Eastney Storm Pumping Station
£20m ten-point plan to protect Portsmouth from flooding

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Southern Water's storm pumping station at Eastney, Portsmouth, has been in operation since 1868. The James Watt & Co. beam engine pumps of 1887, housed in the original Victorian engine house, were replaced with diesel engine-powered pumps in 1954 but preserved as museum pieces. In recent years, with the increasing frequency and intensity of storm events, flooding has become a growing threat in Portsmouth, where large areas of the city are below sea level. In 2007, Southern Water announced a £20m ten-point plan to provide the city with greater protection from flooding. The plan included constructing an underground pumping station in Bransbury Park, Eastney, to pump stormwater and sewage to nearby storage tanks, providing a vitally needed back-up to the existing station.

Aerial view of the shaft during construction   *Courtesy of 4Delivery*

Solution

The new pumping station was designed to secure a one-in-76-year flood protection to Portsmouth by providing standby capacity to reinforce the existing 14,000l/sec equipment, which transfers storm water to storage tanks at nearby Fort Cumberland.

The main requirements of the design brief were:
- To provide 9,000l/s of standby storm pump capacity to storage tanks;
- All structures not within existing pumping station boundary to be underground;
- Connect new pumps to existing inlet sewer and outlet rising main;

- Provide upgraded dual feed high voltage power supply;
- Provide a facility to install 6mm two-dimensional screens at a later stage;
- Carry out a comprehensive survey of the sewerage catchment.

The design solution provides the following new facilities:
- 4 No. ITT Flygt 2,250 l/s submersible electric pumps;
- Underground wet well and valve chamber within 18m deep shaft;
- Access to new chamber via underground tunnel from existing works;
- New control panels within existing control building.

New storm pumps in position   *Courtesy of 4Delivery*

The pumping station was built entirely underground and housed in an 18m diameter shaft, the walls formed from 85 No. bored concrete secant piles, 1.2m in diameter, installed to a depth of 21m. The shaft was completely covered and grassed over, leaving a number of maintenance access covers as the only visible sign of the structure in the park.

Design

During the design stage, much effort was put into ensuring the best and most innovative methods of construction were developed. Some of the most successful ideas were:

- The original pile design called for full-depth temporary pile casing to enable drilling below the groundwater level, only two metres below the surface. However, an extensive ground dewatering system was installed before installing piles, removing the groundwater pressure within the entire footprint of the works. This system remained in operation throughout the construction period;

- Flow into the new pumps is via an existing three metre diameter segmental construction interceptor sewer at a depth of 14 metres below ground level. Precise survey methods were necessary to ensure the sewer was accurately located so it aligned correctly with the piles forming the new shaft walls;

- Flow from the new pumps is via a 135 metre length of 2.2 metre diameter rising main formed from continuously welded steel pipe sections. This eliminated the need for thrust blocks.

Extensive modelling of the whole catchment network was undertaken in the initial design stage, providing valuable details of hydraulic performance and flooding mechanisms. This information will also enable the team to target future flood protection works. Scale models of the proposed pumps and wet well were created to hydraulically test different pump configurations across a range of flow conditions. This resulted in the pump arrangement being re-designed to reduce the footprint of the works in the public park.

Construction

Construction began in June 2008 and the completed works became operational three months ahead of schedule in March 2010. The work was carried out by 4Delivery, a consortium comprising United Utilities, Costain and MWH, which has been carrying out environmental improvement and water quality schemes for Southern Water. 4Delivery was responsible for the project management, design and delivery.

A main objective during construction was to maintain the full capability of the existing pumping facility. This was achieved by detailed planning of every key activity and innovative engineering techniques, particularly when connecting 'live' pipelines to new equipment. The construction site was located in a densely populated residential area of Portsmouth so the project team was particularly sensitive to the needs and concerns of the local community. Construction methods, particularly for piling and excavation, were selected to ensure that noise and dust had a minimal impact.

Completion

Careful choice of design and construction methods, together with a fully integrated design and construction team, ensured the project was delivered under budget, three months early and with more than 145,000 man-hours worked without any lost-time accidents or environmental incidents. In addition, the existing facility remained fully operational at all times throughout the project.

This project has provided Southern Water with enhanced and sustainable facilities to protect Portsmouth from the growing threat of flooding with virtually no visual impact.
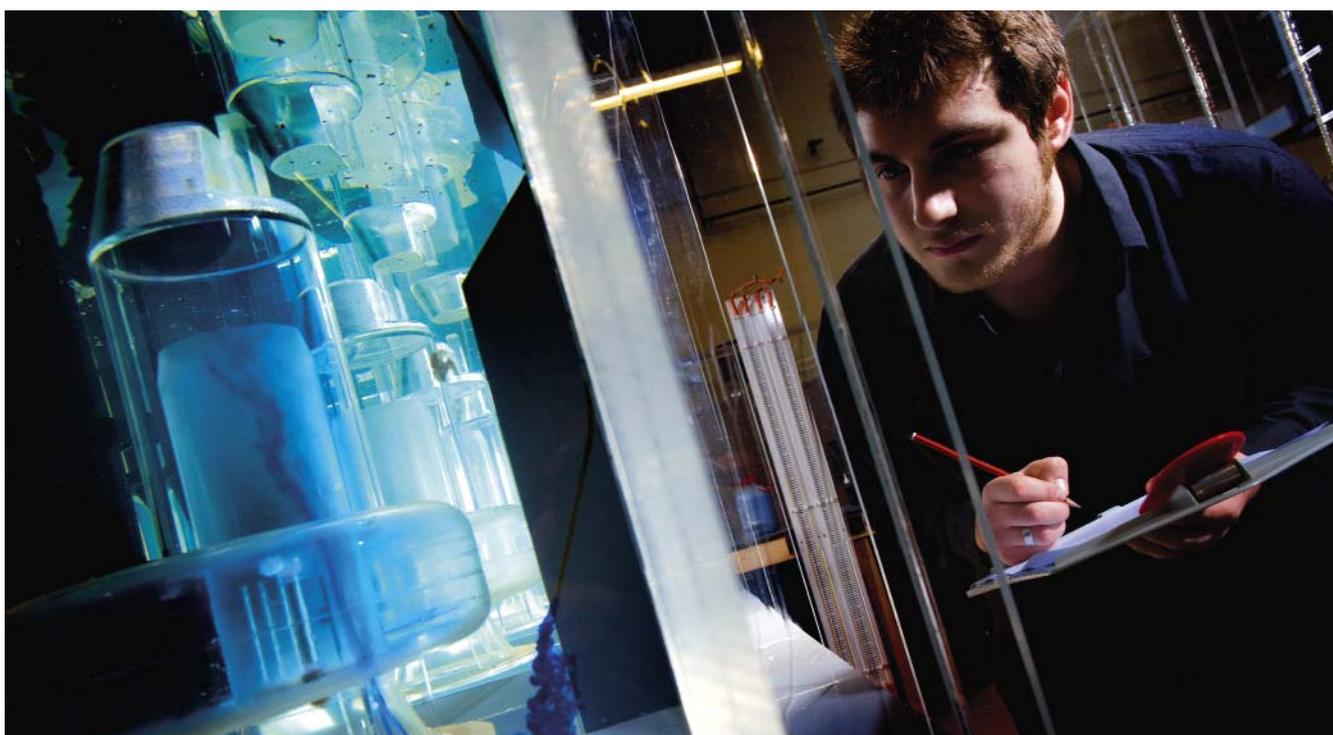
Model Testing   *Courtesy of 4Delivery*