Castlecaulfield WwTW

new RBC plant in County Tyrone with a 2030 design horizon

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Castlecaulfield is a rural village, located in County Tyrone in Northern Ireland. The existing Wastewater Treatment Works (WwTW) was nearing the end of its useful life, and with a newly imposed, more stringent, Northern Ireland Environmental Agency discharge consent, Northern Ireland Water (NIW) decided to invest in a new works through the Integrated Waste Water Framework (IWWF) works improvement programme. The new works is sized for a maximum population equivalent (PE) of 1,729 and a DWF of 5.62l/s. The design standard was 20mg/l (BOD), 30mg/l (SS) and 6mg/l (NH_4). The new plant was constructed on the site of the existing works, and in order to keep the works operational, phased construction and commissioning was required, followed by demolition of the outdated plant.

General overview of Castlecaulfield showing 2 (No.) PSTs in foreground, 2 (No.) RBCs in middle with 2 (No.) final tanks behind. An FE booster kiosk is on the right - Courtesy of Enpure Ltd

The Shearwater Consortium JV (Enpure Ltd, GEDA Construction Ltd and Lagan Construction Ltd), which is part of the IWWF, designed and constructed the replacement works based around Rotating Biological Contactors (RBCs) with a 2030 design horizon. The contract valve of the new works was £3.99 million in 2010.

Existing works

The existing Works at Castlecaulfield WwTW was constructed in the mid-1980s (replacing the original works) and consisted of:

- A manually raked inlet works.
- 2 (No.) primary settlement tanks.
- 2 (No.) biological filter beds.
- 2 (No.) humus tanks.

Legislative requirements enforced by Northern Ireland Environment Agency required NIW Ltd to consider a new process to replace the existing works. Due to planning consents, it was only possible to gain planning permission for a new works if it was constructed on the existing site, meaning the new process would be constrained by the size of the existing works.

Through a detailed design development process (undertaken as a PSC with NIW Ltd and Shearwater Consortium) Enpure Ltd developed a solution based on the use of RBCs.

New Castlecaulfield WwTW

The new process selected for Castlecaulfield WwTW comprised the following:

Castlecaulfield WwTW - Inlet Works screen
Courtesy of Enpure Ltd

View of inlet channel flume with inlet works in back ground
Courtesy of Enpure Ltd

- Inlet works with CSO, screening equipment, and separate grit and grease removal equipment.
- 2 (No.) Primary Settlement Tanks.
- 2 (No.) Rotating Biological Contactors.
- 2 (No.) Final Settlement Tanks.
- Final Effluent Return Pumping Station (during low flows).
- Sludge treatment process including sludge holding tank and return liquors pumping station.
- Blind and Online Storm Water Holding Tanks.
- Ancillary plant including service water and final effluent booster sets.
- MCC building including an emergency Stand-by Generator.

The new plant comprised the following main features:

- Inlet works with duty/stand-by 6mm screens supplied by Haigh Engineering Ltd.
- Separate grit and grease removal equipment from Huber Technology (RoK6).
- 2 (No.) GRP hopper bottomed primary settlement tanks from KEE Process Ltd, fitted with actuated de-sludge bellmouths from Rotork Ltd and Flow Technology Ltd.
- 2 (No.) 4.5m diameter RBC units supplied by KEE Process.
- Blind and online storm storage tanks complete with mixers and return storm water pumping plant from ITT Flygt Ltd.
- An FG Wilson Ltd containerised standby generator complete with integral fuel tank.
- Motor Control Centre from TES Ltd, sited in a GRP kiosk supplied by Carn Plastics Ltd.

The works was constructed by GEDA Construction Ltd with Atkins Ltd providing professional civil design services.

Castlecaulfield Wastewater Treatment Works receives flows from a rural catchment with a maximum design variation between 5.62l/s (DWF) to 45.67l/s (Formula A). Flows in excess of Formula A are discharged direct to the receiving watercourse via a CSO screen, which returns screenings to the main flow.

Screened sewage up to Formula A gravitates through a flume to a distribution chamber for primary settlement. Flows in excess of 14.26l/s overflow into a blind tank and an online storm tank, which overflows when full. The storm tanks are fitted with submersible pump mixing systems. Storm water is returned to the head of the works automatically by means of duty/stand-by submersible return pumps in the Blind Storm Tank, into which the Online Storm Tank drains.

The 2 (No.) PSTs are fitted with automatic de-sludge and manual scum removal facilities. These drain to a sludge pumping station and are pumped to the sludge holding tank. Settled sewage passes the RBC splitter chamber where it gravitates through 2 4.5m diameter RBC units for biological treatment.

The flow passes onto the final settlement tanks, which are fitted with automatic de-sludge and manual scum removal facilities. These drain to a sludge pumping station, and are pumped to the sludge holding tank.

Final Effluent passes through an FE collection chamber, sample chamber, and FE pumping station before discharging through a Tideflex valve into the Torrent River. Final Effluent is delivered to the FE Break Tank for use on site ,and automatically re-circulated to the PST and RBC splitter chambers during low flows.

The Wastewater Treatment Works is controlled by a PLC, interfaced by HMI, and runs on software, which makes the operation of the plant fully automatic, logging critical performance data over a rolling 30 day period. A Serck Telemetry outstation provides full radio telemetry communication with the Northern Ireland Water Control Room – providing availability and fault alarms as well as flow and quality data.

Raised inlet works (left) with PST desludge bellmouth chamber (right) Courtesy of Enpure Ltd

View of inlet flume and distribution chamber to 2 PST's with Liquor and sludge return pipework - Courtesy of Enpure Ltd

Civil works

The works are constructed principally of mass concrete for all major structures, with the exception of the MCC building which is GRP. The emergency stand-by generator is located beside the MCC kiosk. The boundary of the site has been landscaped and planted with indigenous tree species.

Commissioning

The plant was commissioned in two phases. Phase one was completed in August 2009 when the PSTs, RBCs and FSTs were commissioned. A temporary MCC panel was provided to allow the new PST/RBC/FST stream to be commissioned reaching the new effluent standard within 4 weeks. This facilitated the demolition of existing PSTs and biological filters to complete the rest of the works, including new sludge and storm retention tanks, new MCC kiosk and SBG plinth which were fully commissioned in January 2010.

Conclusion

A phased approach was adopted due to site restrictions at the existing Castlecaulfield WwTW, and the need to maintain treatment of sewage, while the new sludge storage tank and storm retention tanks were constructed.

This phased approach facilitated the demolition of the existing works, to allow construction of treatment and storage plant on the same site. The new Castlecaulfield WwTW is operating well within the Guaranteed Performance Standards, achieving a 20mg/l (BOD), 30mg/l (SS), and 6mg/l (NH_4) quality effluent.

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