

HK Hydrology Ltd.

10 Salamons Way

Flood Risk Assessment



On behalf of **Integrated Skills Limited**

Project Ref: 2331 | Report 1 | Date: March 2024

Registered Office: 10 St Huber Road, Waterloooville

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This report has been prepared with all reasonable care and diligence within the terms of the contract with the client. HK Hydrology Ltd. disclaim any responsibility to the client and others in respect of any matters outside the scope of the contract. We accept no responsibility to third parties to whom this report, or any part, thereof is made available. Any such party relies upon the report at their own risk. The findings of this report are based on data available at the time of writing.

1. Introduction

1.1 Instruction

HK Hydrology Ltd. has been instructed by Integrated Skills Limited (the Client) on behalf of May Glass Recycling Ltd. (the Operator) to provide a Flood Risk Assessment (FRA) for a site in Rainham ("the Site" -see Figure 1.1 for location map). Instruction to proceed was provided by email on the 8th February 2024.

1.2 Background

The Operator is seeking to obtain planning permission to change the use of the land to permit the storage of waste glass and UPVC and treat glass to produce cullet.. The Site is currently used for storing oil. With regards to flood risk, the Site will remain a "Less Vulnerable" development post-development.

The Site is located within Flood Zone 3 (although protected by flood defences). The planning application must therefore be supported with an FRA. This document constitutes the FRA for the planning application.

1.3 Scope of the report

The scope of this assessment is as follows:

- Preparation of an FRA, written in line with the National Planning Policy Framework (NPPF) and supporting Planning Practice Guidance (PPG) to satisfy the Environment Agency (EA) and the Lead Local Flood Authority (LLFA, Havering Borough Council - HBC) that all potential flood risks to and from the proposed development have been considered and that the proposed development is appropriate, as defined in the NPPF.
- Consideration of appropriate Site-specific flood risk mitigation measures.

1.4 Data sources

The main sources of data utilised in this assessment are summarised below:

- The planning statement for the proposed development as provided by the Client (Integrated Skills, 2024);
- EA flood risk data including model output data from the 2019 Beam and Ingrebourne Modelling Study and the 2018 Thames Tidal Downriver Breach Inundation Modelling;
- The Havering Level 1 Strategic Flood Risk Assessment (SFRA) (Jacobs, 2017);
- The Thames Estuary 2100 Plan (Environment Agency, 2012).
- Ordnance Survey mapping;
- LiDAR Digital Terrain Model (DTM) data; and

- British Geological Survey (BGS) mapping data and borehole logs.

1.5 Qualifications

This report has been drafted by Henry Kelly of HK Hydrology Ltd. Henry has an MSc in Hydrology and Water Resources Management from Imperial College London and is a chartered member of CIWEM. He also has 12 year's experience in environmental consultancy, specialising in flood risk and drainage work.

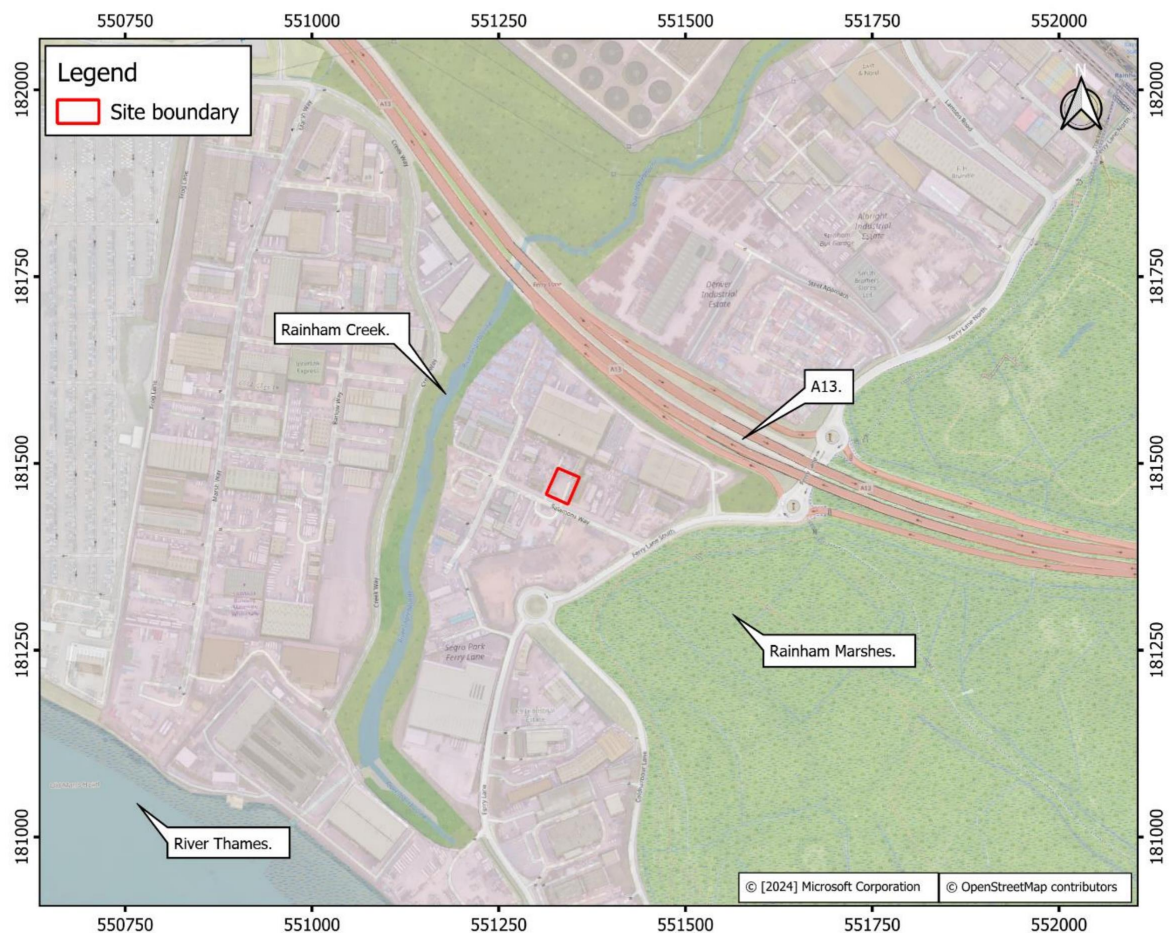


Figure 1.1 Site location

2. Site description

2.1 Site setting and surrounding area

The Site is located on the southern side of Rainham, East London RM13 9UL (see Figure 1.1). The National Grid Reference for the approximate centre of the Site is TQ 51336 81467.

Figure 2.1 provides aerial imagery of the Site to illustrate its current layout and condition. The Site comprises a rectangular plot within an industrial estate on the northern side of Salamons Way. Currently the Site is used for the storage of oil. The plot is covered with concrete hardstanding and is occupied with several storage containers and a temporary structure/shed. The access to the Site is via the southern boundary (Salamons Way).

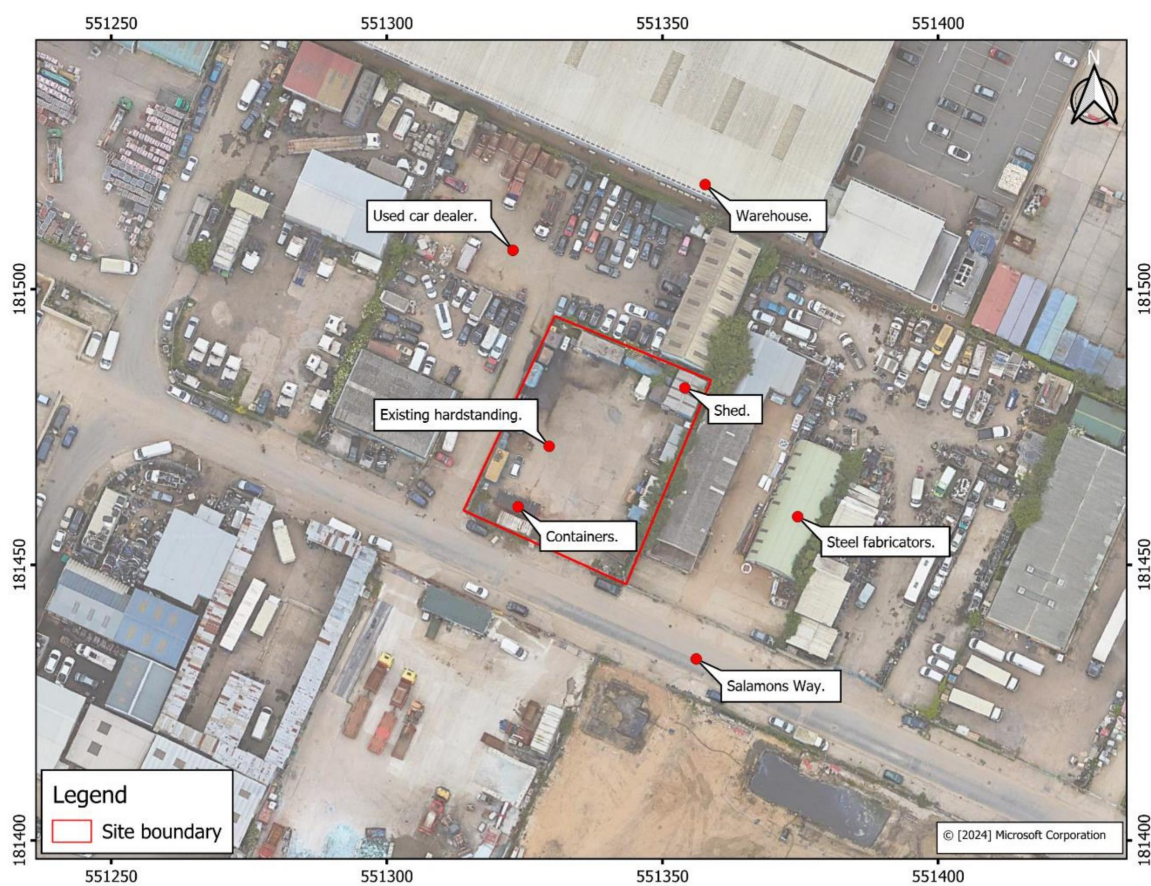


Figure 2.1 Existing Site layout

The Site is approximately 1,231 m² in size and the ground elevation is low lying, between c. 2.24 mAOD and c. 3.16 mAOD, with a gradual fall to the southwest. LiDAR topographical data for the area is included in Figure 2.2, along with local water features and flow directions.

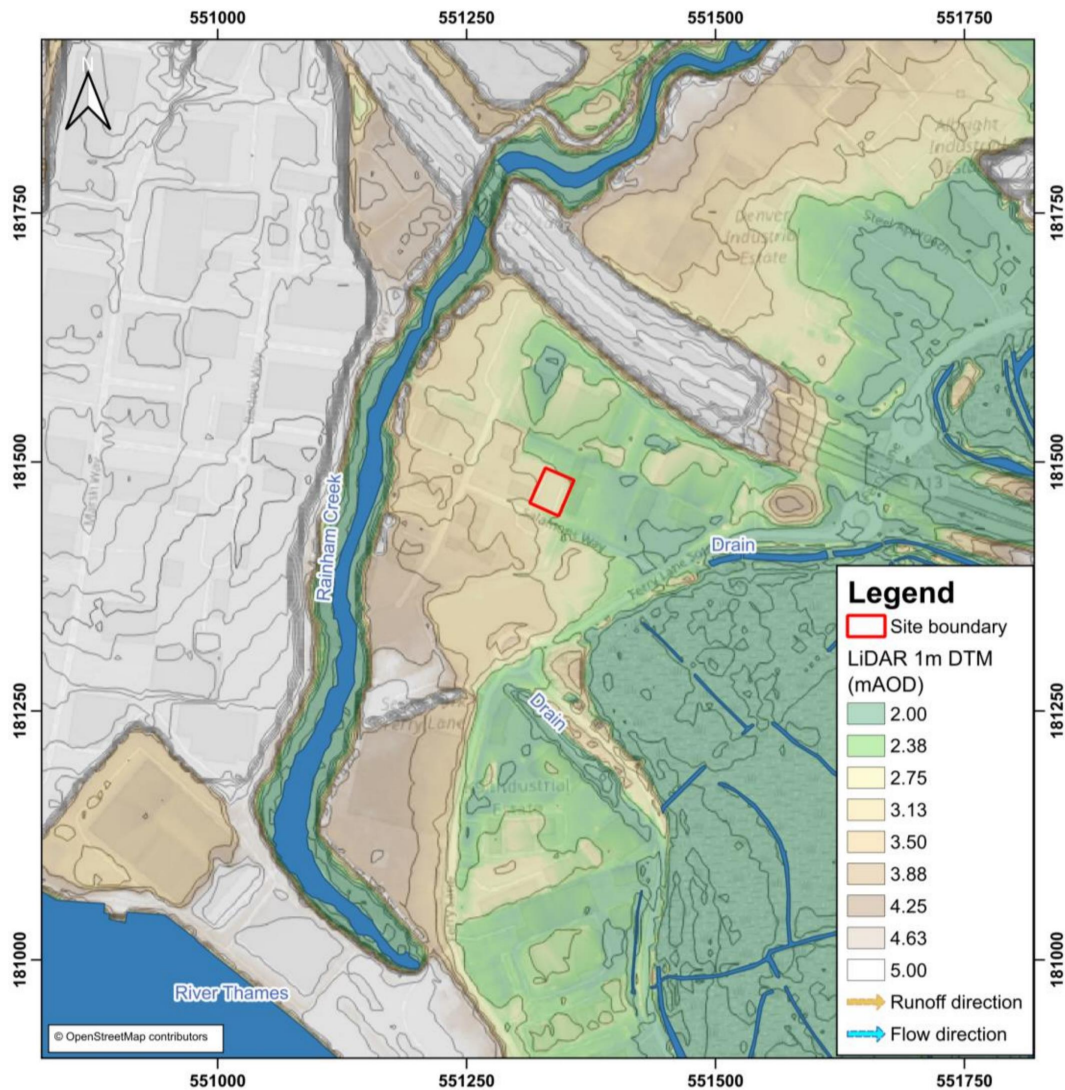


Figure 2.2 LiDAR 1 m Digital Terrain Model (DTM) and water features

2.2 Geology and Hydrogeology

According to British Geological Survey (BGS) 1:50,000 scale mapping, the geological sequence underlying the Site is as follows:

- Superficial deposits: Alluvium (clay, silt, sand and peat)
- Solid geology: London Clay Formation (clay, silt and sand)

The Alluvium beneath the Site is classified by the Environment Agency (EA) as a Secondary (undifferentiated) aquifer. These are defined by the EA as 'permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers'.

The underlying London Clay Formation is classified as an unproductive stratum. These are described by the EA as deposits with low permeability that have negligible significance for water supply or river base flow.

However, it is noted that the area is also classified as being infilled land, and an historical landfill site. As such, the ground underlying the Site is thought to be made ground (artificial material). A clayey material is noted in BGS borehole log TQ 51415 81597 located just north of the Site.

The Site is not located within a Source Protection Zone.

2.3 Climate

The Standard Annual Average Rainfall (SAAR) at the Site is 555 mm (UK Centre for Ecology & Hydrology, 2024).

2.4 Hydrology

The location of water features in the vicinity of the Site are shown on Figure 2.2, as well as Figure 2.3 below. Rainham Creek is located 155 m to the west of the Site. This is part of the River Ingrebourne which is a statutory main river draining a large catchment from the Thames up to the Brentwood area. The feature discharges to the Thames 550 m south of the Site.

There are numerous drains associated with the Rainham Marshes, although these are located in the lower elevations of the marshes to the east.

The Thames (and related flood defences) is located 550 m south of the Site.

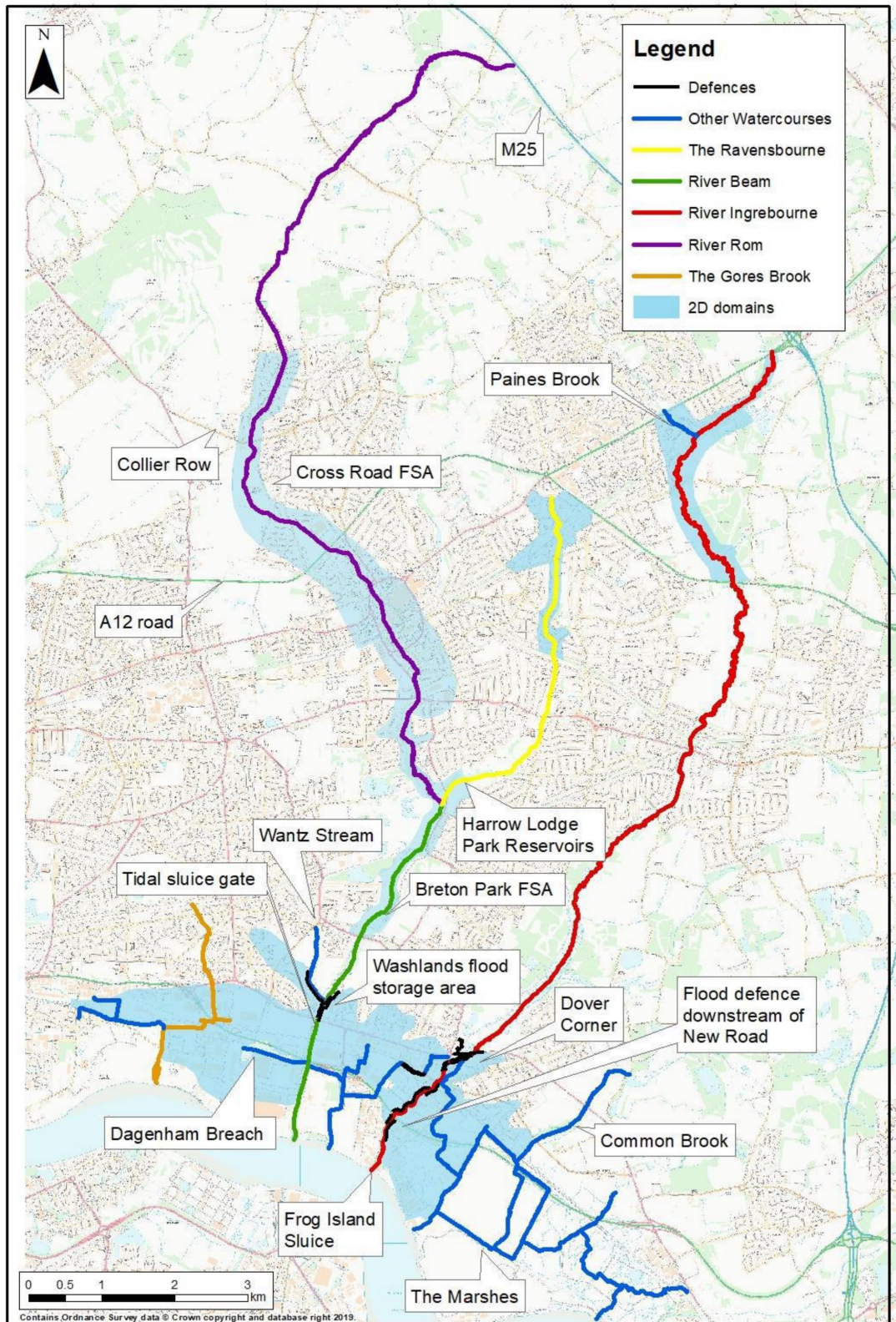


Figure 2.3 Watercourses in the Rainham area (JBA, 2019)

3. Proposed development

Planning permission is being sought to change the use of the existing industrial site, from oil storage, to storage of waste glass and UPVC and treat glass to produce cullet.

The proposed development plans are included in Appendix A. The Site is currently surfaced with an aging concrete pad which would be removed and replaced with a new concrete pad – there would be no change in impermeable surface area. An interceptor would be installed to improve the water quality of site runoff before it discharges to the public sewer system (this represents a continuation of existing runoff arrangements).

The proposed development also includes the installation of several storage bays for glass and UPVC and machinery for producing cullet. The access to the Site will change from a single point to separate in and out access points.

A total operational lifespan of 20 years (finishing in 2044) has been applied in this assessment.

The current use of the Site – storage and distribution – would be classified as “less vulnerable” with regards to flood risk according to the definitions within the PPG for flood risk and coastal change. The future use of the Site – waste management – would also be classified as “less vulnerable”.

4. Flood risk to the proposed development

4.1 Fluvial and tidal

The principal sources of fluvial flood risk in the vicinity of the Site is the River Thames to the south and the River Ingrebourne to the west. The Site is within Flood Zone 3 (see Figure 4.1) when the influence of flood defences is not considered. Flood Zone 3 is defined as having a 1% (1 in 100) or greater chance of flooding from rivers and 0.5% (1 in 200) or greater chance of flooding from tidal water each year.

The Site benefits from the influence of nearby flood defences, however, as discussed below. The flood risk to the Site (from fluvial and tidal sources) is therefore residual.

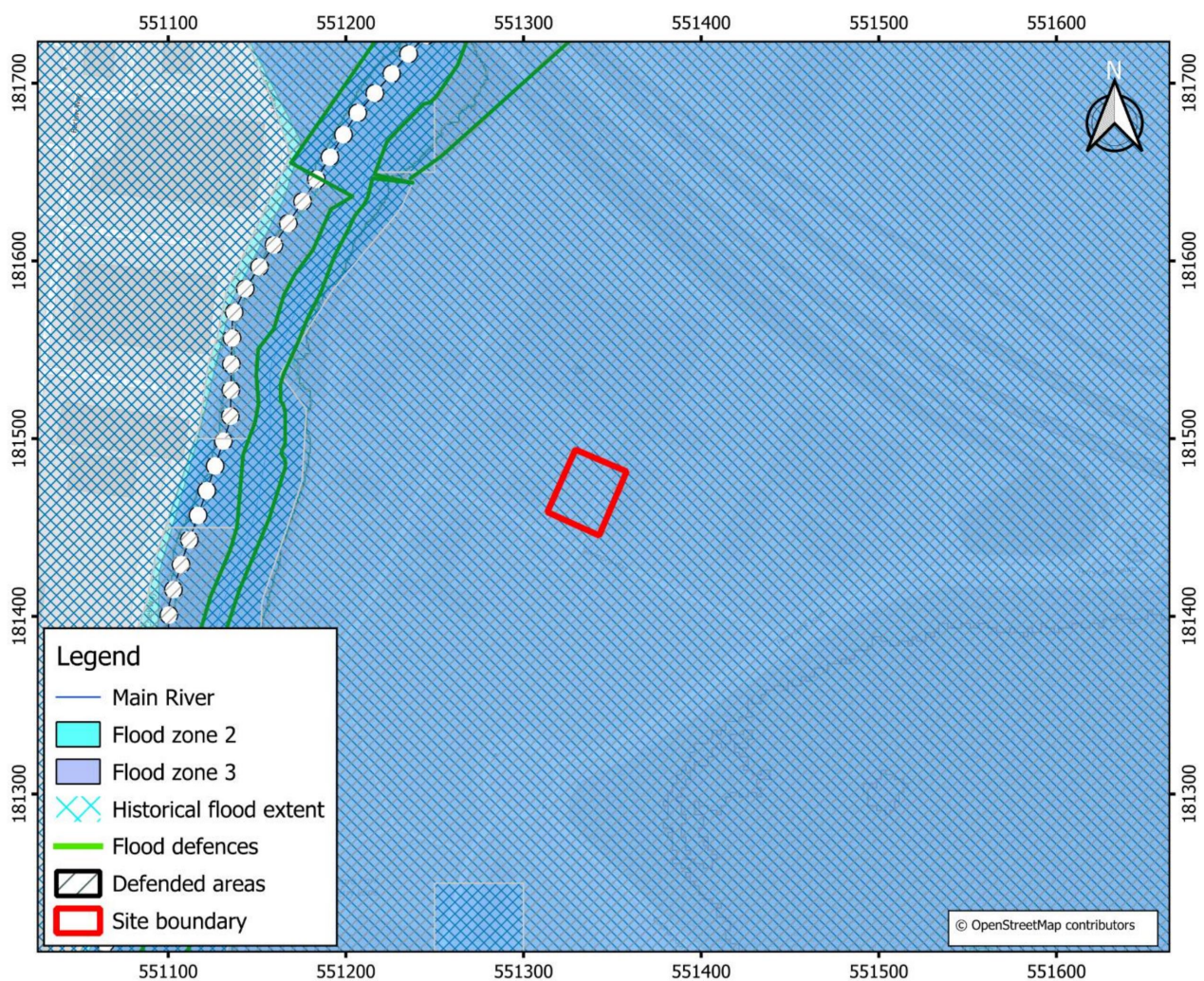


Figure 4.1 EA fluvial flood risk data

4.2 Flood defences

Flood defences are in place along the banks of the River Thames, and along the bank of the River Ingrebourne to the west of the Site (Figure 4.1). The Site and surrounding area is mapped as being “defended areas” with regards to flood risk. The flood risk at the Site is therefore “residual” i.e., would only manifest in the unlikely event of a breach in the defences during a high magnitude storm event.

The defences along the River Ingrebourne are noted as being the “Natural High Ground” variety of defence in this area. The (actual) crest elevation of the defences in the area are stated as being 4.98 mAOD in the available EA data. Defended model results are presented below, the Site is not within the maximum flood envelope under any of the storm simulations.

The tidal River Thames poses a potential risk of flooding to properties within the Borough. The Site is currently protected from combined tidal and fluvial flooding by the Thames Tidal Defences (TTD) up to the 1 in 1,000-year even. The TTD defences along the bank of the Thames to the south have a crest elevation of 7.1 mAOD. Given that the Site is protected by the TTD up to the 1 in 1,000 yr. event, the risk of flooding to the Site from tidal sources come primarily in the form of a breach in the flood defences. Modelled flood data for a breach scenario is provided below.

4.3 Flood model data

EA flood model data was obtained from the 2019 Beam and Ingrebourne Modelling Study and the 2018 Thames Tidal Downriver Breach Inundation Modelling. Product 4 data were not provided by the Environment Agency, but the salient output from each model is discussed below.

Beam and Ingrebourne Modelling Study

Modelled flood extents and model nodes in the vicinity of the Site are shown in Figure 4.2. The defended model results differ in terms of maximum flood extents to the EA Flood Zones displayed in Figure 4.1 (which also include tidal flooding extents). No flooding within the Site boundary is expected based on the modelled flood extents provided, even under the extreme 1 in 1000 yr. defended and undefended scenarios.

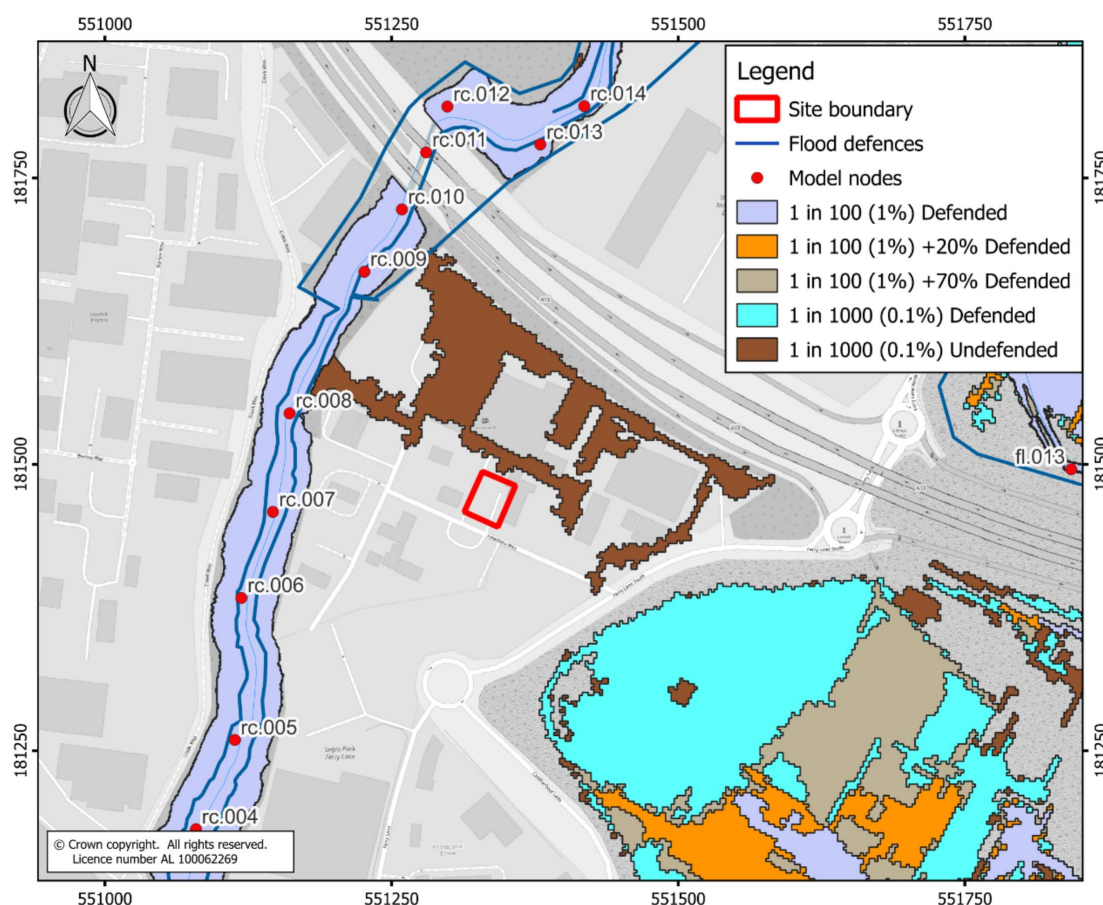


Figure 4.2 Beam and Ingrebourne model data

The peak modelled elevations of the closest model nodes shown have been used to estimate flood levels in the vicinity of the Site. Modelled flood levels for a range of probabilities are shown in Table 4.1. The modelled flood levels are for water elevations within the river channel.

Table 4.1 EA modelled fluvial flood elevations adjacent to the Site

Model Node	1% AEP (mAOD)	1% AEP + 25% Climate Change (mAOD)	1% AEP + 70% Climate Change (mAOD)	0.1% AEP (mAOD)
rc.009	3.21	3.33	3.39	3.44
rc.008	3.21	3.33	3.39	3.44
rc.006	3.21	3.33	3.39	3.44

The peak flood elevations in the vicinity of the Site show little variation over this short reach of Rainham Creek. The model data indicates that the estimated flood elevation in the vicinity of the Site for the 1% AEP and 1% AEP plus 25% climate change allowance events are 3.21 mAOD and 3.33 mAOD respectively.

The modelling results do not include the exact current allowances for climate change in this area (Environment Agency, 2022) which have recently been updated. The EA guidance states that a highly vulnerable land use in Flood Zone 2 and 3 should use the central band allowance. For the London Management Catchment the central allowance is 14% for the 2050s (the expected lifespan of the development will end in c. 2044) and 21% for the Upper allowance. The modelled elevation of 3.33 mAOD has been taken as a conservative estimate for the 1% flood elevation with an increase for climate change in the area.

As stated in Section 2.1, the ground elevation at the Site ranges between c. 2.24 mAOD and c. 3.16 mAOD, with a gradual fall to the south. This is below the in-bank peak flood elevation within Rainham Creek stated above. Given that the simulated levels are within the banks of the watercourse, the fluvial flood risk associated with the River Ingrebourne does not pose a risk to the Site.

Thames Tidal Downriver Breach Inundation Modelling

This Section provides a summary of the salient information from the 2018 Thames Tidal Downriver Breach Inundation Modelling.

Figure 4.3 and Figure 4.4 present the modelled flood depths, velocities and hazard rating at the Site under a breach scenario for the 1 in 200 year event with climate change allowances for the 2005 and 2115 scenarios. These show that a flooding hazard in this scenario would pose a "Low Hazard" (under the 2005 scenario to a "Danger to Most" (under the 2115 scenario). The western part of the Site is not considered to be at any risk at all under the 2005 breach scenario.

The modelled peak flood elevation at the Site for the 1 in 200 year event for the year 2005 is 2.74 mAOD, under this scenario expected flood depth may range from 0 to up to 0.50 m. . The modelled peak elevation raises to 3.43 mAOD for the year 2115 (with allowances for climate change). The proposed Site use is only expected to be operational for around 20 years so the expected peak elevation for the 1 in 200 year event might be expected to be between 2.74 and 3.43 mAOD over the operational life, but towards the lower end of the range.

The probability of tidal flooding at the Site is extremely low and would only manifest if the flood defences were breached in a location proximal to the Site during a very high magnitude storm event. Given the very low probability of such an occurrence, the overall risk is considered to be low. Mitigation measures are proposed in Section 6, however, to provide safety measure for Site staff.

Flood Risk Assessment - 10 Salamons Way

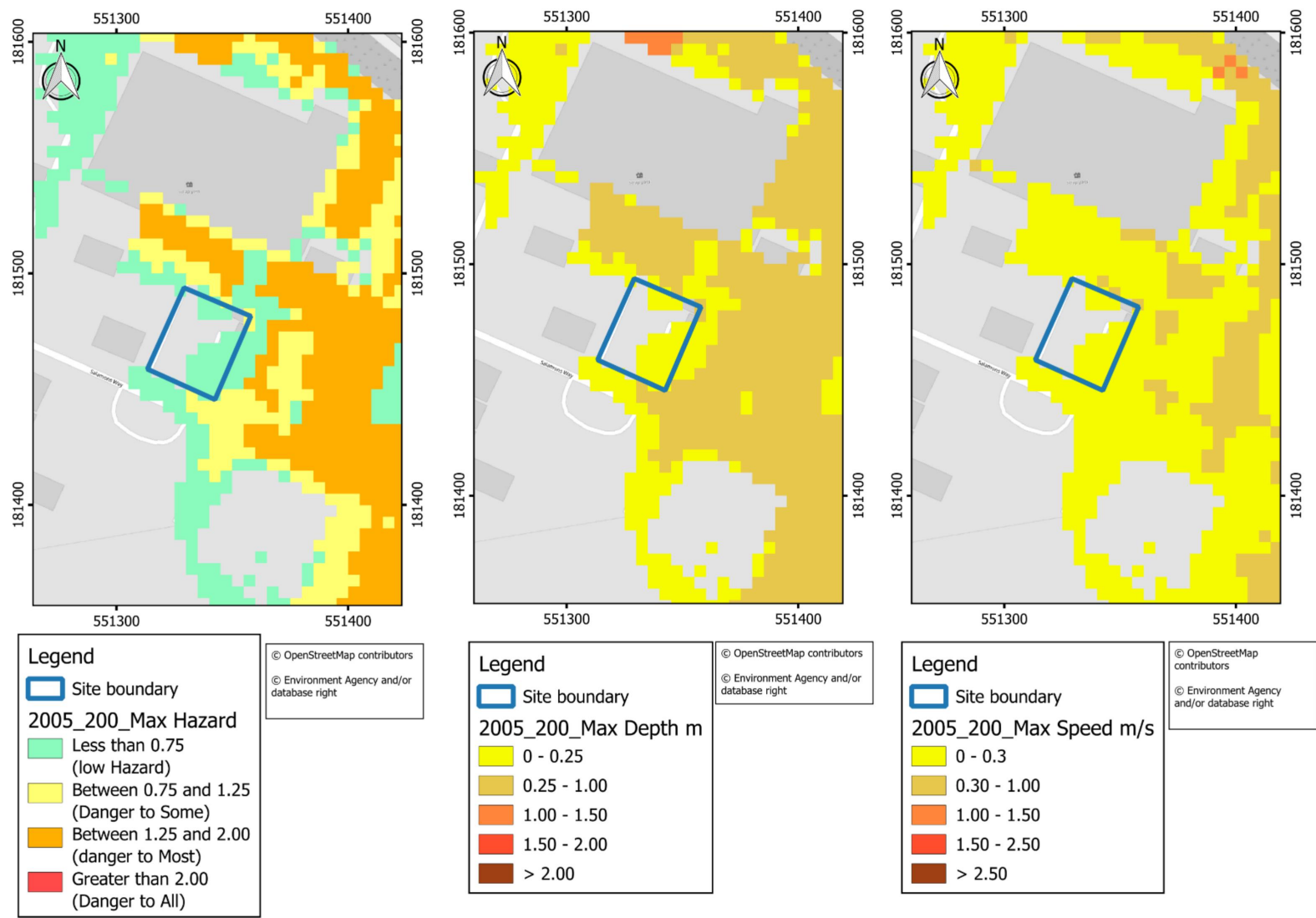


Figure 4.3 Modelled maximum flood hazard across the Site under a 2005 breach scenario (T200)

Flood Risk Assessment - 10 Salamons Way

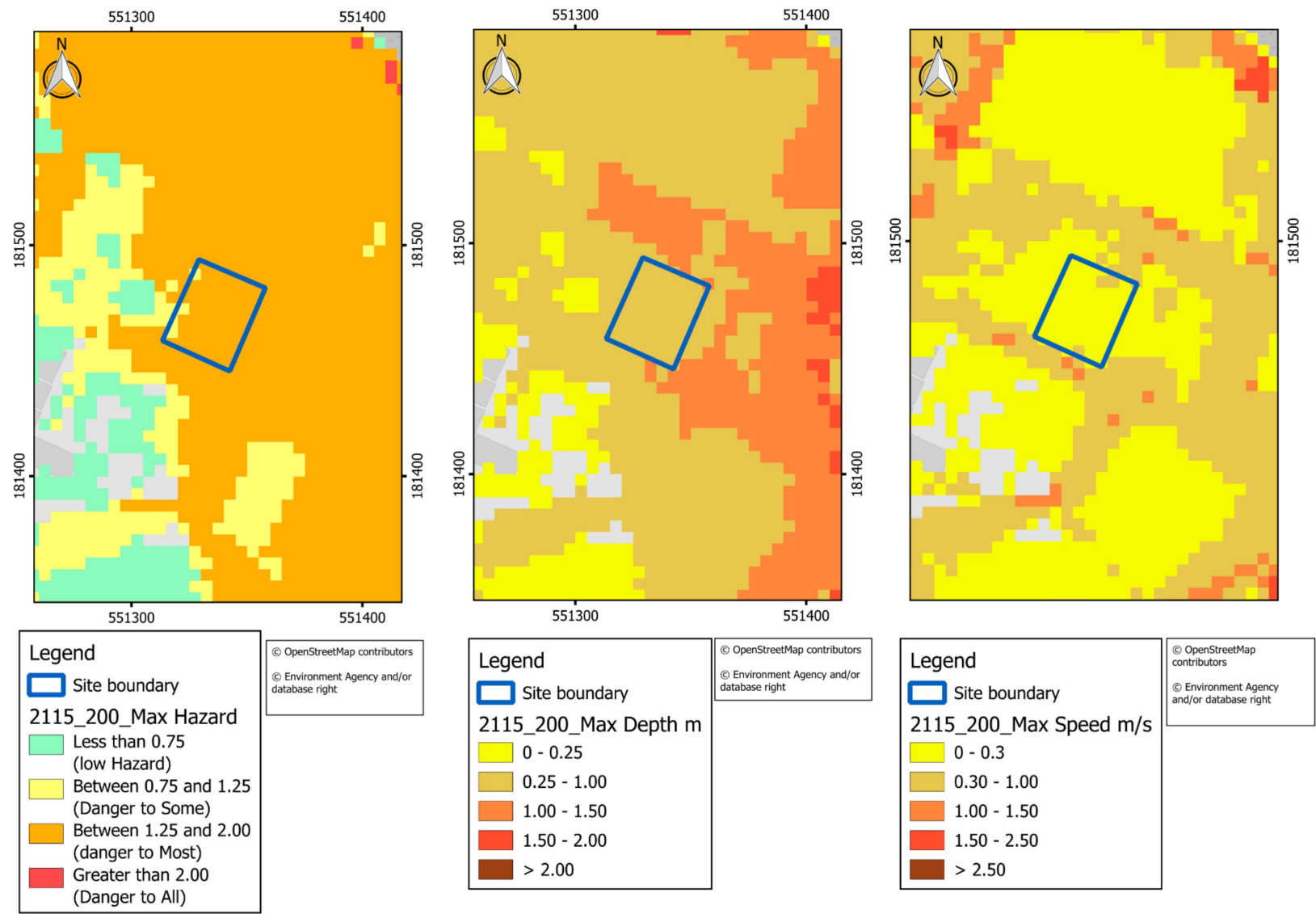


Figure 4.4 Modelled maximum flood hazard across the Site under a 2115 breach scenario (T200)

4.4 Surface Water (Pluvial)

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. Rainfall that is unable to infiltrate into the ground generates overland flow which can lead to flooding or 'ponding' in localised topographical depressions before the runoff is able to enter local drainage systems and watercourses.

A map of surface water flood risk is shown in Figure 4.5. The Site is at a very low risk of surface water flooding, with areas of elevated risk (low to medium probability) present just to the north and south of the site area.

The Site is not thought to be situated within a Critical Drainage Area as defined by the EA.

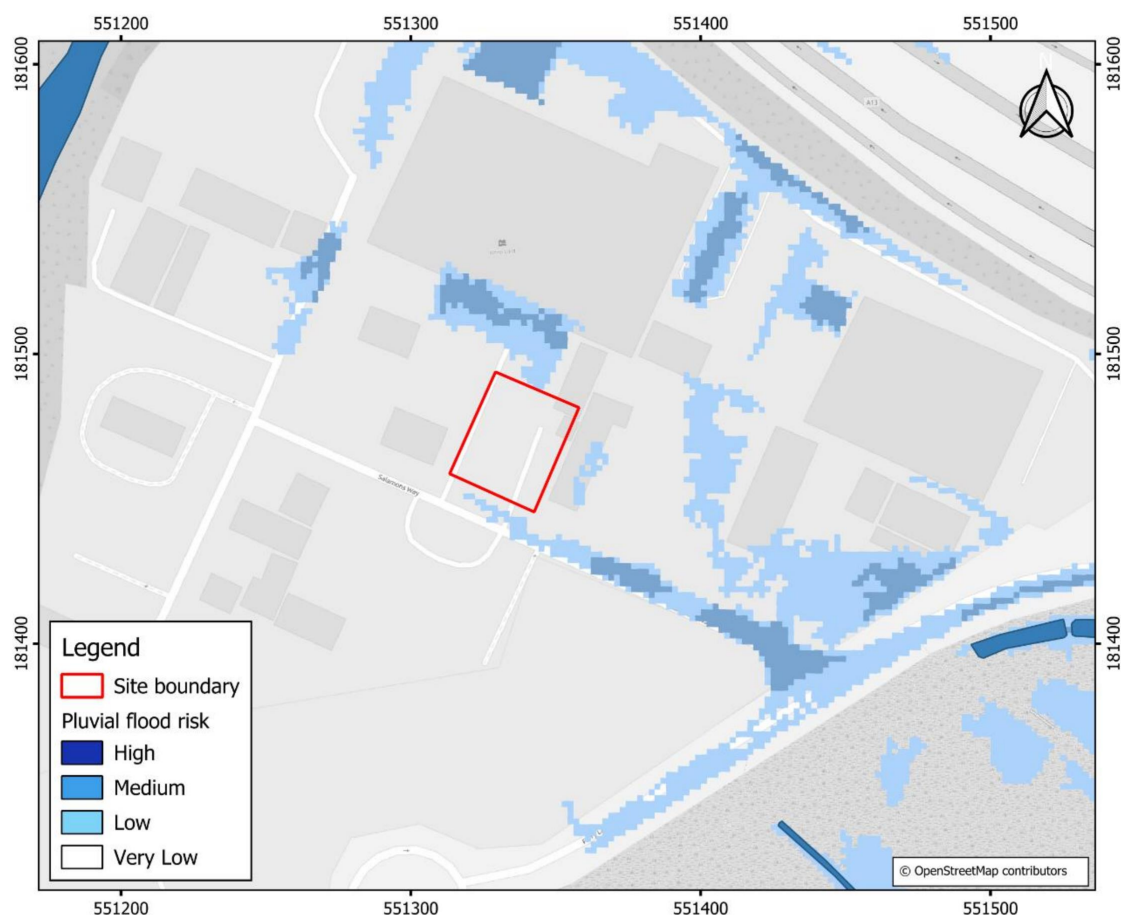


Figure 4.5 EA pluvial flood risk data

4.5 Groundwater

Groundwater flooding occurs when the water table rises above the surface elevation (or the floor of sub-surface structures).

The Site is underlain by made ground (clayey material in this instance) which is associated a low hydraulic conductivity and so the volumes of water stored within and passing through the deposits is of a low order of magnitude. The associated risk of groundwater flooding is considered to be low.

4.6 Sewer Flooding

Sewer flooding can occur during periods of intense rainfall and /or if a sewer becomes blocked with debris.

The Havering Level 1 Strategic Flood Risk Assessment (SFRA) contain details of areas of elevated risk of sewer flooding, in the form of number of historical flooding events per postcode area (provided by Thames Water). The RM13 area is noted as being at the lowest recorded flooding events, with just 19 recorded external flooding events over the period of data collection (no internal flooding recorded).

The local sewer assets are located beneath Salomons Way. The ground elevation slopes southwards towards the road and is at an elevated position relative to the gulleys.

4.7 Catastrophic failures

This Section considers catastrophic failures of water bearing infrastructure in the area of interest.

The Site is not at risk of flooding in the event of reservoir failure (see Figure 4.6). The risk of reservoir flooding is related to the failure of a large water storage reservoir. The risk of failure is considered to be extremely low (DEFRA, 2010), therefore this flood extent represents a worst-case scenario.



Figure 4.6 Risk of flooding from reservoir failure

4.8 Historical flooding

The EA database of historical flooding contains evidence of flooding having occurred in this area (see Figure 4.1). This was part of the widespread flooding in the 1953 event and this is also noted within the Havering Level 1 SFRA data. The flood defences along the Thames were not in the form that they are now, and the ground elevation of the area has also altered since this time owing to landfilling operations in the area.

5. Suitability of the proposed development

The Sequential Test, outlined in the NPPG (DCLG, 2014), identifies that developments should be directed to areas with the lowest probability of flooding.

The previous use of the Site – storage and distribution – would be classified as “less vulnerable” with regards to flood risk according to the definitions within the PPG for flood risk and coastal change. The future use of the Site – waste management – would also be classified as “less vulnerable”.

The Site is in a defended area with regards to tidal flood risk. Low vulnerability classes are allowable in such locations.

Given that there is not change to the vulnerability of the Site, or flood risk present at the Site, the proposed development is considered to be appropriate with regards to flood risk.

5.1 Sequential development

Where flood risk is present to varying degrees across a Site, layouts should be tailored to ensure the most sensitive parts of a development are located in parts of the Site least at risk of flooding.

The development plans are included in Appendix A. All parts of the proposed development would be classed as “less vulnerable” with regards to flood risk.

6. Flood Risk from the proposed development and mitigation measures

This Section considers the potential for the proposed development to increase off-site flood risk, and what mitigation measures may be appropriate given the level of flood risk currently present.

6.1 Key considerations

To meet the PPG requirements, all land uses will be considered appropriate for locations within areas protected by flood defences provided they also:

- Remain safe in times of flooding whilst taking climate change into account;
- Do not result in a net loss of floodplain storage;
- Do not impede existing water flow pathways; and
- Do not increase the volume and rate of surface water runoff leaving a site over its intended design lifetime.

Each of these requirements is discussed in relation to the proposed development in Sections 6.2 to 6.5 below.

6.2 Remain safe in times of flooding

The Site is protected by flood defences and is not expected to flood during a storm event. In the unlikely event of a future flooding event under a tidal breach scenario in the vicinity, some of the Site is expected to experience flooding (the extent and depths depending on the breach location, how far in the future this may occur and how much climate change allowance is applied). Given the expected lifespan of the proposed site operations, any breach scenario occurring during this period is expected to represent a "Low Hazard" to a "Hazard to Some" over the Site area.

It should be noted that the Site would only be at risk of flooding in the event of a c. 1 in 200 year storm event or greater whilst also there is a breach of the flood defences in close proximity to the Site. The probability of either events occurring over the design life of the Site are low and the probability of both occurring simultaneously is extremely low.

The Site manager should sign up to flood warnings and disseminate this information to employees as necessary. Given that flooding would only occur under a breach scenario, of greater importance would be an on-site alarm which would be engaged should anyone see evidence of floodwaters on-Site. Training on the use of alarms and the location of exits and safe havens (see below) would be provided during initial staff training with follow up refresher training similar to fire hazard training.

The primary safe haven for any personnel on-Site would be the elevated cabin office in the existing site, on the opposite side of Salamons Road. This room is elevated by around 3 m above the ground elevation which is well above the modelled (breach) flood elevations. The first response on on-Site personnel seeing flood inundation should be to raise the alarm and head to the safe haven.

The exit route under a such an extreme tidal defence breach flood event would be westwards, along Salamons Way to the end of the road, although this route should only be taken if dry and safe to do so. This area is at a higher elevation than the Site and is expected to be outside of the flood envelope for the tidal breach scenario over the lifetime of the proposed operations. However, the primary guidance is to head to the designated safe haven (stated above) and remain there until the floodwaters recede. This information is shown in Figure 6.1 and should be made known to staff and visitors to the Site.

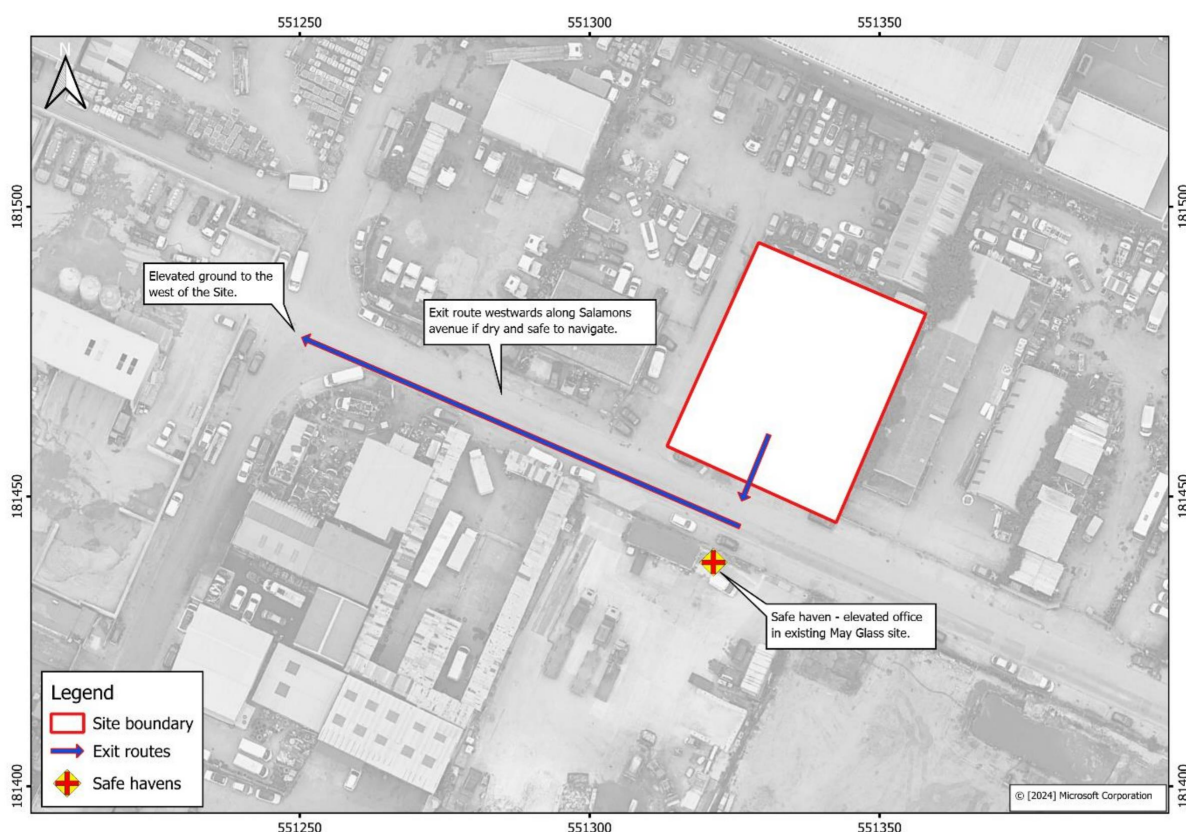


Figure 6.1 Flood evacuation data in event of tidal defence breach

6.3 No net loss of floodplain storage

The proposed development would not result in a net loss of river floodplain storage.

6.4 No impediments to flood water flows

The proposed change of use would not result in any impedance of flood flows. The Site is not within a floodplain or surface water flowpath.

6.5 No increase in the volume and rate of surface water runoff

The National Planning Policy Framework (NPPF) stipulates that all new developments must be "safe, without increasing flood risk elsewhere". As such stipulations are provided in the EA guidance for managing rainfall runoff (Environment Agency, 2013) for new development.

No changes are proposed to the impermeable surface area or general drainage arrangements of the Site. The runoff profile from the Site will remain unchanged, therefore.

7. Conclusions

The Site is predominantly within Flood Zone 3, although this risk is residual owing to the influence of flood defences in the area.

The proposed future use at the Site (waste management) has flood vulnerability classification of 'less vulnerable', as does the current use (storage and distribution). Less vulnerable development types are permissible within areas protected by flood defences.

Potential flood risk from surface water is very low over the Site area and there is considered to be a low risk of groundwater flooding owing to the nature of the underlying made ground. As noted in Section 4 it is indicated that there is also a low risk of flooding from surcharging sewers in the area. The Site is at risk of flooding under a tidal flood defence breach scenario. Under this very unlikely event, any on-Site personnel would be able to take refuge in the elevated office cabin within adjacent May Glass site. Training of Staff to the potential risks and actions required to keep safe are provided in this report.

Given that proposed development will result in no changes in off-site flood risk and will be of the same flood vulnerability rating, no specific flood mitigation measures are proposed (beyond the adherence to the proposed flood evacuation measures).

References

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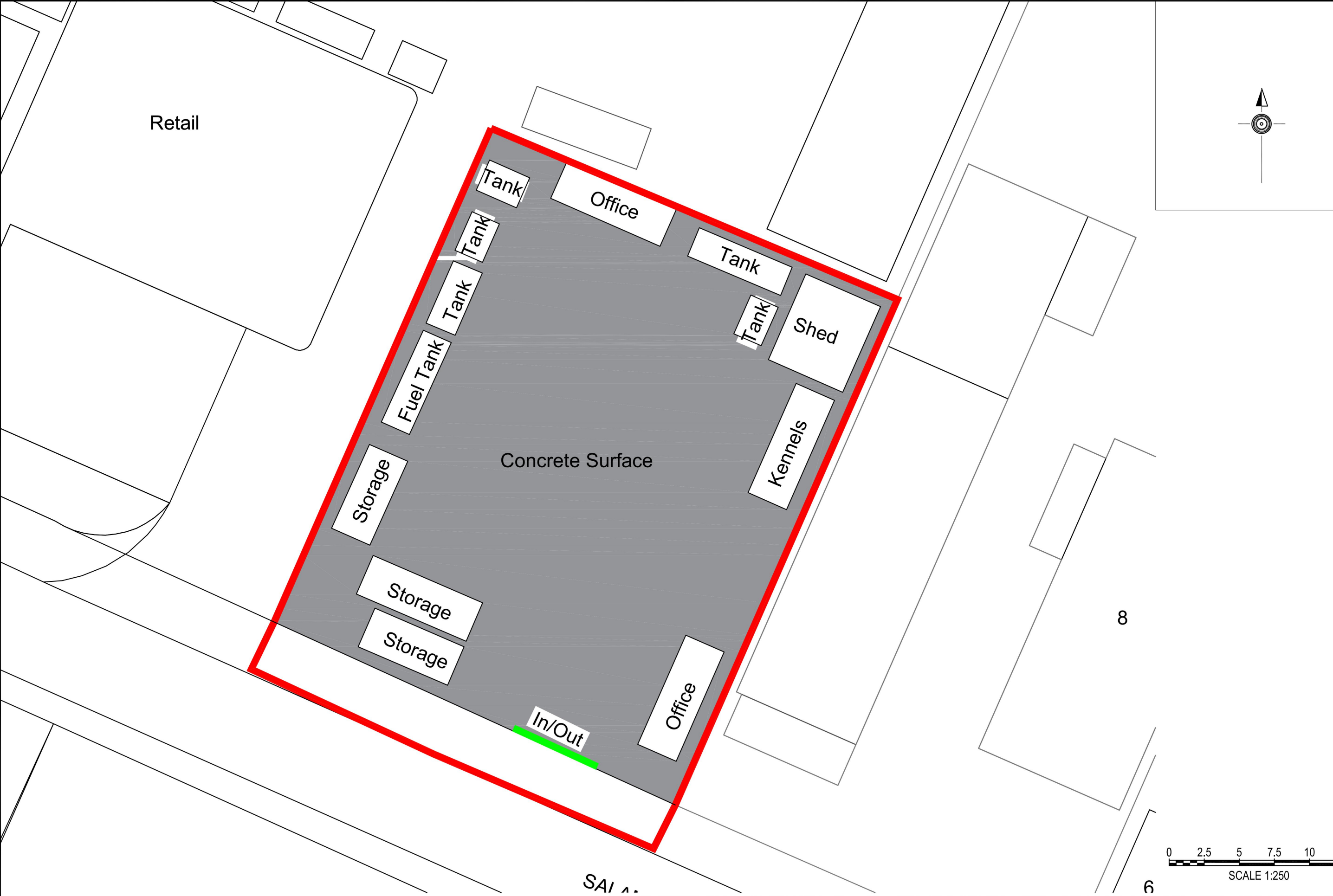
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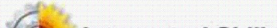
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Appendices

Appendix A Site layout and development plans



 SUITE 3A CHAPEL ALLERTON HOUSE, 114 HARROGATE ROAD, LEEDS, LS7 4NY TEL: 03300888670 EMAIL: ukinfo@integrated-skills.com (www.integrated-skills.com)	PROJECT 10 Salamons Way Rainham RM13 9UL	DRAWING EXISTING LAYOUT	CLIENT MAY GLASS RECYCLING	DRAWING NO. MGR-SW-EXI-01					REV
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