plate, so in the event of a storm, the process could be protected and any storm water would follow the old route in order to prevent scouring of the RBC whilst seeding.

The flow was then re-directed through the old works in order to keep the levels that were being achieved consistent via over-pumping on a telemetry alarm system (in order to mitigate pollution potential). Once the ammonia levels met the new consent the flows were directed onto the new reed beds and the old works were then demolished and landscaping undertaken to remove their existence from the surroundings.

The project was completed in November 2012, with no complaints from the local community, no pollution events or failures of consent. The process was handed back to STW with no snags and satisfied the consent date set out by the EA, which was the main driver of the project.

The Editor & Publishers would like to thank Danny Begley, Site Agent with Costain Ltd, for providing the above article for publication.