

# Harlech/Llanbedr, Fairbourne, Nefyn, Barm'th “greenfield” WwTW schemes for coastal communities

The North Wales team of Dwr Cymru Welsh Water’s AMP3 Capital Alliance is nearing completion of its programme of “green field” wastewater treatment schemes which has involved providing “first time” secondary treatment for several coastal communities with populations ranging from 500 to 7,000 around the north west coast of Wales. Clearly, two of the fundamental decisions that need to be made in the design development of waste water treatment schemes are site selection and process selection. In turn the team found that these key issues are themselves inter-related, particularly because of the sensitive locations involved. However, beneath this, a number of factors feed into the decision making process and have to be balanced out to arrive at the optimum solution.



Harlech/Llanbedr WwTW scheme under construction

courtesy: Welsh Water Capital Alliance

These do include the obvious engineering considerations such as the configuration of the existing sewerage system and its hydraulic performance, any existing infrastructure (e.g. pumping stations, outfall pipelines), topography & ground conditions and proximity/classification of potential receiving waters for treated effluent (taking into account the legislative drivers). However, there are also a range of other “softer” issues such as:-

- \* public opinion – historically Welsh Water had encountered problems in this area, the team, therefore, developed a comprehensive programme of consultation with Community Councils and the general public through liaison meetings and exhibitions;
- \* planning – some schemes are located within the Snowdonia National Park, which tends to lead to more constraints on development;
- \* environmental considerations – most of the North Wales coastline is a designated candidate Special Area of Conservation (cSAC). There are also SSSI, AONB & other statutory designated sites scattered across the area;
- \* landowners – views/willingness to release land for development.

Once all the above information had been gathered, the team, which comprises *Galliford Try Construction North* (civil engineering partner), *Meica Process Limited* (M & E/process partner), *EC Harris* (cost consultant) and *Dwr Cymru Welsh Water*, held a Key-Stage Workshop in April 2002, where decisions on site selection and type of treatment process were taken for each of the nine schemes. The workshop was attended by representatives from each of the strategic partners, designers and (importantly with respect to treatment process selection) the Operations Contractor, *United Utilities Operational Services*. The outcome from this workshop was that membrane technology was selected as the preferred treatment process for four of the larger plants. These four schemes were at Fairbourne, Nefyn, Harlech/Llanbedr and Barmouth.

Clearly this presented the team with a great opportunity to develop a standardised design for a Membrane Bio-Reactor (MBR) treatment plant, which could be taken from scheme to scheme. With the exception of Fairbourne, which is the smallest plant of the four and could be used as a “learning curve” the other three catchments are a similar size.

Specific detail of one of the four wastewater treatment works schemes, and why the MBR treatment process was selected is outlined as follows.

**Harlech/Llanbedr**

The historic town of Harlech, lying on the north-west coast of Cardigan Bay, and the adjacent small villages of Llanbedr and Llandanwg/Llanfair are served by three separate sewerage systems. The combined population equivalent is 7,100 during the peak tourist season.

The Harlech system collects at a terminal pumping station near the town centre. From there, flows were previously pumped to an existing WwTW, where they received primary treatment only prior to discharge to sea via a short outfall. The WwTW was situated within the coastal sand dunes, which form part of the designated Morfa Harlech SSSI, and the coastal waters are a cSAC site. The plant itself was in very poor condition and was only meeting its existing consent by chemical dosing of the effluent.

At Llandanwg/Llanfair the system flowed under gravity to an existing treatment works receiving primary treatment prior to discharge to sea via a separate short outfall. As at Harlech, the plant was in poor condition and failing to meet the consent standards (resulting in failures to meet designated Bathing Water standards at Llandanwg beach).

Both of the discharges were listed on the NEP, for improvements to be carried out under the UWWTD and the Bathing Waters Directive. The scheme had originally been included on the AMP2 Programme, for completion by 31 March 2001; but had encountered severe planning difficulties, as outlined below. As a result, it had been deferred into the AMP3 Capital Programme.

It had long since been Welsh Water's plan to transfer flows from the Harlech and Llandanwg/Llanfair catchments to an upgraded treatment facility in nearby Llanbedr. The existing plant at Llanbedr was built in the 1970s and, even though it didn't have sufficient capacity to cater for the additional flows itself, land was available for the proposed upgrade. Furthermore, the Llanbedr plant discharged to the adjacent Afon Artro, away from the designated bathing beaches. In contrast, redevelopment of the existing plants at Harlech and Llandanwg would have faced objections from statutory bodies such as CCW (due to the SSSI), and the existing sea outfall pipe would have needed long extensions through the cSAC designated coastal waters.

Consequently, a scheme was developed in 1998, whereby the existing Llanbedr WwTW would be reconstructed utilising an extended aeration treatment process. The proposals were strongly opposed by sections of the Llanbedr community who objected to the transfer of Harlech sewage in principle. A Public Enquiry found in favour of Welsh Water in January 2002. However, by that stage the appointed Contractor *Amey* had handed the project back to Welsh Water, and it was therefore passed to the AMP3 Capital Alliance partners.

Although planning approval having now been granted for the Extended Aeration plant, there was still strong opposition in Llanbedr to the proposals. The team, therefore, decided to undertake a full review of the scheme, looking at ways to address the community concerns. At this point MBR treatment process was brought into consideration. MBR had originally been ruled out in



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1998 on cost grounds, but had become much more competitive. It also had the significant advantage that it would considerably improve the standard of sewage treatment at Llanbedr, as well as catering for the additional flows from Harlech and Llandanwg/Llanfair. After extensive consultation the Llanbedr community endorsed the revised proposals and planning permission was granted for an MBR plant at Llanbedr in June 2004.

#### Llanbedr WwTW

The plant comprises a 4-cell Membrane Bio Reactor treatment process situated within a 25m long x 12.6m wide x 4.3m deep reinforced concrete structure, and a stone clad headworks/control building. Both structures are raised above ground level, as the site lies within the flood plain of the adjacent Afon Artro.

Following on from the Fairbourne and Nefyn schemes, the MBR process utilises the *kubota* membrane system and will treat the effluent to a high standard. The *Meica Process* team developed the solution to deal with treatment quality, storm storage and longer than normal rainwater runoff periods, giving the optimum treatment volume against storage. The FFT through the plant is 35l/s (23l/s from Harlech, 7l/s from Llandanwg/Llanfair and 5l/s from Llanbedr catchment itself).

Two tanks within the existing WwTW have been modified to suit the new plant with the remainder of the existing works being de-commissioned and demolished on completion of the scheme.

#### Harlech

As above, the existing works at Harlech was in poor condition and discharged effluent to the sea via a short outfall pipeline. The site was also located within an SSSI, in the coastal sand dunes at Harlech golf course. This was one of the principal factors that discounted the redevelopment of the site, hence the transfer of Harlech sewage to Llanbedr, in selecting the original scheme strategy.

The flows have been intercepted at the existing Harlech terminal PS located within the town itself. The pumped flow to Llanbedr (23l/s) had to be designed to overcome a head of 73m.

*Meica Process* called on previous experience to solve the problem of the unscreened, low flow, high head transfer; and suggested the use of *Strate pumps*, which had previously been successfully used to deal with this and two other schemes in Wales.

To enable the transfer of flows to the upgraded Llanbedr WwTW 450 cubic metres of storm storage has been provided at the site and the existing outfall pipeline to the sea has been retained for limited use in compliance with Bathing Waters Directive restrictions.

Under the new regime only flows for treatment are transferred to Llanbedr, thereby ensuring that storm spill frequency is not increased at this sensitive location.

The storm storage and pump well have been housed within a

permanent steel sheet piled cofferdam. This was developed in conjunction with *Corus*, as a follow-on from the tank constructed at Fairbourne.

It is also worth noting that the excavated material from the tank which was known to be sand, has been used to fill in some disused sludge drying beds adjacent to the old Harlech WwTW. This will enable the site to be reclaimed as sand dunes. This work has been done in consultation with the Countryside Council for Wales (CCW), who are delighted with the efforts made by the team and the finished result.

#### Transfer pipeline

The Llandanwg transfer main is 1.6km long x 125mm diameter MDPE, and passes through a number of Tir Gofal designated fields (Tir Gofal is an agri-environment scheme which encourages agricultural practices aimed at protecting and enhancing the landscape in Wales).

The Harlech transfer main is approximately 4.5km long x 225mm diameter MDPE, and included a section approx 50m long which rises up Harlech Cliff. This was installed by *Perco* using specialist directional drilling techniques.

The pipeline routes were particularly difficult with a significant number of constraints having to be taken into account. The most obvious route between Harlech and Llanbedr would have been along the main A496 coastal road. However, the road is extremely narrow in places and already has a number of utilities laid within it. The route was discounted on safety and disruption grounds. The selected route took into account a significant number of constraints:

- \* Tir Gofal wetlands – consultation was required with CCW who agreed the working methodology;
- \* National Trust land – consultation & a working methodology in consultation with the National Trust;
- \* Harlech Cliff – specialist directional drill;
- \* sand dunes at the foot of Harlech Cliff – environmentally & archaeologically sensitive, necessitating watching briefs with an archaeologist engaged;
- \* narrow access road past a college – extensive consultation required to maintain access;
- \* section in road which passes within the control zone of main railway level crossing in Harlech - consultation required with Network Rail;
- \* various stream crossings requiring EA consents;

The scheme has recently been commissioned to meet the 31/03/05 deadline for the end of the AMP3 period, and demolition of the decommissioned plants at Harlech and Llandanwg is now underway. ■

**Note:** *The Editor & publishers thank Dwr Cymru and the Alliance team for preparing the above article.*