Technical Note

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Project title	A63 Castle Street Improvement Scheme	Job number	237912-00
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Subject	Environment Agency relevant representation response: Pumping station flood resilience		

This Technical Note has been prepared in response to the Environment Agency's Relevant Representation comments on the Flood Risk Assessment[1] that was submitted on 20 December 2018.

1 Environment Agency Comment:

"Risk to Surface Water Pump

Section 2.6.30 of the FRA states that a water storage and pumping station structure would be required to collect the drainage of the underpass and pump it away for discharge. Drawing no. TR010016/APP/2.6(M) Rev 0 shows the proposed pumping station receptor, located to the south east of the proposed Mytongate Bridge. However, we have been unable to find any detailed plans or information relating to the control room, generator room and sub-station. Without this, we are unable to determine whether the pumping station is sufficiently resilient to flooding, to allow continued operation in a flood event. Details on the level of operating equipment above ground should be included within the FRA."

[1] https://infrastructure.planninginspectorate.gov.uk/projects/yorkshire-and-the-humber/a63-castle-street-improvement-hull/?ipcsection=relreps&relrep=31932

2 Response:

As part of the Pumping Station Approval in Principle (AIP) document, a Mechanical and Electrical (M&E) Equipment AIP was prepared to highlight the preliminary design considerations that will inform the detailed design. Below are key extracts and summaries from this M&E AIP which are relevant to flood risk resilience.

Additionally, this response also includes an overview of different flood risks pertaining to the proposed pumping station control room, generator room and proposed relocated sub-station.

However, it should be noted that it was always the intention of this scheme to address these three components as part of the detailed design. We would therefore be open to review and address and concerns raised by the Environment Agency in respect to these buildings. It is our intention to develop these designs in a collaborative manner to ensure we deliver a reliable and safe asset.

2.1 General description

The modified highway will be within an underpass with a grade separated junction. A new bridge will span over the underpass to carry traffic between Ferensway and Commercial Road. Access on and off the A63 is provided in all directions by slip roads in the four corners of the new junction. Mytongate pumping station is required to collect surface drainage from the underpass and discharge via a rising main. The pumping station is located to the south east of the Mytongate Junction Bridge as shown below:

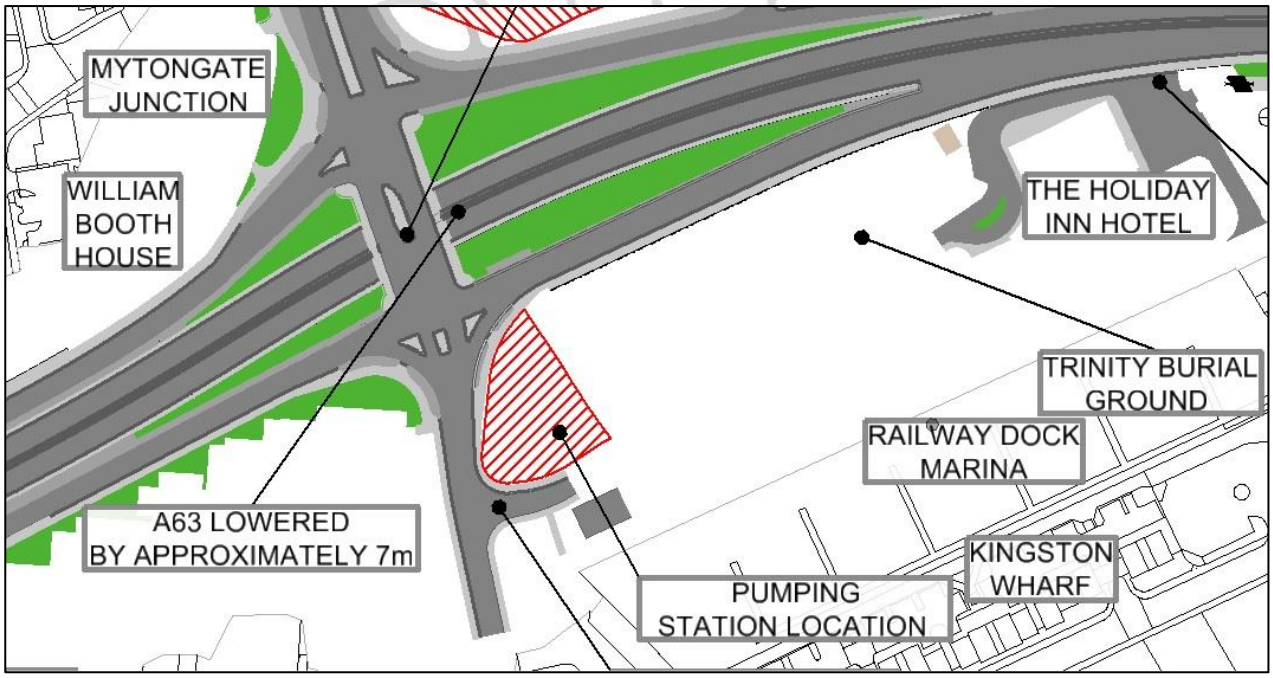

Figure 1: Proposed Site Layout

The design of the pumping station and approach to balancing pumped discharge rate with storage volume has sought to balance the following factors: -

- The high flow rates generated by the 1-in-100-year design storm mandated by the EA, which will generate significant volumes of runoff;
- The extremely challenging ground conditions at the site, which will significantly increase the cost and risk of constructing the pumping station civil works and disproportionately increase the cost of storage-based solutions versus pump-rate-based ones;
- The need to mitigate the impact of flow rates on the YW sewer network; and
- The need to maintain operational flexibility and resilience.

Mindful of the constraints above, it is proposed that the pumping rate be based on the peak flow rate from a 1-in-5-year storm event. The modelled flow from the catchment for such an event is 202.9 l/s, and therefore a design pumping rate of 200.0 l/s has been selected. It is anticipated that this will be provided by three pumps operating in a duty/assist/standby configuration. The proposed approach is considered optimal for the following reasons: -

- The proposed flow rate is accommodated within the overall site peak flow rate of not more than the existing;
- Higher pumping rates would only result in marginal reductions in the volume of the pumping station wet well, whilst increasing the impact on the YW network;
- Lower pumping rates would result in disproportionate cost of construction due to the volume of the civil works; and
- Lower pumping rates would reduce the resilience of the drainage system to storm events beyond the design criteria and would increase the time taken to drain the underpass in the event of flooding.

It should be noted, that the pumping station is not intended to keep the underpass free from of flooding during a big tidal flood.

2.2 Brief description of structure operation and maintenance framework

2.2.1 Type of structure

The purpose of the structure is to collect surface drainage water from the underpass, provide a water storage volume and housing for a pumping system, which will discharge water to a rising main.

The structure itself is a circular reinforced concrete shaft with a provisional internal diameter of 11.45m to accommodate the desired pump size and water storage volume. A buried pipe approximately 39m long and 600mm internal diameter will connect the underpass to the pumping station.

For details of the proposed pumping station refer drawing HE514508-ARP-SSPS0_ ML_PS-RP-CB-000001.

2.2.2 Accommodation of M&E services

The M&E services relevant to this AIP are restricted to those associated with the Mytongate pumping station serving as part of the surface water drainage of the underpass.

The Mytongate pumping station is located to the south east of the Mytongate Junction Slip Road, adjacent to the Trinity Burial Ground. The proposed highway layout in this area is shown below.

2.2.3 Location of monitoring centre and maintenance buildings

The control building for the Mytongate pumping station would be adjacent to the pumping station shaft as illustrated on drawing HE514508-ARP-SSP-S0_ML_PS-RPCB-000001.

2.2.4 Proposed arrangements for inspection and maintenance

This access hole will be of sufficient dimensions to accommodate a winched man-rider lift system, which can lower maintenance personnel down the shaft to a safe landing platform at the base of the shaft. The access arrangements and details of any landing platforms, access chambers, folding safety covers, etc., will be further developed during the detailed design period in consultation with the maintaining authority.

Details will be developed in accordance with industry “best practise” including the recommendations of authoritative documents including “Sewers for Adoption - 7th Edition” and “CIRIA C686 - Safe access for maintenance and repair”.

The pumps and level instruments in the shaft would be normally lifted in and out of position (by lifting chains or similar) through a separate ground level access hole(s) with removable cover(s) without requiring any access into the shaft itself. The lifting equipment (chains/winches) required will be determined by the weight of the pumps, which will be confirmed when final flow rates are agreed.

In the case of failed/jammed lifting equipment or other situation where access is required within the shaft, the same arrangements for accessing the structure would be used as described above.

Access to the pump control panel and other electrical items would be via the secure kiosk/building provided at ground level. Access would be simply by foot from the paved area provided. The pump shut-off valves would also be accessed from ground level via a hatch to a valve chamber just below the paved surface.

The shaft will be classified as a Confined Space and all access should be by safe working procedure including access equipment, planning, trained personnel and personal gas detection (e.g. Carbon Monoxide, Hydrocarbons and Oxygen) with pre-entry gas checks. Access will be via a removable cover in the shaft roof which is sized to permit a man riding basket to be lowered to the invert of the sump. The cover will be positioned to facilitate safe access to and from the basket once inside. Pump lifting, and removal is proposed to be by use of a HIAB or other suitable vehicle.

Due to the depth of the sump and the weight of the pumps a removable davit is unlikely to be appropriate and permanent lifting equipment would be at risk of vandalism in a publicly accessible location therefore vehicle access and direct lifting is the most suitable method.

The same considerations apply for accessing the pumping equipment during a tidal flood event, thus providing some resilience to respond during such an event.

2.2.5 Location of services building

The control building for the Mytongate pumping station would be adjacent to the pumping station shaft as shown on drawing HE514508-ARP-SSP-S0_ML_PS-RPCB-000001.

2.2.6 Design working life of M&E services

The design working life of the major M&E components is expected to be:

- Pumps 20 years
- Control Panel 20 years
- Generator 20 years

2.3 Electrical power supply and distribution

2.3.1 General description

A secure kiosk/control building will be provided at ground level to house the control panel, standby generator (with fuel store) and other electrical equipment. The power supply will be confirmed following the detailed design of the pumping station and equipment selection.

2.3.2 Supply distribution

The power supply for the Pumping Station is to be provided from an existing substation which will be re-located and will retain the existing demands with the addition of further load from the pumping station. The location of the substation is in design development, but currently it is proposed to be sited adjacent to the Pumping Station.

2.3.3 Emergency arrangements

Due to the criticality of the pumping station for maintaining drainage a standby generator will be installed, sized for the same power rating to ensure the whole pumping station is operational in the event of a grid power failure. It is proposed that there will be a fuel supply that is sufficient for 48 hours full pumping station operation. It is anticipated that fuel will be stored in a double skinned below ground storage tank with secure external connection facility for deliveries.

Based on a 200kVA generator the estimated fuel storage requirements for 48h operation at full load are approximately 2400 litres. The generator sizing will be confirmed during detailed design and fuel storage capacity adjusted to suit.

The generator will be installed within a building and external noise limited by the building structure.

2.3.4 Cabling

Cable routes will be confirmed at detailed design. These will be ducted, and routes selected to reduce the risk of damage due to vehicle movements or vandalism. External drawpits will be avoided where possible to reduce security risks.

Within the sump cables are suspended by cable support grips, which are secured to a bracket at the top of the shaft. These will be accessed through the pump lifting covers and lifted with the associated pump.

This will provide access and resilience during an emergency flood event.

2.4 Services buildings and plant rooms

2.4.1 General description

The pumping station control equipment and standby generator shall be housed within a secure kiosk/building at ground level near to the pumping station shaft.

2.4.2 Design criteria and layout

The notional layout is as per the drawing in Appendix B, to be confirmed during detailed design.

2.4.3 Building security and protection

The building specification is expected to be a minimum of LPCB Level 3, details of doors, louvers and structural security measures will be confirmed by security risk assessment during detailed design.

The current landscaping proposal is to provide Hedgerow around the entire perimeter of the Pumping Station compound, with vehicle access on Commercial Road. This vehicle access also provides vehicle access to the Trinity Burial Ground via a grasscrete route. It would be possible to provide either a gate or lockable bollards at the entrance to prohibit unauthorised vehicles from entering the site.

2.5 Flood Levels Review

Flood levels obtained from the Flood Risk Assessment indicate that the pumping station and associated building is only at significant risk of flooding during either the 1-in-1000-year Humber wave overtopping or the 1-in-200-year (plus Climate Change) Humber wave overtopping events (See Table 1 below).

Table 1 below shows the maximum flood depth at the pumping station area for different simulation scenarios.

Table 1: Pumping Station Flood Levels

Scenario	Min ground level (mAOD)	Mean ground level (mAOD)	Max ground level (mAOD)	Max Level (mAOD)	Max Depth (m)	Simulation
Pluvial 100CC	3.250	4.179	4.862	-	0.000	Pluvial 100CC Proposed Pumping Station SIM 272
Humber Defended 200CC	3.250	4.179	4.862	7.300	3.960	Humber Defended 200CC Proposed Pumping Station SIM 278
Humber Defended 200	3.250	4.179	4.862	3.320	0.070	Humber Defended 200 Proposed Pumping Station SIM 283
Humber Defended 1000	3.250	4.179	4.862	4.080	0.640	Humber Defended 1000 Proposed Pumping Station SIM 280
Hull Tidal 200	3.250	4.179	4.862	-	0.000	Hull Tidal 200 Proposed Pumping Station SIM 281
Hull Tidal 1000	3.250	4.179	4.862	-	0.000	Hull Tidal 1000 Proposed Pumping Station SIM 282

The modelling therefore shows that the pumping station will need to be resilient for the design of severe flood events to ensure that the pumps would be operational during the recovery stage after the event has passed. This will be developed further during the detail design stage.

2.6 Landscape Proposals for Pumping Station Compound

Preliminary landscaping proposals have been produced for the pumping station compound area. Indicative visualisations of these are shown in the images below:

- Figure 2: Shows a visualisation of the proposed Mytongate Junction and the pumping station compound area. The pumping station, with the service buildings is shown in the bottom right hand corner;
- Figure 3: Existing location where the proposed pumping station will be installed; and
- Figure 4: A visualisation of the proposed pumping station and associated buildings.

Figure 2: Proposed Mytongate and pumping station layout

Figure 3: Existing location of proposed pumping station

Figure 4: Visualisation of proposed pumping station and associated buildings

2.7 Design Review Comments Sheet

The following are extracts from the Design Review Comments Sheet, which formed part of the Pumping Station AIP approval process:

Comment No.	Design Review Comment (C) / Observation (O)		BB/Arup Response
17.4	Given the location close to the waterfront, has the risk of sea water flooding due to a tidal surge been assessed? (Tidal surges seem to happen more frequently nowadays).	Covered by response to Comment 18. How will the substation, generator and control kiosk be protected from flooding?	In 2014 Mott MacDonald Grontmij produced a Flood Risk Assessment that reviewed the various flood risk impact of the scheme. The following flooding scenarios were reviewed for specific Return Periods: - Pluvial @ 1:100 plus climate change - Tidal from River Hull (with Hull barrier open) @ 1:1000 - Combined fluvial and tidal from River Hull (with Hull barrier open) @ 1:1000 - Wave overtopping (defended) from River Humber @ 1:200 plus climate change - Tidal (undefended) from River Humber @ plus climate change The report concluded that the scheme will be protected by the flood defences in events up to 1:200 years. There is a risk of fluvial flood events arising in a 1:100 year event. However, the pumping station building is situated higher than the rest of the scheme, and most flood models indicate little to no flooding for 1:100 year flood events.
18	Section 3.1: I note that the pumping station has now been relocated to a position just south of the proposed Westbound off-slip road and Mytongate bridge. The GA drawings contained in Appendix B appears to show that the surface level of the cover slab is at 0.00 AOD. Taking into account the proximity of the pumping chamber to the coastline and the 120 year design life of the structure, is it considered that the pumping station and Kiosk is protected against extreme weather events including tidal surge?		Firstly, we would like to highlight that the surface of the level of the cover slab isn't at 0.00m AOD as quoted in the comment. The actual surface level is in the order of 3.50m AOD. Secondly, according to the FRA prepared by Mott MacDonald Grontmij, the likelihood of a tidal surge exceeding the Hull Tidal Surge Barrier minimum level of 4.43m AOD. The flood models indicate that the flood depth (m) will not exceed 1.0m at the proposed pumping station location during a 1 and 1000 year period undefended tidal flooding from River Hull (See Figure 10.54).

Additional flood risk modelling and assessments were done after the submission and approval of the Pumping Station AIP, which supersedes some of the comments that are highlighted above. The additional modelling will be incorporated in the detailed design of the pumping station and associated buildings.

3 Conclusion

It is clear from the preliminary design, flood risk modelling and consultation that additional work is required during the detailed design stage to make the pumping station and associated buildings as flood resilient as reasonably possible.

Further consultation is required to help inform the detailed design and will be done as part of Stage 5 design.

DOCUMENT CHECKING (not mandatory for File Note)

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