

# Hamiltonsbawn WwTW

## new Inclined Bubble Aeration process with a 2030 design horizon

by  
Matthew Simpson

**H**amiltonsbawn is a rural village, located in County Armagh in Northern Ireland. Operated by Northern Ireland Water Ltd (NIW) the existing works, which was constructed in the 1980's, was nearing the end of its useful life and with a newly imposed more stringent Northern Ireland Environmental Agency (NIEA) discharge consent, NIW Ltd decided to invest in a new works through the Integrated Waste Water Framework (IWWF) works improvement programme.



*Tertiary sand filter treatment*

*Courtesy of Enpure Ltd*

The works is sized for a maximum Population Equivalent (PE) of 1750 and a DWF of 4.2 l/s. The design standard was 10 mg/l BOD, 15 mg/l SS and 3 mg/l NH<sub>4</sub>. However, with the use of tertiary sand filtration the works produces a 5 mg/l BOD, 10 mg/l SS and 3 mg/l NH<sub>4</sub>. The Contract Value of the Works was £3.6 million in 2008.

The Shearwater Consortium JV (Enpure Ltd, GEDA Construction Ltd and Lagan Construction Ltd) is part of the IWWF, and designed and constructed a new Inclined Bubble Aeration works with a sand filter for a 2030 design horizon. The new plant was constructed on the site of the existing works and required a temporary works to be built in an adjacent field to allow demolition of the existing works.

### Existing Works

The existing Works at Hamiltonsbawn WwTW was constructed in the mid 1980's and consisted of a manually raked inlet works, 2 No. primary settlement tanks, 2 No. biological filter beds and 1 No. humus tank. Additional sand filtration was added in 1996 when the works was refurbished. Legislative requirements enforced by Northern Ireland Environment Agency to improve the quality of the Hamiltonsbawn WwTW effluent to a 2030 design horizon 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 they were constructed on the site of the existing works and 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 number of possible process options for the site each one fitting into the existing site. After considering all the options with NIW Ltd and their Project Managers AECOM Ltd, the Enpure signature solution of a single stream Inclined Bubble Aeration (IBA) plant with 'bolt on' skid mounted tertiary treatment sand filter was the chosen option. The IBA process provides a single lane aeration process which is aerated and then allowed to become anoxic so providing ammonia reduction. The IBA process was chosen based on its past performance on other NIW treatment works sites following the review of the performance of the IBA plants at Claudy and Sion Mills – other Shearwater projects.

### New Hamiltonsbawn WwTW

The new process selected for Hamiltonsbawn WwTW comprised the following:

- Inlet works with screening equipment, and separate grit and grease removal equipment;
- Inlet lift pumping station and storm tank with integral mixing system;
- Secondary treatment process IBA tank, GRP hopper bottomed final settlement tanks and their associated ancillary plant;
- RAS and SAS pumping stations;
- Sludge treatment process including drum thickener, liquid polyelectrolyte preparation plant and sludge holding tank;
- Containerised Standby generator and fuel tank;
- Ancillary plant including service water and final effluent booster sets.

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

#### Temporary Hamiltonsbawn WwTW

Before the existing works could be demolished a temporary treatment facility had to be constructed and commissioned alongside to maintain treatment for the duration of the construction and commissioning period of the permanent works. With careful programming the resulting temporary unit process were able to be largely re-located to Annaghmore WwTW and installed as their permanent solution to upgrade that works once the new works at Hamiltonsbawn came on stream.. This project was executed following on from Hamiltonsbawn and is currently undergoing final process commissioning during July 2010. Enpure Ltd designed and executed a temporary works comprising:

- Inlet pumping station, compete with static screen and storm pumps supplied by ITT Flygt Pumps Ltd;
- Storm water storage and sludge GRP storage tanks from Silotank Ltd;
- Three No. GRP Primary Settlement Tanks from KEE Process Ltd;
- Three No. 3.6 m diameter Rotating Biological Contactors (KEE Process Ltd);
- Four No. Final Settlement Tanks (KEE Process Ltd);

- A Motor Control Centre designed and constructed by TES Ltd;
- A GRP MCC enclosure from Cairn Plastics Ltd.

The works were constructed under the Main Contract which used NEC Option A Second Edition Conditions of Contract. Construction time for the temporary Works was 12 weeks and flows were turned through the plant in November 2008. Satisfactory effluent quality was established within 3 weeks following which demolition of the existing Works commenced.

#### New Hamiltonsbawn WwTW

The new Hamiltonsbawn Works was based around an Enpure Ltd signature solution of a single stream Inclined Bubble Aeration plant with sand filtration to meet the required final effluent guarantees.

The new plant comprised the following main features:

- Inlet works with duty/stand-by 6mm screens supplied by Haigh Ltd;
- Separate grit and grease removal equipment from Huber Technology;
- Inlet lift pumping station and storm tank with integral mixing system from ITT Flygt Pumps Ltd;
- Secondary treatment process IBA tank;
- 2 No. GRP hopper bottomed final settlement tanks from KEE Process Ltd, fitted with actuated de-sludge bellmouths from Rotork Ltd and Flow Technology Ltd;
- RAS and SAS pumping stations supplied by Seepex Ltd;
- SAS drum thickener from Alfa Laval Ltd with liquid polyelectrolyte preparation plant and concrete sludge holding tank;
- An FG Wilson Ltd Containerised Standby generator complete with integral fuel tank;
- Motor Control Centre from TES Ltd.

Hamiltonsbawn receives flows from a rural catchment with a maximum design variation between 4.2 l/s (DWF) to 31.7 l/s (Formula A). Maximum flows of 80 l/s can be received by the inlet

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Permanent works IBA tank

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Temporary works installation

Courtesy of Enpure Ltd

works which screen the flows to 6mm in two directions. Flows in excess of Formula A are discharged, after screening, direct to the receiving water course via an adjustable penstock and inlet flume arrangement which measures flows up to Formula A. FFT (10/1 l/s) is pumped forward to the IBA lane and recorded by an MCERTified magflow meter. Flows in excess of 10 l/s overflow into a storm tank, which has a submersible pump mixing system. Mixed storm water is returned to the FFT PS wet well and surplus flows overflow to the same receiving water.

The IBA lane contains two Flygt banana blade flow inducers and an aeration system provided by Suprafilt Ltd. Flows pass through IBA lane and settle in two 60 degree hopper bottom FST of GRP construction. Sludge is removed by means of actuated bellmouths into a wet well and is returned to the IBA lane. Surplus sludge is drawn directly from the RAS line and delivers SAS to an automated drum thickener which thickens the sludge to a minimum of 5% ds and discharge into a concrete storage tank with a pumped mixing system from Hidrostal Ltd. Settled effluent passes from the FST to a Final Effluent PS which delivers a maximum of 12 l/s to a Severn Trent Services TETRA Modular Deep Bed Filter packaged unit for final filtration before discharging through a short outfall pipe. Quality instrumentation measure Turbidity and Ammonia concentrations.

The Works are controlled by an 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. Mixed liquor levels and DO in the IBA lane are controlled to operator adjustable set-points to minimise Operator time on site only requiring sludge tank and polymer levels to be monitored remotely. A Serck Telemetry outstation provides full radio telemetry communication with NIW Ltd Control Room – providing availability and fault alarms as well as flow and quality data.

**Civil Works**

The works are constructed principally of mass concrete for all major structures with the exception of the MCC building which is built of concrete blocks and rendered. The emergency stand-by generator is located beside the MCC building and the works are concealed by means of a wooden faced welded mesh security fence with operator access key-pad. The boundary of the site has been landscaped and planted with indigenous tree species.

**Commissioning**

The plant was successfully tested in October 2009 when flows entered the new works for the first time. After initial seeding and establishment of the required bio-mass in the IBA lane Performance Testing was carried out in December 2009 and Feb 2010. The works are currently operating well within their Guaranteed Performance Standards.

**Conclusion**

Due to the restricted plan area of the existing Hamiltonsbawn WwTW site, a temporary treatment plant, consisting of package Rotating Biological Contactor treatment units, GRP PST's and FST's was required to maintain treatment of the incoming sewage whilst the new plant was constructed on the site of the existing works. The new works comprised an Enpure Ltd Inclined Bubble Aeration plant with FST's and deep bed sand filtration to achieve a 5 mg/l BOD, 10 mg/l SS and 3 mg/l NH<sub>4</sub> quality effluent.

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