

Carmarthen Wastewater Improvement Scheme

Dŵr Cymru Welsh Water resolve pollution and sewer collapses in Historic Carmarthen

by Carli van Niekerk BEng

Brickyard Lane Sewage Pumping Station (SPS) is the terminal pumping station for the catchment of the historic town of Carmarthen. The asset provides both a facility for storm storage as well as the transfer of flows to the treatment works at Parc y Splott approximately 2km away. The population served by the Brickyard Lane SPS is approximately 20,000 with its consented pass forward flow being 224l/s. At commencement of the project, foul flows were being passed forward by duty/standby variable speed pumps through a single rising main. Storm flows were pumped into the local storm tanks by duty/standby pumps.



River Towy - Courtesy of Dŵr Cymru Welsh Water

As part of the AMP5 works being carried out by Welsh Water to upgrade and improve the existing wastewater infrastructure, Morgan Sindall were appointed principal contractor, with Grontmij as their design partner, to address a number of project drivers linked to the sewerage system serving Carmarthen, namely:

- Reduction of pollution incidents
- Reduction of equipment failure
- Remove risk of rising main failures
- Eradicate consent breaches

The severity of pollution incidents had even resulted in a cancellation of the popular annual regatta held as part of the Carmarthen River Festival with consequent high profile local interest in the resolution of the problems.

Welsh Water had promoted three separate projects for different assets in the catchment, but also identified the benefits of grouping these together to develop an overall catchment solution.

Works included in the combined scope were spread over four SPS sites, namely Brickyard Lane, Pensarn, Pothouse Wharf and Parc Hinds.

Challenges

A significant number of challenges faced the design and construction team. Brickyard Lane SPS delivers flow to Parc y Splott Wastewater Treatment Works (WWTW) via twin 14" ductile iron rising mains, and shares a section of the main with Pensarn SPS. The mains were reported to be in poor structural condition and suffered frequent bursts.

One section of rising main had been de-commissioned because of a major burst, resulting in Brickyard Lane flows being handled by just one of the rising mains and Pensarn flows being re-routed to Parc y Splott via the remaining usable section of rising main length. Due to the difference in pump rates from each station, the Pensarn main was under-utilised whilst the Brickyard Lane flows were restricted.

The pumps at Brickyard Lane had to be throttled back to reduce the risk of further bursts, resulting in potential breaches of consent. The reduced pumping capacity meant that the storm tanks remained full for longer than designed and hence spilled more frequently into a tributary of the River Towy, which is classified as a Special Area of Conservation (SAC).

Pothouse Wharf and Parc Hinds SPSs are both located within the Brickyard Lane catchment. The pumped flows combine close to Pothouse Wharf's outlet, from where the flows gravitate to Brickyard Lane SPS.

The combined sewer overflow (CSO) at Pothouse Wharf SPS frequently spilled un-screened flow due to insufficient screening capacity. This gave rise to a great deal of public complaint because of the outfall's location near the local sailing club.

The Parc Hinds SPS also suffered unsatisfactory intermittent discharges (UIDs) from the wet well, again giving rise to complaints. The situation at Parc Hinds was further exacerbated by frequent bursts on the rising main.

The overall solution provided some asset renewal and rehabilitation work within Carmarthen such that the appropriate flow rates were reliably transferred to the Brickyard Lane SPS with a new CSO screen at Pothouse Wharf protecting this sensitive location from UIDs.

Rehabilitation of the rising main between Brickyard Lane and Parc y Splott WwTW and a reconfiguration of the flows and controls between the Brickyard Lane and Pensarn SPS enabled the maximum re-use of existing assets whilst providing the required pass forward flows. Combined with improvements to the storm system at Brickyard Lane, the overall solution delivers the project outputs for a capital expenditure below the business plan budget whilst also reducing operational expenditure costs.

Design and construction

The key project participants are:

<i>Client</i>	Dŵr Cymru Welsh Water
<i>Principal Contractor</i>	Morgan Sindall
<i>Technical Consultant</i>	Grontmij
<i>Commercial Consultant</i>	EC Harris
<i>Lining Contractor</i>	Lanes for Drains
<i>Screen Supplier</i>	Huber Technology

The construction undertaken by the project team at the four sites included:

Brickyard Lane & Pensarn SPS

- Cured-in-place pipe (CIPP) lining of 2 (No.) 420m long rising mains.
- Off-line replacement of 2 (No.) 320m long rising mains with 400mmø PE pipe.
- Replacement of 6 (No.) air valves along the rising main.
- Mechanical screens to inlet channels at storm tanks.
- New storm pumps, penstocks and actuators to automate the storm return flows.
- Real time linked pump operational controls between the sewage pumping stations.



River Towy next to Pothouse Wharf SPS
Courtesy of Dŵr Cymru Welsh Water



Twin mains lined through in foreground, railway bridge in background
Courtesy of Dŵr Cymru Welsh Water



New emergency generator at Parc Hinds SPS ensuring that the pumps keep running in the event of a power failure
Courtesy of Dŵr Cymru Welsh Water



New screens at Brickyard Lane storm tanks
Courtesy of Dŵr Cymru Welsh Water

The Brickyard Lane rising main route presented numerous challenges including:

- Crossing of the A40 trunk road.
- Crossing the car park of a B&Q warehouse.
- A pipe bridge crossing of a tributary of the Towy.
- Crossing difficult-to-access marshy flood plain.

Furthermore, Network Rail lines crossing the route meant the existing mains had been routed between a bridge abutment and the River Towy in close proximity to a high pressure gas main.

The team challenged the scheme scope, identifying the root cause of the problems with the rising mains which led to a reduction of the length of main to be replaced.

Rehabilitation techniques were investigated, but conventional lining techniques could not negotiate the bends in the existing pipe work, which would be critical in order to avoid excavation within Network Rail land, close to the existing bridge abutments and high pressure gas main and the associated risks and protracted liaison.

Woven lining materials capable of negotiating bends were known to have been used in pressure pipes in the Gas Industry. Research found that this technology had transferred to the Water Industry outside of the UK. Following enquiries with lining contractors, two were found that had some relevant experience and the innovative technique was adopted to produce a thin fully structural pressure lining for the rising mains.

Analysis of the relative pump performances confirmed that the twin mains could be much more effectively utilised by injecting Pensarn flows into the main whilst using both to transfer the flows from Brickyard Lane. The two pumping stations were linked with real-time control (RTC) to ensure that in combination the consented pass forward to Parc y Splott WwTW was being consistently achieved.

Pothouse Wharf SPS

The unscreened spills were addressed by increasing the screening capacity of the CSO. The two small screens were replaced with a single large auger screen fitted with an integral lifting system for easier and safer maintenance. The existing chambers were also modified to receive the new mechanical and electrical equipment.

These modifications proved challenging because of the high incoming flows. The design flow rate for the screen is 3,200l/s, which gives an indication of the catchment's significant storm response. Furthermore, the chamber is located partly underneath the SPS building, therefore the stability of the structure had to be considered in the design and throughout the construction process.

Parc Hinds SPS

The risk of further rising main failures was removed by the off-line replacement of 600m of rising main with a new 300mm diameter ductile iron pipe. Again, the team challenged the need to replace the rising main in its entirety, and ground investigation and detailed analysis proved that only the upstream half needed replacement.

A 6mm static screen was installed within the SPS wet well to resolve the UID aesthetic driver. Back-up power generation was provided in the form of a standby generator. The generator was installed within the compound and housed in a secure 6m container raised 1.2m above ground to ensure that it was above the flood level. This approach enabled Welsh Water to obtain the necessary emergency overflow consent.

Key achievements

The successful completion of the programme allowed Welsh Water to achieve consent compliance and reduce the risk of pollution of a special area of conservation, the River Towy. The RTC link between Brickyard Lane and Pensarn enables full utilisation of the previously under-utilised twin mains. Welsh Water will be saving approximately £35k in operational costs per annum, achieved by reducing the system head and running the foul pumps more efficiently. Lastly, the scheme is anticipated to be delivered more than £500k below Business Plan.

The team demonstrated innovation using the CIPP pressure liner, with the added benefit of avoiding tunnelling under the A40 and open-cut excavation through a marshy area and Network Rail land. In fact, the CIPP pressure line secured a win for the project team for the Welsh Water First Award in the Innovation category.

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CCTV footage of CIPP lining
Courtesy of Dŵr Cymru Welsh Water



New screen at Pothouse Wharf
Courtesy of Dŵr Cymru Welsh Water