

## BELFAST SEWER STUDY

Ted Osborn and Andy Sharpe  
Binnie & Partners  
Grosvenor House  
69 London Road  
Redhill  
Surrey RH1 1LQ

### 1 Introduction and background

The study was commissioned by the Department of the Environment for Northern Ireland, Water Executive in July 1991. The study was carried out by Binnie & Partners, who were assisted by Ferguson & McIlveen.

The sewer systems included in the Belfast Sewer Study are those that drain by gravity to Duncrue Street STW (Sewage Treatment Works). These systems, or catchments, total twenty in number and are shown schematically in a block diagram in Figure 1.

The study area covers approximately 40 sq km with a population of 208,000.

In addition to the gravity systems, a hydraulic only study was made of one pumped catchment (known as the Abattoir PS catchment) for the purpose of calculating gravity flows to the future inlet works at Duncrue Street STW.

The sewers in Belfast form a combined system (ie convey both foul and storm flows). The flows are conveyed to Duncrue Street by the three large diameter sewers listed below:

- Low Level Sewer (LLS), constructed between 1888 & 1896
- High Level Sewer (HLS), constructed between 1888 & 1896
- High Level Interceptor Sewer (HLIS), constructed between 1960 & 1972.

Development within the study area has increased the run-off entering the system so that all the trunk sewers and many of the branch sewers are now hydraulically incapable of conveying storm flows to Duncrue Street STW. To relieve the system and prevent out-of-sewer flooding of foul flows during storms, overflows have been constructed that spill either directly to the River Lagan or its tributaries. A total of 106 overflows were identified.

One of the main objectives of the study is to find ways of eliminating as many of the storm overflows as is practicable and to ensure that the remaining ones comply with established guidelines. This work has become more urgent following the commissioning of the Lagan Weir in 1993, which has greatly reduced the tidal flushing of the River Lagan above the weir.

- Cl concentrations are dependent on location and tide level as well as on total flow volume and level. They are a measure of the seawater entry into the sewerage system and do not lend themselves to prediction in the same way as the other determinants.

Using the empirical method, and simulating an annual series of Belfast storms (known as the Belfast Time Series Rainfall) the average annual pollution load passed over the overflows was calculated.

## 5 Upgrading options

Upgrading has been considered in the instances where one or more of the following triggers occurs:

- continuation flow before overflow operates to be less than the Formula A flow;
- flooding of occupied premises occurs more than twice in 10 years on average (an OFWAT DG5 requirement). A 10 year return period storm has been used for this analysis, backed up by historical record and site checks;
- flooding in excess of 50 m<sup>3</sup> for a 2 year return period storm again confirmed by records or residents;
- significant tidal inflow.

### Upgraded system performance

The upgraded works are designed to meet the following standards:

- continuation flow of at least Formula A before overflow operates;
- no out of sewer flooding in excess of 50 m<sup>3</sup> as a result of a storm of return period 1 in 20 years;
- no significant surcharge (1m above soffit) of strategic sewers as a result of a storm of return period 1 in 1 year;
- no direct tidal inflow.

### Options

The proposed upgrading works have been separated into two types:

- local
- global.

The local improvements are required where a hydraulic deficiency is due to a local restriction or inadequacy in the system. Typically the solutions to these problems are one or more of the following:

- flow diversion;
- local storage;
- increased flow capacity (duplicate or larger sewer);
- flow attenuation.