MOTT MACDONALD

Priority Schools Building Programme

Collis Primary School - Flood Risk and Drainage Broad Overview

October 2016

Education Funding Agency

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Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
A	Oct 2016	James Powis	Terry Chung	Terry Chung	First Issue

Information class: Standard

Disclaimer:

The consultant has followed accepted procedure in providing the services but given the residual risk associated with any prediction and the variability which can be experienced in flood conditions, the consultant takes no liability for and gives no warranty against actual flooding of any property (client's or third party) or the consequences of flooding in relation to the performance of the service. This report has been prepared for the titled project 'Priority Schools Building Program – Collis Primary School - Flood Risk and Drainage Broad Overview' and is for the purposes of informing the feasibility study for the proposed redevelopment only.

Contents

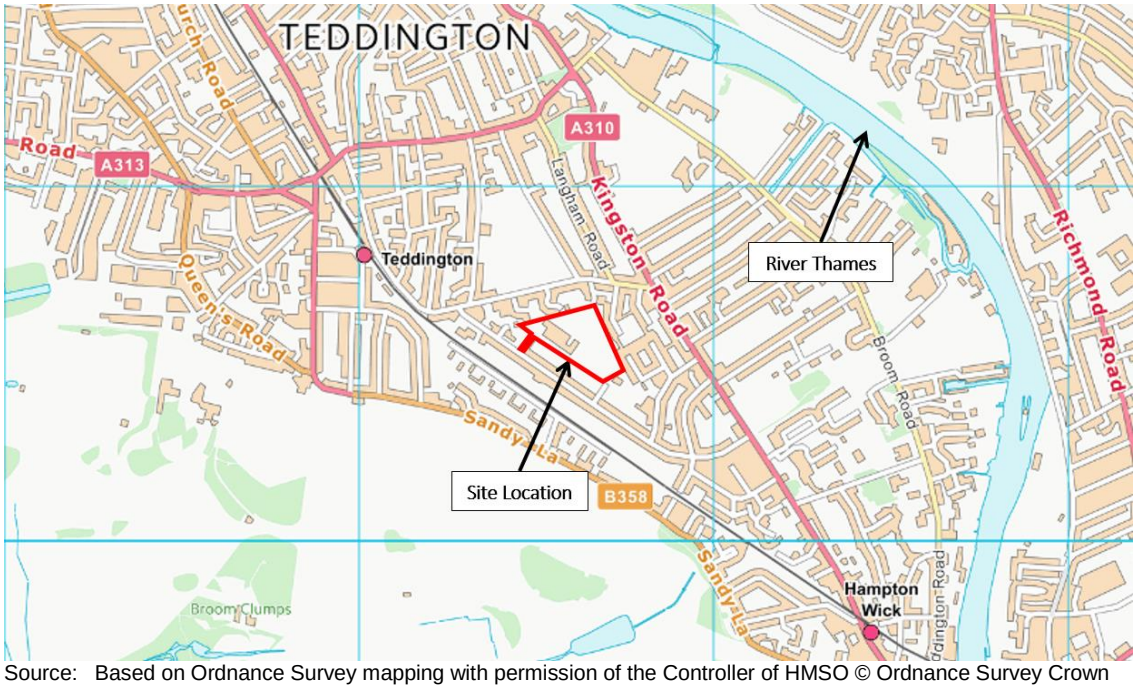
1 Introduction

1.1 Scope of Assessment

As part of the Priority School Building Programme (PSBP), the Education Funding Agency (EFA) proposes to rebuild part of the main building at Collis Primary School at Fairfax Road, Teddington, TW11 9BS. Mott MacDonald has been commissioned by the EFA to undertake a broad overview of the potential flood risk and drainage issues associated with the proposed redevelopment of Collis Primary School to inform the feasibility study for the proposed redevelopment.

The site location is shown in Figure 1.1 and falls within the administration boundary of the London Borough of Richmond upon Thames (referred to as the LB of Richmond from this point further). The redline boundary of the site is included in Appendix A. The site is surrounded on all sides by residential areas with a narrow access road to the west running onto Fairfax Road. The development on the site is located in the western corner with grass covering the east of the site.

Figure 1.1: Collis Primary School Location Plan



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As the details of the proposed development of the school are unknown at this stage, this broad overview only intends to assess the potential flood risk of the site based on a research of the information available in the public domain. Although the assessment largely follows the Planning Practice Guidance (PPG) to the National Planning Policy Framework (NPPF), it does not mean to be a complete site specific flood risk assessment and no site visits have been undertaken to check the actual site conditions. Subject to the findings of this broad overview, further assessment will be recommended to pinpoint any identified significant flood risk or drainage issues.

2 Flood Risk

2.1 Background

The NPPF states that site specific Flood Risk Assessments (FRAs) are required for all sites over 1ha in size and for all sites located within fluvial Flood Zones 2 ('medium' flood risk), 3a ('high' flood risk) and 3b (the functional flood plain).

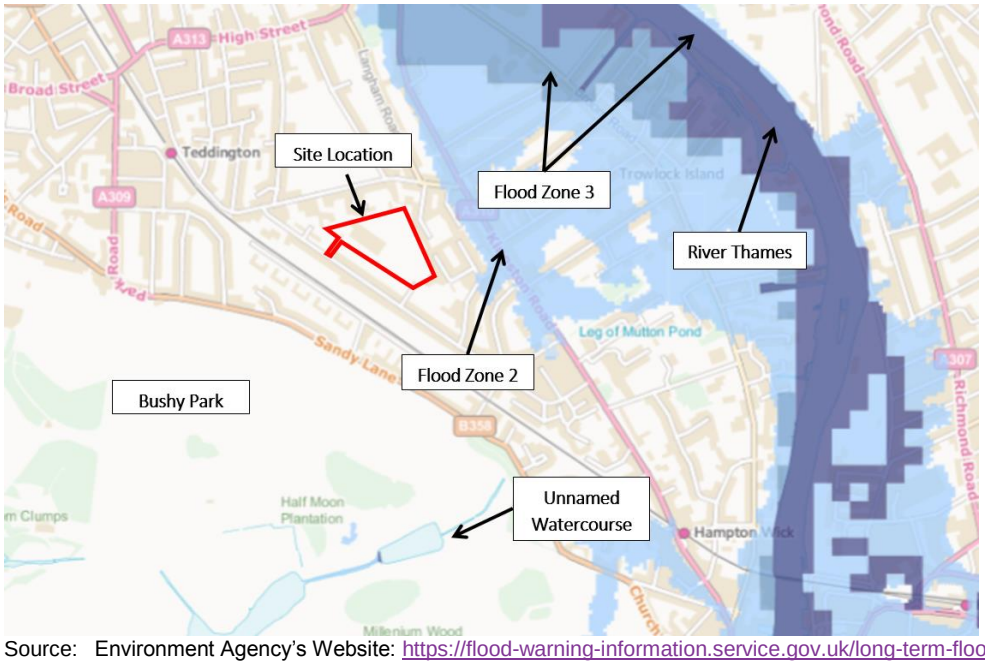
There have been area specific flood risk reports produced by the LB of Richmond including the Preliminary Flood Risk Assessment (PFRA), Strategic Flood Risk Assessment (SFRA), Surface Water Management Plan (SWMP) and Local Flood Risk Management Strategy (LFRMS).

2.2 Fluvial Flood Risk

The nearest watercourses located to the site are the River Thames approximately 800 meters to the north and an unnamed watercourse which runs through Bushy Park and into the Thames approximately 650 meters to the south of the school site.

The fluvial flood risk map shown in Figure 2.1 is taken from the Environment Agency's (EA's) website. The site is located within Flood Zone 1, the lowest risk category. The EA defines an area with an annual chance of flooding of less than 1 in 1000 (0.1%) as Flood Zone 1. There are higher flood risk areas closer to the River Thames to the north east of the site. An area of Flood Zone 2 is approximately 200 meters from the site, the EA defines an area with an annual probability of flooding of between 1 in 100 (1%) and 1 in 1000 (0.1%) as Flood Zone 2. There are also areas approximately 500 meters to the north of the site defined by the EA as within Flood Zone 3 which is an area with an annual probability of flooding of greater than 1 in 100 (1%).

Figure 2.1: Fluvial Flood Risk Map taken from the Environment Agency's Website



Source: Environment Agency's Website: https://flood-warning-information.service.gov.uk/long-term-flood-risk

The LB of Richmond Local Flood Risk Management Strategy (LFRMS) utilises the EA fluvial flood risk maps for its report so agrees with the Flood Zones taken from the EA's website. This means that ordinary watercourses, which are small watercourses that are not within the scope of the EA, are not included in the flood risk maps. The SFRA however, does not indicate that ordinary watercourses pose a significant flood risk to the borough. Ordinary watercourses have smaller catchment areas so are more prone to flash flooding in the areas directly surrounding the watercourse as the nearest watercourse is 650 meters from the site there is minimal flood risk from ordinary watercourses.

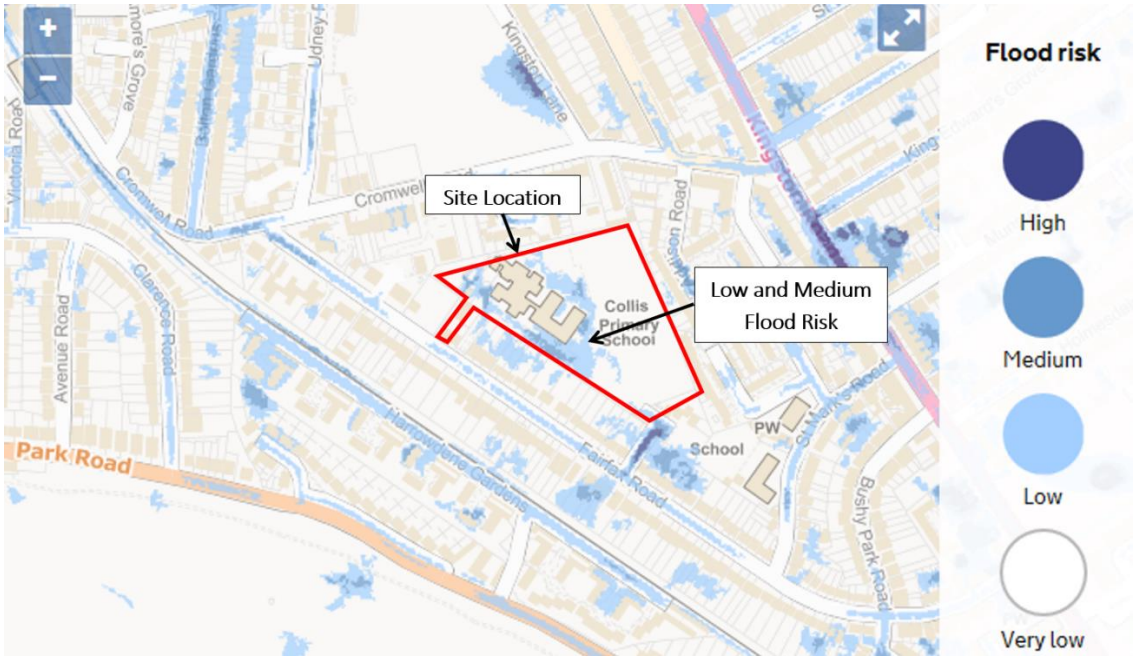
The Planning Practice Guidance for the NPPF states in Table 3 of the Flood Risk and Coastal Change section that all uses of land are appropriate in this zone but a site specific flood risk assessment is required for site comprising one hectare and above. As the site has an area of 3.11ha a site specific flood risk assessment will be required for this site.

2.3 Surface Water Flood Risk

The LB of Richmond SFRA relies on the EA's Updated Flood Map from Surface Water (FMfSW) to assess surface water flood risk within the borough. Figure 2.2 shows the FMfSW and indicates areas of low and medium surface water flood risk around the school buildings. The EA defines an area with an annual probability of flooding between 1 in 100 (1%) and 1 in 1000 (0.1%) as low risk and areas with a probability between 1 in 30 (3.3%) and 1 in 100 (1%) as medium risk.

There are areas with medium or high risk of surface water flooding near the site on the surrounding roads. The closest area of high risk is located on the southern boundary of the site on Harlequin Road. An area with a high risk of flooding has an annual probability of greater than 1 in 30 (3.3%). The SFRA states that *"Ground floor levels should be set to ensure no flooding of buildings occurs during the 1 % chance in any one year surface water flood event (generally 100 to 150mm above surrounding ground levels)"*, the FMfSW estimates that the depth for a 1 in 100 year flood event at the location of the proposed development is below 300mm.

Figure 2.2: Surface Water Flood Risk Map taken from the Environment Agency's Website



Source: Environment Agency's Website: https://flood-warning-information.service.gov.uk/long-term-flood-risk

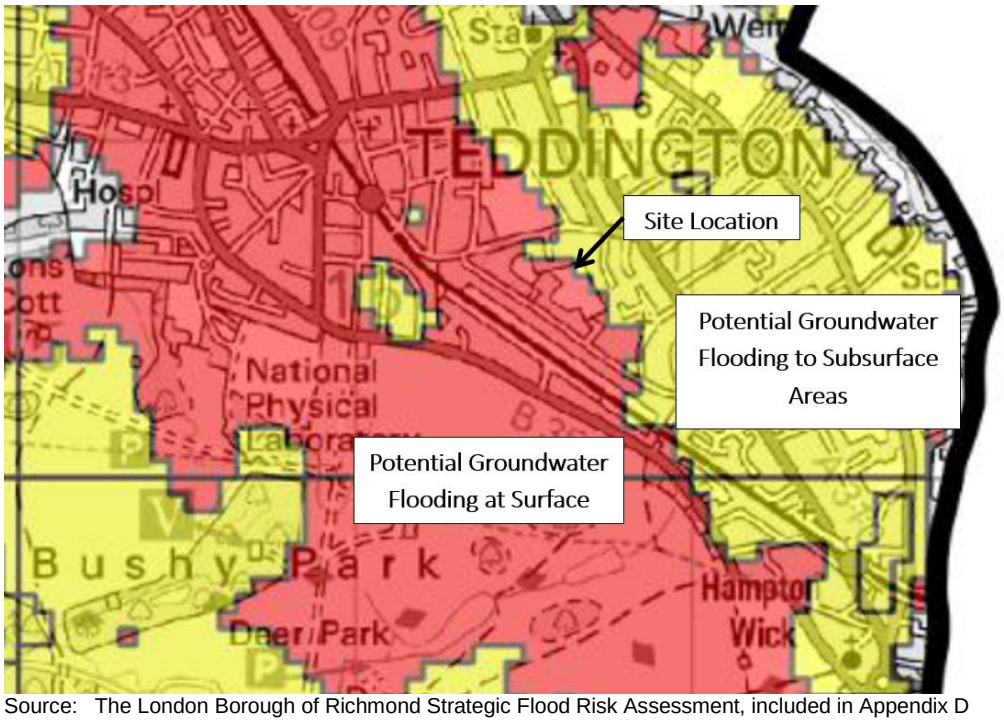
The surface water should be collected through the on-site sewer system. Following contact with the school, see Appendix B, they have identified issues with heavy rain causing ponding in the playgrounds on the site and surface water to back up within the on-site sewer system. They have also identified issues with the existing soakaway being too small for its current requirement and being blocked up with debris, limiting its effectiveness.

2.4 Groundwater Flood Risk

The LB of Richmond's LFRMS report includes a geological deposits map, see Appendix C, which identifies the area that the school is located on being within the Kempton Park Gravel Formation. As permeable ground conditions more easily allow the movement of groundwater this allows the mechanism that causes groundwater flooding to occur. The historical flooding record included in the LFRMS, included in Appendix D, identifies a number of groundwater flooding incidents near the school site including two on Fairfax Road adjacent to the site.

The SFRA includes a Susceptibility to Groundwater Flooding Map based on information from the British Geological Survey, included in Appendix E. Figure 2.3 shows a section of that map. The site is on the boundary between areas of groundwater flood risk at the surface and below ground level. Any below ground development should be avoided if possible. As groundwater flooding issues are highly localised a ground investigation should be conducted to confirm the type of soil and the ground water levels on the site to better inform the risks posed by ground water.

Figure 2.3: Susceptibility to Groundwater Flooding taken from the LB of Richmond SFRA



Source: The London Borough of Richmond Strategic Flood Risk Assessment, included in Appendix D

2.5 Tidal Flood Risk

The nearest section of the River Thames from the school site is approximately 800 meters north of the site and is the location of the Teddington Weir which is the formal end of the Thames Tidal Area. The LB of Richmond Local Flood Risk Management Strategy (LFRMS) states that upstream of the weir there is not judged to be any risk of tidal flooding. Downstream of the weir the existing Thames Tidal Defence system is estimated to provide protection for up to a 1 in 1000 (0.1%) tidal flooding event. The report judges the risk of tidal flooding to be residual for the borough. Therefore tidal flooding should not pose a significant risk to the school site.

2.6 Sewer Flood Risk

The LB of Richmond LFRMS does not class the area that the school is located in as a critical drainage area. The SWMP states that Thames Water Sewers are only designed for a 1 in 10 year or 1 in 15 year rainfall event.

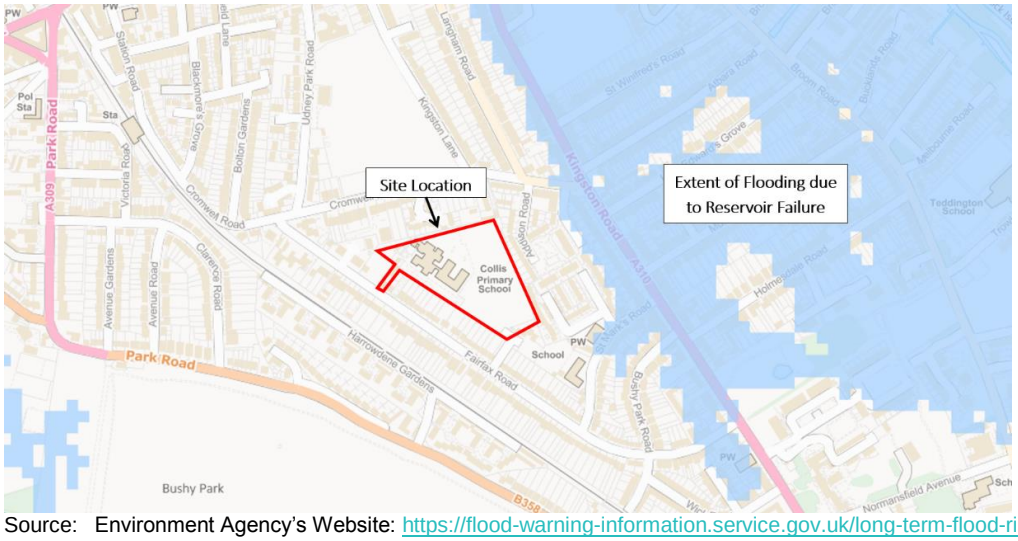
Following contact with the school, included in Appendix B, they have identified several issues with the existing surface water sewer system on site which has regular issues with becoming blocked and flooding from manholes. The foul sewers regularly become blocked with sections of the sewers requiring unblocking several times a year. The school have attributed these issues to the undersized capacity of the soakaway installed on the site and a shallow gradient and high surface roughness of the sewers on the site though this should be confirmed with a sewer inspection and survey.

2.7 Reservoir Flood Risk

There are several reservoirs located to the east of the site which store water from the River Thames and its tributaries. These reservoirs are operated by Thames Water and Affinity Water and are used to store water for use at water treatment works. The EA has produced a flood risk map, shown in Figure 2.4, to show the extent of flooding following a reservoir failure.

The map shows that the site is not at risk of flooding with the nearest area within the extent of flooding being approximately 150 meters to the east of the site. Both the EA and the SFRA stress the low probability of a reservoir failure.

Figure 2.4: Extent of Flooding Due to Reservoir Failure taken from the Environment Agency's Website



Source: Environment Agency's Website: https://flood-warning-information.service.gov.uk/long-term-flood-risk

3 Attenuation Requirements

The LB of Richmond states in the SFRA that "*Any discharge should be reduced to greenfield run-off rates wherever feasible.*" The Planning Guidance Document: Delivering SuDS in Richmond states that a greenfield runoff rate of 5l/s/ha should be used for areas with underlying gravel deposits. This report goes on to state that the attenuation system should contain a 1 in 100yr rainfall event plus climate change within the site.

Therefore attenuation will be designed for all rainfall events up to 100yr return period plus an appropriate climate change allowance which should be taken as 40% as required by the new Climate Change Allowance in the planning practice guidance for the NPPF. There are no further recommendations from documents produced by the LB of Richmond.

As there is currently a connection to the surface water sewer and the school has identified possible issues with the existing soakaways the attenuation will be designed for discharge into the TW sewer system.

From the redline boundary shown in Appendix A the total area of the site is approximately 3.11ha of which 1.24ha (40%) of the existing surfaces are impermeable. The information on the proposed option is currently limited to the design shown in Appendix A with the proposed block being located to the south of the existing buildings on the grass area. The new building takes up a smaller footprint (0.1ha) than the current building (0.17ha). It is assumed that the area currently used by the existing building will be changed to grass area to compensate for the grass area lost during the construction of the new block. The walkways around the existing building are assumed to be replaced by a similar area of paving surrounding the new block and linking the school buildings with the access road and gardens at the north of the site. It is therefore expected that there will be a small decrease in impermeable areas on the site due to the size difference between the old and new buildings (0.07ha).

The maximum allowable runoff from the site is taken as 5l/s/ha for 1 in 100 year storm events plus 40% climate change. The site is 3.11ha so the peak forward flow rate will be 15.6l/s. Due to the gentle topography of the site it is not expected that the green areas within the school area will contribute significant runoff. To limit the runoff rate to the required Greenfield rate for 1.17ha of impermeable surfaces 550m^3 of storage will be required. Despite the onsite surface water sewers being less than 1m below ground level (BGL), the TW Sewer Records show the public sewer in Fairfax Road is at 3m BGL so should allow the attenuation system to connect to the public sewer. The attenuation tank could be located either under the access road or the carpark and grass area to the south west of the school buildings. Given the large attenuation volume and the congestion in the west of the site the peak forward flow rate should be confirmed as early as possible with TW and the LB of Richmond.

The attenuation volume estimated in this assessment should be reviewed after the site layout is confirmed and the pass forward flow rate to the public sewer agreed with the water company. For this site, the control device can be in the form of a Hydrobrake or similar flow control device to limit the pass forward flow rate to 15.6l/s. Prior to adopting the above approach, further ground investigations and soakaway tests should be conducted to minimise surface water being discharged into the public surface water sewer.

4 Drainage

The site falls within the Thames Water (TW) administration boundary for sewer connection services. The site is currently developed and has existing connections and drainage in place for the existing buildings. The site is connected to the TW sewer system in Fairfax Road. The TW sewer records, shown in Appendix F, identify separate foul and surface water gravity sewers running in the roads surrounding the site. The Topography and Underground Services drawings included in Appendix G show a separated surface water and foul water sewers connecting the existing buildings on the site. The foul water sewer and part of the surface water sewer network discharge into their respective TW sewers in Fairfax Road. The foul water sewers serve the school buildings and cross under the buildings rather than run around the perimeter. Most of the foul sewers are gravity operated. However, there exists a pumping station (with a section of rising main) serving one of the school buildings. The site is generally flat and the sewers run at a shallow depth and small gradient.

There are four separate surface water sewers collecting surface water on the site, all of which are gravity operated. The surface water sewer which connects to the TW sewer collects surface water from the south west side of the main school buildings. According to the underground services drawing there are three soakaways located on the north side of the site, two located within the grass area, one under the playground. The proposal drawing only identifies one soakaway. Contact with the school has revealed a problem with a single soakaway so the location, condition and capacity of these soakaways should be further investigated.

The proposed building is located to the south of the existing site. It is likely that a gravity system will not be possible for a direct foul sewer connection to the TW sewer which also appears to be at a very shallow depth. Depending on the capacity of the existing pumping station, the foul outlets from the new development could be connected to the existing pumping station or to a new pumping station and riser main. New surface water drainage should be discharged through a soakaway if the ground condition is suitable. However, although soakaways are being used on site, the potential high groundwater level of the site may preclude them from operating effectively.

The topography of the site, shown in Appendix G, shows that the site is very flat with the entire site being within a 0.5 meter level range. Given that the school has identified existing issues with surface water pooling on the hard surfaces care should be taken to ensure that any new surfaces have a suitable gradient to avoid pooling.

Due to the issues with sewer flooding reported by the school, see Appendix B, in both the building which is due to be demolished and the newer building, any sewers which will be reused as part of the development should be inspected to confirm their condition and capacity. Given the drainage issues highlighted improvement works may need to be carried out to reduce the amount of sewer flooding experienced by the school.

The discharge of surface water into an infiltration device should be prioritised and a ground investigation should be carried out to determine the suitability of infiltration, if this is not possible and the TW sewer is used the SFRA requires that the developer *"provide evidence that capacity exists in the public sewerage network to serve their development."* Sewer capacity should also be checked with TW to ensure that with a potential increase in students and staff the capacity of the sewer system is sufficient.

5 Summary

The following summarise the key points identified in this broad overview:

1. The site falls within Flood Zone 1 – the area of lowest fluvial flood risk according to the EA website information.
2. The site has a large area surrounding the buildings which is classified as having low and medium risk of surface water flooding.
3. The site has been identified as being susceptible to groundwater flooding. It is recommended that a ground investigation be carried out to identify the soil type and groundwater level on the school site.
4. There are only minimal risks of flooding related to tidal and reservoir sources.
5. There have been a number of previous issues with the existing drainage system which cause sewer flooding of both foul and surface water on the site. The current drainage system should be studied further to identify the causes of the flooding and recommend measures that can be undertaken as part of the development to reduce the occurrences of sewer flooding.
6. The site has an area of 3.11ha so will require a site specific flood risk assessment.
7. An attenuation volume of 550m^3 will be required for this development in order to reduce the runoff rate to Greenfield runoff rate as required by the LB of Richmond SFRA.
8. The new drainage should continue to keep foul and surface water system separated; any reused sewers should be inspected to confirm their condition. The new development will most likely need a pump for the foul water sewer. The opportunity should be taken to ensure that the existing sewer network is still suitable for its requirements given the amount of flooding reported by the school.

6 Recommendations

Based on this broad overview, although the site specific flood risk assessment for the site can be carried out only when the details of the development are available, it would be prudent to investigate as early as possible into the existing surface water and foul water system due to the previous flooding issues caused by them. In particular, the foul water system would require a fundamental review of the current pumping arrangement and what improvement should be made in the future system to make it more efficient to build and operate.

A detailed ground investigation is recommended to establish the current ground conditions and the water table level onsite in order to better determine the groundwater flood risk. The infiltration rate of the ground should also be tested to determine whether the site is suitable for an infiltration device to discharge surface water.

The condition of the existing onsite sewer network which is expected to be reused should be confirmed through a CCTV investigation.

In view of the large attenuation volume required if the pass forward rate is to be limited to the Greenfield runoff rate, early consultation with both the LB of Richmond and TW is recommended to confirm the attenuation requirement and the surface water pass forward flow rate.

The capacity of the public sewers should be confirmed with TW once the final occupancy and proposed option is confirmed.

Appendices

A. Proposed Site Layout

B. Collis Primary School Flooding Response

C. Geology of Richmond Borough

D. Historical Flooding Events in Richmond Borough

E. Susceptibility to Groundwater Flooding in Richmond Borough

F. Thames Water Sewer Records

G. Topography and Underground Services drawings