# CHAPTER 13 – APPENDICES

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# Appendix 13.1: Flood Risk Assessment

# Flood Risk Assessment - Richmond upon Thames College Redevelopment

# Flood Risk Assessment - Richmond upon Thames College Redevelopment

## Prepared for

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**Report reference:** 62335R3, June 2015
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## APPENDICES

# 1 INTRODUCTION

## 1.1 Background

Richmond upon Thames College is situated at National Grid reference TQ 15384 73787 (nearest postal code TW2 7SJ) in Twickenham adjacent to the south side of Chertsey Road, in south west London. It is proposed to redevelop the college building with new college buildings, a secondary school, a school for children with special needs, a Tech Hub, residential buildings and sports ground. The junction between Chertsey Road and Langhorn Drive is also a part of the development. The redevelopment project is known as Richmond Education and Enterprise Campus (REEC) project.

## 1.2 Scope of work

Cascade Ltd. instructed ESI Ltd. (ESI) in February 2014 to prepare a Flood Risk Assessment (FRA) in support of a planning application for the Site. ESI is an independent environmental consultancy which specialises in hydrogeological and hydrological assessment.

The scope of work included the preparation of the FRA, following the guidance of the National Planning Policy Framework (NPPF) (DCLG, 2012), to satisfy both the Environment Agency and the LPA that all potential flood risks to and from the proposed development have been considered. The site boundary is taken from the illustrative plan SK-160.

The London Borough of Richmond upon Thames (LBRuT) local authority has indicated that a robust assessment of flood risks must be undertaken. The Level 1 Strategic Flood Risk Assessment of LBRuT was consulted. Reference is also made to the LBRuT's Site Allocation Plan (2014) to help inform the results of sequential and exception tests of the Site.

The Environment Agency required in their scoping opinion that the FRA should address all potential sources of flooding from the Site. Wherever possible, all proposed buildings should lie outside the fluvial 1 in 100 year storm event, plus allowance for climate change impact. If this is not possible, flood plain compensation will be required. Where required, the applicant must demonstrate a safe route of access and egress for any building located near or in the fluvial 1 in 100 chance in any year, plus allowance for climate change impact.

## 1.1 Data sources

The information presented in the report is predominantly based on secondary data analysis associated with both the Site itself and the surrounding land area. The main sources of data are summarised below.

- GroundSure Flood Report, 2014 (Appendix A)
- Site Location Plan (Drawing SK-120) provided by Cascade Ltd (Appendix B);
- Illustrative Masterplan (Drawing SK-160) provided by Cascade Ltd (Appendix B);
- Site Building Zones Parameter Plan (Drawing SK-124) provided by Cascade Ltd (Appendix B);
- Topographical Survey (2008) undertaken by 3 Sixty Measures (Appendix B);
- Environment Agency Modelled Flood Levels and Maps (Product 4) (Appendix C);
- Thames Water Sewer Flooding Enquiry (Appendix D)
- Ordnance Survey mapping;
- Site-specific rainfall data from the CEH Flood Estimation Handbook (NERC, 2009);

- British Geological Survey mapping for desk study of geology and ground condition;
- Soil types and permeability data from the National Soil Research Institute (NSRI, 2014).

### 1.2 Report limitations

It is noted that the findings presented in the report are largely based on information supplied by third parties, therefore no guarantee can be offered as to its validity.

This report excludes consideration of potential hazards arising from any activities within the Site other than normal use and occupancy for the intended land uses. Hazards associated with any other activities have not been assessed and must be subject to a specific risk assessment by the parties responsible for those activities.

### 1.3 Risk assessment approach

An assessment of flood risk has been undertaken in accordance with the NPPF (DCLG, 2012) and following the technical guidance available in Environment Agency (2014). Flood risk to and from the Site has been assessed and potential mitigation measures have been outlined.

# 2 SITE DESCRIPTION

## 2.1 Site setting and surrounding area

The current use of the Site is a built up educational campus, with surrounding residential areas. The college is located between Chertsey Road and Craneford Way. The eastern and western boundary of the college is limited by Marsh Farm Lane and Egerton Road respectively. The College playing field is also part of the development site. The River Crane flows to the south of the playing field.

The REEC campus consists of approximately 9 ha of land. The topography is relatively flat with an average elevation between 8.5 mAOD to the south and 9.0 mAOD to the north (3 Sixty Measurement, 2008).

## 2.2 Current Development (Baseline Phase)

The northern section is occupied by a sports hall with associated facilities, a grass sports pitch, and a car park in the north east corner. The central section is occupied by a collection of buildings housing the College's academic and workshop facilities. The northern section and the central section are divided by a private road which joins Langhorn Drive and subsequently Chertsey Road which is the main vehicle access route. The College playing fields are bounded to the south by the River Crane, to the north by Craneford Way (a public road), and to the east by private housing (

Figure **2.1**).

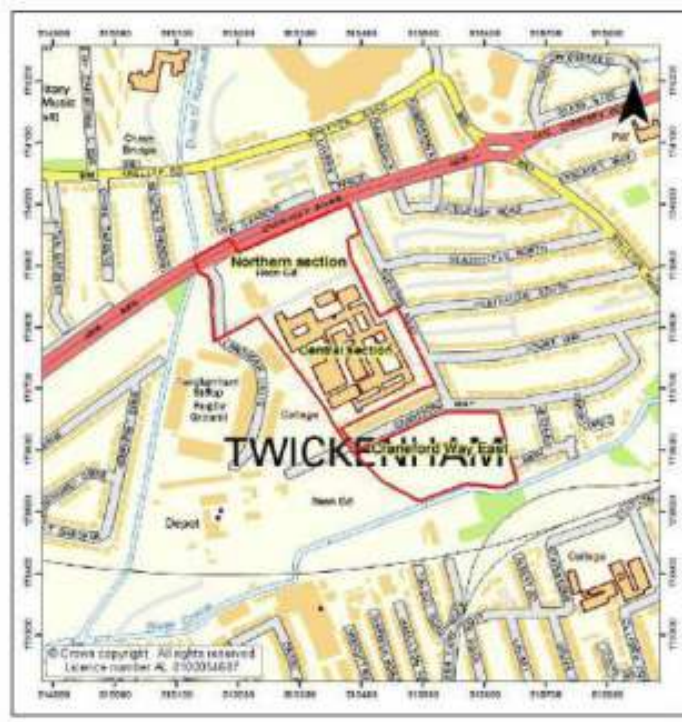


**Figure 2.1 Location Plan**

### 2.3 Proposed Development (Operational Phase)

The northern section will be redeveloped into new college buildings, a secondary school, a school for children with special needs, a Tech Hub, STEM centre and Sports centre. The road junction between Chertsey Road and Langhorn Drive will be modified to accommodate increased traffic after redevelopment.

The central section will be redeveloped into a residential area. The College playing fields to the south of Craneford Way will be improved with one all weather and one grass pitch. The Illustrative Masterplan for the Site is shown in Appendix B.

### 2.4 Geology

The underlying geology comprises London Clay (Clay and Silt). The superficial deposits comprise the Kempton Park Gravel Formation (sand and gravel).

### 2.5 Hydrology

#### 2.5.1 Rainfall

The Standard Average Annual Rainfall (SAAR) at the Site is 602 mm based on data for the period 1961 -1990 (NERC, 2008).

#### 2.5.2 Surface Water Features

The River Thames runs 1 km to the south east of the Site and is the main river the watercourses around the Site feed into. Existing watercourses are shown on the Site location map Figure 2.2. Adjacent to Craneford Way East on the south side, the River Crane runs in a man-made canal from west to east, before joining the River Thames further east at NGR TQ 16669 75383.

The Duke of Northumberland River is located west of the Site and flows from south to north towards the River Thames which is located c. 2 km to the east of the Site. It branches off from the River Crane 500 m south west of the Site and flows under Chertsey Road further downstream. A tributary to the River Crane appears at the ground surface, east of Twickenham stadium to the north east of the Site and flows west to east, to join the River Crane 1 km north east of the Site (Figure 2.2).

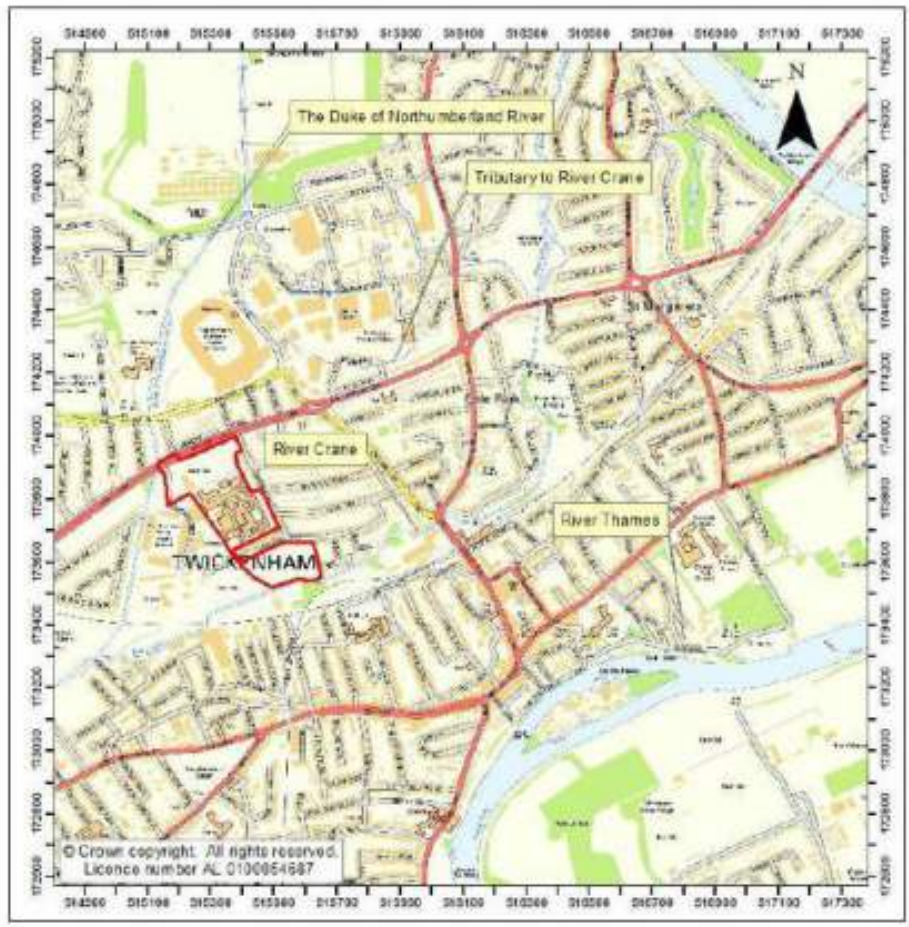


**Figure 2.2 Existing Drainage Features**

# 3 FLOOD RISK TO THE DEVELOPMENT SITE (BASELINE PHASE)

## 3.1 Historical Flooding

The River Thames has a considerable history of flooding with significant events (resulting in property flooding) occurring no less than nine times within the past 100 years (LBRuT, 2010). The most recent River Thames flood occurred in 2003 in which a number of areas to the west of London were severely affected, resulting in damage to homes and businesses within low lying Boroughs (including Spelthorne and Windsor & Maidenhead) along the Thames corridor. The River Crane catchment areas are much smaller than the Thames catchment, and they are subsequently 'flashier' systems that will respond to a rainfall event faster than the River Thames.

The Local Council is aware of localised flooding issues within 1.5 km of the Site at the following locations (LBRuT, 2010):

-Twickenham Bridge

-Twickenham dip

-Back gardens adjacent to the River Crane downstream of Chertsey Road

All of these events occurred further than 500m from the Site and no incidents have been reported on the Site itself. According to Groundsure (2014), no historical flooding has been recorded within 250m of the Site. However, the absence of data does not provide a definitive conclusion that the Site has never flooded, only that the Environment Agency hold no record of any flooding at the Site. Anecdotally, the Community Liaison Forum says that there has been flooding at the Site in the past.

## 3.2 River and Coastal Flooding

The majority of the Site (including the northern and central section) lies in Flood Zone 1 (Figure 3.1) which has lower than a 1 in 1000 year annual probability of flooding.

The southern half of the College playing field the south of Craneford Way is within Flood Zone 2 which has lower than a 1 in 100 year but higher than a 1 in 1000 year annual probability of flooding.

The SFRA (LBRuT, 2010) indicates that a large proportion of Twickenham, north of the railway line, is within Flood Zone 2 which has between a 1 in 100 and 1 in 1000 year probability of being affected by fluvial flooding from the River Crane and Duke of Northumberland's River.

There is a flood defence comprising a 1.5m high wall and lined channel on the River Crane south of the Site. The design standard of protection of the defence is 1 in 10 year. As the playing field south of Craneford Way is located on a relatively higher ground level to the flood defences, the chance of flooding is estimated to be less than 1 in 100 year based on the EA's flood indicative maps and the River Crane Mapping Study (Halcrow, 2008). .

The Duke of Northumberland's River has bank protection on both sides. The design standard of protection is 200 years. The defences along the River Crane and the Duke of Northumberland's River are presented in Figure 3.2.

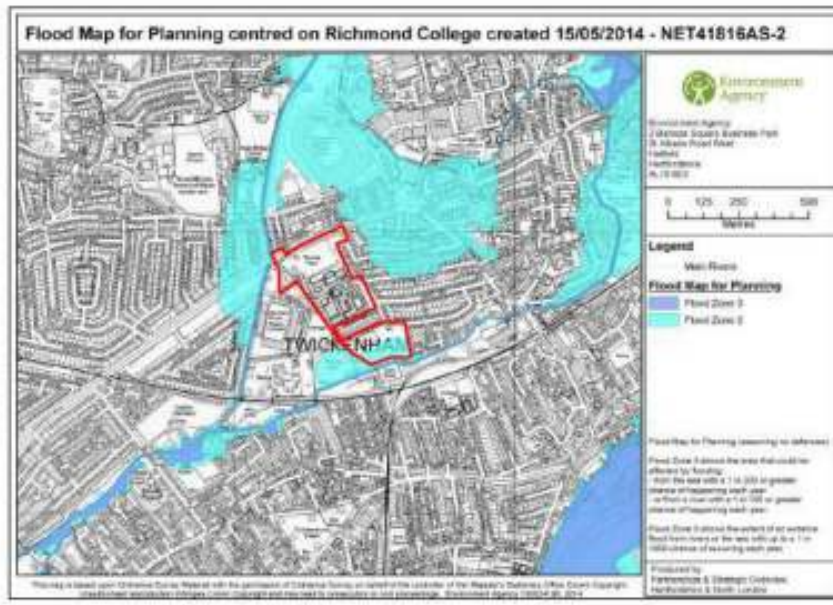


**Figure 3.1 Environment Agency River and Coastal Flood Zone map (EA, 2014)**

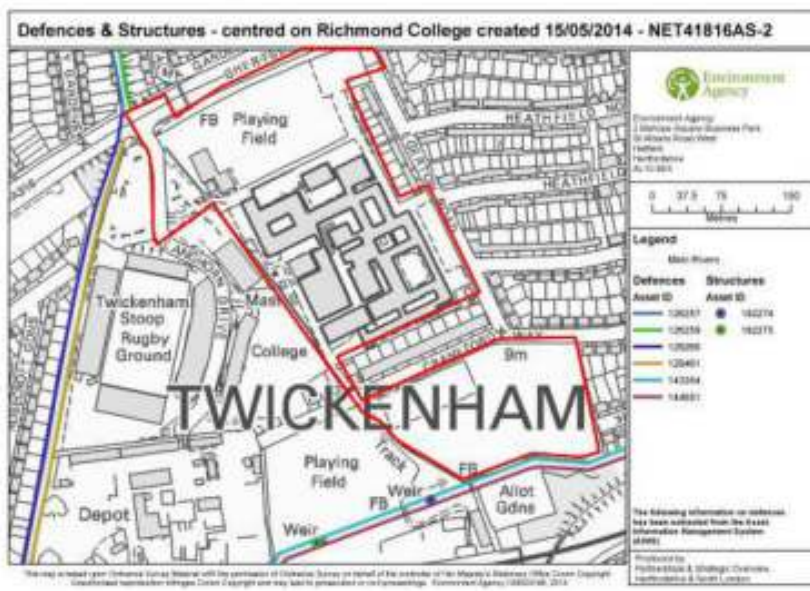


**Figure 3.2 Flood defences**

### 3.3 Surface Water Flooding

Surface water (pluvial) flooding is usually associated with extreme rainfall events but may also occur when rain falls on land that is already saturated or has a low permeability. In each case, the rainfall generates overland flow which can lead to flooding before the runoff is able to enter a sewer or watercourse. Overland flow can also generate 'ponding' in localised topographical depressions.

The risk of pluvial flooding has been assessed using results from the JBA surface water flooding map (Figure 3.3, taken from GroundSure, 2014) which shows a varied risk of pluvial flooding throughout the Site ranging from negligible to high.

The map shows some areas potentially at risk of surface water ponding for the modelled event. However JBA surface water modelling assumes a symbolic drainage and effectively maps overland flow over topography. JBA mapping is an indication that the risk of surface flooding may exist. A detailed modelling exercise will have to be undertaken to assess the real risk during the detailed design stage. Finished floor levels of REEC should be higher than the modelled surface water flood level.

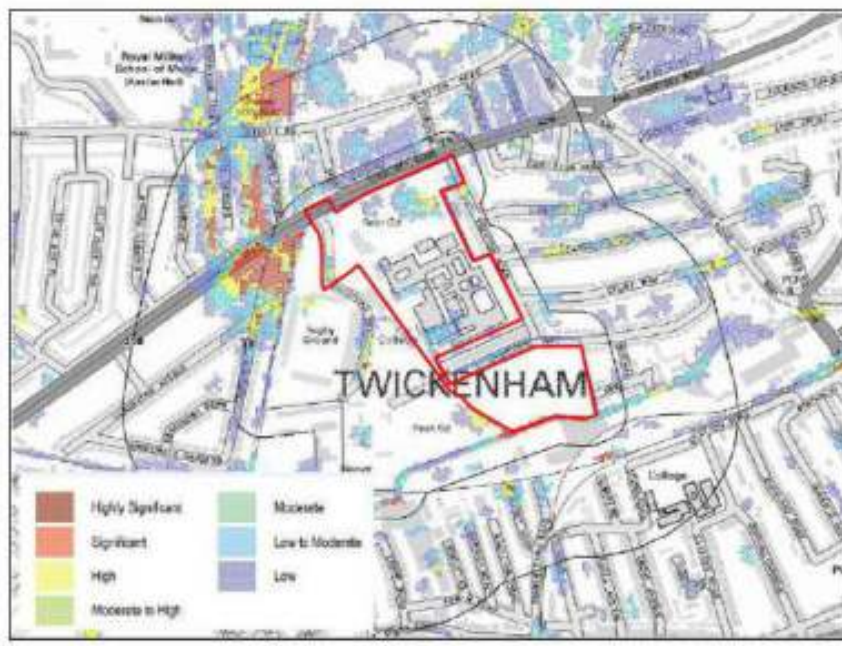


**Figure 3.3 Surface Water flood map**

The areas associated with the high pluvial flood risk are small and associated with small parts of the grass sports pitch in the northern section. This is believed to be caused by local depressions and locally impermeable soils. The remainder of the Site presents small patches of low to moderate pluvial risk associated with impermeable surfaces and poor drainage.

### 3.4 Groundwater Flooding

Groundwater flooding occurs when the water table rises above the ground surface. Geological mapping (www.bgs.co.uk) of this Site indicates that the bedrock geology

underlying the Site is the London Clay Formation which is not associated with groundwater flooding and has no aquifer designation. There are superficial deposits of Kempton Park Gravel Formation (sand and gravels) beneath the Site (BGS, 2014) and these are classified as a principal aquifer.

The British Geological Survey (BGS) susceptibility map identifies the Site as having "potential for groundwater flooding at surface" (GroundSure, 2014). However based on a risk assessment the site is considered at negligible risk of groundwater flooding according to the ESI groundwater flood risk map (ESI, 2014), for the 1 in 100 year event based on the map in Figure 3.4. Deep subterranean structures and basements would potentially be at risk of groundwater ingress. In relation to the groundwater flood risk, the ESI map is a National risk map (as used by LandMark) based on modelled groundwater levels and is our selected method for screening the Site. The other reports rely on a susceptibility to groundwater flooding, not risk and are considered to be overly conservative.

The sand and gravels below the Site are most likely in hydraulic continuity with the River Thames. The groundwater response, to a river flood event, could exceed the ground level in the vicinity of the river, even if river bank defences are not overtopped, however the impact is unlikely to extend beneath the main site.


**Figure 3.4 Groundwater Flood Risk Map (ESI, 2014)**

### 3.5 Sewer Flooding

The flooding records held by Thames Water indicate that there have been no incidents of flooding in the area as a result of surcharging public sewers (Thames Water, 2014).

### 3.6 Modelled Flood Level with Climate Change

A part of the College playing field south of Craneford Way is submerged for the 1 in 1000 year fluvial flood event (Figure 3.5). The River Crane Mapping Study (Halcrow, 2008) modelled the River Crane and the Duke of Northumberland's River. The flood levels at the following node labels presented in Table 3.1 are adjacent to the College playing field.

**Table 3.1 Modelled flood level in the River Crane**

| Node label | Easting | Northing | 100 yr +CC |
|---|---|---|---|
| C526 | 515584 | 173537 | 8.413 |
| C527 | 515506 | 173513 | 8.575 |
| C528 | 515504 | 173513 | 8.568 |

All the proposed buildings are located to the northern section of the Site and are outside the 1 in 100 year plus climate change flood extent. Therefore this satisfies the Environment Agency's requirement that all proposed buildings should lie outside the fluvial 1 in 100 year storm event, plus allowance for climate change impact.

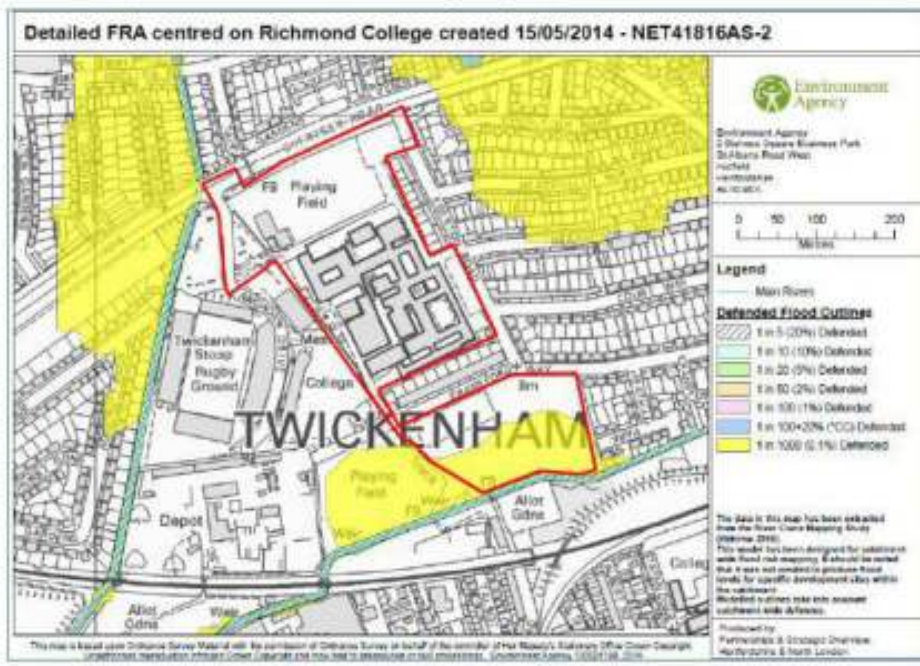


**Figure 3.5 The EA Modelled Flood Outline for Different Return Periods**

### 3.7 Geological Indicators of Past Flooding

Geological indicators of past flooding include superficial deposits which are susceptible to flooding, either from coastal inundation or fluvial (inland) water flow.

There are geological indicators of flooding within 250 m of the Site relating to the sand and gravel superficial deposits which are associated with riverine processes in the past 10,000 years (BGS, 2014).

### 3.8 Flooding in the Event of a Reservoir Failure

The Site is not located within an area identified as being at risk of flooding due to the event of a reservoir failure (Groundsure, 2014).

# 4 FLOOD RISK FROM THE DEVELOPMENT SITE

## 4.1 Flood Risk during Construction/Demolition Phase

Given the scale of the development, the current expectation is that the development construction programme would commence in 2016 in a phased manner over a 4 year period. For the purposes of the ES, the year of completion and full operation of the development is therefore considered to be 2019. Whilst full details regarding the demolition and construction works are not yet finalised, general information about the likely timing of activities, are described in the Environmental Statement (Cascade, 2015).

Flood risk during construction is likely to differ from the long term condition, as there will be changes in hardstanding on the Site. The construction area of each construction phase and runoff generated is outlined in the drainage assessment report (ESI, 2015). There will be no stockpiling of materials within the identified 100 year return period floodplain during the demolition and construction process.

A strategy to manage the surface water run-off during the construction phase is described in the drainage assessment report (ESI, 2015). Run-off with high loading of suspended solids should be prevented from leaving the Site and entering the surrounding water bodies. This would have a detrimental effect on the local ecology of the water bodies.

Sustainable Drainage System (SuDS) will be required for the development as part of the planning process. It is proposed to install these water management systems at an early stage in the construction process. Care should be taken to protect any SuDS features for long term operation and in particular from being compromised by demolition and construction activities. For example, locations identified for soakaways at conceptual/outline drainage design stage, should not be used as drive ways for lorries during demolition/construction as the loading from the lorries will alter the underlying soil structure and permeability.

In general, it is assumed that works will take place in accordance with standard best practice to prevent impact on water quality associated with any significant rainfall event.

The REEC development scheme will not have plant located below ground or basement or underground parking. Based on the available information at the outline/planning stage, it is reasonable to assume dewatering is not required. At detailed design stage, if the depth of foundation is greater than the maximum groundwater table, dewatering will be required. In that case, a detailed infiltration tests and ground condition is required to undertake estimation of dewatering volume during construction. Provisions should be made to manage this potential issue in line with standard industry practice for construction in saturated ground.

## 4.2 Flood Risk during Operational Phase

The development of a conceptual site drainage plan at an early stage is required to inform operation of the Site. A sustainable drainage strategy (ESI, 2015) has been developed for operational phase. The proposed drainage scheme assessed the existing drainage of the Site as well as the new SuDS techniques according to the DM SD 7 surface water drainage policy (LBRuT, 2011) and the London Plan. The surface run-off from the proposed development is estimated for return period of 1 in 10 year, 1 in 30 year and 1 in 100 year plus climate change rainfall event. A range of suitable drainage techniques are recommended (green roofs, permeable pavement, soakaways and flood storage area). In the operational phase, the Site is designed to manage surface runoff for a 1 in 100 years plus climate change rainfall event with no discharge to surface watercourses.

A site wide Utility Statement was undertaken by Atkins in May 2014 (Atkins, 2015). The report confirms presence of a soakaway system for draining the current site. The report also suggests a gravity connection to a combined Thames Water manhole MH 5703, serving the eastern portion of the site. However the connections are thought to be blocked and this assumption may need to be verified.

It has therefore been assumed that the current site is successfully drained by soakaway. It is possible that the current soakaways are not adequate to fully drain the Site in extreme rainfall conditions but there is no evidence of flooding occurring on the Site as a consequence, or of informal discharges from the Site into adjacent watercourses during extreme rainfall.

A similar system of soakaways with additional SuDS features should thus be sufficient to attenuate the runoff from the proposed development without a discharge to surface watercourses. Details are described in the sustainable drainage assessment report.

# 5 SUITABILITY OF THE PROPOSED DEVELOPMENT

## 5.1 Sequential Tests

Based on the classification of the NPPF, (DCLG, 2012), the proposed development falls into various flood risk vulnerability classifications (Table 2 of NPPF, (DCLG, 2012)). The residential, college and school buildings are classified as more vulnerable infrastructure. The Tech Hub is a less vulnerable and the College playing field is a water compatible infrastructure. The Sequential Test (DCLG, 2014) identifies that development should be directed to areas with the lowest probability of flooding. According to Site Allocation Plan (LBRuT, 2014), the development has passed the sequential test, however this was based on an old Site boundary different from the current one (Figure 5.1) which was solely in Flood Zone 1. The new Site has now been extended to include the College playing fields on Craneford Way East which is within Flood Zone 2. The Site would need to be reconsidered for a sequential test with the current Site boundary. The development on Craneford Way East would consist of outdoor sports and recreation facilities which is 'water compatible development' (Table 2 of NPPF (DCLG, 2014)) so the development is still expected to pass the sequential test.

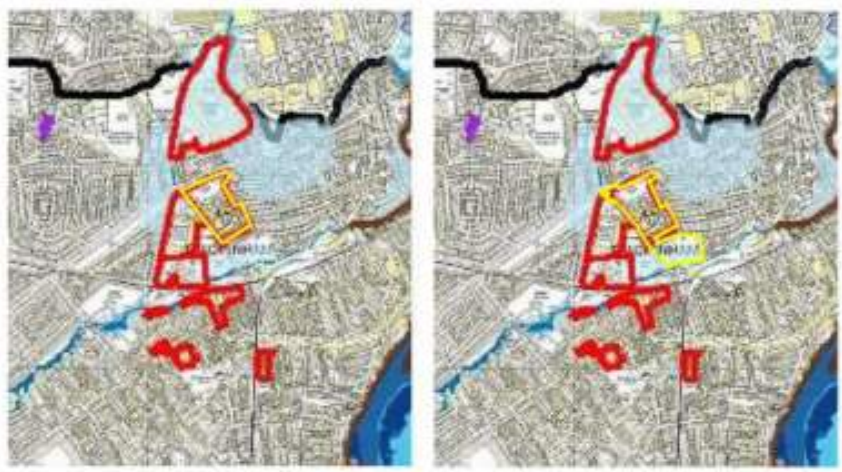

**Figure 5.1 Comparison of the New Site Boundary (Right) with the Old Site Boundary (Left) (LBRuT, 2014)**

## 5.2 Exception Test

Assuming the sequential test is passed the flood risk vulnerability and flood zone 'compatibility' guidance in Table 3 of NPPF (DCLG (2014)) indicates an exception test (see glossary) is not required and the development is considered to be appropriate for this Site (Table 5.1)

**Table 5.1 Flood risk vulnerability and flood zone compatibility**

| Flood risk vulnerability classification | | Essential infrastructure | Water compatible | Highly vulnerable | More vulnerable | Less vulnerable |
|---|---|---|---|---|---|---|
| Flood Zone | Zone 1 | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Zone 2 | ✓ | ✓ | Exception Test required | ✓ | ✓ |
| | Zone 3a | Exception Test required | ✓ | x | Exception Test required | ✓ |
| | Zone 3b functional floodplain | Exception Test required | ✓ | x | x | x |

✓ Development is appropriate.

**x** Development should not be permitted.

Data source: National Planning Policy Framework (NPPF) Technical Guidance, 2014.

# 6 POTENTIAL MITIGATION

The flood mitigation measures would be considered for REEC for different phases as presented in Table 6.1 (baseline, construction and operation).

## 6.1 Safe Access and Egress

The Environment Agency states in their scoping opinion that wherever possible, all proposed buildings should lie outside the fluvial 1 in 100 year storm event, plus allowance for climate change flood extent. If this is not possible, flood plain compensation and demonstration of a safe route of access and egress will be required.

All the proposed buildings are located outside the 1 in 100 year plus climate change flood extent as discussed in section 3.6. The College playing field lies in Flood Zone 2. Since the site is not located and surrounded by the 1 in 100 year plus climate change flood extent, a flood plain compensation and safe route of access and egress plan is not required.

Though the College playing field lies in Flood Zone 2, it is considered a water compatible structure and will provide flood storage to attenuate excess runoff (ESI, 2015). Therefore it may provide additional flood storage benefit.

**Table 6.1 Potential Receptors, Impact and Flood Mitigation Measures**

| Potential Sensitive Receptors | Potential Impact | Potential Effect | | Potential Mitigation Measures |
|---|---|---|---|---|
| | | Scoped In (requires further consideration) | Scoped Out (requires no further consideration) | |
| Rivers and ecology | Silty water (all phases) | ✓ | | SuDS features. |
| Basement/underground structures | Groundwater flooding (all phases) | | ✓ | N/A |
| Playing fields | Fluvial flooding (all phases) | ✓ | | No mitigation is required. |
| Entire Site | Sewer flooding | ✓ | | Extensive usage of SuDS to reduce future potential. |
| Entire Site | Reservoir flooding | | ✓ | N/A |
| Entire Site | Surface water flooding | ✓ | | Appropriate landscaping and use of SuDS |
| Off-site receptors | Flood risk from the proposed development | ✓ | | Design and implementation of a comprehensive SuDS drainage strategy. |
| Chertsey Road Junction (site entrance) | Fluvial flooding | | ✓ | N/A |
| Future operational soakaways SuDS components | Reduce soil infiltration capacity (construction and demolition) | ✓ | | Make sure heavy machinery is directed away from such receptors. |
| Site drainage and SuDS | Silty water (all phases) | ✓ | | Protect the SuDS from sedimentation. |

# 7 CONCLUSION

It is proposed to re-develop Richmond College in London to a new college building, a secondary school, a school for children with special needs, a Tech Hub and sports grounds, with enabling residential development. The junction connecting Chertsey Road and Langhorn Drive is also a part of the new development. The Site area is c. 9 ha and is currently used for educational purposes.

The majority of the Site, and the area where all new buildings will be located, lies in Flood Zone 1 which has less than 1 in 1000 year annual probability of flooding. A part of the College playing field to the south of the Site lies in Flood Zone 2 which has annual probability of flooding between 1 in 1000 and 1 in 100 year.

The site benefits from flood defences. There are formal defences on both bank of River Crane and The Duke of Northumberland's River.

The River Thames flows approximately 1 km to the south of the Site and it has a considerable history of flooding with significant events (resulting in property flooding) in 2003. However no historical flooding has been recorded within 250m of the Site.

The Site has low to high risk of surface water flooding in different areas according to the JBA surface water flooding map. Groundwater flood risk is negligible at the Site according to the ESI groundwater flood risk map.

Reference is made to the LBRuT's Site Allocation Plan (2014) to help inform the results of sequential and exception tests of the Site. The northern section of the proposed site has passed the sequential test as a part of LBRuT's Site Allocation Plan. The College playing field to the south of the development is a water compatible land use according to the NPPF (DCLG, 2014). Therefore no exception test would be required and the development is appropriate for this location, provided suitable mitigation measures are in place.

Flood risk to the potential receptors and suitable mitigation measures have been assessed. The flood risk from the proposed development during construction/demolition and operational phase has been assessed in a separate sustainable drainage assessment report (ESI, 2015). The report also presents surface runoff produced during a 1 in 100 year plus climate change event and drainage strategy to manage and attenuate the excess runoff without discharging to surface watercourses.

The Environment Agency's comments during scoping opinion have been addressed in the FRA. All proposed buildings lie outside the fluvial 1 in 100 year storm event, plus allowance for climate change impact. Therefore no flood plain compensation will be required and the requirement of a safe route of access and egress is not necessary for the proposed Site.

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# APPENDICES

# APPENDIX A

## Groundsure flood report

centremapslive.com
the mapping portal from Laser Surveys

| | |
|---|---|
| Report Reference: | CMAPS-CM-325206-28958-150514 |
| Your Reference: | 28958 |
| Report Date: | 15 May 2014 |
| Report Delivery Method: | **Email - pdf** |
| Client Email: | andy@centremaps.com |

## GroundSure Floodview

**Address: RICHMOND-UPON-THAMES COLLEGE,EGERTON ROAD,ST MARGARETS AND NORTH TWICKENHAM,TWICKENHAM, TW2 7SJ**

Dear Sir/Madam,

Thank you for placing your order with CENTREMAPS. Please find enclosed the GroundSure Floodview report as requested.

If you need any further assistance, please do not hesitate to contact our helpline on 01886 832972 quoting the above CENTREMAPS reference number.

Yours faithfully,

CENTREMAPS

Enc.
GroundSure Floodview

# CHAPTER 13 – APPENDICES

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# Appendix 13.1: Flood Risk Assessment

# Flood Risk Assessment - Richmond upon Thames College Redevelopment

# Flood Risk Assessment - Richmond upon Thames College Redevelopment

## Prepared for

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**Report reference:** 62335R3, June 2015
**Report status:** FINAL

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# Flood Risk Assessment - Richmond upon Thames College Redevelopment

This report has been prepared by ESI Ltd. (ESI) in its professional capacity as soil and water specialists, with reasonable skill, care and diligence within the agreed scope and terms of contract and taking account of the manpower and resources devoted to it by agreement with its client, and is provided by ESI solely for the internal use of its client.

The advice and opinions in this report should be read and relied on only in the context of the report as a whole, taking account of the terms of reference agreed with the client. The findings are based on the information made available to ESI at the date of the report (and will have been assumed to be correct) and on current UK standards, codes, technology and practices as at that time. They do not purport to include any manner of legal advice or opinion. New information or changes in conditions and regulatory requirements may occur in future, which will change the conclusions presented here.

This report is confidential to the client. The client may submit the report to regulatory bodies, where appropriate. Should the client wish to release this report to any other third party for that party's reliance, ESI may, by prior written agreement, agree to such release, provided that it is acknowledged that ESI accepts no responsibility of any nature to any third party to whom this report or any part thereof is made known. ESI accepts no responsibility for any loss or damage incurred as a result, and the third party does not acquire any rights whatsoever, contractual or otherwise, against ESI except as expressly agreed with ESI in writing.

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**62335R3. FINAL**

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| Reviewed by | Paul Ellis | [redacted] |

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| Issue | Report ref | Comment | Author | Checker | Reviewer | Issue date | Issued to |
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| 3 | 62335R3 | Final | PXG | BS | PAE | 11/06/2015 | Cascade Consulting |
| 4 | | | | | | | |

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## APPENDICES

# 1 INTRODUCTION

## 1.1 Background

Richmond upon Thames College is situated at National Grid reference TQ 15384 73787 (nearest postal code TW2 7SJ) in Twickenham adjacent to the south side of Chertsey Road, in south west London. It is proposed to redevelop the college building with new college buildings, a secondary school, a school for children with special needs, a Tech Hub, residential buildings and sports ground. The junction between Chertsey Road and Langhorn Drive is also a part of the development. The redevelopment project is known as Richmond Education and Enterprise Campus (REEC) project.

## 1.2 Scope of work

Cascade Ltd. instructed ESI Ltd. (ESI) in February 2014 to prepare a Flood Risk Assessment (FRA) in support of a planning application for the Site. ESI is an independent environmental consultancy which specialises in hydrogeological and hydrological assessment.

The scope of work included the preparation of the FRA, following the guidance of the National Planning Policy Framework (NPPF) (DCLG, 2012), to satisfy both the Environment Agency and the LPA that all potential flood risks to and from the proposed development have been considered. The site boundary is taken from the illustrative plan SK-160.

The London Borough of Richmond upon Thames (LBRuT) local authority has indicated that a robust assessment of flood risks must be undertaken. The Level 1 Strategic Flood Risk Assessment of LBRuT was consulted. Reference is also made to the LBRuT's Site Allocation Plan (2014) to help inform the results of sequential and exception tests of the Site.

The Environment Agency required in their scoping opinion that the FRA should address all potential sources of flooding from the Site. Wherever possible, all proposed buildings should lie outside the fluvial 1 in 100 year storm event, plus allowance for climate change impact. If this is not possible, flood plain compensation will be required. Where required, the applicant must demonstrate a safe route of access and egress for any building located near or in the fluvial 1 in 100 chance in any year, plus allowance for climate change impact.

## 1.1 Data sources

The information presented in the report is predominantly based on secondary data analysis associated with both the Site itself and the surrounding land area. The main sources of data are summarised below.

- GroundSure Flood Report, 2014 (Appendix A)
- Site Location Plan (Drawing SK-120) provided by Cascade Ltd (Appendix B);
- Illustrative Masterplan (Drawing SK-160) provided by Cascade Ltd (Appendix B);
- Site Building Zones Parameter Plan (Drawing SK-124) provided by Cascade Ltd (Appendix B);
- Topographical Survey (2008) undertaken by 3 Sixty Measures (Appendix B);
- Environment Agency Modelled Flood Levels and Maps (Product 4) (Appendix C);
- Thames Water Sewer Flooding Enquiry (Appendix D)
- Ordnance Survey mapping;
- Site-specific rainfall data from the CEH Flood Estimation Handbook (NERC, 2009);

- British Geological Survey mapping for desk study of geology and ground condition;
- Soil types and permeability data from the National Soil Research Institute (NSRI, 2014).

### 1.2 Report limitations

It is noted that the findings presented in the report are largely based on information supplied by third parties, therefore no guarantee can be offered as to its validity.

This report excludes consideration of potential hazards arising from any activities within the Site other than normal use and occupancy for the intended land uses. Hazards associated with any other activities have not been assessed and must be subject to a specific risk assessment by the parties responsible for those activities.

### 1.3 Risk assessment approach

An assessment of flood risk has been undertaken in accordance with the NPPF (DCLG, 2012) and following the technical guidance available in Environment Agency (2014). Flood risk to and from the Site has been assessed and potential mitigation measures have been outlined.

# 2 SITE DESCRIPTION

## 2.1 Site setting and surrounding area

The current use of the Site is a built up educational campus, with surrounding residential areas. The college is located between Chertsey Road and Craneford Way. The eastern and western boundary of the college is limited by Marsh Farm Lane and Egerton Road respectively. The College playing field is also part of the development site. The River Crane flows to the south of the playing field.

The REEC campus consists of approximately 9 ha of land. The topography is relatively flat with an average elevation between 8.5 mAOD to the south and 9.0 mAOD to the north (3 Sixty Measurement, 2008).

## 2.2 Current Development (Baseline Phase)

The northern section is occupied by a sports hall with associated facilities, a grass sports pitch, and a car park in the north east corner. The central section is occupied by a collection of buildings housing the College's academic and workshop facilities. The northern section and the central section are divided by a private road which joins Langhorn Drive and subsequently Chertsey Road which is the main vehicle access route. The College playing fields are bounded to the south by the River Crane, to the north by Craneford Way (a public road), and to the east by private housing (

Figure **2.1**).

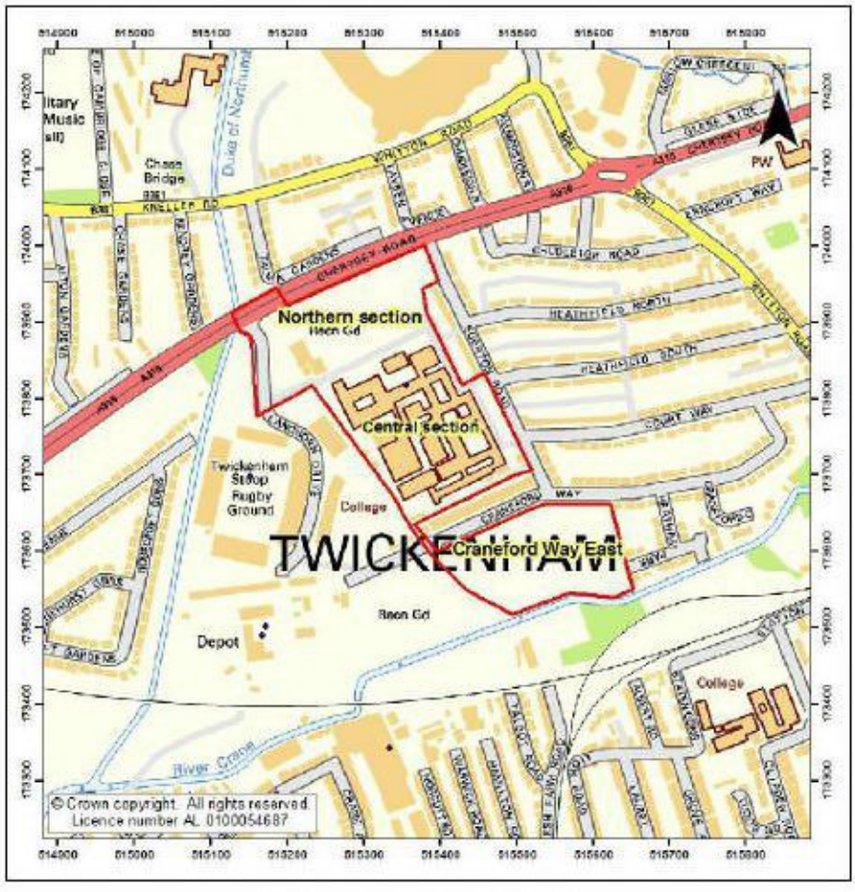


**Figure 2.1 Location Plan**

### 2.3 Proposed Development (Operational Phase)

The northern section will be redeveloped into new college buildings, a secondary school, a school for children with special needs, a Tech Hub, STEM centre and Sports centre. The road junction between Chertsey Road and Langhorn Drive will be modified to accommodate increased traffic after redevelopment.

The central section will be redeveloped into a residential area. The College playing fields to the south of Craneford Way will be improved with one all weather and one grass pitch. The Illustrative Masterplan for the Site is shown in Appendix B.

### 2.4 Geology

The underlying geology comprises London Clay (Clay and Silt). The superficial deposits comprise the Kempton Park Gravel Formation (sand and gravel).

### 2.5 Hydrology

#### 2.5.1 Rainfall

The Standard Average Annual Rainfall (SAAR) at the Site is 602 mm based on data for the period 1961 -1990 (NERC, 2008).

#### 2.5.2 Surface Water Features

The River Thames runs 1 km to the south east of the Site and is the main river the watercourses around the Site feed into. Existing watercourses are shown on the Site location map Figure 2.2. Adjacent to Craneford Way East on the south side, the River Crane runs in a man-made canal from west to east, before joining the River Thames further east at NGR TQ 16669 75383.

The Duke of Northumberland River is located west of the Site and flows from south to north towards the River Thames which is located c. 2 km to the east of the Site. It branches off from the River Crane 500 m south west of the Site and flows under Chertsey Road further downstream. A tributary to the River Crane appears at the ground surface, east of Twickenham stadium to the north east of the Site and flows west to east, to join the River Crane 1 km north east of the Site (Figure 2.2).

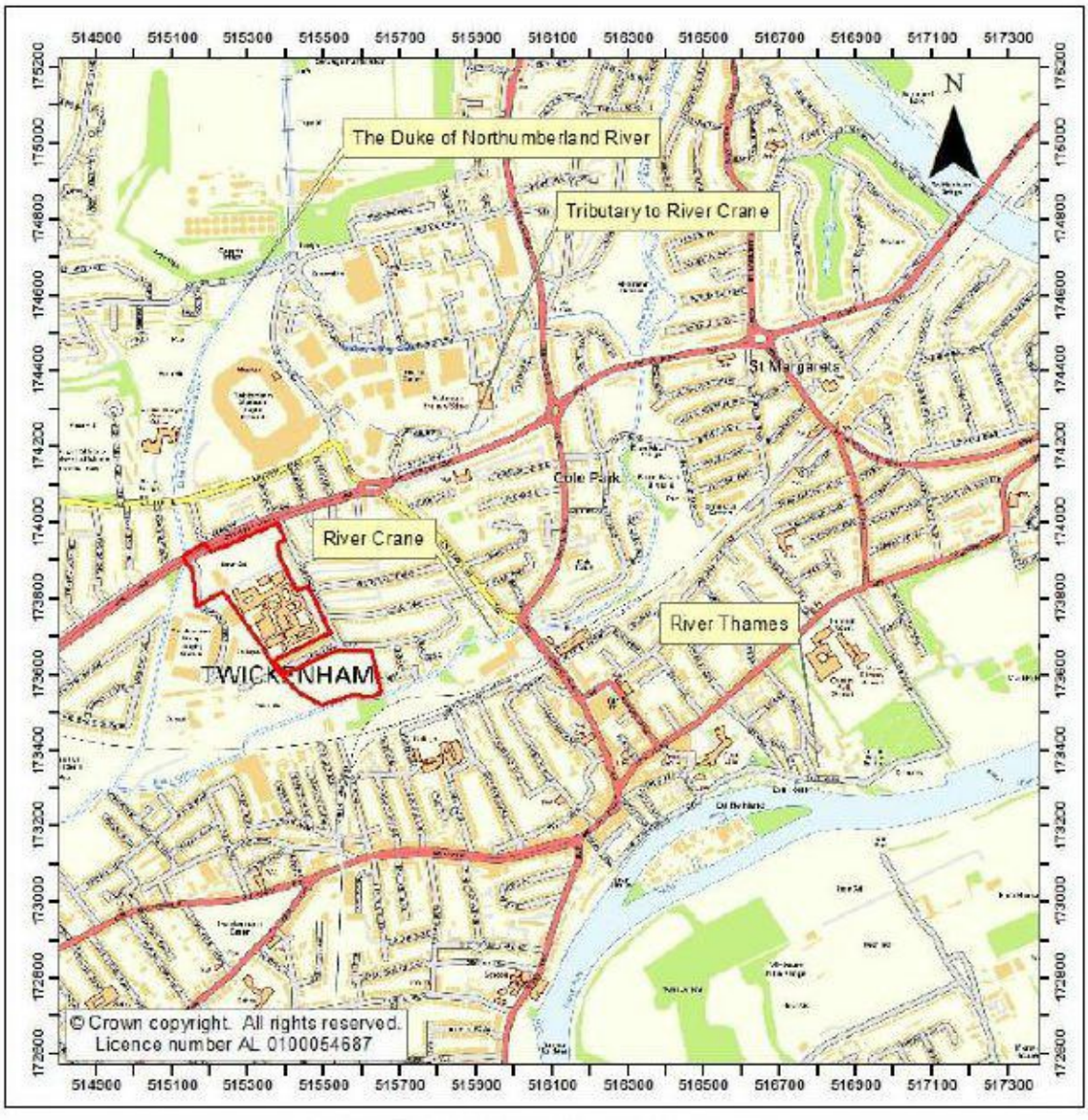


**Figure 2.2 Existing Drainage Features**

# 3 FLOOD RISK TO THE DEVELOPMENT SITE (BASELINE PHASE)

## 3.1 Historical Flooding

The River Thames has a considerable history of flooding with significant events (resulting in property flooding) occurring no less than nine times within the past 100 years (LBRuT, 2010). The most recent River Thames flood occurred in 2003 in which a number of areas to the west of London were severely affected, resulting in damage to homes and businesses within low lying Boroughs (including Spelthorne and Windsor & Maidenhead) along the Thames corridor. The River Crane catchment areas are much smaller than the Thames catchment, and they are subsequently 'flashier' systems that will respond to a rainfall event faster than the River Thames.

The Local Council is aware of localised flooding issues within 1.5 km of the Site at the following locations (LBRuT, 2010):

-Twickenham Bridge

-Twickenham dip

-Back gardens adjacent to the River Crane downstream of Chertsey Road

All of these events occurred further than 500m from the Site and no incidents have been reported on the Site itself. According to Groundsure (2014), no historical flooding has been recorded within 250m of the Site. However, the absence of data does not provide a definitive conclusion that the Site has never flooded, only that the Environment Agency hold no record of any flooding at the Site. Anecdotally, the Community Liaison Forum says that there has been flooding at the Site in the past.

## 3.2 River and Coastal Flooding

The majority of the Site (including the northern and central section) lies in Flood Zone 1 (Figure 3.1) which has lower than a 1 in 1000 year annual probability of flooding.

The southern half of the College playing field the south of Craneford Way is within Flood Zone 2 which has lower than a 1 in 100 year but higher than a 1 in 1000 year annual probability of flooding.

The SFRA (LBRuT, 2010) indicates that a large proportion of Twickenham, north of the railway line, is within Flood Zone 2 which has between a 1 in 100 and 1 in 1000 year probability of being affected by fluvial flooding from the River Crane and Duke of Northumberland's River.

There is a flood defence comprising a 1.5m high wall and lined channel on the River Crane south of the Site. The design standard of protection of the defence is 1 in 10 year. As the playing field south of Craneford Way is located on a relatively higher ground level to the flood defences, the chance of flooding is estimated to be less than 1 in 100 year based on the EA's flood indicative maps and the River Crane Mapping Study (Halcrow, 2008). .

The Duke of Northumberland's River has bank protection on both sides. The design standard of protection is 200 years. The defences along the River Crane and the Duke of Northumberland's River are presented in Figure 3.2.

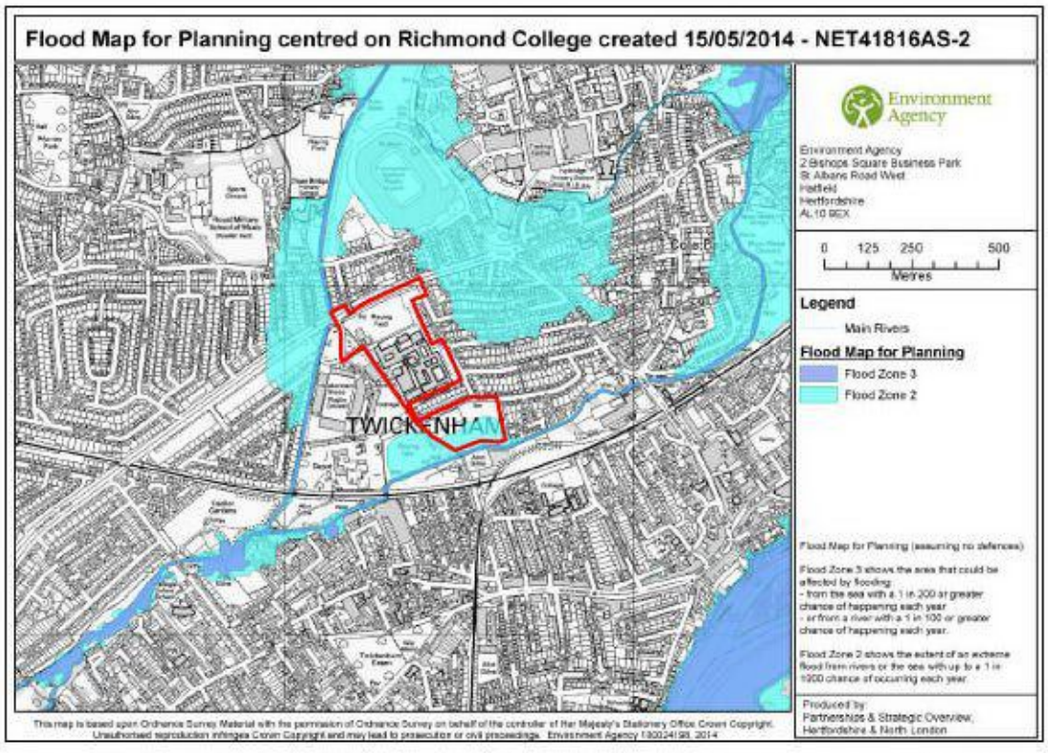


**Figure 3.1 Environment Agency River and Coastal Flood Zone map (EA, 2014)**

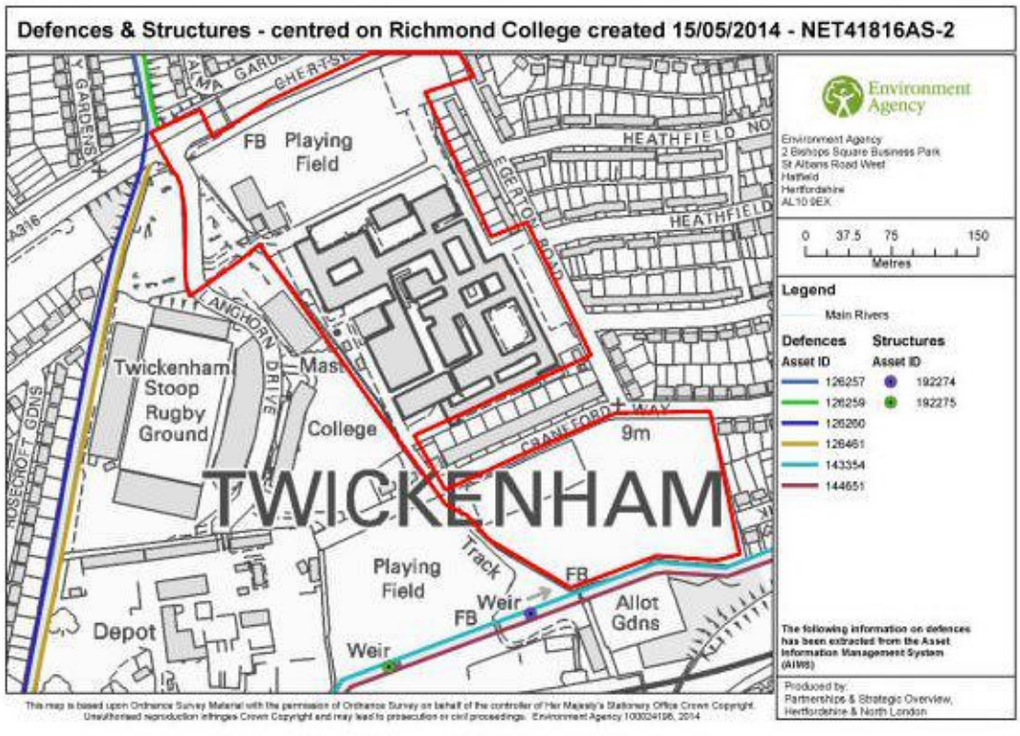


**Figure 3.2 Flood defences**

### 3.3 Surface Water Flooding

Surface water (pluvial) flooding is usually associated with extreme rainfall events but may also occur when rain falls on land that is already saturated or has a low permeability. In each case, the rainfall generates overland flow which can lead to flooding before the runoff is able to enter a sewer or watercourse. Overland flow can also generate 'ponding' in localised topographical depressions.

The risk of pluvial flooding has been assessed using results from the JBA surface water flooding map (Figure 3.3, taken from GroundSure, 2014) which shows a varied risk of pluvial flooding throughout the Site ranging from negligible to high.

The map shows some areas potentially at risk of surface water ponding for the modelled event. However JBA surface water modelling assumes a symbolic drainage and effectively maps overland flow over topography. JBA mapping is an indication that the risk of surface flooding may exist. A detailed modelling exercise will have to be undertaken to assess the real risk during the detailed design stage. Finished floor levels of REEC should be higher than the modelled surface water flood level.

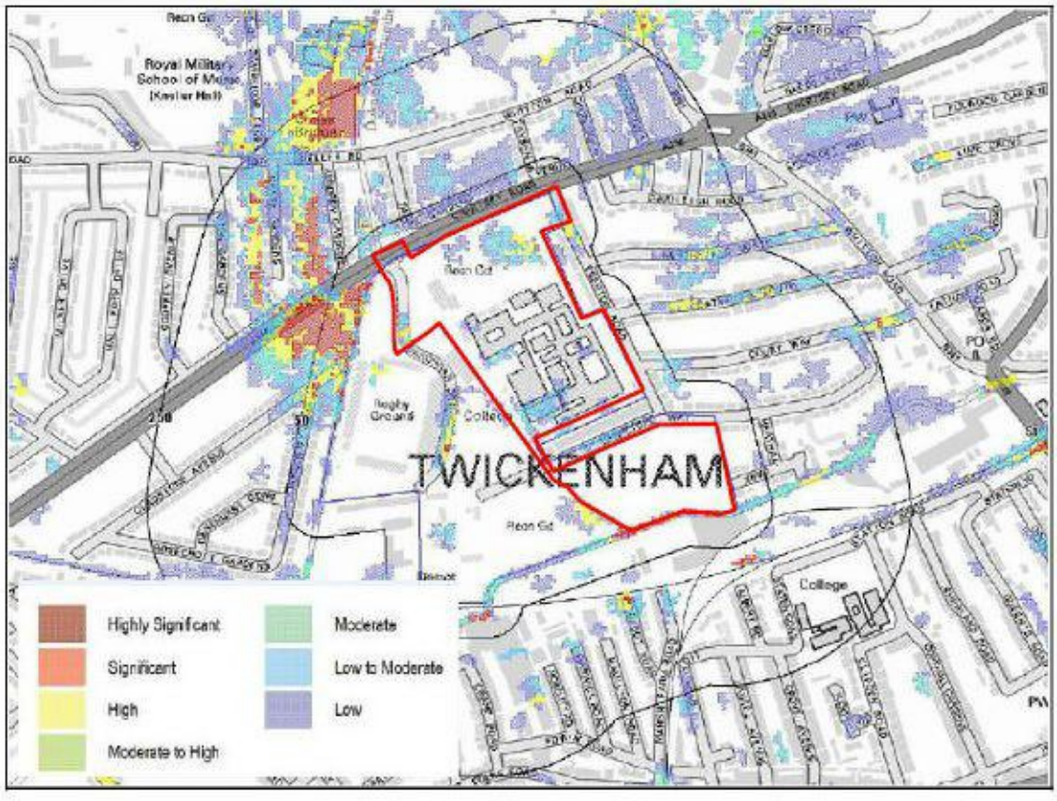


**Figure 3.3 Surface Water flood map**

The areas associated with the high pluvial flood risk are small and associated with small parts of the grass sports pitch in the northern section. This is believed to be caused by local depressions and locally impermeable soils. The remainder of the Site presents small patches of low to moderate pluvial risk associated with impermeable surfaces and poor drainage.

### 3.4 Groundwater Flooding

Groundwater flooding occurs when the water table rises above the ground surface. Geological mapping (www.bgs.co.uk) of this Site indicates that the bedrock geology

underlying the Site is the London Clay Formation which is not associated with groundwater flooding and has no aquifer designation. There are superficial deposits of Kempton Park Gravel Formation (sand and gravels) beneath the Site (BGS, 2014) and these are classified as a principal aquifer.

The British Geological Survey (BGS) susceptibility map identifies the Site as having "potential for groundwater flooding at surface" (GroundSure, 2014). However based on a risk assessment the site is considered at negligible risk of groundwater flooding according to the ESI groundwater flood risk map (ESI, 2014), for the 1 in 100 year event based on the map in Figure 3.4. Deep subterranean structures and basements would potentially be at risk of groundwater ingress. In relation to the groundwater flood risk, the ESI map is a National risk map (as used by LandMark) based on modelled groundwater levels and is our selected method for screening the Site. The other reports rely on a susceptibility to groundwater flooding, not risk and are considered to be overly conservative.

The sand and gravels below the Site are most likely in hydraulic continuity with the River Thames. The groundwater response, to a river flood event, could exceed the ground level in the vicinity of the river, even if river bank defences are not overtopped, however the impact is unlikely to extend beneath the main site.

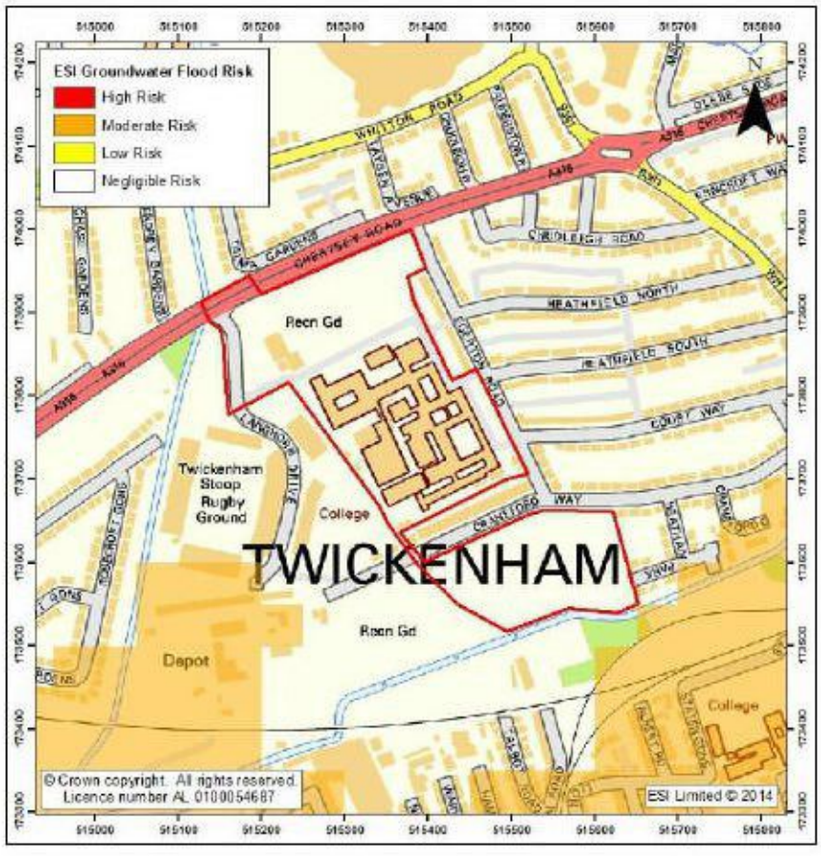


**Figure 3.4 Groundwater Flood Risk Map (ESI, 2014)**

## 3.5 Sewer Flooding

The flooding records held by Thames Water indicate that there have been no incidents of flooding in the area as a result of surcharging public sewers (Thames Water, 2014).

### 3.6 Modelled Flood Level with Climate Change

A part of the College playing field south of Craneford Way is submerged for the 1 in 1000 year fluvial flood event (Figure 3.5). The River Crane Mapping Study (Halcrow, 2008) modelled the River Crane and the Duke of Northumberland's River. The flood levels at the following node labels presented in Table 3.1 are adjacent to the College playing field.

**Table 3.1 Modelled flood level in the River Crane**

| Node label | Easting | Northing | 100 yr +CC |
|---|---|---|---|
| C526 | 515584 | 173537 | 8.413 |
| C527 | 515506 | 173513 | 8.575 |
| C528 | 515504 | 173513 | 8.568 |

All the proposed buildings are located to the northern section of the Site and are outside the 1 in 100 year plus climate change flood extent. Therefore this satisfies the Environment Agency's requirement that all proposed buildings should lie outside the fluvial 1 in 100 year storm event, plus allowance for climate change impact.

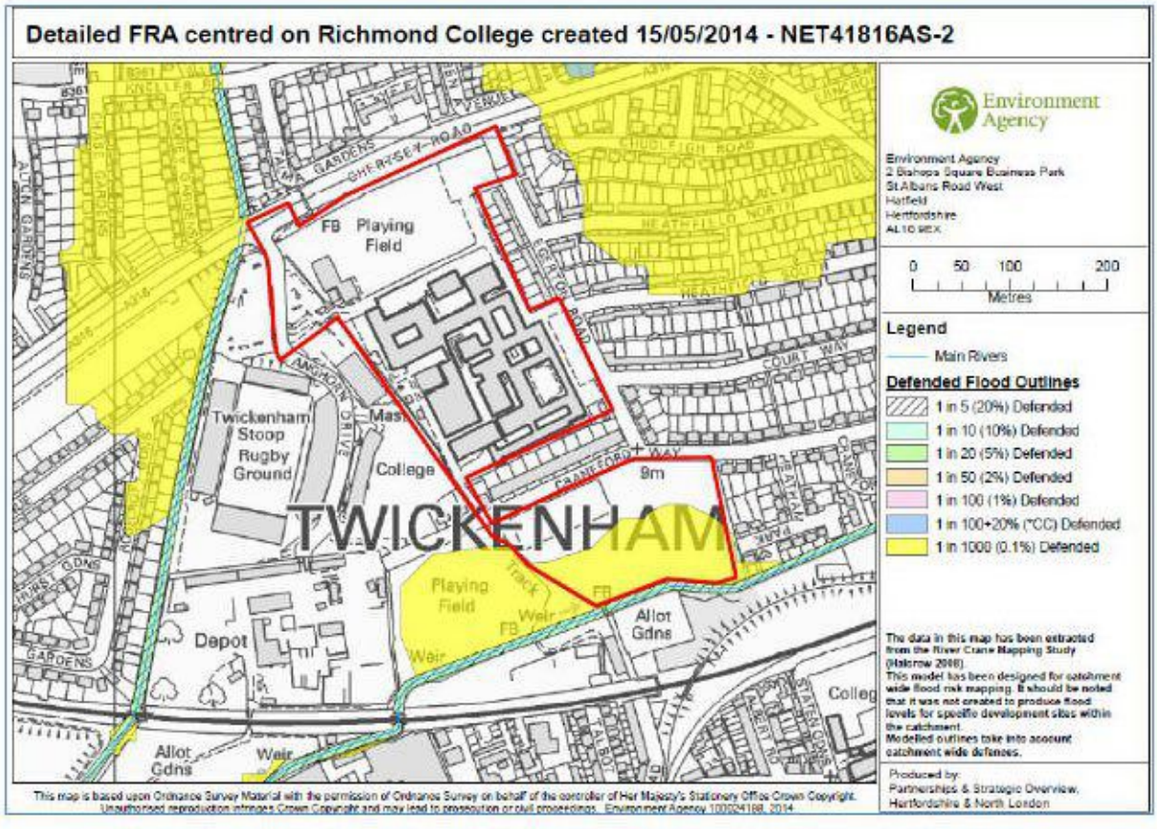


**Figure 3.5 The EA Modelled Flood Outline for Different Return Periods**

### 3.7 Geological Indicators of Past Flooding

Geological indicators of past flooding include superficial deposits which are susceptible to flooding, either from coastal inundation or fluvial (inland) water flow.

There are geological indicators of flooding within 250 m of the Site relating to the sand and gravel superficial deposits which are associated with riverine processes in the past 10,000 years (BGS, 2014).

### 3.8 Flooding in the Event of a Reservoir Failure

The Site is not located within an area identified as being at risk of flooding due to the event of a reservoir failure (Groundsure, 2014).

# 4 FLOOD RISK FROM THE DEVELOPMENT SITE

## 4.1 Flood Risk during Construction/Demolition Phase

Given the scale of the development, the current expectation is that the development construction programme would commence in 2016 in a phased manner over a 4 year period. For the purposes of the ES, the year of completion and full operation of the development is therefore considered to be 2019. Whilst full details regarding the demolition and construction works are not yet finalised, general information about the likely timing of activities, are described in the Environmental Statement (Cascade, 2015).

Flood risk during construction is likely to differ from the long term condition, as there will be changes in hardstanding on the Site. The construction area of each construction phase and runoff generated is outlined in the drainage assessment report (ESI, 2015). There will be no stockpiling of materials within the identified 100 year return period floodplain during the demolition and construction process.

A strategy to manage the surface water run-off during the construction phase is described in the drainage assessment report (ESI, 2015). Run-off with high loading of suspended solids should be prevented from leaving the Site and entering the surrounding water bodies. This would have a detrimental effect on the local ecology of the water bodies.

Sustainable Drainage System (SuDS) will be required for the development as part of the planning process. It is proposed to install these water management systems at an early stage in the construction process. Care should be taken to protect any SuDS features for long term operation and in particular from being compromised by demolition and construction activities. For example, locations identified for soakaways at conceptual/outline drainage design stage, should not be used as drive ways for lorries during demolition/construction as the loading from the lorries will alter the underlying soil structure and permeability.

In general, it is assumed that works will take place in accordance with standard best practice to prevent impact on water quality associated with any significant rainfall event.

The REEC development scheme will not have plant located below ground or basement or underground parking. Based on the available information at the outline/planning stage, it is reasonable to assume dewatering is not required. At detailed design stage, if the depth of foundation is greater than the maximum groundwater table, dewatering will be required. In that case, a detailed infiltration tests and ground condition is required to undertake estimation of dewatering volume during construction. Provisions should be made to manage this potential issue in line with standard industry practice for construction in saturated ground.

## 4.2 Flood Risk during Operational Phase

The development of a conceptual site drainage plan at an early stage is required to inform operation of the Site. A sustainable drainage strategy (ESI, 2015) has been developed for operational phase. The proposed drainage scheme assessed the existing drainage of the Site as well as the new SuDS techniques according to the DM SD 7 surface water drainage policy (LBRuT, 2011) and the London Plan. The surface run-off from the proposed development is estimated for return period of 1 in 10 year, 1 in 30 year and 1 in 100 year plus climate change rainfall event. A range of suitable drainage techniques are recommended (green roofs, permeable pavement, soakaways and flood storage area). In the operational phase, the Site is designed to manage surface runoff for a 1 in 100 years plus climate change rainfall event with no discharge to surface watercourses.

A site wide Utility Statement was undertaken by Atkins in May 2014 (Atkins, 2015). The report confirms presence of a soakaway system for draining the current site. The report also suggests a gravity connection to a combined Thames Water manhole MH 5703, serving the eastern portion of the site. However the connections are thought to be blocked and this assumption may need to be verified.

It has therefore been assumed that the current site is successfully drained by soakaway. It is possible that the current soakaways are not adequate to fully drain the Site in extreme rainfall conditions but there is no evidence of flooding occurring on the Site as a consequence, or of informal discharges from the Site into adjacent watercourses during extreme rainfall.

A similar system of soakaways with additional SuDS features should thus be sufficient to attenuate the runoff from the proposed development without a discharge to surface watercourses. Details are described in the sustainable drainage assessment report.

# 5 SUITABILITY OF THE PROPOSED DEVELOPMENT

## 5.1 Sequential Tests

Based on the classification of the NPPF, (DCLG, 2012), the proposed development falls into various flood risk vulnerability classifications (Table 2 of NPPF, (DCLG, 2012)). The residential, college and school buildings are classified as more vulnerable infrastructure. The Tech Hub is a less vulnerable and the College playing field is a water compatible infrastructure. The Sequential Test (DCLG, 2014) identifies that development should be directed to areas with the lowest probability of flooding. According to Site Allocation Plan (LBRuT, 2014), the development has passed the sequential test, however this was based on an old Site boundary different from the current one (Figure 5.1) which was solely in Flood Zone 1. The new Site has now been extended to include the College playing fields on Craneford Way East which is within Flood Zone 2. The Site would need to be reconsidered for a sequential test with the current Site boundary. The development on Craneford Way East would consist of outdoor sports and recreation facilities which is 'water compatible development' (Table 2 of NPPF (DCLG, 2014)) so the development is still expected to pass the sequential test.

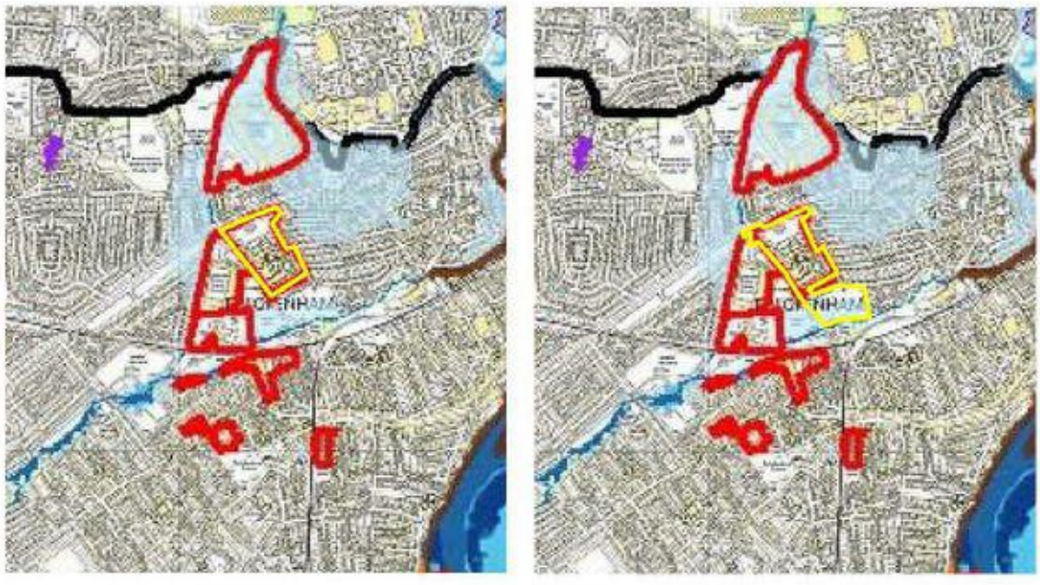

**Figure 5.1 Comparison of the New Site Boundary (Right) with the Old Site Boundary (Left) (LBRuT, 2014)**

## 5.2 Exception Test

Assuming the sequential test is passed the flood risk vulnerability and flood zone 'compatibility' guidance in Table 3 of NPPF (DCLG (2014)) indicates an exception test (see glossary) is not required and the development is considered to be appropriate for this Site (Table 5.1)

**Table 5.1 Flood risk vulnerability and flood zone compatibility**

| Flood risk vulnerability classification | | Essential infrastructure | Water compatible | Highly vulnerable | More vulnerable | Less vulnerable |
|---|---|---|---|---|---|---|
| Flood Zone | Zone 1 | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Zone 2 | ✓ | ✓ | Exception Test required | ✓ | ✓ |
| | Zone 3a | Exception Test required | ✓ | x | Exception Test required | ✓ |
| | Zone 3b functional floodplain | Exception Test required | ✓ | x | x | x |

✓ Development is appropriate.

**x** Development should not be permitted.

Data source: National Planning Policy Framework (NPPF) Technical Guidance, 2014.

# 6 POTENTIAL MITIGATION

The flood mitigation measures would be considered for REEC for different phases as presented in Table 6.1 (baseline, construction and operation).

## 6.1 Safe Access and Egress

The Environment Agency states in their scoping opinion that wherever possible, all proposed buildings should lie outside the fluvial 1 in 100 year storm event, plus allowance for climate change flood extent. If this is not possible, flood plain compensation and demonstration of a safe route of access and egress will be required.

All the proposed buildings are located outside the 1 in 100 year plus climate change flood extent as discussed in section 3.6. The College playing field lies in Flood Zone 2. Since the site is not located and surrounded by the 1 in 100 year plus climate change flood extent, a flood plain compensation and safe route of access and egress plan is not required.

Though the College playing field lies in Flood Zone 2, it is considered a water compatible structure and will provide flood storage to attenuate excess runoff (ESI, 2015). Therefore it may provide additional flood storage benefit.

**Table 6.1 Potential Receptors, Impact and Flood Mitigation Measures**

| Potential Sensitive Receptors | Potential Impact | Potential Effect | | Potential Mitigation Measures |
|---|---|---|---|---|
| | | Scoped In (requires further consideration) | Scoped Out (requires no further consideration) | |
| Rivers and ecology | Silty water (all phases) | ✓ | | SuDS features. |
| Basement/underground structures | Groundwater flooding (all phases) | | ✓ | N/A |
| Playing fields | Fluvial flooding (all phases) | ✓ | | No mitigation is required. |
| Entire Site | Sewer flooding | ✓ | | Extensive usage of SuDS to reduce future potential. |
| Entire Site | Reservoir flooding | | ✓ | N/A |
| Entire Site | Surface water flooding | ✓ | | Appropriate landscaping and use of SuDS |
| Off-site receptors | Flood risk from the proposed development | ✓ | | Design and implementation of a comprehensive SuDS drainage strategy. |
| Chertsey Road Junction (site entrance) | Fluvial flooding | | ✓ | N/A |
| Future operational soakaways SuDS components | Reduce soil infiltration capacity (construction and demolition) | ✓ | | Make sure heavy machinery is directed away from such receptors. |
| Site drainage and SuDS | Silty water (all phases) | ✓ | | Protect the SuDS from sedimentation. |

# 7 CONCLUSION

It is proposed to re-develop Richmond College in London to a new college building, a secondary school, a school for children with special needs, a Tech Hub and sports grounds, with enabling residential development. The junction connecting Chertsey Road and Langhorn Drive is also a part of the new development. The Site area is c. 9 ha and is currently used for educational purposes.

The majority of the Site, and the area where all new buildings will be located, lies in Flood Zone 1 which has less than 1 in 1000 year annual probability of flooding. A part of the College playing field to the south of the Site lies in Flood Zone 2 which has annual probability of flooding between 1 in 1000 and 1 in 100 year.

The site benefits from flood defences. There are formal defences on both bank of River Crane and The Duke of Northumberland's River.

The River Thames flows approximately 1 km to the south of the Site and it has a considerable history of flooding with significant events (resulting in property flooding) in 2003. However no historical flooding has been recorded within 250m of the Site.

The Site has low to high risk of surface water flooding in different areas according to the JBA surface water flooding map. Groundwater flood risk is negligible at the Site according to the ESI groundwater flood risk map.

Reference is made to the LBRuT's Site Allocation Plan (2014) to help inform the results of sequential and exception tests of the Site. The northern section of the proposed site has passed the sequential test as a part of LBRuT's Site Allocation Plan. The College playing field to the south of the development is a water compatible land use according to the NPPF (DCLG, 2014). Therefore no exception test would be required and the development is appropriate for this location, provided suitable mitigation measures are in place.

Flood risk to the potential receptors and suitable mitigation measures have been assessed. The flood risk from the proposed development during construction/demolition and operational phase has been assessed in a separate sustainable drainage assessment report (ESI, 2015). The report also presents surface runoff produced during a 1 in 100 year plus climate change event and drainage strategy to manage and attenuate the excess runoff without discharging to surface watercourses.

The Environment Agency's comments during scoping opinion have been addressed in the FRA. All proposed buildings lie outside the fluvial 1 in 100 year storm event, plus allowance for climate change impact. Therefore no flood plain compensation will be required and the requirement of a safe route of access and egress is not necessary for the proposed Site.

# 8 REFERENCES

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**ESI Ltd (ESI), 2015.** Sustainable Drainage Assessment, Richmond upon Thames College Redevelopment. May 2015.

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**London Borough of Richmond upon Thames** (21/05/14) Telephone communication with Andrea Kitzburger 02088917117

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**Thames Water (02/06/14)** Telephone conversation with a member of staff

**3 Sixty Measurement, 2008** Underground Service Survey report

# APPENDICES

# APPENDIX A

## Groundsure flood report

centremapslive.com
the mapping portal from Laser Surveys

| | |
|---|---|
| Report Reference: | CMAPS-CM-325206-28958-150514 |
| Your Reference: | 28958 |
| Report Date: | 15 May 2014 |
| Report Delivery Method: | **Email - pdf** |
| Client Email: | andy@centremaps.com |

## GroundSure Floodview

**Address: RICHMOND-UPON-THAMES COLLEGE,EGERTON ROAD,ST MARGARETS AND NORTH TWICKENHAM,TWICKENHAM, TW2 7SJ**

Dear Sir/Madam,

Thank you for placing your order with CENTREMAPS. Please find enclosed the GroundSure Floodview report as requested.

If you need any further assistance, please do not hesitate to contact our helpline on 01886 832972 quoting the above CENTREMAPS reference number.

Yours faithfully,

CENTREMAPS

Enc.
GroundSure Floodview