

Cressbrook STW

a technically challenging project, with significant ecological, environmental and geographic constraints, in the heart of the Peak District

by Pete Howard

Cressbrook is a small village located five miles north-west of Bakewell in the heart of the Peak District National Park, Derbyshire, and is situated in an Area of Outstanding Natural Beauty (AONB) bordered by a Site of Special Scientific Interest (SSSI). The original sewage treatment works at Cressbrook was built in the late 19th century and currently serves a population equivalent of approximately 150 (with associated seasonal increases related to tourism). The existing plant and equipment at Cressbrook STW needed upgrading as part of Severn Trent Water's AMP5 capital investment programme. Working with delivery partner MWH Global, Severn Trent Water has successfully built a brand new sewage treatment works at Cressbrook, in a new location to the south of the village. Commissioned in March 2014, the new sewage works safeguards the local wastewater infrastructure and allows the works to meet stringent new environmental controls.



Rotating biological contactor (RBC) installed at Cressbrook STW in a geographically challenging area of the Peak District - Courtesy of MWH Global

The need for change

The existing works process comprised a primary settlement tank (PST) with a single filter bed and hydraulically powered filter arm, and operated without power or telemetry. The works are fed by a combined system and discharges directly to ground via a soakaway under a descriptive consent.

The topography at Cressbrook is very challenging and the ground levels of the catchment vary between 281.4mAOD at the highest point and 247mAOD at the original treatment works. Cressbrook STW was also subject to new legislation relating to the Groundwater Directive and needed upgrading to meet new consent levels as shown below:

	BOD	SS	Ammonia
To ground	25mg/l	45mg/l	5mg/l
To River Wye	30mg/l	45mg/l	15mg/l

The assets at Cressbrook STW were in a poor condition and the site had the following constraints, which needed to be considered when developing the process solution:

- No vehicle access. Access is via a stone path and steps.
- No power, telemetry or water on site.
- No land available for extension at existing location.
- Poor condition of the existing assets.
- No capacity for storm flows.

Developing a process to meet the demands of all stakeholders

As early as 2002, Severn Trent Water had identified that Cressbrook STW would need upgrading. However, a number of stakeholders that had a vested interest in the project included the local Parish Council, the Environment Agency, Peak District National Park Authority, County Council Planning & Highways departments and a local angling club. It would prove challenging to develop a solution that would meet the expectations of these groups as shown in the project timeline below.

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The original plant had no vehicle access and there was no land available for additional assets - Courtesy of MWH Global



Excavation of the RBC base in difficult terrain - Courtesy of MWH Global



Stabilizing the bank with soil nails and sprayed concrete
Courtesy of MWH Global



Vehicle movements in accordance with Traffic Management Plan
Courtesy of MWH Global

Pre 2004	<ul style="list-style-type: none"> Scheme promoted to Ofwat. Environment Agency (EA) confirmed to Severn Trent Water that a descriptive consent would remain.
2004	<ul style="list-style-type: none"> Consent application issued to EA by Severn Trent Water. EA issued Schedule 10 stating that Formula A flows should be treated and spill frequency assessment into Cress brook should be assessed.
2005	<ul style="list-style-type: none"> EA asked for Severn Trent Water to withdraw application as a 2mg/l limit would be imposed. New application submitted and objections received from local angling community. EA proposed new consent with no storm overflow.
2006-10	<ul style="list-style-type: none"> Protracted discussions with the EA and other stakeholders, with network and storm modelling being undertaken by MWH and Severn Trent Water.
2011	<ul style="list-style-type: none"> New approach taken and Severn Trent Water and MWH Global hold face-to-face meetings with EA and local stakeholders to discuss storm tank options and potential to discharge to ground.
2012	<ul style="list-style-type: none"> EA acceptance of proposal to discharge to ground with Storm discharge blending to meet a 25/45/5 consent. Public exhibition held with local community at Cressbrook to discuss proposals for new sewage works and abandon original works. Planning permission granted.
2012/2013	<ul style="list-style-type: none"> Project's detail design completed and construction starts on site.
2014	<ul style="list-style-type: none"> Scheme commissioned and brought into service.

Engineering a solution by sharing knowledge and expertise

Using knowledge from its global business, MWH carried out a full design review of Severn Trent Water's network model and associated calculations. A flow study of the sewerage system was undertaken and a hydraulic model constructed to determine the spill frequency and spill volume. Options to provide enough storage volume to eliminate the storm discharge were reviewed and submitted to the EA. This established that a 'treat, capture and spill' strategy could achieve the scheme's objectives.

Following a detailed optioneering exercise and discussions with all stakeholders, the following solution was agreed upon. Abandon the existing site and gravitate all flows to a new rotating biological contactor (RBC) works with balance tank, located in land south of the original works. This process would remove the risk to the environment by discharging to soak-away rather than to the river. The scope of this solution included:

- Demolition of the existing works.
- A new gravity sewer to convey all flows to the new works.
- An RBC unit and balance tank with return pumps.
- New soak-away for final effluent and storm flow discharges.

Developing the solution

Through further review and data analysis, the design team reduced the size of the balance tank required, which in turn reduced the scale of development and minimised the excavation. This change was made possible by reviewing the network model and calculating the minimum volume capture required before the effects of dilution would ensure the discharge met the permitted consent. With continued design development, stakeholder consultation and knowledge sharing, the main areas of the agreed solution were:

- A 6PG integral RBC with balance tank, with sludge tankered off site three-monthly, reducing traffic and H&S hazards.
- Resizing the balance tank (220m³ down to 44m³) to reduce the site excavation and temporary works substantially.
- Discharging to soak-away using the natural topography, thus removing the need for the 800m pipe to outfall and associated headworks.
- Works built in sympathy with the local environment using innovative 'soil nailing' to stabilise steep slopes.

Constructing the new works in a challenging location

The agreed location for the new sewage works at Cressbrook was 500m south of the original site with limited access via a narrow track. The area was steeply-sided with dense vegetation and underlying bedrock at shallow depths. These factors, together with Planning and ecological constraints through working in an AONB (Area of Outstanding Natural Beauty), would make construction of the new works extremely challenging.

Excavations for the rotating biological contactor and balance tank revealed the underlying ground conditions were mainly Glacial Till, comprising large boulders and loose debris. The steep side of the excavation therefore required stabilizing using soil nailing, with rock anchors installed to a depth up to 12m.

Once secured, the anchors were overlaid with steel mesh layers before sprayed concrete was applied as the finishing surface. The stabilization process was sequentially completed in 3m "drops", with the final excavation depth approximately 7m down from finished ground level. The excavation and bank stabilization activities, including planning and managing all temporary works, were safely completed in under six weeks working with supply chain partners Naylor Plant Hire and CAN Geotechnical.

All vehicle movements were controlled via a Traffic Management Plan, which included escorting vehicles along a route bypassing Cressbrook to minimize local disruption.

Following blinding of the excavation, a FRC type balance tank was constructed, after which the RBC was installed. This large structure arrived on an articulated lorry under vehicle escort and was carefully reversed onto site, before the RBC was lifted into position with a 100tonne all-terrain crane, supplied by ABA Cranes Ltd. The rotating element and upper cover of the RBC were then fitted, successfully completing this challenging installation.

Despite the difficult terrain and a tightly constrained site, the operation to off-load and install the RBC was completed with no H&S or Environmental incidents. The final stage of the construction was to create a limestone wall, which has been fixed to the side of the stabilized bank. This unique feature was a key requirement of planning conditions and constructed by local craftsmen to allow the new works to blend in with its natural surroundings.

Innovative ecological management

Nesting birds, rightly protected by legislation, can cause programme delays when present on construction sites. Working closely with ecological specialists, the team came up with an innovative solution to this potential problem: falconry. Before the nesting season started, a professional falconer flew a specially trained Hawk at regular intervals around the site of the new works. The presence of this natural predator acted as a very visible deterrent and nesting birds were 'encouraged' to find alternative homes.

Creating a lasting memory for the community at Cressbrook

After consulting with the local community, it was decided to landscape the village green at Cressbrook. The new features of the legacy project at Cressbrook included renewing dry-stone walls, creating a paved viewing area, planting flower beds and renewing pathways and improving access. The new village green has been provided by a joint Severn Trent Water and MWH Global team with kind assistance from the supply chain who were involved in construction of the new sewage works.

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RBC rotating element awaiting installation - Courtesy of MWH Global



RBC and balance tank - Courtesy of MWH Global



Limestone wall provides aesthetically pleasing backdrop
Courtesy of MWH Global



A natural deterrent for nesting birds - Courtesy of MWH Global