

# Llangadfan Catchment Pumping Stations Project

## new pumping stations and mains to replace an outdated system with inadequate capacity in mid-Wales

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Llangadfan is located at the extreme west of Severn Trent Water's operational area, approximately 20km west of Welshpool, in mid-Wales. This remote catchment consists of several small hamlets located alongside the River Banwy, over a distance of nearly 5km. The River Banwy is an upland tributary of the River Severn, and is an important high quality fishery, particularly for trout. The A458 Trunk Road, which runs from the West Midlands to the mid-Wales coast, passes east/west through the catchment.



*The River Banwy at Llanerfyl*

*Courtesy of Severn Trent Water*

### Background

The permanent resident population of the Llangadfan catchment is about 600. However, there are two large caravan parks at Foel and Cann Office that contribute a further transient population of up to 300, in static and touring caravans. The population is spread over five small catchments at Llanerfyl, Penybont, Cann Office, Glan y Morfa and Foel. Llanerfyl is the largest of these, and accounts for nearly 50% of the total resident population.

In order to provide sewage disposal facilities for this population, a sewerage system had been constructed in the 1960s. This comprised five separate gravity sewer systems draining to an equivalent number of sewage pumping stations.

These were all based on positive displacement pumps, pumping through 50mm diameter rising mains to a Terminal Pumping Station at School, which delivered the flow to a sewage works located roughly central in the catchment.

The whole system had been designed on the basis of foul flows, with four of the pumping stations capable of delivering less than 2l/s. The Sewage Treatment Works could treat a maximum flow of 8l/s, and had no storm route.

### The need for improvements

The sewerage system was becoming problematic in wet weather, as the pumping stations were unable to cope with flows being received. This was most prevalent in Llanerfyl, where sewage regularly overflowed in wet weather, via a private garden to a watercourse, and ultimately to the River Banwy. Significant efforts were made to relieve this flooding by changing pumps, and by employing regular expensive tankering operations. Although not as significant elsewhere, a similar problem was found at the other pumping stations.

The initial solution adopted was to seal all the sewers and manholes in the catchment. This addressed the problem on the public sewers, but there was still significant infiltration into connected private sewers. In two locations where significant stormwater inflow could be identified to an obvious single source, arrangements were made with the owner to modify the private drainage.

However the flooding problems at the pumping stations continued, and an interim solution was agreed with the Environment Agency for the pumping station at Llanerfyl. A temporary time-limited CSO consent was granted, and a new discharge pipe and outfall were constructed, which allowed time for progression of a major project.

Existing pumping station  
in caravan park

Courtesy Severn Trent Water



Access to the existing  
Llanerfyl Pumping Station

Courtesy Severn Trent Water

### Planning

A Capital Works Project was promoted initially to deal with the problems at Llanerfyl, but subsequently, extended as the full extent of problems became clear. None of the pumping stations had a suitable vehicle access, the worst being Llanerfyl, which only had pedestrian access down steps from a private road. Another two of the pumping stations were located within caravan parks, and access was shared with caravan users (see above). There were also Health & Safety issues with maintaining pumping stations in restricted sites, and the M & E equipment was reaching the end of its useful life. Additionally, one private property in the catchment was identified on the Floods Register as suffering foul flooding on a 1 in 20 year basis. The Llangadfan Project was progressed internally by Severn Trent Water Asset Creation, from inception through to handover to the Design and Build Contractors, utilising specialist consultants where required.

Investigation of the Sewage Treatment Works (STW) revealed that the record of performance was good, and securely within the EA discharge consent. The maximum flow to the STW was limited by the installed pumps at the Terminal Pumping Station, so that it never received flows in excess of 8l/s. There was one issue highlighted relating to the original sludge storage lagoon. This lagoon had originally been constructed within a steep earth bank, and access for emptying was identified as a Health & Safety risk.

### Permanent solution

It became clear that the problems in the Llangadfan catchment would only be resolved permanently following major investment by Severn Trent Water. The sewerage system was undersized in wet weather, and the Environment Agency would not grant any permanent CSO consents, as this would cause a deterioration in river quality. Flows were measured in the sewers and various solutions were hydraulically modelled. The modelling established that both the storage volume and pumping rates at all the pumping stations needed increasing.

The increased flow rates of 6l/s to 28l/s were within the range of the Severn Trent Water standard template for submersible pumps. Taking account of the existing problems with access, it was decided to purchase new sites to enable complete rebuild of each pumping station, as local refurbishment would not resolve the most important problems at the sites. Detailed investigation identified the opportunity to combine two catchments and eliminate one pumping station, which reduced both capital cost of the project, and future operating costs for Severn Trent Water. The rising mains also needed upsizing as the existing pipes could not carry the required flow rate. The existing gravity sewer system serving the properties has been retained.

The solution for the sewerage catchment also had an impact on the Sewage Treatment Works, as future inflows would vary from 7l/s in



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### Sewage Treatment Plants



### Water Treatment Plants



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dry weather up to 28l/s in wet weather. This necessitated provision of a storm route, which is to be achieved using an aerated storm reed bed. Although reed beds are commonly used for treatment within Severn Trent Water, the use of an aerated bed is innovative and allows a significant reduction in the size of the reed bed. A glass coated steel sludge holding tank will be provided to eliminate the Health & Safety issues with the existing sludge lagoon.

#### Securing the sites

In November 2009, having determined the solution and gained internal approval in principal to a £3.9m project, the key to delivery of the was securing the 4 (No.) new sites on which to construct the new pumping stations. This was challenging, and required considerable liaison with various landowners, local authority highways, planning officers, other utilities and numerous other stakeholders. Careful consideration of the impact on the main A458 road was required to avoid the need for closure, as the diversion route would have added nearly one hour to journeys.

Various site investigations and surveys were carried out, both for the pumping stations and for the new rising mains and sewers. With the exception of protection of fish in the River Banwy, there were no significant ecological issues to be dealt with. By directionally drilling the new rising mains beneath the river, and planning the construction of the gravity sewer crossing outside the fish spawning season, the ecological impact was minimised. The area is also considered important for archaeology, and a watching brief was required for some of the rising main work. The site investigation identified two radically different strata, hard siltstone (Wenlock Shale) overlain by silty, gravelly alluvium containing very large boulders and cobbles, and with a high water table.

#### Undertakings

Following handover from Severn Trent Water Asset Creation, the construction work was progressed through Severn Trent Water's

One Supply Chain West, based in Shifnal, Shropshire, via two separate Design & Build contracts.

The larger contract, for the sewerage element, was awarded to Enterprise Managed Services. This contract comprised 4 (No.) new sewage pumping stations, approximately 6km of 150mm diameter MDPE rising mains, and 700m of small diameter gravity sewer to connect to the new pumping stations, and resolve the property flooding in the catchment. Enterprise sub-contracted the detailed design work to GHA Livigunn, and the construction works to Land & Marine Project Engineering, RW Services Ltd and Pims Pumps.

The construction works commenced in September 2010, with completion due in October 2011, tying in with the commissioning of the modifications to the Sewage Treatment Works.

Procurement of one of the new pumping station sites has been delayed by legal and planning issues, and construction work has been unable to commence on this site at present. This will not delay commissioning of the remainder of the Project.

#### STW modifications

The smaller contract for the Sewage Treatment Works modifications has been awarded to Mott Macdonald Bentley (MMB), in line with the Severn Trent Water framework of non-infrastructure work. Modifications comprised a new inlet screen, an aerated reed bed, and a new sludge holding tank, together with access road improvements. Construction of the STW commenced on site in March 2011 and is due for completion in October 2011.

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New pumping station under construction

Courtesy of Severn Trent Water