Gillingham (Dorset) Sewage Treatment Works

meeting high rate of housing development

by
John Pokojski IEng,, FIWO

Gillingham STW, which serves a population of 15,100, is a traditional waste water treatment works operating in an area where significant levels of housing development are occurring. These developments are predicted to continue at a high rate over the next 20 years. Over the last five years as the load on the works increased, effluent quality, in terms of BOD and ammonia-N, has been steadily deteriorating and an extension to the works was required to avoid any risk of failing the existing biochemical oxygen demand BOD, and the ammonia standard.

Gillingham STW: Two circuular humus tanks (foreground); biological tanks in background *courtesy: Wessex Water*

Existing treatment process

The majority of flow at Gillingham is pumped to an elevated inlet works which consists of a 6mm stepped screen with a hand-raked by-pass screen, a *Jones & Attwood Jeta* grit trap and a storm overflow weir which feeds the storm tank.

Flow to full treatment, FFT, is controlled by a modulating penstock which is linked to a *Panametrics* flow meter downstream of the storm overflow weir. From the inlet works, flow gravitates to five primary settlement tanks, four upward flow square tanks and one circular radial flow tank. After passing through distribution chambers and dosing syphons the flow continues through eight stone media biological filters and finally into three radial flow humus tanks before discharging into the River Stour.

Existing works consent:

Consented DWF	1705 m^3/d	19.7 l/s;
Consented FFT	4380 m^3/d	50.7 l/s
Effluent Quality	20:40:10	(BOD:SS:Amm-N

New works consent (effective after 31 December 2005):

Consented DWF	2184 m^3/d	25.3 l/s
Consented FFT	6552m^3/d	76 l/s
Effluent Quality	15:30:8	(BOD:SS:Amm-N)

Option selection

A wide range of treatment options were considered, most based on

the provision of additional trickling filter capacity, both mineral and plastic media, plus tertiary sand filters. In addition there were three further options based on provision of add-on tertiary nitrification and solids removal processes. Following more detailed examination with cost estimates the agreed solution by Wessex Engineering Services was the provision of tertiary aerated sand filters. One of the key benefits being that it is based upon modular plant that could be easily installed with minimal impact upon operation of the existing works.

Procurement

At the time of tendering, Wessex Water was carrying out most of its capital works by using alliance contractors. To test the market, it was agreed to tender competitively using two alliance and two non alliance contractors. The design and construct contract was awarded to *Morgan Est (Water Division)* a non alliance contractor.

Summary of principal scheme components.

*** Inlet works**

Installation of new duty/standby 6mm (in two directions) *Brackett Green* Band Screens (capacity of each screen 280 l/s). A *Haigh Ace 1000* screenings conditioning package with duty/standby macerators and a liquid separator; increasing the storage volume of the inlet works by constructing an off-line storage chamber, to prevent premature spills to the storm tank.

*** Tertiary aerated sand filter (TASF) pumping station**

The construction of a TASF pumping station with duty/assist/stand by variable speed submersible pumps. Installation of a *Copasac* screenings facility (6mm in two directions) immediately upstream of the pumping station.

*** Tertiary aerated sand filters (TASF)**

Installation of 4 continuous upward flow *Vexamus* TASFs. Their associated civil works together with a reinforced concrete hard-standing and access road to the filters and the TASF pumping station, the motor control centre (MCC), GRP enclosure, air blowers, air compressors, pipe work, valves etc.

*** Wash water pumping station**

Construction of a final effluent washwater pumping station with duty/standby submersible washwater pumps and hydro-pneumatic booster together with a dedicated rising main which will supply the new inlet screens. In addition, the washwater pumping station will feed a new washwater ring main which has been sized to supply 10 hose connection points.

*** Standby generator**

The installation of a permanent 200 kVA auto start on mains failure, containerised standby generator and associated bulk fuel storage tank.

*** SCADA and telemetry signals**

Installation of an expandable SCADA PC to provide monitoring and control of the works process from one location. All work undertaken jointly with *Wessex Water automation department*. The updating of the site telemetry system to deal with the existing and new plant.

Tertiary aerated sand filters (TASF)

The largest component of the scheme was the design, supply and installation of the TASFs using *Vexamus Water,* a nominated sub contractor for *Morgan Est*. The tertiary plant was constructed on the

Installation of 4 Vexamus Tertiary Sand Filters *courtesy: Wessex Water*

site of the old abandoned sludge drying beds and consisted of four upward flow aerated sand filters. Manufactured in stainless steel and painted dark green at the recommendation of Dorset County Council planning department, the TASFs were bolted to a new reinforced concrete base slab. The continuously backwashed sand filters are each approximately 10.3m high and 2.5m dia and have a combined treatment capacity of 85 l/s. Flows (FFT 76 l/s) leaving the humus tanks gravitate to the TASF pumping station where it is screened through *Copasacs* and then pumped and distributed equally to the four aerated sand filters.

The effluent is pumped to the bottom section of each filter where it rises up through the aerated sand media, where it is cleaned, and then leaves the filter through the high level outlet. By gravity, the final effluent flows through the new washwater pump sump to the final effluent sampling chamber and thence forward to the River Stour.

Aerating the sand bed produces oxygen for the nitrifying biomass that develops on the sand particles. Contaminated sand at the very bottom of the filter is transported by an air lift pump to the sand washer at the top of the filter. Severe agitation caused by the air lift pump and the constant colliding of sand particles as it rises up the central air/sand lift tube causes the contaminants to become separated from the sand. At the top of the air/sand lift tube the sand is discharged into the washer box where an upward flow of filtered effluent removes the contaminants, backwash water, and the clean sand falls through the washer on to the top of the sand bed. The filters and the sand cleaning operate continuously. The dirty backwash water is returned to the head of the works at a rate of 9 l/s.

Commissioning

Commissioning started in March 2005 by introducing a low flow of humus tank effluent into all the sand filters to flush out all the fine particles from the sand bed. During this period all the effluent was returned to the head of the works for further treatment.

After flushing the filters for a week, a bacteria culture provided by *Vexamus* was introduced and the filters allowed to rest for approximately four hours. Low volumes of humus tank effluent were again introduced with the quantity of flow being increased over a period of time until the TASF were treating the FFT (76 l/s). Subject to normal Spring temperature conditions it is expected that the TASFs will be fully seeded (biologically active) within six weeks from the introduction of the bacteria culture. Completion of the whole scheme is expected by the end of May 2005.■

Note: *The author of this article, John Pokojski, is Lead Design Engineer, Wessex Water.*