

Park Avenue Flood Alleviation Scheme

£2.4m project sets a new benchmark within Scottish Water for customer care and delivery within a tight timescale

The town of Paisley in the west of Scotland, just outside Glasgow, has historically had fluvial flooding problems from the Espadair Burn as well as a flood risk from the combined sewer network. The local authority, Renfrewshire Council, implemented a flood protection scheme on the Espadair Burn in 2002, which protected a large area, but there were still 27 properties classed as being at risk from sewer flooding within the Park Avenue area of the town. This increased pressure on Scottish Water to deliver a sewer flood prevention scheme, which they subsequently committed to delivering by March 2009.



Aerial View showing the restrictive working area available

Courtesy of Scottish Water Solutions

The March deadline coincided with the year end for Scottish Water to meet their annual targets agreed with the regulator. Therefore successful commissioning of this scheme was critical in contributing 27 flooding outputs to meet the overall programme target. The Park Avenue Flood Alleviation Scheme set a new benchmark within Scottish Water for customer care and delivery within a tight timescale. Despite a constrained site within housing, and major risks the £2.4m project was designed and implemented without any H&S incidents and within 10 months. The scheme was delivered as a partnership between Scottish Water Solutions, Grontmij and Carillion.

Design Phase

Design was progressed utilising output from an Infoworks hydraulic model of the sewer network and local watercourses. Analysis confirmed customer information that the flooding occurred from two sources - an overloaded trunk sewer and also a Combined Sewer Overflow (CSO) outfall sewer, which was under capacity leading to overland flows from surcharging manholes. Resolving the outfall capacity was a simple matter of upsizing whilst option analysis confirmed that the only cost effective method of prevention of flooding from the trunk sewer was localised storage – there was insufficient downstream capacity to allow any on line upsizing.



Jacking in Operation within the clearly constrained site Courtesy of Scottish Water Solutions

Immediately upstream of the flood area, the trunk sewer passed through some open land which was identified as suitable for storage. A scheme was identified which would provide off-line storage in the form of Weholite sewers. At a meeting with the landowners, a housing developer, it was indicated that they were opposed to the proposals. This was confirmed when the developer subsequently objected to the statutory notice issued.

In view of the timescales required to resolve this issue it was decided not to pursue this option further and alternative solutions were developed. As designers of the scheme, Grontmij identified a number of alternates for both site location and the type of storage to be provided. In conjunction with the Scottish Water Solutions project manager and the delivery partner Carillion, a new preferred option was agreed which would provide “off-line” storage with pumped return in another area of open land adjacent to the Park Avenue area.

However, this site was considerably smaller than the previous site, and was bounded by roads on two sides, and two watercourses, the

Espadair and a tributary the Glen Burn. There was also a major 30” water main within the adjacent Park Road whilst the 750mm diameter trunk sewer passed through the site. To meet the storage requirements within the construction footprint available the solution developed was a 12.5m diameter shaft 18m deep. To meet the desired March 2009 completion, this new design had to be substantially completed within the timeframe of May-July 2008.

The hydraulic design was based on setting a weir level to allow spills to the shaft and the provision of sufficient storage in order that there were no spills to the watercourse for a 1 in 5 year storm. This eliminated the need for a stormscreen and was a philosophy that SEPA were willing to endorse. Renfrewshire Council too were willing to accept the additional discharges to the Espadair Burn as modelling demonstrated no increased flood risk for a 1 in 200 year event.

A pump return regime was established to maximise draw down of the storage tank, and a full one year time series of rainfall was run to check performance against “follow on” storms. Discussions with the Operations Department also identified a need for a method to discharge into the shaft to ensure that the stormpumps operated on a regular basis, and so the design also incorporates an actuated valve which is programmed to open if the pumps have not run for two weeks. The control philosophy incorporates level checks to ensure that the valve will only open if there is sufficient capacity in the downstream sewer to receive return flows from the pumps.

Construction

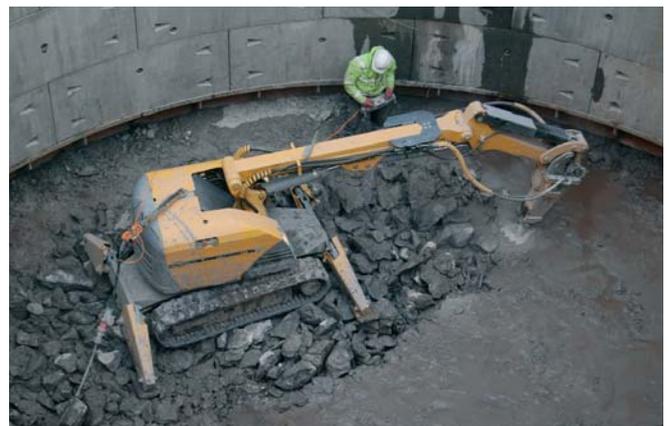
The basis of the scheme was to relay the 750mm diameter trunk sewer to free up the main area of the site for the shaft. However, this required digging close to the water main, the condition of which was uncertain. To ensure protection of the main, vibration limits were established and a monitoring regime specified for the works.

The general site logistics constrained progress and little work could be done in parallel. The sewer diversion had to be complete before any shaft work could commence and the lack of land area meant that neither spoil nor materials could be stockpiled on site for later use or removal. What little room existed was enhanced by temporarily culverting the Glen Burn.

During the design phase the contractor confirmed that the shaft would be sunk by caisson, utilising jacks to drive the shaft down. Site Investigation (SI) confirmed that bedrock was approximately 8m below surface. This was overlain with a mixture of clays gravels and silts. Interrogation of the SI by Grontmij confirmed that in order to have strata with sufficient bearing capacity to support the jacking collar, the collar formation level required to be at a depth of 3m. With no room to batter the excavation, piling was required to be able to excavate to this depth and form the collar. The chosen methodology for sinking the piles was “silent piling”; this was more expensive but resulted in less vibration and noise, which was a factor due to the proximity of the nearest property.



Brokk in action



Courtesy of Scottish Water Solutions



Park Avenue during construction (left) and once completed (right)



Courtesy of Scottish Water Solutions

The piling and jacking operations through the clay were successful, but problems were encountered when in the rock. The SI had indicated a wide rock strength range of 15mPA to 100mPA, but even the upper layers proved too strong for normal breaking equipment. Drill and blast techniques were eliminated due to the proximity of the adjacent property, so a remote controlled demolition robot from Brokk was utilised. This was the largest robot Brokk had, and the only one of its type in the UK, and greatly increased productivity.

Overall Achievements

Despite the rock excavation, a delay for a utility diversion and the general site constraints, the shaft and pipework were completed in time to meet the March deadline for output delivery. This achievement was testament to the partnership ethos between the client, Scottish Water Solutions, the designer, Grontmij and also the contractor, Carillion. The project was runner up in the Partnership category of Scottish Water’s annual awards ceremony and it has been

used as an example of excellent customer care throughout the business – the strength of dialogue with customers was illustrated by one writing to thank Carillion for their work referring to the workforce as; “like having a group of kindly uncles at the end of the street”.

At a final cost of £2.4m, the project fell well within the maximum funding available of £125k per property and helped to contribute to the financial aspect of the overall programme. Therefore the scheme delivered on the main criteria of cost, timescales, customer experience and safety, while delivering the required flooding relief for 27 houses, which has subsequently been robustly tested by the Scottish weather.

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Working with Scottish Water and Carillion Plc on the Park Avenue Flood Alleviation Scheme

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