

Newport Parrog Long Sea Outfall

Dŵr Cymru Welsh Water installs a new long sea outfall to improve bathing water quality on key Pembrokeshire beach

by Abby Downing MEng (Hons)

The town of Newport in Pembrokeshire is a popular holiday resort, which attracts visitors to its golden beaches where water sports and nature activities can be enjoyed. In order to maintain this attraction, it is important to ensure the highest standards of bathing quality on the beach and in May 2008, Newport Sands was one of eleven beaches in Pembrokeshire awarded Blue Flag status. During a pre-bathing season inspection by Environment Agency Wales (EAW) in 2008, the existing long sea outfall constructed in the 1960s was found to be damaged. Following this inspection an effective temporary repair was undertaken and in 2011, Dŵr Cymru Welsh Water replaced the long sea outfall at a cost of £2.35 million as part of their AMP5 works to upgrade existing waste water infrastructure.



Sinking of new outfall pipe - Courtesy of Dŵr Cymru Welsh Water

Time for an upgrade

Newport Parrog Long Sea Outfall is part of the Newport catchment, which is a predominantly rural separate system with a domestic population of approximately 1,300, which rises significantly during holiday periods. It is situated immediately south of the Afon Nyfer Estuary and is within the Pembrokeshire Coast National Park. It is also in close proximity to the Cardigan Bay Special Area of Conservation (SAC) and the Newport Cliffs Site of Special Scientific Interest (SSSI).

The previous 250mm diameter long sea outfall extended approximately 620m offshore. During 2008, a fracture was identified near the Mean Low Water Springs (MLWS) level where flows were discharging to the sea at a point inshore of the consented discharge point. The water quality had been continuously monitored since the

fracture was discovered, and EAW stated that it was necessary for the test results to improve for the Newport Sands beach to retain its Blue Flag status. Welsh Water determined that the original outfall was in need of replacement in order to meet the requirements of the Blue Flag status and to improve the water quality for the local residents and tourist beach users.

Waste water treatment

Cwm Sewage Pumping Station (SPS) is the terminal station within the Newport catchment where all combined flows are received. This SPS is situated 60m inland behind the old lifeboat station, now a holiday home, and is directly connected to the marine outfall. The capacity of Cwm SPS was increased following the construction of a relief sewer in stages during AMP3 and AMP4 to improve the unsatisfactory Parrog Combined Sewer Overflow (CSO).

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Old lifeboat station and Grade Listed lifeboat slipway - Courtesy of Arup

Full treatment flows (FFT) of 14 l/s are lifted to the Newport Waste Water Treatment Works (WwTW), located approximately 800m south of the SPS, for preliminary, primary and secondary treatment. The treated effluent from Newport WwTW returns to Cwm SPS and connects to the marine outfall. The SPS CSO also screens and spills storm flows in excess of the 14 l/s FFT, up to 270 l/s, directly to the marine outfall.

Design and construction

The key projects participants are:

<i>Client</i>	Dŵr Cymru Welsh Water
<i>Principal Contractor</i>	Morgan Sindall
<i>Technical Consultant</i>	Arup
<i>Commercial Consultant</i>	EC Harris
<i>Marine Works Contractor</i>	Kaymac Marine & Civil Engineering
<i>Land Works Contractor</i>	Jones Brothers of Henllan



Floating working platform - Courtesy of Morgan Sindall

Marine works

Kaymac Marine & Civil Engineering were commissioned by Morgan Sindall to undertake the marine works. Kaymac used their experience in the marine environment to review the design alongside Arup with regards to its buildability and the logistics of sourcing and transporting the required materials to site. The design was developed so that the original scope of importing thousands of tonnes of rock as backfill material could be replaced with the use of on-site excavated material and precast concrete weight collars and mattresses that would be fitted to and around the pipeline. This provided a more cost effective and sustainable solution due to the reduction of materials used, reduced transportation, quicker installation, and minimised off-site waste disposal.



Precast concrete mattresses - Courtesy of Arup

Access for the majority of plant was granted from Cwm SPS to the beach through the grounds of the old lifeboat station and a removed "Pembrokeshire" wall, and over the Pembrokeshire coastal path. A temporary stone access ramp was installed to the beach to allow the plant access to the site.

The ramp lay adjacent to an original 130 year old Grade Listed lifeboat slipway which could not be used for access as any tracked plant could cause damage to the structure. The land-based plant included two 70 tonne telescopic piling rigs which were required to install over 530 Larssen sheet piles over the course of the project. Due to their size this plant had to be brought along the mile of Newport Beach from the golf course access slipway.

Access and delivery for the pipe and space for the pipe welding operation became an issue as the works location was over a mile away from the nearest usable beach access slipway, and with a little space on the beach it was decided that the best option would be to import the fabricated pipeline whole, rather than attempt to weld individual sections of pipe together on the beach. This option was also preferred by the local residents as it avoided congestion of the narrow access roads with deliveries during the busy summer months.



Positioning of the pipeline
Courtesy of Kaymac Marine & Civil Engineering

With careful planning and consultations with the Norwegian supplier, Pipelife Norge AS, the pipeline was sourced, fabricated to the required design and delivered via a tug boat from Stathelle in Norway to Fishguard Harbour (over 960 nautical miles). Once delivered, the 640m long 630mm diameter OD PE pipe was split into three lengths. Over 200 precast concrete collars each weighing 320kg were individually attached (in Fishguard harbour) to the pipe and steel sinking lids were fixed to the open pipe ends. These sinking lids included fixed valves which allowed the control of the influx of water into the pipe and expulsion of air during the sinking procedure.

Piling

The design depth of the beach excavation required sheet piles to be installed by the two piling rigs. The sheet piles, ranging from 10-12m in length, were installed during the twice daily low tidal period. The ground conditions that were encountered required the installation of a support propping system to enable the excavation works to be carried out in a safe manner. A Notice to Mariners was issued to ensure that local people were notified of the sheet piles, as the location is very popular with fishing vessels and water enthusiasts. As a requirement, the navigable channel had to be kept open at all times during the project.

Laying the pipeline

The seaward excavation was carried out by a dredging vessel with on-board GPS and 3-dimensional dig software. Both the beach-based and marine-based excavations were carried out simultaneously to meet the required depth and also counter the influx of excavated material caused by the rip tides and strong currents. Once a suitable weather window had been selected the excavation works was coordinated to allow the pipeline to be towed approximately 7 nautical miles (with the 200 precast weight collars attached) to the works location. Due to the underlying water table, the beach excavation was always filled with water at any state of the tide. This allowed the pipeline to be floated into position beneath the support propping system via a shore-based manually operated tractor and winch system.

Once the position of the pipeline had been checked by a Kaymac dive team, the pipe was sunk by introducing water into the system and allowing the air to escape via the valves fixed to the sinking lids. The sinking procedure had to be undertaken in a controlled manner to prevent damage to the pipe but also had to be carried out before the rising tide level reached the underside of the support propping system.

Divers ensured that the pipe was sunk accurately into the trench and that it was angled correctly to allow the later attachment of the diffuser head. Once the position had been confirmed, the pipe sections were connected by divers using marine grade stainless steel fixings. A 50 tonne crane on board a floating work barge was used to lift and position 53 precast concrete mattresses, each weighing 9 tonnes, around the pipeline along the majority of its length, which provide protection to the pipe from wave, tidal and river erosion, notably under the Afon Nyfer channel.

The outfall was graded to minimise the risk of air entrainment and air ventilation pipes were installed to dissipate entrapped air back from the outfall and upstream to Cwm SPS. The outfall was fitted with a single riser diffuser with a 630mm diameter removable top access flange and four 315mm diameter PE ports, each fitted with a Tideflex non-return valve to prevent backwash of tidal deposits.



Sinking of new outfall pipe - Courtesy of Dŵr Cymru Welsh Water

The new discharge is adjacent to the existing consented discharge point which was later abandoned upon completion of the new outfall.

The excavation was then backfilled to the original bed level and the marine plant demobilised from site. The sheet piles were removed from the beach and a dye test was carried out and proved that the outfall installation had been a success.

Modifications to the existing pumping station

In addition to the installation of a new long sea outfall modifications to the existing inland Cwm SPS were required. The outfall was designed to convey a maximum storm flow of 270l/s but in dry weather flow (DWF) conditions it will only be required to convey 14l/s of treated effluent (TE). To maintain self-cleansing velocity in the outfall, a new TE flushing tank was provided by utilising a 2.1m diameter Weholite tank, installed by contractors Jones Brothers of Henllan, alongside the SPS.

A new manhole was constructed upstream of the tank where the treated flows from Newport WwTW are intercepted and stored in the tank. It is equipped with two exit penstocks; one open to the new tank and one closed on the existing pipe to act as a bypass, thus allowing treated flows continuous discharge to the outfall if the tank is temporarily taken off line. The new flushing tank includes a 600mm diameter automated penstock which periodically opens to effectively flush the final effluent through the new outfall pipe. It has an overflow weir set at a level to permit treated flows continuous discharge to the outfall in the event of penstock failure. An ultrasonic level detector and penstock actuator were installed with power and telemetry supplied from Cwm SPS control room to provide flushing control to operational staff.

Conclusion

The successful completion of this complex scheme sees a significant improvement made to the sewerage system of the town of Newport with the reinstatement of discharge to the consented point, removal of outfall spills above MLWS and a larger capacity outfall allowing the improvement of Parrog CSO.

This investment made by Welsh Water will support Pembrokeshire County Council in providing a clean and safe beach for this popular tourist resort and will also contribute towards maintaining the current Blue Flag status for the Newport Sands beach, which is so vital to the community of Newport.

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Excavation trench - Courtesy of Morgan Sindall