Salford 172 Project

4,500m³ tank to store storm sewage and prevent discharge into the local watercourse during periods of heavy rainfall

Salford 172 forms part of a cluster of projects in the Manchester area and is a new 4,500m³ storm retention tank and diversion chamber designed to store storm sewage and prevent the discharge in periods of heavy rainfall to the local watercourse. The original 3m diameter Victorian sewer is part of the storm spill pipe network that discharged straight into the local watercourse in storm conditions. As part of the commitment to provide cleaner rivers and canals United Utilities (UU) required a solution that would store storm flows, returning them to the sewer which flows back to Salford WwTW However, should the storm continue, any flows passing to the watercourse would be screened to minimise pollution, improving the quality of the local watercourse. The project is part of the £3.6 billion being invested by UU in AMP5 across the North West to improve water quality and the environment by 2015.

Shaft and distribution chamber under construction - Courtesy of GCA JV

Location

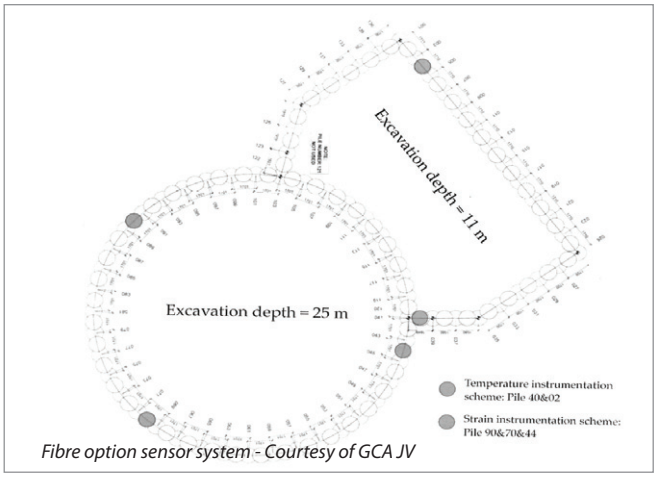
The Salford 172 Project is being delivered by Galliford Try-Costain-Atkins Joint Venture (GCA JV) as main contractor for United Utilities. A suitable plot on which to build the retention tank has taken several years to locate due to the high level of development in the area. A small patch of land on an industrial estate in Salford was identified; however, this location for the works has led to many constraints which have had to be overcome prior to start on site.

The site borders Weaste Cemetery on one side, and industrial units with offices on the others. Consideration was made to the fact that they may have been burials outside the consecrated cemetery boundary and access had to be arranged through a car park belonging to one of the industrial units. Noise and vibration have been high considerations in the development of the solution in these locations.

Construction/piling

The construction involved a circular 21m diameter x 24m deep, below ground water storage structure, which is formed from permanent cased secant pile elements. A diversion chamber, also constructed from cased secant piles, has been built integral with the storage chamber to connect the current 3m diameter Victorian sewer to the storm retention tank.

BG42 piling rig on site - Courtesy of GCA JV



Fibre option sensor system - Courtesy of GCA JV

BG42 piling rig - Courtesy of GCA JV

Cementation Skanska installed a total of 133 (No.), 1,180mm diameter segmental cased piles for the secant pile wall that forms the circular tank and chamber with 80 (No.) 24m long piles for the tank and 53 (No.) 15.5m long piles for the diversion chamber. To avoid damage to the Victorian asset, 16 (No.) of the piles above the existing culvert are at 6.5m. Ground conditions at the site are made ground over alluvial deposits and sands and gravels before changing to sandstone at about 12m.

Accuracy was a key concern due to the proximity of the existing Victorian main sewer and local buildings so the BG42 piling rig was used. This piling rig is the largest of its type in the UK and has been designed for accuracy specifically in close proximity to other buildings. The rig also benefits from reduced $C0_2$ and noise emissions and uses biodegradable oil to reduce any environmental impact.

Secant piling can cause a lot of vibration, and as this is in the immediate vicinity of the local offices, the site team visited the nearby businesses to explain what could be expected. Cementation Skanska also changed the concrete mix to include a plasticiser to help reduce the vibration during the coring to minimise the vibration effect on nearby buildings.

One of the big issues at the site is the groundwater which is at 6m below ground level. WJ Groundwater installed 7 (No.) 40m deep wells around the site to draw the water level down below the base level during the excavation and base casting phase.

Hoop stresses

To effectively monitor the hoop stresses in the structure, an innovative approach was used using an optical fibre sensor system. This new technique is supported by the Centre for Smart Infrastructure and Construction (CSIC) at the University of Cambridge, which focuses on the innovative use of emerging technologies in sensor and data management.

This proposal was used at SAL 172 due to the fact that no field tests had been conducted to monitor the hoop stress within a secant wall shaft historically due to limitations on available instrumentation. The use of the innovative fibre optic sensor system provided distributed measurement data every 100mm continuously along a single fibre optic sensor.

This information and technology assists to interpret the behaviour of the pile and improve the current understanding of hoop stress design for circular shaped structures formed by secant wall piles, leading to more economical similar design solutions in the future.

A 4m by 12m hole in the tank was required to install a concrete portal window to allow water in the diversion chamber to flow in and out of the shaft. At the point where the piles were broken, the shaft stopped being a hoop so monitoring was crucial at this stage. Once the beams and cross channels at the top of the tank were tied into the portal windows, shaft excavation could progress.

Minimising working at height

The requirement for working at height has been minimised due to an innovative sequence of operations on the project. The construction process has been reversed so that the workforce are working at ground level on the shaft walls before further excavation can be carried out with the process finishing off with the base pour.

Once the shaft has reached full depth, the 2.5m thick fully reinforced base will be cast and fixed to the secant piles using 700 (No.) dowels following the M&E equipment installation.

Connecting the pipeline

The existing pipe will need to be broken out with a temporary flume constructed to carry the flow. Precast wall and pipe concrete

sections will be used within the diversion chamber to ensure that installation is as efficient as possible and flow through the existing pipe will only be interrupted briefly, which will cause only minimum disruption.

The weather will be closely monitored during this 2-3 week period and the team will work 24 hours a day in this phase to minimise the flooding risks. There is potential for the flow to reach up to 6,000 litres per second.

As the project involves connecting a pipeline that is permanently surcharged with water from the nearby watercourse and has to have uninterrupted passage for storm spill flows, innovative construction techniques for managing the water during the process have to be used. These include temporary stop gates, spill alarms and detailed sequencing of the works.

Health, safety, environment and sustainability

The project has utilised a number of innovative solutions to reduce environmental impact including carbon efficient cabins, LED lighting and Enviro hoarding.

Enviro hoarding reduces the environmental impact specifically in the local area as it is an over ground, no dig hoarding with temporary works technology. Consequently no damage is caused to tree roots and the system can be easily removed leaving no permanent remains.

Attention has also been paid to the sustainability and carbon footprint of the project using reusable and recycled materials wherever possible. 7,500t of recycled aggregate was imported for the piling mat and the plan is to export 5,000t of this for reuse on other GCA JV sites, plus 1,000t of concrete pile trimmings are to be re graded and recycled for use on other GCA JV sites.

The site uses a pedestrian demarcation system with barriers and red pedestrian walkways together with a wheelchair access ramp to allow easy and safe access to the site for all pedestrians. SHE information stations and portable first aid stations have been placed at strategic points on the site and include defibrillators so that emergency aid is easily accessible to workers in the site area.

GCA JV and United Utilities' commitment to health, safety and sustainability is evident through our performance, achieving an AFR of 0.00 and an EFR of 0.00 on this project.

Excellent working relationships were built with all local businesses prior to start on site which enabled the site team to arrange and maintain access to the site. The team has also been able to manage neighbouring businesses' expectations by keeping them informed of project progress through a bi-weekly update and a newsletter. Any concerns are recorded on an issues log so that they were managed and dealt with immediately to mitigate any customer complaints.

Summary

Within the AMP5 programme of works, GCA JV are scheduled to achieve contract completion on time and to budget. The scheme has a regulatory deadline for completion of 30 June 2015.

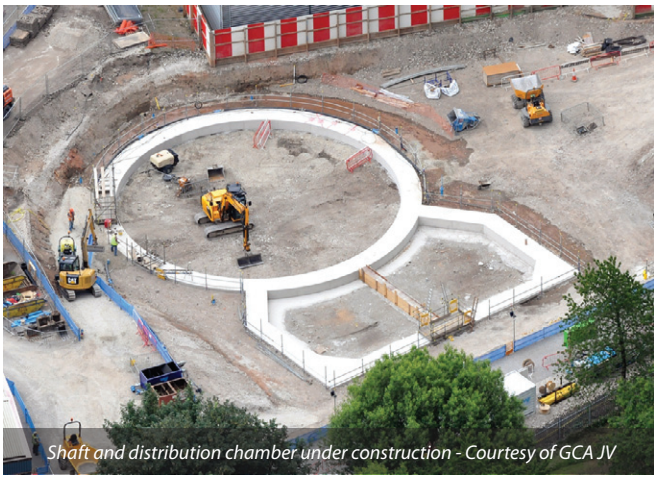
The long term partnership arrangement between GCA JV and United Utilities across AMP3, 4 and 5 has helped develop the delivery options and value manage costs out of the project as much as possible, to ensure that the project remains on target for delivery and to realise significant savings against the original forecasts.

The Editor & Publishers would like to thank United Utilities and GCA JV for providing the above article for publication.

Shaft and distribution chamber under construction - Courtesy of GCA JV

Portable first aid station - Courtesy of GCA JV

Areial view showing proximity of businesses - Courtesy of GCA JV



Shaft and distribution chamber under construction - Courtesy of GCA JV