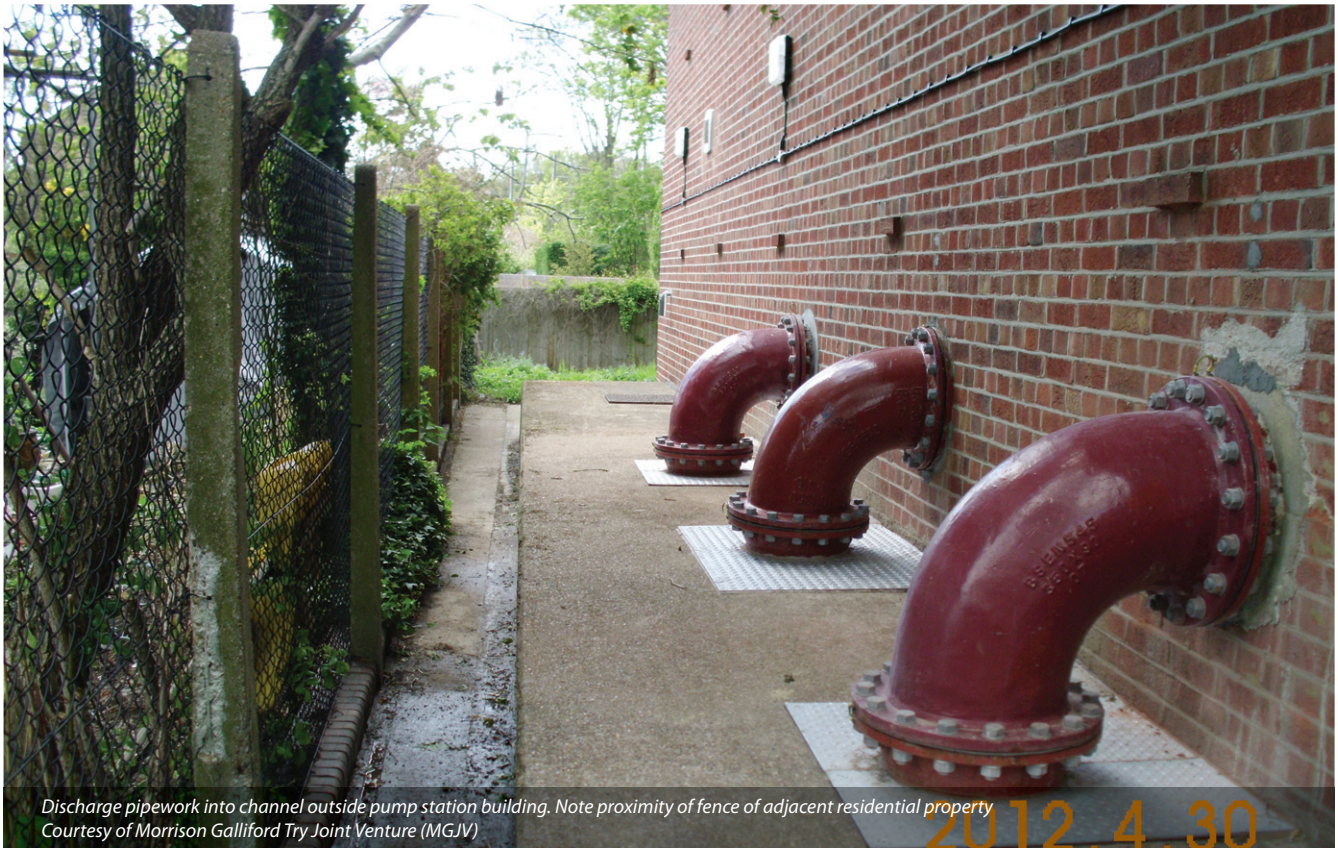
Rowden Road Sewage Pumping Station

refurbishment to extend the asset life of a critical pumping station helping secure service for the next 30 years

by Robert Ashiley

Rowden Road Sewage Pumping Station (SPS) in Beckenham, Kent serves an estimated population of 325,000 people in the South East of London. The station was built in the late 1960s and Thames Water had planned for refurbishment to extend the asset life of the pumping station. Records showed that flows expected into the SPS could reach 2,300l/s and as such was very critical. There was risk of flooding to more than 50,000 properties and businesses if the station failed. Due to its criticality and the catchment which it served, it was imperative that it was kept in operation during the entire duration of the upgrade project.



Discharge pipework into channel outside pump station building. Note proximity of fence of adjacent residential property
Courtesy of Morrison Galliford Try Joint Venture (MGJV)

Background

The SPS is bordered to the south and west by residential properties and to the immediate north by a railway line. There are three main incoming sewers into the station - two 300mm diameter foul sewers entering from the west and a 1,400mm diameter combined sewer from the east. The 1,400mm sewer was an overflow from the South Norwood trunk sewers. The overflow only discharges into the SPS in significant storm conditions.

The upgrade project consisted of hydraulic modifications to the wet wells and MEICA upgrades to comply with current DSEAR regulations. Due to space constraints at the site, new assets had to be co-located within the existing building.

Existing equipment

The pumping station consisted of two separate wet wells. A dry weather flow (DWF) well and a storm well. Both located below the ground floor of the main pump building. The dry weather flow well was a wet well/dry well configuration. The storm well however had only one well in which the pumps were also located. Flows from the station are initially discharge into a channel outside the pump station from where it drains into the West Kent "A" sewer to Longreach STW.

The dimensions of the DWF wet well were 5.5m x 1.2m x 5.5m deep and that for the storm well was 7m x 5m x 4m deep. Each well had three pumps operating in a duty/ assist/assist arrangement with each of them having a dedicated rising main discharging into a channel just outside the pump station building. The existing DWF pumps were driven by 30HP Crompton Parkinson motors. The storm well pumps were driven by WH Allen 80HP motors. The motors for the DWF and storm pumps were located on the ground floor of the pump station.

Other equipment located within the main pump building included:

- 1 (No.) MCC (control panel).
- 1 (No.) Serck Proteus 2000 telemetry outstation.
- A 4-ton rated lifting gantry.
- 1 (No.) UK Power Network substation; the substation had its own dedicated entrance for UK Power Networks staff.
- Ventilation fan for the DWF dry well.

As the population served by the SPS was likely to have changed significantly since it was built, the flows arriving at the pumping station had to be confirmed before any design work could be undertaken. The design parameters listed below were obtained from the project brief.

Dry Weather Flow Pumps No. 1, 2 and 3	22.5kW each
Dry Weather Flow Pumps Flow Rate	400l/s at 3.73m static head
Storm Pumps No. 4, 5 and 6	45kW each
Storm Pumps Flow Rate	800l/s at 3.73m static head
SPS Design Flow	2,300l/s
Max. DWF	581l/s
Max. 10 year storm event flow	1,797l/s

Confirmation of design parameters

The expected incoming flows into the pumping station were confirmed using an existing hydraulic model for the catchment. The expected peak DWF into the SPS was confirmed to be 450l/s. The peak flow in storm conditions (1 in 10-year return period) was also confirmed to be 1,200l/s.

The existing outputs of the pumps were also checked. Initially, a conventional drop test could not be undertaken to confirm the output rate of the pumps, due to the location of the wells and the arrangement of the existing pumps.

A flow monitoring survey was therefore undertaken. The pumped flows from the station were monitored over a two-week period. This confirmed the output of the DWF pumps to be between 120l/s and 156l/s each. The flow recorded from the storm pumps was 435l/s. These output rates were used for pump design and selection. The design parameters used were as follows:

DWF Design Flow	135l/s per pump
Storm Design Flow	435l/s per pump
Pumping Station Total Output	1,140l/s (equivalent to 2 (No.) DWF pumps plus 2 (No.) storm pumps running together)

The key reason for restricting the total output to 2 (No.) DWF pumps and 2 (No.) storm pumps was because Thames Water Operations had indicated that if all three storm pumps were turned on at the same time, the manhole just downstream of the pumping station on the West Kent "A" sewer, was unable to cope with the flows and it caused localised flooding at the location.

After assessment of different options and configurations of pumping arrangements for the proposed upgrade, the option taken forward to detail design was to install three new variable speed pumps in the storm well to deal with both DWF and storm overflows from the South Norwood trunk sewer. The pumps were to be operated in a duty/assist/standby (D/A/S) arrangement. Flows into the existing DWF were to be channelled into the storm well.

Design

The selected pumps for the modified storm well were submersible pumps. Access to the pumps, located in the wet well, was required tfrom the pump room.

The existing access openings had to be increased to ensure the new pumps could be removed and maintained with ease. To utilise the existing lifting beam, the pumps were also placed in line with the beam, which was rated at 4 tonnes.

Original layout of assets. DWF pump motors located on far end of room. Original MCC (immediate left) located opposite the storm pumps Courtesy of Morrison Galliford Try Joint Venture (MGJV)

New pump access openings/covers Courtesy of Morrison Galliford Try Joint Venture (MGJV)

Openings in weir wall to achieve optimum flow presentation to new pumps - Courtesy of Morrison Galliford Try Joint Venture (MGJV)

New MCC enclosure Courtesy of Morrison Galliford Try Joint Venture (MGJV)

To comply with current DSEAR regulations, the MCC was proposed to be located in its own separate enclosure within the main pump room. The openings for the pumps were also designed as gas tight to prevent gases from the wet well escaping into the pump room during normal operations.

The wet well was vented directly to the atmosphere using the existing vent column at the pumping station. Forced ventilation was also introduced into the MCC enclosure. This prevented ingress of gases into the enclosure. Similarly, cable routes from the new pumps and level instruments to the new MCC were also sealed to prevent the migration of gases from the well to the MCC.

Pump selection

The configuration of the pumps was selected based on the design parameters that had been confirmed, the requirement to meet current DSEAR regulations and the physical dimensions of the pumps and the ability to fit them into the existing storm well. The positioning of the pumps was also to enable ease of maintenance and use of the existing lifting beam.

The design flows, determined using the results of flow monitoring, were used in completing WIMES sheets and requesting quotations from pump suppliers. The information sent to suppliers was:

Parameter	Value
Minimum Flow Rate	135l/s per pump
Maximum Flow Rate	435l/s per pump
Flow rate to be met at 45 Hz	380l/s per pump
Static Head	5.14m
Maximum Total Head	12m

The submissions from pump suppliers were reviewed before a final selection was made. The selection of which pump to use was initially based on:

- ***Physical dimensions:*** As the room available within the storm well allowed for only three pumps.
- ***Weight:*** As the existing lifting beam was to be utilised to lift the pumps.
- ***Rated current:*** As the power supply to the pump station had an upper limit specified by UK Power Networks.
- ***Pump minimum stop level:*** As the stop level in the base of the wet well would dictate whether the lowest incoming sewer would be fully drained during each pump cycle.

Whole Life Cost analyses were the undertaken for the pumps that met the selection criteria. Overall, the pumps with the least whole life cycle costs were selected.

Construction

In order to keep the station operational during the refurbishment, the DWF well had to be kept in during the project. This required careful planning of the preceding activities such as hydraulic modification of the storm well, MCC changeover and construction of the new MCC enclosure.

Modification of wet well

The storm well had to be hydraulically modified to receive flows from all three incoming sewers. The presentation of flows to the 3 (No.) newly installed pumps were also assessed to ensure optimum flow conditions to the pumps and maintain the best possible cleansing regime for the newly modified wet well.

The presentation of flow to the pumps was achieved by cutting openings in the existing weir wall in the storm well and benching the floor in the direction of the new pumps.

Newly installed MCC - Courtesy of Morrison Galliford Try Joint Venture (MGJV)

MCC changeover

The station was required to be fully operational during the entire period of the project. This meant that the existing MCC had to be kept in operation until the new MCC and pumps were fully operational.

A phased changeover had to be carefully planned and executed because the original MCC was in the way of the proposed rising mains from the storm well. The original MCC had to be decommissioned in sections, whilst maintaining the power supply to the DWF pumps until the rising mains for the new pumps were installed and powered by the new MCC. The foul flow into the existing DWF well had to be channelled into the storm well before the DWF pumps were decommissioned.

In carefully planning the changeover, minimal interruption was ensured and the pumping station was kept operational during the project.

DSEAR compliance

To ensure full compliance with current DSEAR regulations, the MCC had to be located in an un-zoned space. Due to space limitations, it had to be located within the main pump room. To ensure the MCC was within an un-zoned space, submersible pumps were chosen to be installed in the storm well. This ensured that the pumps were fully below the pump floor. The access covers were made gas tight and so in normal operation the ground floor of the main building could be classified as zoned. It only became a zoned area when the pump access covers were open. In this scenario, the forced ventilation into the MCC enclosure was utilised to force any gases out of the MCC enclosure.

Asset standards non-compliance

Thames Water's asset standards required that flow meters were installed on the outgoing rising mains. The position for the meter however required five straight lengths of the rising main diameter before the installation point and two straight lengths after. This was not feasible due to the length of the main. A waiver was therefore required for the proposal not to use a flow meter.

However, in order to achieve a method of discharge flow measurement, use was made of the flow calculating facility provided by MultiSmart® Pump Station Manager.

Conclusion

Close liaison between Thames Water, MGJV and Mott MacDonald ensured that at all stages during the project, key decisions were agreed promptly hence minimising delays to the delivery programme.

The unusual setup of the pumping station required careful analysis and deliberations in order to ensure that the requirements of the project brief were met.

The station was also kept fully operational during the entire period of the project and this ensured the population served by the pumping station did not experience any problems during the entire upgrade.

The asset life of the pumping station has been extended and this will help secure the service of station for the population served for the next 30 years.

The Editor & Publishers would like to thank Robert Ashiley for preparing the above article for publication. The author is an AMP5 Design Framework Manager with Mott MacDonald (for the Mott MacDonald-MGJV).