Chew Stoke STW Expansion

extensions required to meet growing demands

by
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Chew Stoke STW enjoys a rural location within farmland in the valley of the River Chew. The STW receives flows via sewage pumping stations in the villages of Chew Stoke, Chew Magna and Bishop Sutton. Wessex Water has identified that Chew Stoke STW is operating close to its capacity and that predicted growth in the local area means that extensions are required. The existing consent parameters are 20:30:10 mg/l BOD:SS:AmmN. Bristol International Airport (BIA) has also recently completed construction of a new passenger terminal. A significant growth in passenger numbers is forecast and this will also increase flows to Chew Stoke STW.

Chew Stoke: New tertiary sand filters under construction *Photo: courtesy Wessex construction services*

The increase in flows will result in a corresponding tightening of the existing EA discharge consent to ensure that the increased discharge from the STW will not impact upon the receiving watercourse. Future flows and loads have been calculated based upon a design horizon of 2014. These values were used to determine the new discharge consent parameters. The new values approved by the EA are 15:23:8 mg/l BOD:SS:AmmN and will come into effect on the 1st April 2006. In addition, is is required that the annual average P concentration is maintained below 2mg/l.

Wessex Water proposed the following two stage approach to address the capacity issues at Chew Stoke STW:

* upgrade of the Chew Magna pumping station and associated rising main to deliver the increased flows from BIA to the STW;
* upgrade of the treatment facilities to process the additional flows and loads.

Advancement works - existing pumping station

The existing Chew Magna pumping station consisted of two foul and three storm pumps. The two-speed foul pumps operated on a duty/standby basis and were designed to deliver a maximum of 66 l/s to the STW. The storm pumps operated on a duty/assist/standby basis and pumped flows directly to the River Chew. Storm pumps were rated at 42 l/s each and delivered 58 l/s under duty/assist operation. The pumps were installed in the dry well with suction pipes into the adjacent wet well. The foul and storm sumps were divided by a weir wall. The pass forward flow to Chew Stoke STW was transferred via approximately 1250m of 9inch cast iron rising main.

PS modifications
The sewerage system discharging to the existing pumping station was diverted via a new 450mm diameter concrete pipe to a new wet well. The new pumping station comprises an 8m diameter, smooth bore, single pass shaft 9.35m deep. The main body of the shaft contains the foul pumps. A 3m diameter well 5m deep, houses the storm pumps

A single dry weather flow foul pump discharges up to 35 l/s to Chew Stoke. The two main foul pumps are *Flygt* submersible units (CP 3300.181 HT 441mm impeller) with variable speed drives, and operate on a duty/standby basis.The pumps are sized to discharge a maximum of 94 l/s, this being equivalent to Formula A for the Chew Magna catchment.

When incoming flows exceed the capacity of the foul pumps, the water level rises in the main shaft and flow enters the storm well via a mechanically raked 6mm screen. The screen is a *COPA* horizontally mounted unit with remote hydraulic power pack located outside the pumping station. The storm screen is sized to pass 60 l/s, to match the output of the proposed storm pumps. Screenings removed during storm conditions fall back into the main well to be discharged with the foul flow.

The two storm pumps are *Flygt* submersible units (NP3153.090 MT237mm impeller), with fixed speed drives, and operate on duty/standby basis. A fan assisted odour control unit is provided adjacent to the pumping station to remove odour from air drawn from the wet well

Rising Main
A new rising main has been installed from the new Chew Magna PS to a connection point with the existing 9inch cast iron rising main. The new main is approximately 1090m long in 355 OD PE80 black MDPE SDR11.

Low effluent velocities are initially anticipated in the new rising main due to the pipe being sized for the design horizon flow rates. At minimum pumping rates (30 l/s), the velocity in the rising main will be 0.42m/s. A flushing cycling has been incorporated into the pumping station control to generate effluent velocities in excess of 0.75m/s at least once in every 24 hours period.

Advancement works at STW
The existing duty/assist *Haigh ACE* screens were replaced with duty/standby *Brackett Green* Band Screens sized to pass 140 l/s whilst screening to 6mm in two dimensions. The new units are installed in new fabricated stainless steel channels suspended above the existing balancing tank feed chamber. The existing six storm tanks originally operated in series. The tanks were reconfigured to operate in parallel to improve their process performance.

Procurement
The advancement works design was completed by *Carl Bro Ltd* and the project was constructed directly by *Wessex Construction Services*. The advancement works were successfully completed on programme in January 2005

Upgrade of Chew Stoke STW
The existing works consisted of a conventional filter process plant incorporating an inlet works (upgraded during the advancement works as noted above), a single 15m diameter PST, four 23m diameter trickling filters, three 9m diameter HST, primary and secondary storm tanks and 2 sludge storage tanks.

Proposed works - *Plastic media tower filter*
A new flow distribution chamber has been provided downstream of

the existing PST to split settled sewage between the new plastic media tower filter and the existing filters.

A new pump station lifts settled sewage into the new plastic media tower filter. The pump station comprises two (duty/standby) fixed speed pumps. The new plastic media tower filter consists of a glass coated steel tank housing a *Marley* distributor drive assembly with trough type distributor arms. The arms distribute sewage across the structured crossflow plastic media with a minimum specific surface area of $150m^2/m^3$..

Flows from the new and existing filters pass through the existing HST to the new TSF.

Tertiary Sand Filters
A new pump station lifts humus tank effluent into the tertiary sand filter. The pump station comprises two (duty/standby) variable speed pumps designed to maintain a level within the pump station's wet well. Humus tank effluent is screened by *Copasacs* prior to the pump station to prevent leaves and other solids blocking the sand filters..

Three *Vexamus* upward flow tertiary sand filters are installed incorporating a continuous airlift sand wash facility. The filters are prefabricated stainless steel. The tertiary sand filter plant is supplied complete with duty/standby air compressors, receivers and condensers, housed in a separate kiosk.

Washwater from the tertiary sand filters is piped into a new pump station comprising two duty/standby fixed speed pumps operated on level within the wet well. The washwater is pumped to the inlet channel feeding the primary settlement tank. The filter plant is sized such that the design treatment capacity is available with one of the filters out of service. Effluent from the TSF discharges to the river via a sampling chamber.

Chemical dosing and storage
A new chemical dosing system is installed for the removal of phosphorus (P). The equipment provided is a *Michael Smith Systems - a division of Gee & Company* - package dosing plant.

Sludge storage
Two additional sludge storage tanks have been constructed to provide a total sludge storage capacity of $550m^3$. The new tanks are designed with a bunded tanker loading facility.

Procurement
After completion of the outline design by *Wessex Engineering Services*, the project was transferred to *Wessex Construction Services* for delivery of the detailed design and construction of the works.

The scheme was tendered as a design-build, ECC Option C Contract. *Morgan Est* was awarded the contract in February 2005. The detailed design was completed by *Hyder Consulting* on behalf of *Morgan Est.*

Morgan Est mobilised on site in June 2005 after completion of the detailed design. The works were completed prior to the regulatory date of 31st Match 2006.■

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