# Benone Area Sewerage Scheme

## complex wastewater treatment and infrastructure upgrade project to protect the quality of bathing water at one of Northern Ireland's blue flag beaches

by Michael Donnelly & Joe Sweeney

The Magilligan region is located on the north coast of Northern Ireland approximately 11 kilometres north of Limavady. It is comprised of a large, flat triangle of land stretching from the cliffs of Binevenagh (east and south), to the shores of Lough Foyle (west), to the shoreline of the North Channel (north). At the apex of the triangle is Magilligan Point. The Benone Area Sewerage Scheme represents an £8m investment by Northern Ireland Water to rationalise and upgrade the existing wastewater collection, transfer and treatment systems in the Benone/ Magilligan area of County Londonderry. Implementation of the scheme will ensure compliance with existing and future European Wastewater Treatment Directives and protect the quality of bathing waters and rivers in the region.

*Magilligan Strand with Mussenden Temple in foreground - Courtesy of Northern Ireland Water*

### Background

A very popular tourist area, the Magilligan region incorporates a Blue Flag beach at Benone as well as a significant portion of land designated as a Special Area of Conservation (SAC). Development in the region is limited, with settlements dispersed along the major roads.

The main settlements in the area are at Benone (primarily a tourist location comprised of caravan parks and holiday homes, Aughil (a small hamlet located 2.5km southwest of Benone), and Drumavalley (a small hamlet located 2.5km southwest of Benone). Further populations are present at the Ministry of Defence (MoD) Estate and at Magilligan Prison – both located near to Magilligan Point.

### Need for the scheme

Prior to implementation of the Benone Area Sewerage Scheme there were five WwTWs - one to serve each of the five main population centres. Each site was experiencing operational and/or compliance problems as shown in the table on page 2.

### Feasibility/scheme development

The two key constraints in developing a scheme or schemes which would ensure effluent compliance with both Northern Ireland Environment Agency (NIEA) and EU directives, whilst providing a flexible design capable of adapting to the seasonal variation in the contributing population, were: (1) the availability of suitable land in the Magilligan region and (2) the location or locations for effluent discharge.

| Operational and/or compliance problems at the treatment facilities of the five main population centres | |
|---|---|
| ***Benone WwTW*** | • Integral RBC process unable to adequately treat the variation in loading arising from the transient tourist population.<br>• Site located within the SAC – no scope for upgrade at existing location.<br>• Final effluent soakaway field, located within the SAC, inappropriate for location and ground conditions. |
| ***Drumavalley WwTW*** | • Works non-compliant with consent requirements and in poor condition.<br>• No available land to facilitate upgrade or replacement.<br>• Preference for removal of effluent discharge into Lough Foyle. |
| ***Aughil WwTW*** | • Works approximately 40 years old.<br>• Effluent discharge into small watercourse which provided little dilution. |
| ***Ministry of Defence (MoD) WwTW*** | • Package plant in need of a significant upgrade.<br>• Discharge to a small watercourse in the ASSI with little dilution. |
| ***Magilligan Prison WwTW*** | • Works overloaded.<br>• Discharge to a small watercourse in the ASSI with little dilution. |

It had been established that new treatment locations were required for Benone and for Drumavalley. Based on this requirement and considering the needs of the other wastewater treatment facilities in the area, an economic assessment, which analysed a range of options for the area, was completed.

As a result of this assessment it was concluded that a single wastewater scheme for the Magilligan region would be the most cost-effective solution whilst offering additional qualitative benefits for the area and its inhabitants and visitors.

Most of the surrounding area around Benone and along the shorelines of the North Coast and Lough Foyle is either protected by statutory Nature Conservation Designations or lies within the Cordon Sanitaire for Benone or other clusters of small development. In addition, a significant percentage of the land located to the west of Benone is owned and occupied by HMP Magilligan or MoD Estates; whilst the geography to the east (Binevenagh Mountain) precluded this area from consideration.

There were three potential effluent outfall locations in the scheme area, these were:

- The North Channel.
- Lough Foyle.
- The Big Drain Stream (the only inland watercourse which could provide acceptable dilution).

Initially discharge into the North Channel was not favoured as this area included the Blue Flag beach at Benone. Public perception and the potential for affecting that designation resulted in this option being deemed unacceptable. Discharge to Lough Foyle was discouraged due to the presence of shellfish beds which were located throughout the potential discharge areas and therefore, the Big Drain Stream was initially selected as the best location for effluent discharge.

A number of potential sites for the WwTW near to the Big Drain were identified, however NI Water was unable to reach agreement

for the purchase of land in the area. As a result discussions began for the potential for obtaining land from the Ministry of Defence and eventually a parcel of land near to Magilligan Point was agreed for sale.

This location however, resulted in the necessity to re-evaluate the preferred effluent outfall location. Following additional investigations and consultation with NIEA, a discharge consent was provided for a short sea outfall adjacent to Magilligan Point.

## Contract details

The Benone Area Sewerage Scheme was advertised in the European Journal in February 2011. The project was subject to a two-stage procurement strategy. In the first stage a pre-qualification questionnaire package was completed by eight JV companies.

Five companies successfully qualified to tender for the main body of work. The second (tender) stage was concluded in September 2011. Of the five JVs who were invited to tender four were returned.

Tender adjudication was based on a 50:50 cost/price model. The winning tender was submitted by the JV team comprising BSG Civil Engineering Ltd and Williams Industrial Services Ltd (both firms have their head office located in Northern Ireland).

## Scheme description

The Benone Area Sewerage Scheme consists of the following main elements:

***Benone SPS & WwTW***: Upgrade of Benone Sewage Pumping Station (SPS), demolition of the existing Benone WwTW and reinstatement of the area with indigenous vegetation. Removal and reinstatement of Benone WwTW final effluent soakaway and the laying of 180mm diameter dual transfer mains 3.6km between Benone SPS and the new Aughil SPS.

***Drumavalley SPS***: Demolition of the existing Drumavalley WwTW (removing effluent discharge from Lough Foyle), construction of a new SPS on the site, and the laying of a 160mm diameter transfer main, 3.6km between Drumavalley SPS and the new Aughil terminal SPS.

***Aughil SPS***: Demolition of the existing Aughil WwTW (removing continuous effluent discharge from a tributary of Lough Foyle), construction of a new terminal SPS on the site, and the laying of a 180mm diameter dual transfer main, 2.8km between Aughil SPS and the new Magilligan WwTW.

***Magilligan SPS***: Demolition of the existing MoD and HMP WwTWs (removing continuous effluent discharge from a tributary of Lough Foyle), construction of a new SPS to serve the MoD and HMP sites, as well as reinstatement of the area, and the laying of a 160mm diameter transfer main, 1.9km between this new Magilligan terminal SPS and the new Magilligan WwTW.

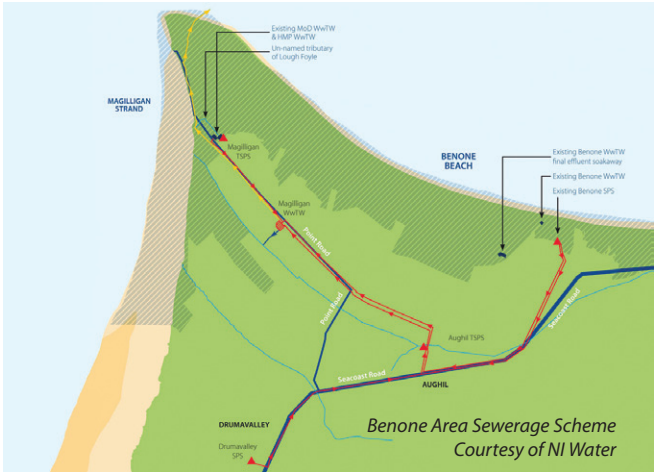
***Magilligan WwTW***: The construction of a new WwTW on a greenfield site at Magilligan and the laying of a 300mm diameter storm overflow pipeline from the WwTW to the Drumman Burn.

***Magilligan Outfall Pipe***: The laying of a 280mm diameter final effluent transfer main, 3.4km from the Magilligan WwTW to an outfall located in the North Channel off Magilligan Point.

## Consent Requirements

Benone is a very popular tourist location and as such the transient population can create difficulties in treating the varying volumes of sewage to a consistent and acceptable standard.

Seasonal PE fluctuations, projected future PE and the corresponding design flow figures are provided in the table on the next page:



*Benone Area Sewerage Scheme*
*Courtesy of NI Water*


*Existing treatment facilities at Aughil - Courtesy of NI Water*


*Computer-generated image of the new Magilligan WwTW*
*Courtesy of Northern Ireland Water*


*Primary settlement tanks during construction*
*Courtesy of Northern Ireland Water*

*View from upstream of PSTs and flow split chamber*
*Courtesy of Northern Ireland Water*

*Storm holding facilities*
*Courtesy of Northern Ireland Water*

*On site Health and Safety inspections*
*Courtesy of Northern Ireland Water*

*Inlet works and adjacent landscaping and screening*
*Courtesy of Northern Ireland Water*

| | Season/Year | | | |
|---|---|---|---|---|
| | Winter | | Summer | |
| | Exist | 2030 | Exist | 2030 |
| PE | 2,581 | 5,674 | 3,715 | 8,696 |
| DWF ($m^3$/d) | 495 | 767 | 1,083 | 1,641 |
| FFT ($m^3$/d) | 1,244 | 1,943 | 2,729 | 4,162 |
| Form 'A' ($m^3$/d) | 2,056 | 2,699 | 4,203 | 5,581 |

*The effluent standard is required to comply with the Urban Wastewater Treatment Regulations (NI) 1995. In addition, NIEA stipulated the following consent criteria:*

| Parameter | Average | |
|---|---|---|
| | 95% | Nr. |
| BOD | 30 | - |
| SS | 50 | - |
| E. Coli | - | 2,000/100 ml |

## Magilligan WwTW detailed description

Sewage is delivered to the inlet works reception chamber, at a maximum rate equivalent to future formula 'A', via the Aughil and Magilligan SPSs. All incoming flow passes through inlet screens and a grit removal system.

Following preliminary treatment, flows in excess of FFT will overflow to the storm tanks (1 blind, 1 on-line), each of which is provided with a jet-type mixer. The contents of the tank are automatically returned during low-flow conditions. If tank capacity is fully utilised the blind tank will spill with stormwater passing by gravity to the nearby Drumman Burn.

Downstream from the inlet works, flow up to a maximum of future FFT is split between 2 (No.) radial-flow, primary settlement tanks. After primary settlement has taken place the sewage is forwarded to a selector tank (which also receives return activated sludge) and then is evenly split between 2 (No.) aeration lanes. Each lane has been constructed as a circular annulus, within which lies the final settlement tanks.

After the secondary settlement phase of the process the effluent passes through one of two (duty/standby) micro-screens which provide a final element of solids removal and enable the ultraviolet treatment system, located downstream, to operate efficiently and ensure adequate disinfection in accordance with the required effluent standard.

Following UV disinfection, treated effluent flows to a final effluent pumping station before being discharged into the North Channel.

## Flexibility of WwTW process

Magilligan WwTW is expected to experience large variations in loading. Between peak summer loading and minimum winter loading there is expected to be a variation of more than a factor of three. The peak summer PE is almost 9,000 and minimum winter loading will be around 2,500 PE. The plant is designed to be capable of treating wastewater under all conditions.

There are two full treatment streams each consisting of a primary settlement tank, a biological aeration tank and a clarifier, as well as a tertiary filter and UV disinfection.

Under full summer loading, all 6 (No.) tanks will be in operation together. In autumn, tanks will gradually be taken out of service, so that for minimum loading conditions only 1 (No.) aeration tank and 1 (No.) clarifier will be in operation. The tertiary clarifier and UV disinfection will operate all year round.

## Environmental and design considerations

A full Environmental Impact Assessment was undertaken for the Benone Area Sewerage Scheme which examined a wide variety of aspects including archaeology, ecology, geology and hydrogeology in the area, landscape and visual impact, cultural heritage, socio-economic effects and much more. The recommendations provided in the report ensured that during the scheme's development, impacts from construction were minimised; the integrity of the area was not compromised and that the facilities were sited sensibly and landscaped where appropriate.

A qualified archaeologist was present during the stripping of all topsoil to ensure that any significant finds were recorded and preserved. The design of each of the different work elements in the scheme was developed taking into account extensive constraining engineering, environmental and economic criteria so that the best solutions could be reached.

## Sympathetic construction

Minimising the effects of construction in an area where tourism plays such a major role was a key objective for NI Water. In partnership with the NI Water Project Managers, AECOM and BSG/WIS, aesthetically-pleasing designs and landscaping proposals have been developed that will minimise the visual impact of the new construction.

At the location of the new pumping stations most of the highly-visual above ground buildings and elements of the sites will be demolished (following full commissioning of the new Magilligan WwTW), with new tanks and structures buried or placed as close to ground level as possible.

At Magilligan WwTW, the control building has been designed with a curved roof to echo a traditional agricultural building and has been finished in a subdued 'field-pattern' colour to integrate with the surroundings. All spoil excavated on the Magilligan WwTW site has been reused in landscaping the area around the periphery of the new works, where a thick band of native trees and shrubs was planted out earlier this year.

The programme of works for the Benone Area Sewerage Scheme was carefully planned to minimise disruption during the main tourist seasons - as a result no pipelaying work was undertaken on roads during busy holiday periods - and to ensure compliance with numerous environmental requirements identified in the EIA.

Well in advance of construction start, the project team held information events to advise the local community on what the scheme entailed and carried out visits to local primary schools. Letter drops were undertaken ahead of each pipeline section and key project milestones were published in the local media.

## Current situation

The new Magilligan WwTW will begin treating sewage in September 2013. On completion of the flow diversion/commissioning process, the old pumping station structures will be demolished and reinstatement completed. There will be a further 12-month period of performance trials, operational and process testing before construction completion by the JV and handover of the new works to NI Water Operations.

The extensive new infrastructure installed will help protect public health, ensure cleaner beaches and safeguard the environment for many years to come.

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*Installation of final effluent outfall pipeline*
*Courtesy of Northern Ireland Water*

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