

Brighton & Hove Wastewater Treatment Scheme

over 250,000 people to benefit from a modern wastewater treatment system

by
Richard Goodridge MAPM

Work has started on a £300 million environmental improvement scheme to bring cleaner seas to Sussex. When the new wastewater treatment works has been completed in 2013 it will be able to fully treat the 95 million litres of wastewater generated each day by over 250,000 people in the catchment area of Brighton and Hove. After treatment, the cleaned water will be recycled back to the environment 2.5 kilometres off-shore.



The site at Peacehaven

Courtesy of 4Delivery Ltd

Improvement Driver

Southern Water Services is required to provide wastewater treatment to a secondary standard for the Brighton and Hove catchment to comply with the European Urban Wastewater Treatment Directive (91/271/EEC) and associated Urban Waste Water Treatment (England and Wales) Regulations 1994.

At the moment, wastewater from the area travels through local sewers, many of which date back to the original Victorian infrastructure, to Portobello Wastewater Treatment Works at Telscombe Cliffs. Here, it receives basic treatment before being pumped out to sea through a 1.8 kilometre long sea outfall. As a result, Brighton and Hove is now the only area in Sussex, and among the last in Europe, not to benefit from modern wastewater treatment.

The Solution

Brighton and Hove 4Delivery Ltd is a joint venture between United

Utilities, Costain, and MWH, and is undertaking the design and construction of the project on behalf of Southern Water. The project comprises the following elements:

- A wastewater treatment works (WTW) and sludge recycling centre (SRC);
- Transfer infrastructure including pipelines, pumping stations, tunnels, shafts and work to connect to the existing sewerage infrastructure;
- Long sea outfall (LSO) at Friars Bay.

The project will serve the Brighton and Hove catchment area, which includes Brighton and Hove along with Roedean, Woodingdean, Ovingdean, Rottingdean, Saltdean and Peacehaven. The WTW and SRC are being constructed at Peacehaven, while the transfer infrastructure extends from Brighton Marina in the west, eastwards to Peacehaven and then on to the LSO at Friars Bay.



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The project falls within the administrative areas of both Brighton and Hove City Council (BHCC) and East Sussex County Council (ESCC) with the project divided between the administrative areas as detailed below:

Administrative Area	Project Components
Brighton & Hove City Council	Brighton Marina Connection Chamber, pipeline, shafts (Marine Gate)
	Marine Drive Pumping Station, pipeline, shafts and associated infrastructure
	Pipeline, shafts and associated infrastructure from Marine Drive Pumping Station to the administrative boundary at Saltdean
East Sussex County Council	Pipeline from administrative boundary to Peacehaven WTW, including Portobello Pumping Station, shafts and associated infrastructure
	Peacehaven WTW and SRC, including pipeline to Friars Bay (Head shaft)
	LSO, including Friars Bay Promenade Shaft

Transfer Infrastructure

The infrastructure works include the following:

- 18 No. shafts (of which three are pumping stations);
 - Marine Drive;
 - Portobello;
 - Inlet works (Peacehaven WTW);
- 9.1 kilometres of 2.44 metre diameter bored tunnel;
- 1.6 kilometres of 1.80 metre diameter pipejack tunnel;
- New LSO at Friars Bay.



Photo shows contiguous piled wall, bulk excavation (supported by SCL) and headworks for pumping station shaft at Portobello Courtesy of 4Delivery Ltd

Pumping Stations

Works commenced on the pumping stations in the summer of 2009. There are 3 No. 17.5 metre diameter pumping station shafts to be constructed at Marine Drive, Portobello and Peacehaven WTW. Their purpose is to lift the wastewater allowing it to then gravitate through the sewer tunnel to the WTW at Peacehaven.

Ecological and archaeological surveys and clearance works were carried out in summer 2009. This was closely followed by necessary traffic management operations at Marine Drive and Portobello on the A259 South Coast Road. Marine Drive and Portobello both required the construction of contiguous piled walls to provide support to the A259 while the shaft sinking works are carried out. Over 150 No. 900mm diameter piles between 12 metres and 20 metres deep have been installed to support the bulk excavations adjacent to the A259.

The shafts are being constructed using pre-cast concrete segmental linings, installed using ‘underpinning’ techniques followed by sprayed concrete lining (SCL) applied using hand nozzle techniques as well as a remote control spraying machine.

The deepest shaft on the project is the pumping station shaft at Marine Drive, with excavation to -14.00 metres AoD, meaning the finished structure is 46 metres deep to invert. Generally excavation of all of the pumping station shafts has been to levels below that of the existing ground water levels. Therefore extensive grout injection ground treatment and dewatering operations have been required across the sites.

Tunnel Construction

Two principal routes were considered for the transfer tunnel between Brighton Marina and the WTW/SRC at Peacehaven, these were a coastal route and an inland route. The coastal route was selected on the basis that it would be more direct, better related to existing sewerage infrastructure and less likely to be disruptive to the local amenity during construction.

The 9.13 kilometres of segmentally lined transfer tunnel on the project will be driven using Lovat tunnel boring machines (TBMs). The TBMs will be launched from shafts at Peacehaven and at



Remote control application of SCL at Marine Drive Pumping Station Courtesy of 4Delivery Ltd

Ovingdean with reception shafts at Marine Drive, Friars Bay and two at Portobello. The tunnels are 2.44 metre internal diameter constructed out of single pass trapezoidal segments. The segments are 175mm thick and are constructed utilising steel fibre reinforcement. The TBMs will be delivered at the start of July 2010 and reach a maximum expected output of 50m/day for each machine.

In addition, there are a number of shorter headings for interconnecting pipework between reception shafts and pumping station shafts, as well as the local network connections that will be carried out using other techniques such as micro-tunnelling and traditional headings.

There are also two substantial 1,800mm diameter pipejacks at each end of the project totalling 1.6 kilometres in length.

The Wastewater Treatment Works at Peacehaven

This section includes all process, mechanical, electrical and auxiliary services to treat intercepted wastewater flows of up to 3.5 DWF in compliance with the discharge consent requirements. There are three principle processes that take place; wastewater treatment, sludge recycling and odour control treatment.

The wastewater treatment includes:

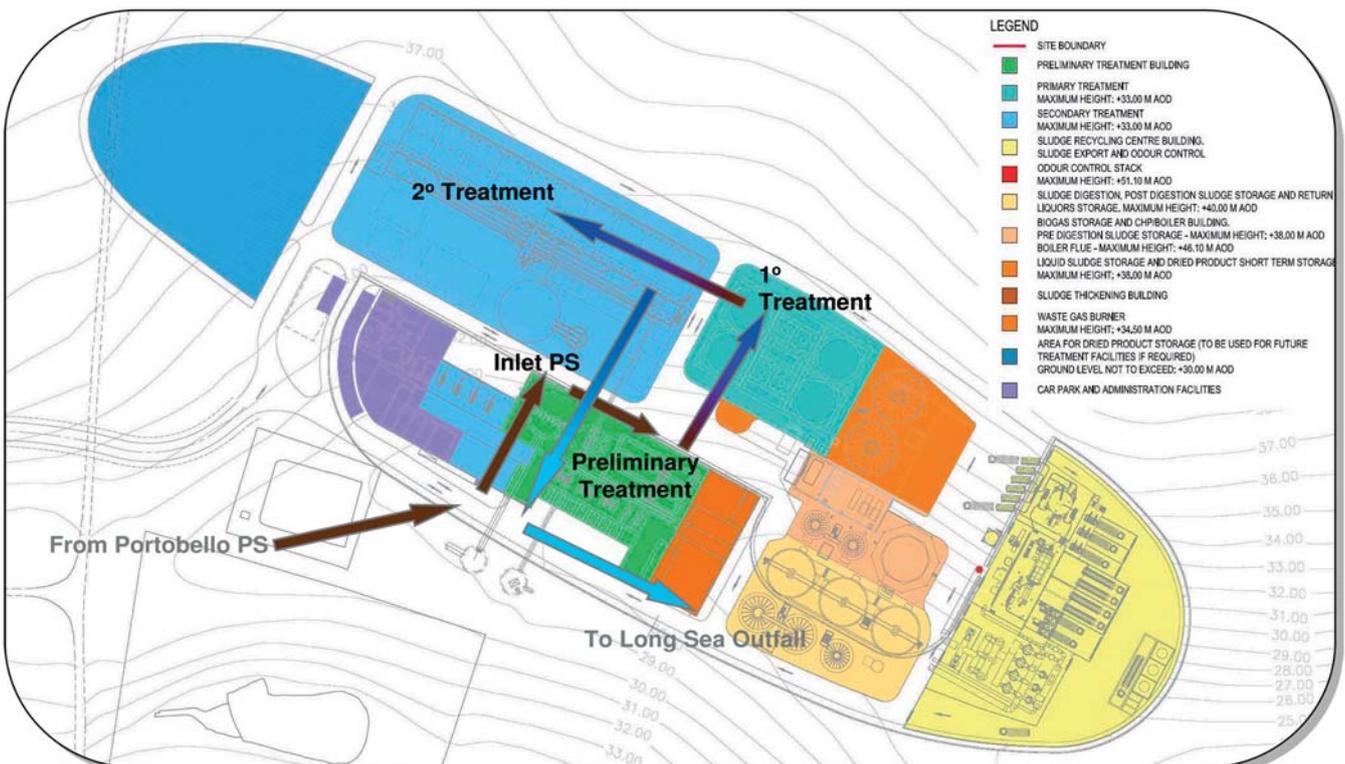
- a) Inlet works comprising:
 - screens and screenings processing
 - grit and grease removal and grit and grease processing
- b) High rate primary sedimentation process: this includes a set of Lamella Clarifiers, pre-conditioned with polymer to allow settlement of a flocculated particle, and a circular scraped cone sludge collection zone.
- c) High rate biological treatment process: this system consists of 10 BAFF cells, using media which is held in suspension by air forced through the cells by five blowers delivering air through a common manifold.

The sludge recycling includes:

- a) Indigenous sludge dewatering and processing: a series of thickening, straining and dewatering of sludge suitable for digestion.



The first of two TBMs being launched at Ovingdean Courtesy of 4Delivery Ltd



Simple plan view of the WTW & SRC showing different process areas

Courtesy of 4Delivery Ltd



Reinforced concrete works for the BAFF, Lamella & SRC at Peacehaven WTW

Courtesy of 4Delivery Ltd

- b) Imported sludge dewatering and processing: the plant will be capable of accepting and processing imported raw sludge, imported cess and dry solids in the form of cake from other Southern Water sites.

The odour treatment system at Peacehaven

The plant includes facilities to capture and control all odours emanating from the WTW and SRC. The odour control includes multiple stages of scrubbing and has interconnection of units to allow for maintained performance in the event of failure or shut-down of individual units. The odour control system will consist of a cover and collect stage, followed by a treatment stage. Treated air is finally emitted from a common stack to atmosphere.

Long Sea Outfall

The new long sea outfall will be 2,446 metres in length and comprises of approximately 686 metres of pipejacked tunnel that is 1.8 metres internal diameter and 1,760 metres of SDR 26 PE pipe, 1.4 metres

external diameter. The end of the outfall tapers to a diffuser section which is made up of 12 ports at 18 metres centres, the risers for which vary from 350 mm diameter to 450 mm diameter. A 17 metre head of treated effluent will be available to drive the discharge from the diffuser section. The outfall diffuser, situated in 16 metres depth of water below Chart Datum, will discharge continuously, to stop inflow of seawater. Scour protection is to be provided around the diffuser ports to resist the increased currents around the risers.

The outfall pipe is made in Norway, in approximately 550 metre long pieces, which are towed by tug to the installation zone on the south coast of England. Before installation the pipe sections are connected, by mechanical joints, into a full length string. This operation takes place on shore, by pulling the shorter make-up lengths onto the pipe make-up area, making the mechanical joints, and then gradually pulling the pipe back into the sea using a winch barge.

The outfall pipe is to be laid in open trench, dug by backhoe dredger, and then generally backfilled with the excavated material. Between excavation and backfill the excavated material will be temporarily stored on the sea bed on the eastward, leeward current, side of the trench.

The tunnelled section and the pipe section are to be connected underwater by a “spool piece”, a short section of make-up pipe.

Conclusion

When the new wastewater treatment works has been completed in 2013 it will be able to fully treat the 95 million litres of wastewater generated each day by over 250,000 people in the catchment area of Brighton and Hove.

Note: *The Editor & Publishers thank Richard Goodridge, Construction Manager with 4Delivery Ltd, for providing the above article for publication. ■*



Dredging of sea bed for LSO

Courtesy of 4Delivery Ltd