

Tucking Mill WTW

back into service after a complete redesign and rebuild in the confines of surrounding woodlands and narrow access roads on the outskirts of Bath

by Shaun Hobbs BA (Hons)

Tucking Mill Water Treatment Works is a base load source located on the southern slopes of Bath, approximately 1km west of Monkton Combe village. Water is derived from local springs and receives disinfection treatment before being pumped to Bathampton Down Reservoir and Hayeswood Tower. The site is rurally located and road access is via a single-track country lane either from the east, via Monkton Combe village or from the west, via B3110 and Midford. Access from the public highway to the treatment works is via a private access track, approximately 300m long, running adjacent to a Wessex Water owned, disabled fisherman's lake.



Completed WTW contact tank, raw water & pump hall - Courtesy of WECS Civils

Design criteria and process performance

Based on an assessment of the raw water quality the spring water is of category 2a and river abstraction is of category 3* hence the disinfection process must achieve a minimum ECt of 15 mg.mins/l under all flow conditions. The new contact tank design is based on a contact tank outlet chlorine concentration of 1mg/l.

The new contact tank is designed to accommodate a maximum flow of 10ML/d, which is the maximum site output. This includes both the springs and the membrane plant water. The super chlorination and de-chlorination process shall be retained with the new works.

The new contact tank comprises a single compartment with a working volume of 235m³. This is based on an effectiveness value of 68.35%, a contact tank outlet chlorine concentration of 1mg/l and 65% plug flow efficiency. The calculated t10 value at maximum flow condition is 21.95 minutes.

It should be noted that the estimated plug flow efficiency is slightly lower than the design standard recommendation of 70% because

the design aspect ratios of the new contact tank deviate slightly from those recommended in DS661. This results from limitations imposed by the confined site, requiring a reduced footprint.

Phosphoric acid is dosed together with chlorine upstream of the contact tank via a common static mixer. The static mixer installed will achieve a CoV of 0.05 at the point of sampling over all predicted operating conditions.

The chlorine dosing and control system ensure that sufficient chlorine can be delivered to provide the disinfection required. The free chlorine residual is controlled to within +/- 0.1 mg/l of the set-point.

The pumping stations upstream and downstream of the contact tank have sumps of sufficient working volume to balance the intermittent raw and treated water flows with the output of the variable speed pumps and so minimise pump start/stops and ensure flow rate changes are slow enough to allow accurate chemical dosing.

Raw water pumping

The raw water pumping station is a wet-well arrangement of approximately 85m³ working volume to accommodate the variations in flows from the individual spring and GAC treatment plant sources.

Raw water pumps	Number of pumpsets	Pump duty	Flow rate MI/day
To contact tank	1	Duty	1.0* – 5.0
	1	Assist	1.0* – 5.0
	1	Boxed spare	As above
Total	3	Total	1.0* – 10.0

Operating and control

Tucking Mill is a base load station and is currently operated continuously. Primarily the site feeds Bathampton Down Reservoir whilst also pumping to Hayeswood Tower as required.

The treatment works will run at a constant and maximum available flow rate as long as the demand from the network (available reservoir storage capacity) and availability of source water will permit.

Under normal conditions up to 4.5MI/d will be pumped to Bathampton Down to provide the base load. The pumps to Hayeswood Tower will be operated on reservoir level control and will start/stop as required, delivering at a pre-selected rate of up to 1.2MI/d. The raw water pumps are flow-controlled to match the combined output of the re-lift pumps.

In the event of low demand, as the reservoirs approach their maximum storage capacity, flow from the raw water sources will be sequentially reduced (stopping Midford pumps first). Flow will

stop if there is no more available storage capacity at the receiving reservoirs.

When the drought relief plant is not operating, the maximum theoretical output of the works will be 5.7MI/d (4.5MI/d to Bathampton Reservoir – limited by the capacity of the main, and 1.2MI/d to Hayeswood Tower).

Environmental and third party management

The very restrictive nature of the road layout in Monkton Combe, in conjunction with possible public relations issues with the parish council and Monkton Combe private school, all construction traffic approaches and leaves the site via the western, Midford route.

It was also evident at very early stages of construction that the above access issues limited the size of construction plant to the site. Provision was made to ensure that access along the private access track from the public highway to the site entrance was maintained for disabled fishermen during the construction period.

The working area was located outside the existing works boundary, necessitating temporary diversion of the public footpath.

Japanese Knotweed had been previously identified in the area (but not on the site), but following repeated spraying it had not emerged this year. The identified area was demarcated and left undisturbed during the construction phase.

Construction

It was recognised that a successful project delivery would depend on the quality of liaison with the client and delivery team due to the location and restricted working space that the existing site offered. This was achieved with the assistance of the Wessex Engineering & Construction Services (WECs) in-house civil team as principal contractor.

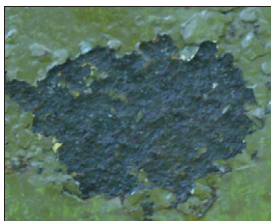
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In addition the manway often doesn't meet current legislation and the controls are frequently outdated and unreliable. This affects the performance of the vessel and imperils the safety of the pumping main.



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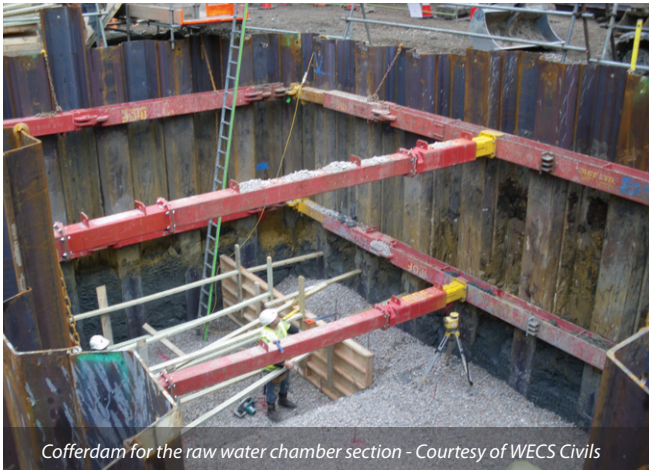
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Cofferdam for the raw water chamber section - Courtesy of WECS Civils



Steel rebar for contact tank roof - Courtesy of WECS Civils

Due to the significant liaison necessary between the principal contractor and all other working trades during the construction phase, WECS lent itself perfectly to the project and enabled rapid and cost effective decision making when foreseen and unforeseen risk events occurred, while keeping Health and Safety and quality to the highest standards.

The demolition of the old contact tank took place late September 2010 which lent a clear run for construction to start early January 2011. The new contact tank consists of 4 (No.) compartments within one structure consisting of:

- A raw water section for the incoming spring inlets.
- The contact tank section which allows a minimum contact of 21.95 minutes.
- Treated water section.
- The dry well pump hall that consists of 4 (No.) VSD pumps and all associated pipework.

Two sides of the existing contact tank walls were left in place, this lent itself as part of the temporary works for the new tank. The remaining two sides were sheet piled using PU20 interlocking piles to help stop any penetration of any existing groundwater.

The contact tank was of a reinforced concrete structure of 16m x 15m x 4m. The walls of the structure had been designed at 350mm thick to allow the structure to be water retaining. The steel rebar used within the reinforced structure was also designed at the European coding of 51xD.

Health and Safety

WECS employs a rigorous attitude to driving Health and Safety standards ever higher. A dedicated Health and Safety team undertook regular audits and four weekly look-ahead reviews in conjunction with the contract program and site team.

Adopting this method has led to an accident frequency ration significantly better than the industry norm. There were no incidents throughout this project.

Business AFR: 0.2

Industry standard AFR: 0.4

Total hours worked with no accidents or incidents: 16,507 hours

The editor & publishers would like to thank Shaun Hobbs, Civils Site Manager with Wessex Engineering & Construction Services, Wessex Water, for providing the above article for publication.



Demolition of existing water treatment works - Courtesy of WECS Civils



Tucking Mill WTW 02. Process Flow Diagram



DRAWING NOT TO SCALE
PIPEWORK MAY BE STAGGERED
FOR CLARITY

