

Bangor Sewerage Improvement Scheme

£10m sewerage improvement programme delivering benefits to North Down coastal bathing waters

by David McGrath

The historic seaside town of Bangor, situated on the southern side of Belfast Lough can be considered a commuter town for the Greater Belfast Metropolitan area. Tourism is an important industry for the town's economy, particularly in the summer months. Bangor hosts the Royal Ulster and Ballyholme Yacht Clubs and the town's Marina is one of the largest in Ireland. Both Crawfordsburn and Ballyholme Bay, two identified and monitored bathing waters under the EC Bathing Waters Directive, are located in and affected by combined sewer overflow (CSO) spills from the Bangor sewerage network. The Bangor and North Down coastal areas are both designated under the EU RAMSAR convention and as a Special Protection area (SPA). In autumn 2013, NI Water embarked on the Bangor Sewerage Improvement Scheme, an extensive multi phased project aimed at improving water quality within streams and coastal waters off the town of Bangor and wider North Down Coastal bathing waters.



Rock Excavation within the sheet pile cofferdam gets underway at the new Pumping Station at Bangor Marina - Courtesy of NI Water



Aerial view of work underway at Bangor, with the marina in the background - Courtesy of NI Water

Project drivers

In order to help achieve EU Environmental Quality obligations, and in agreement with the Northern Ireland Environment Agency (NIEA) prioritization of Drainage Area Plan implementation, the Bangor Drainage Area Plan, completed in 2011, recommended capital works within the sewerage network to include the closure of 26 (No.) unacceptable intermittent discharges (UIDs) within the town's sewerage system by screening, existing CSO rationalisation

and provision of additional network storm storage capacity to ensure remaining CSO spills to the environment are limited to three per bathing water season (July to September)

Programme of works

The six-phase programme of works is programmed for delivery in both NI Water's Price Control periods PC 13 and PC 15 as outlined in the table that follows.

Phase	Project Title	PC Period	Key Element Summary
1	Luke's Point WwPS UID	PC13	<ul style="list-style-type: none"> Additional 3250m³ storm storage to existing WwPS with 150l/s pumped return. Proposed 600l/s screw pump replacement. 6mm static screen.
2	Bangor Marina UIDs	PC13	<ul style="list-style-type: none"> Proposed storm pumping station passing forward 90l/s with 1,700m³ storm storage. 6mm mechanical screen.
3	Clandeboyne Stream UIDs	PC13/15	<ul style="list-style-type: none"> Replacement WwPS with additional 3,300m³ storm storage passing forward 208l/s. 6mm mechanical screen. Proposed storm pumping station passing forward 30l/s with 270m³ storm storage. 6mm mechanical screen.
4	Rathmore Stream UIDs	PC13	<ul style="list-style-type: none"> Proposed 220m³ storm storage with gravity return. 6mm static screen.
5	Carnalea Stream UIDs	PC15	<ul style="list-style-type: none"> Proposed 520m³ storm storage with pumped return. 6mm static screen.
6	Belfast Lough UIDs	PC15	<ul style="list-style-type: none"> Replacement WwPS with additional 2,170m³ storm storage passing forward 45l/s. 6mm static screen. Replacement WwPS with additional 150m³ storm storage passing forward 190l/s. 6mm static screen.

Luke's Point

The first phase of the work involved upgrade work at the existing Luke's Point Wastewater Pumping Station. The existing facility includes three drywell pumps in a duty, assist, and standby arrangement, passing forward 291l/s to Briggs Rock WwPS, which in turn forwards FFT flows to North Down & Ards WwTW, one of NI Water's Public Private Partnership (PPP) operated facilities.

The existing Luke's Point facility also includes an underground 1,600m³ storage tank adjacent to the pumping station, which is utilized once the pass forward flow is exceeded in storm conditions. Twin screw pumps operating at 600l/s in a duty assist arrangement each lift excess flows to this tank and once capacity is exceeded, a 6mm screened overflow discharges to the coastal waters of Belfast Lough.

An optioneering exercise was completed at Luke's Point, including examination of site footprint, constructability, health & safety and operational aspects, as well as whole-life costs including CAPEX, OPEX and NPV calculations, and the following proposals were implemented:

- The construction of a new in situ reinforced concrete attenuation tank providing an additional 3,250m³ of storage (buried adjacent to the existing concrete retention tank) and the provision of inlet and overflow pipework between the two tanks.
- Excavation of rock to facilitate construction (rock located approximately 2m below ground level).
- Re-profiling of the base of the existing 1,600m³ retention tank to direct flows to the proposed tank.



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- The provision of a pumping station to return flows from the proposed retention tank to the existing wet well at Luke's Point WwPS (located adjacent to the existing storm retention tank). The pumps operate using variable speed drives and are capable of returning flows at a maximum flow rate of 150l/s. The pump return facility at this return rate is significantly below the pass forward pumping rate of 291l/s and this allows NI Water to resolve a previously slow gravity return rate experienced by the existing flow regime, reducing the risk of septicity by enabling both tanks to empty in less than nine hours. To further mitigate against septicity and solid settlement, storm tank mixer pumps were specified to aerate and wash down the tank floor as it empties.
- The upgrade and replacement of Archimedes screw pumps at Luke's Point WwPS to provide a flow rate of 1,200l/s in a duty standby arrangement.
- MEICA design and installation for the above elements to be incorporated into the existing WwPS control philosophy and pass forward flow restrictions
- Reinstatement of the construction area and the provision of a car park and landscaped area.

All the work was successfully undertaken while the existing Luke's Point PS remained operational.

Bangor Marina

The second phase of the project is within the Bangor Marina complex. An existing interceptor sewer collects spills from five existing CSOs bounding the Marina site and currently discharges these spills directly to coastal waters adjacent to the Marina. The proposals developed and constructed for the Marina site included;

- The construction of an underground 1,700m³ retention tank in the Bangor Marina Car Park. The works were constructed in a limited area of the car park, while the remainder of the site had to remain operational.
- A circular tank 20m in diameter and 8m deep was constructed and two methods were utilized in the construction of the shaft to accommodate two distinct ground layers (filled material and rock). A bottom up placement of the segmental units from the rock formation level, grouting to the rear of the placed units, then rock excavation and underpin placement method of the segmental units from a centrally placed choker ring.
- Excavation of rock to facilitate construction (Rock located approximately 5m below ground level).
- The provision of an integral pumping station subdivided within the retention tank structure to return flows from the proposed retention tank to an existing combined sewer. The pumps returning flows at a rate of 90l/s.
- Connection of PS pipework to a live 1,200mm x 800mm egg shaped combined sewer. The diversion of flows from existing CSO overflows to the proposed tank.
- The provision of an overflow from the retention tank to the existing overflow sewer - 6mm mechanical screening to be provided.
- Reinstatement of the proposed tank surface to match the existing car park surface and the provision of additional landscaping.

Professional services

NI Water appointed AECOM to act as Project Manager for all six phases of the Bangor Improvements scheme, with main duties for all sites, including the project management of required site investigation, development and production of works and site information, development of NI Water's standard EEC contract documents, reference design and civil/MEICA specification based on NI Water asset standards and specifications and onsite supervision.



Formwork in place for wall construction at Luke's Point
Courtesy of NI Water



(Right) Wall reinforcement at Luke's Point. (Left) Sheer rockface following excavation - Courtesy of NI Water



Formwork placement at Luke's Point, prior to wall pour
Courtesy of NI Water



Placement of concrete segmental units at Bangor Marina
Courtesy of NI Water

Procurement

BSG Civil Engineering Ltd was appointed Principal Contractor following an open market competition using NI Water's Alternate Procurement Vehicle (APV). The APV was recently introduced and developed by NI Water's Engineering Procurement team. It was based on the Department for Finance and Personnel's (DFPNI) Central Procurement Directorate's (CPD) Simplified Procurement Method. Based on the value of the project, a two stage procurement process was completed, with the six highest scoring qualifying contractors proceeding through the PQQ stage to the Design and Build tender stage based on a 30/70 quality cost rational.

Contract

NI Water selected an NEC3 Option A Priced Contract with Activity Schedule with well-developed reference design and benchmarked Interpretive Geotechnical Report. Best Practice guides as well as NI Water Standards were included within the contract, with particular focus on minimizing the environmental and social impact of the construction phase.

A detailed specification to control dust, noise and vibration was developed based on the City of London Codes Of Practice for Deconstruction and Construction sites. Requirements for recycled materials, waste reduction (over 80% of the rock excavated from the sites was crushed on site and reused within projects close to Bangor) and provision of work opportunities for the unemployed, students and apprentices were also included within the contract. NI Water also registered the Luke's Point site for the CEEQUAL Whole Project Award.

Stakeholder engagement

The location of both the Bangor Marina and Luke's Point sites, within a high activity, coastal town, heavily dependent on tourism, posed various challenges to the delivery of the projects. Therefore, a detailed stakeholder management plan was developed and

implemented by NI Water's Public Relations team. The plan involved various presentations to North Down Borough Council and other key stakeholders including various departments within NIEA, DRD Road Service, DARD Rivers Agency and Quay Marinas. An open information session was also held to present proposals to local people, addressing any concerns they may have.

NI Water stipulated a demanding works duration within the contract, avoiding the busy tourist season in order to minimise disruption to the towns established tourism industry. Various accommodations were made throughout the duration of the contract, working with North Down Borough Council, including the provision of temporary car parking and bus transport for a tall ships event and accommodation for a planned F18 World Sailing Championship, hosted in 2014 by Ballyholme Yacht Club.

Current position

As of July 2014, the project team has delivered on target both Luke's Point and Bangor Marina structures, and has restored access to both North Down Borough Council public car parking areas, that were previously used by NI Water during construction.

Project design and development is continuing with the remaining phases of the Bangor programme of works, with extensive pre-construction archeological investigation at the Castle Park site as agreed with NIEA. The proposed site, which replaces an existing WwPS, is within the grounds of Bangor Abbey, an ancient monastic abbey of International Christian Heritage significance. The project team anticipates that work will get underway on this section of the project in Autumn 2014.

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Aerial view of rock excavation, and underpinning at the Bangor marina site - Courtesy of NI Water