Staplefield WwTW

a good example of the challenges faced by water companies in addressing consenting issues on small rural works

Southern Water is undertaking works as part of its AMP5 programme to meet amended consents set by the Environment Agency as part of their National Environmental Programme. One of these sites is Staplefield Wastewater Treatment Works (WwTW), a small works located in a rural village of the same name approximately seven miles south of Crawley in West Sussex. The works currently serves a population of 206 though this is predicted to rise to 234 by 2020.

Bunded ferric chloride delivery bay - Courtesy of 4Delivery

Consent

The phosphate (P) consent has been tightened at this site to 2mg/l phosphorus. The recognised way of removing phosphate from the effluent is to dose the influent with ferric – either sulphate or chloride. An upper tier iron consent of 4mg/l has therefore also been set to ensure that dosed ferric does not impact on the receiving watercourse.

Existing treatment process

The existing treatment at Staplefield Wastewater Treatment Works, which had been in operation for over two decades, consisted of an aerated sludge plant and a three-stage lagoon treatment system, which provided further settlement and polishing of the effluent in the third lagoon.

A storm tank provided balancing of flows in high flow conditions, minimising any bypassing of the treatment facility and ensuring that nearly all the effluent was treated prior to going out to the water course through the lagoons.

Whilst this system operated satisfactorily to the existing consent it did not the have the capability to be adapted to meet the new consent governing phosphorus and iron levels. The existing plant therefore required rebuilding to the latest standards and ensure that the new consents were met.

Proposed treatment

The proposed new WwTW at Staplefield consists primarily of:

- An inlet pumping station (PS).
- 2 (No.) 26m^3 septic tanks.
- Submerged aerated fixed film (SAFF) plant.
- A humus tank.

A desludge PS will re-circulate settled sludge within the humus tank back to the septic tanks, to ensure the septic tanks are not allowed to build up septicity which could be washed through the site in the event of a storm. A new washwater PS will feed final effluent around the site to standpipes for cleaning chambers.

Also included within the package are an iron and phosphorus monitoring kiosk used to examine levels in the final effluent, an MCC (motor and control centre) kiosk, flow meters and a new ferric chloride delivery bay. The ferric delivery bay consists of a bunded area which can be hydraulically isolated. An interception chamber, consisting of a coated manhole, protects the site from having to absorb the impact of a ferric spill during a ferric delivery. During other periods, the valves in the chamber allow rainfall to go through the on-site works drainage system.

Construction challenges

The main construction area at Staplefield was no greater than approximately 750m^2. This was very tight considering the amount of new process units that had to be incorporated. To get the required space to build the scheme, enabling works had to be undertaken, including the removal of the first lagoon and a storm chamber. Land was also needed to be rented from the adjacent landowner to ensure suitable welfare and office facilities could be in place for the duration of construction.

One of the primary drivers of the project was to ensure that the effluent quality was not compromised and that no detriment to the existing works was caused whilst constructing the new facilities. The relationship between the construction and operations teams was therefore critical to ensure that dialogue was maintained and there was continuous awareness of each others activities.

To ensure the site continued to operate effectively during storm conditions, a temporary storm line was installed including a temporary screening chamber using Copasacs. This allowed the excess storm flows to be diverted to the two remaining lagoons. Once the area had been cleared it allowed all the new structures to be constructed off line without impacting the remaining Southern Water process units.

The initial plans for the construction method made use of a coffer-dam system to protect the excavation for the installation of the deep structures. However, through ground investigations and approval from the structural engineer, it was established that the ground conditions were suitable for an open cut dig with an interlocking sheet piled wall providing a barrier against the remaining lagoons. This had advantages both in terms of cost and time.

The construction sequence commenced with the construction of the deep units starting with the humus tank which required a localised cofferdam due to its depth. This was followed by the construction of the SAFF, septic tanks and inlet pump station respectively.

For the SAFF, septic tanks and inlet PS, advantage was taken of the good ground conditions and each was constructed within a localised excavation. The SAFF unit and the septic tanks had to be surrounded with concrete. Due to the high pressures involved with pouring concrete in such a confined area to a tight schedule it was decided to enlist the help of a proprietary formwork designer to design the formwork system. The concrete was poured at a specified rate and the tanks were filled with water to provide ballast against any uplift.

To ensure safety during the construction of all the deeper excavations a temporary works procedure was followed. This ensured the design of the proposed excavation was produced and sent to a structural engineer for checking and approval. Once all the deeper below ground structures had been installed, construction commenced on the shallower installations in the traditional manner with the installation of all pipework, cable ducts and manholes. As these items were completed the footpaths, roads and then eventually landscaping was undertaken.

Operation

Operation of the new plant is fully automated and telemetry has been installed to provide constant monitoring of the process stream. The site can be monitored remotely via a central control system and enables Southern Water to react instantly to any issues that may arise. The septic tanks are scheduled for desludging on a semimonthly basis and the contents taken to a larger treatment works for further treatment.

Staplefield has been constructed with client usability in mind. Feedback on previous schemes has focused on the operation and maintenance of the plant and the ease of which both can be carried out. An assessment of all hazardous operations and access, lifting and maintenance requirements was conducted prior to construction commencing. Continuous liaison between the design and construction teams ensured no usability issues arose and all new items underwent rigorous testing and inspection to ensure the plant met all operational requirements.

The scheme passed its takeover test in May 2012 and Southern Waters operational personnel have received appropriate training to ensure they can operate and maintain the plant. At the time of writing (June 2012) the scheme is undergoing minor hydraulic optimisation prior to being handed back to the client, planned for July 2012.

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Septic tanks with distribution chamber with ferric dosing line in the foreground & MCC kiosk to the left - Courtesy of 4Delivery