

# Londonderry Drainage Area Plan Implementation

£35m upgrade to sewerage network infrastructure on the banks of the River Foyle within the 2013 UK City of Culture

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The City of Derry is the second-largest city in Northern Ireland and the fourth-largest city on the island of Ireland. Located 70 miles north-west of Belfast, the City of Derry has a population of 110,000. The city straddles the River Foyle with the old walled city on the west bank. In 2013 Derry became the inaugural UK City of Culture. The implementation of the £35m Londonderry Drainage Area Plan (DAP) has provided solutions to out-of-sewer flooding problems and removed unsatisfactory discharges to the River Foyle by providing the City of Derry with a wastewater network capable of meeting projected future needs. The upgrades will ensure; a satisfactory level-of-service standards are maintained for Northern Ireland Water's (NI Water) customers; compliance with existing and future European Wastewater Treatment Directives; and protection of the water quality of the River Foyle.



Viewpoint from base level of the Duke Street WwPS scheme shaft showing the secant pile construction method employed - Courtesy of AECOM Ltd



Sewerage network animation – Derry City Centre



Sewerage network animation – East & West River Foyle



Overall catchment animation

Network and catchment animations  
Courtesy of AECOM Ltd

## Background

The Londonderry DAP made recommendations for addressing both the existing and future sewerage network requirements of the city. The upgrades ensure that the Northern Ireland Environment Agency (NIEA) regulatory standards are met, preventing damage to the local water environment.

As Project Manager for NI Water on the Integrated Wastewater Framework (IWWF) since 2006, AECOM has managed the progression and implementation of the outline network upgrade recommendations contained in the DAP. Shearwater Consortium is the IWWF Western Region Contracting Consortium and has constructed the Londonderry DAP solutions.

AECOM has provided feasibility, design development, NEC project management, site supervision and stakeholder engagement services for the project.

## Derry sewerage network

The Derry sewerage network covers an area of approximately 2,600 hectares. Derry is split in two by the River Foyle that flows into Lough Foyle in the north east of the catchment. The River Faughan separates the district of Drumahoe from the rest of the catchment.

The majority of the properties within Derry are served by a combined sewerage system with some of the road network draining to separate surface water systems.

Treatment of wastewater generated by the Derry catchment takes place at Culmore WwTW. Culmore Wastewater Treatment Works (WwTW) is located on the Cityside west bank of the River Foyle approximately 11km from the most westerly connection to the Derry sewerage network.

Waterside flows are passed to the Cityside at two points crossing the River Foyle; firstly at Duke Street Wastewater Pumping Station (WwPS) and secondly at the Strathfoyle siphons comprising 2 (No.) 300mm steel sewers cast in concrete into the bed of the River Foyle.

Flows from the east bank discharge into major trunk sewers located on the west bank which are subsequently pumped at Pennyburn WwPS prior to gravity discharge directly to Culmore WwTW.

#### Model verification

The NI Water hydraulic model used to represent the large and complex sewerage network within the city includes:

- 1,600 (No.) model nodes.
- 1 (No.) WwTW.
- 21 (No.) WwPSs.
- 43 (No.) combined sewer overflows (CSOs).
- A total of 59 (No.) outfalls to the River Foyle and River Faughan.

#### DAP proposals

To meet the drivers detailed (below) and ensure that the wastewater network is capable of meeting projected future needs identified by the model, the following catchment upgrades were developed and advanced to construction:

- **WwPS upgrades:** Upgrade of 13 (No.) catchment WwPSs to meet NIEA regulation including increase in pass forward flow and provision of emergency storage necessary to

prevent pollution of the River Foyle and other watercourses. This includes the replacement of Archimedes screw pumps at 2 (No.) WwPS sites.

- **CSO screening:** Retrofit of screening facilities to 15 (No.) CSOs classified as unsatisfactory intermittent discharges (UIDs) by NIEA.
- **UID removal:** 50 (No.) UID removed through the upgrade of catchment assets, closure of poorly performing assets and provision of screening facilities.
- **Rationalisation of catchment assets:** Rationalisation of the catchment ancillaries to ensure efficient operation of the network and reduction in excessive operation and maintenance costs currently attributed to NI Water through the closure of 27 (No.) assets including WwPSs and CSOs.
- **Resolution of flooding:** Resolution of network flooding through the upgrade of catchment assets and the completion of £6.2m of sewer rehabilitation including removal of structural and serviceability deficiencies to increase sewerage network capacity.

#### Security of wastewater treatment considerations

In addition to the works noted above a review of the security of supply of wastewater flows from the east bank of the River Foyle to the west bank was also undertaken.

Failure of either of the transfer pipelines, namely Duke Street Wastewater Pumping Station rising main and the two Strathfoyle siphons would have a catastrophic impact on the east bank sewerage network resulting in significant out-of-sewer flooding and unconsented unscreened sewerage spills to the River Foyle which would result in potential prosecution by NIEA. Both the Duke Street and the Strathfoyle siphon sites are critical assets for NI Water with major works having been undertaken and in progress at both sites. A case study with details of works completed at the Duke Street site follows.

Table 1: NI Water drivers identified as part of the DAP

Drivers	Description	Consequences
<b>Environmental regulation</b>	NIEA stipulated that all WwPSs and CSOs which do not pass forward a minimum of future 'Formula A' and do not have facilities to screen overflows to receiving watercourses be upgraded to meet these minimum standards as required by the Urban Wastewater Treatment Regulations.	Failure to meet the NIEA regulations would increase the risk of NI Water being prosecuted as a result of breaching their discharge consent and causing pollution of receiving watercourses.
<b>Scottish Development Department (SDD) storage</b>	NIEA have advised of special requirements including additional storage where dilution in the receiving waters, namely streams to the River Foyle, is below the minimum dilution ratio.	
<b>Resolution of catchment flooding</b>	The DAP and model identified 48 areas of historical flooding in the Derry catchment.	Failure to resolve predicted flooding would increase the potential for dissatisfaction of NI Water customers, potential negative media interest and damage to NI Water's public image.
<b>Efficiency improvements</b>	Rationalisation of assets, improvement of carbon footprint, reduction of current excessive operation and maintenance costs and improvement of the level of health and safety for NI Water personnel undertaking ongoing inspections and maintenance of assets would achieve efficiency savings for NI Water.	The sewerage network is currently operating inefficiently with inadequate equipment overloaded by incoming flows. This has resulted in equipment working constantly necessitating excessive maintenance and repair in situations where the level of health and safety is not satisfactory. Failure to rectify these issues will result in rising operational costs and risk to NI Water personnel completing necessary inspections.
<b>Improve security of wastewater treatment</b>	To improve the security of wastewater treatment between the east and west banks.	With only one source of wastewater treatment on the west bank of the River Foyle, the pipework which pass forward flows to the west bank from the east are NI Water's most critical assets. Failure of either of the three transfer pipelines would have catastrophic results.

### Duke Street WwPS

The new Duke Street WwPS was constructed using a 16m deep secant-piled structure, and 2km of transfer pipeline routed across the Craigavon Bridge and along Queens Quay.

Initial assessment of the existing WwPS confirmed that it did not meet NIEA pass forward flow requirements and was regularly spilling unscreened flows directly to the River Foyle. The existing pumping station equipment was found to be inadequate to deal with the material being forwarded to the pumping station and upstream unscreened CSOs.

A survey of the rising main which crossed the Craigavon Bridge and downstream Quay Route sewer also identified serviceability and structural defects which required upgrade.

To resolve the issues identified and to improve the level of security of supply of wastewater flows between the east and west bank of the River Foyle, the following works were undertaken:

- Upgrade of foul pumping station to meet NIEA future 'Formula A' requirements (100l/s to 305l/s).
- Construction of storm pumping station capable of discharging 280l/s.
- Closure of the UIDs at the Duke Street WwPS.
- Installation of a 6mm electrically powered screen between the foul and storm wet wells, as stipulated by NIEA, and a new overflow facility to the River Foyle.
- Replacement of the existing, structurally deficient, rising main with a 500mm diameter ductile iron main to cope with increased flows across Craigavon Bridge, terminating 200m downstream of Queens Quay PS (approximately 2.5km in length).
- De-silting of existing Quay Route Sewer between Craigavon Bridge and Queens Quay PS.
- Provision of emergency storm storage at new pumping station as required by NIEA (243m<sup>3</sup>).
- Replacement of existing 300mm diameter watermain crossing Craigavon Bridge, identified as being in poor structural condition, with a 300mm diameter main.

Following early engagement and development of outline design solutions the Shearwater Consortium was appointed under the NEC – Engineering and Construction Contract (ECC) – Option A, Priced Contract with Activity Schedule to undertake the construction works.

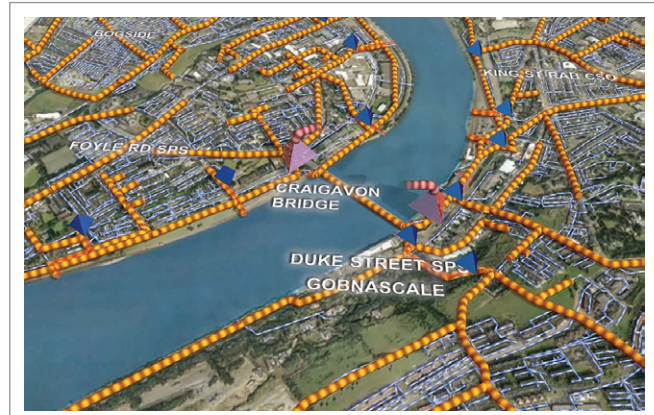
Construction commenced in December 2009 utilising secant piles driven to 16m in an area adjacent to the River Foyle where proposals for groundwater control were key to the success of the project.

The 7.8m diameter, 12m deep WwPS construction was undertaken in conjunction with the new sewage rising main and watermain across the Craigavon Bridge (285m length) with continuation of the rising main 2.5km along Queens Quay and Foyle Embankment. The majority of the rising main was laid in made ground forming the new Quay development, with numerous obstacles identified along the route including anchor blocks and tie rods.

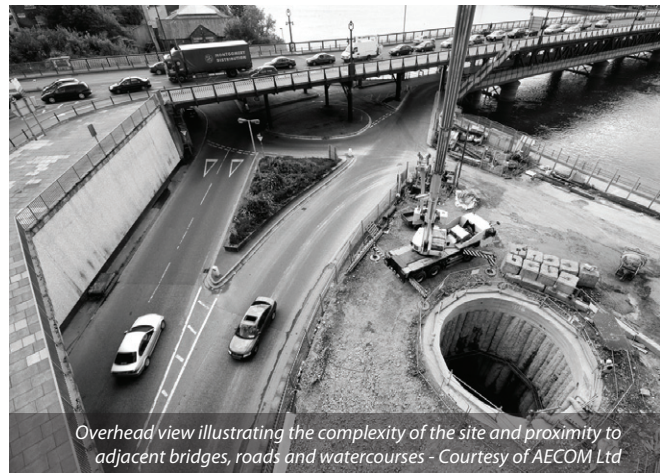
Works were successfully completed and handed over to NI Water in February 2012 with a total capital cost of £3.9m.

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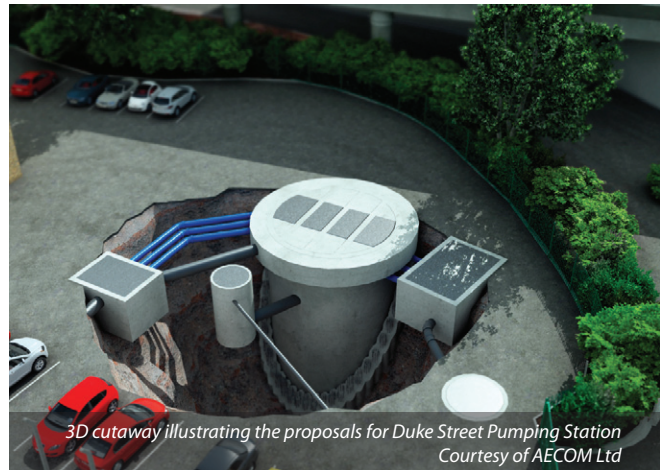
*Thanks also to Alan Lavery for the photography used in this article (please visit [www.alanlaveryphotography.com](http://www.alanlaveryphotography.com)) and Andrew Castle of Pivotal Animations for 3D model production (please visit [www.pivotalanimations.com](http://www.pivotalanimations.com)).*



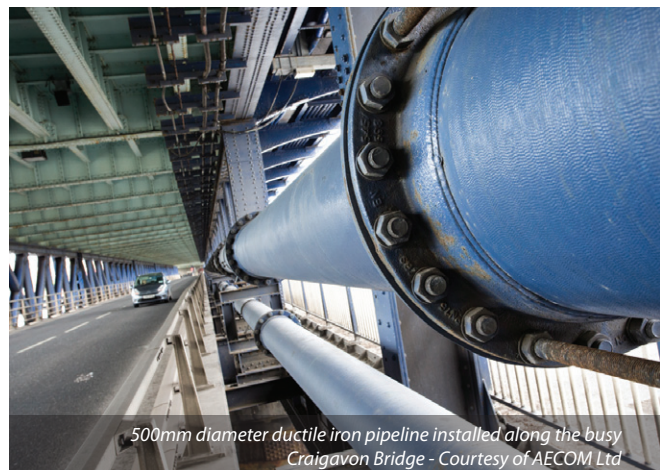
Existing catchment and infrastructure – Duke Street area  
Courtesy of AECOM Ltd



Overhead view illustrating the complexity of the site and proximity to adjacent bridges, roads and watercourses - Courtesy of AECOM Ltd



3D cutaway illustrating the proposals for Duke Street Pumping Station  
Courtesy of AECOM Ltd



500mm diameter ductile iron pipeline installed along the busy Craigavon Bridge - Courtesy of AECOM Ltd