

Lewes Sewerage Improvement Scheme

£14m urban drainage improvements project for historic town

by Richard W. Walton, MEng, CEng, MICE

Lewes Sewerage Improvement Scheme, an urban drainage improvement project for the historical town of Lewes, East Sussex, had the objective to overcome water quality, amenity and property flooding problems associated with twenty combined sewer overflows (CSOs). Fifteen of these CSOs failed to comply with current criteria set out by the Environment Agency, and were listed as being unsatisfactory under the Urban Waste Water Treatment Directive for intermittent discharges. The performances of these CSOs were adversely affected by sewers of inadequate capacity to meet current conditions.



Lewes Sewerage: Southern Water's Jimmy Stakim inspects Brook St., Tunnel

Photo: Connors, Courtesy Southern Water

The scheme catchment serves a population of approximately 13,000, with catchment flows ultimately pumped to Newhaven Wastewater Treatment Works (WwTW). Within the predominantly combined sewer network, the twenty CSOs discharged spills to three local water courses; **The Upper Fells, Winterbourne Stream and the River Ouse.**

Principal considerations

Lewes has stringent development controls due to a number of factors, including being within a conservation area, designated Archaeological Sensitive Area and Area of Outstanding Natural Beauty. Furthermore, it lies within the proposed South Downs National Park. This resulted in the scheme requiring an Environmental Statement to accompany the planning application to East Sussex County Council, which was approved mid-February 2004.

The geology consists of made ground on alluvial deposits, which overlie a chalk bedrock. The delineated Groundwater Protection zone (GPZ) chalk band acts as a significant groundwater aquifer, of which SWS have a 13,000m³/d borehole abstraction for public

water supply, principally for the town of Brighton, in close proximity to the scheme. Contamination of the aquifer due to construction methodology would have led to BVC incurring severe penalties.

Scheme design and development

At project commencement, scheme options based on principal urban drainage solutions, were considered against constraints including programme, environment, constructability and cost.

Options considered were:

- * reinforcement - replacing existing pipes with larger pipes;
- * attenuation - storing the flow in on-line/off line tanks or tunnels;
- * disconnection - detachment of a sub-catchment into further sub areas and developing solutions for each sub area.

It was concluded that attenuation by means of a stormwater tunnel offered the best value solution, principally as it would minimise the scope of works within the built environment, thus reducing the impact within the town and its residents, yet providing a robust hydraulic solution.



Lewes Sewerage: MCC Building, Lewes

Photo: Connors, Courtesy Southern Water



Lewes Sewerage: Pinwall and Delilah

Photo: Connors, Courtesy Southern Water

Scheme description

The scheme involved closing all existing CSOs and diverting spills into a new 1,150m long 1.2m diameter stormwater tunnel with a capacity of almost two million litres. If this capacity is exceeded screened spills are pumped to the River Ouse via a new storm pumping station, Court Road PS. To ensure the sewer system was capable of conveying 1 in 50 year return period peak storm flows, some existing lengths of sewer required upgrading to increase their capacity.

Additionally, new network sewer connection pipelines were constructed to link existing sewers and the stormwater tunnel. These were constructed using trenchless technology (guided auger bore and horizontally directionally drilled) and traditional open cut. The use of trenchless technology helped minimise the impact on local traffic.

The scheme was undertaken by a joint venture between Black & Veatch Ltd and Costain Ltd (BVC) for Southern Water Services Ltd (SWS). BVC were operating in the Western area of SWS's region to ensure their assets complied with AMP3 guidelines by the year 2005. This scheme was the largest project undertaken within SWS's K3 programme of works at a cost of £14 million and completed ahead of programme in early March 2005.

Key physical elements proposed:

- * northern tunnel - 700m long 1200mm internal diameter;
- * southern tunnel - 450m long 1200mm internal diameter;
- * Court road PS - storm pumping station;
- * Pinwell Road Deep Shaft PS - transfer pumping station;
- * storm overflow rising main & outfall - 175m long, 1000mm dia.
- * network sewer connections - pipe diameters range between 150mm & 1500mm.

Shaft & tunnel construction

As outlined above the geology was made ground, overlying alluvium and chalk bedrock. Following comprehensive stratigraphy of the chalk, primary methods of shaft construction were considered against a number of possible engineering, construction and environmental constraints. Constraints included hardness and density of the underlying chalk, excavation dewatering during construction, minimal use of support lubricants due to the GPZ excavation methods, proximity to surrounding structures and the local ecology. It was concluded the tunnel access shafts be constructed using precast concrete caissons jacked into the ground underwater. In preparation, undisturbed ground was pre-augured to

minimise resistance between the caissons and chalk. Specially designed recessed segments and tremmied concrete plugs prevent floatation.

The 1.2m tunnel diameter, based on minimum required for man entry and was constructed using two remote controlled full-faced slurry earth pressure balanced tunnel boring machines. Each tunnel incorporates two intermediate shafts, required for construction of the tunnel based on the maximum drive length in the ground conditions.

Four straight pipejacks were laser guided whilst a single curved pipejack was controlled via a curved guidance system. A sophisticated system of automated and manual monitoring was undertaken to record building movements and ground surface subsidence.

Pumping stations

Court Road PS is a 12.5m diameter, 14.5m deep shaft, where two duty 6mm2D mechanical screens and three stormwater pumps are housed. The duty/assist/standby pump configuration was designed to pump flows up to 2600 l/s. equating to a 1 in 50 years return period, to the River Ouse via a single overflow pipeline. A new motor control centre and dual power supply, housed in a new purpose built building, controls and power the new pumping station.

The tunnel drains from the north and south to a central lift pumping station, Pinwell Road Deep Shaft PS, where flows are transferred to Pinwell Road PS at a controlled rate via duty/standby pumps. Flows are then pumped onward to treatment at Newhaven WwTW.

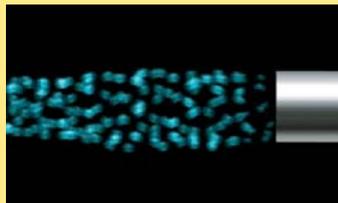
Working with the community

A number of measures were undertaken by SWS and BVC to mitigate impact of the project on the town. Measures included communicating to residents and stakeholders using forum groups, letters, brochures, exhibitions, press releases and information boards. Temporary parking facilities were provided to replace those lost during construction. New children's play equipment was installed in two local play areas, and the project team contributed manpower, advice and support for the entrance design of the local nature reserve.

The community consideration was officially recognised by the Mayor of Lewes, on behalf of the town of Lewes, on the scheme's Opening Day 31st of March 2005, when both SWS and BVC were presented with commemorative paintings. ■

Note: The author of this article, Richard W. Walton, is Lead Design Engineer, Southern Water.

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