

Flood Risk Assessment

for

Insynch Energy Services

12 MWe Gas Peaking Facility, Knowsley Industrial Estate

Project 6623

Issue A2

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Contents

Executive Summary.....	3
1 Introduction.....	4
2 Development Site and Location.....	4
2.1 Location.....	4
2.2 Current Use.....	5
2.3 Flood Zone	5
3 Development Proposals	6
3.1 Development Proposals.....	6
3.2 Vulnerability Classification.....	7
3.3 Lifetime of Development.....	7
4 Sequential Test.....	7
5 Climate Change	8
5.1 Peak River Flow.....	8
5.2 Peak Rainfall	8
6 Site Specific Flood Risk.....	9
6.1 Main Sources of Flood Risk.....	9
6.2 Site Topography and Flood Risk.....	12
6.3 Displacement of Flood Water	14
7 Surface Water Management	15
8 Occupants and Users of the Development.....	15
9 Exception Test.....	16
10 Flood Risk Mitigation	16
10.1 Finished Floor Levels.....	16
10.2 Drainage Strategy.....	17
10.3 Safe Access and Egress.....	17
11 Residual Risk.....	18
12 Conclusions	18
13 Recommendations.....	18
14 Flood Risk Assessment Credentials.....	19
References.....	20
Appendices.....	22
Appendix I. Plans	22
Appendix II. Residual Flood Risk.....	23
Appendix III. Maps.....	24

Revision History

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A2	Peter Shanahan (15/11/2021)	Kate Riley (16/11/2021)	Khaled ElSawaf (16/11/2021)	Fluvial flood risk added.

Executive Summary

Insynch Energy are proposing to develop the Knowsley Industrial Estate site, off Acornfield Road, Kirkby, L33 7UZ. This level 1 Flood Risk Assessment (FRA) has been produced to accompany the planning application for the proposed development.

A small portion of the site (approximately 0.002ha) is within Flood Zone 3a and at risk of river flooding and surface water flooding. The section of the site where the gas engines are to be located will provide minimum finished floor levels of at least 40.5 m above ordnance datum (AOD) which are above modelled flood levels and predicted climate change impacts for river and surface water flooding in accordance with Environment Agency guidance (based on a development lifespan of 20 years).

Flooding of the access and egress route off Acornfield Road is predicted but the site would not be routinely staffed and can be operated remotely during a flood event. In the event of flooding the plant will be subject to remote shut down/isolation.

This report concludes with recommendations for the site development and a residual flood risk register.

This Flood Risk Assessment (FRA) finds that the residual risk of flooding by river and surface water sources to the site and off-site is "low" under the condition that a suitable drainage management system is installed that can handle a design flood.

I Introduction

Stopford Energy & Environment has been instructed by Insynch Energy to prepare a flood risk assessment (FRA) report to accompany a planning application for the proposed construction of six 2 MWe natural gas-powered engines for a gas-peaking electric power generation facility on former Syntor Fine Chemicals works, Acornfield Road, Knowsley Industrial Estate, Kirkby.

The assessment has been undertaken in accordance with the requirements of the National Planning Policy Framework (NPPF) and National Planning Practice Guidance (NPPG).

2 Development Site and Location

2.1 Location

The site is located off Acornfield Road, Knowsley Industrial Estate, Kirkby, L33 7UZ. The central grid reference for the site is 343753,399354. The proposed site is bounded by industrial units to the north, west and south and to the east by Acornfield Road. The proposed site is approximately 0.4882ha (see Figure 1). Sensitive receptors include conservation areas such as Acornfield Plantation Local Nature Reserve (LNR), and local schools and residential areas to the west.

The proposed development will not include any land raising, following site sections drawing in Appendix I.

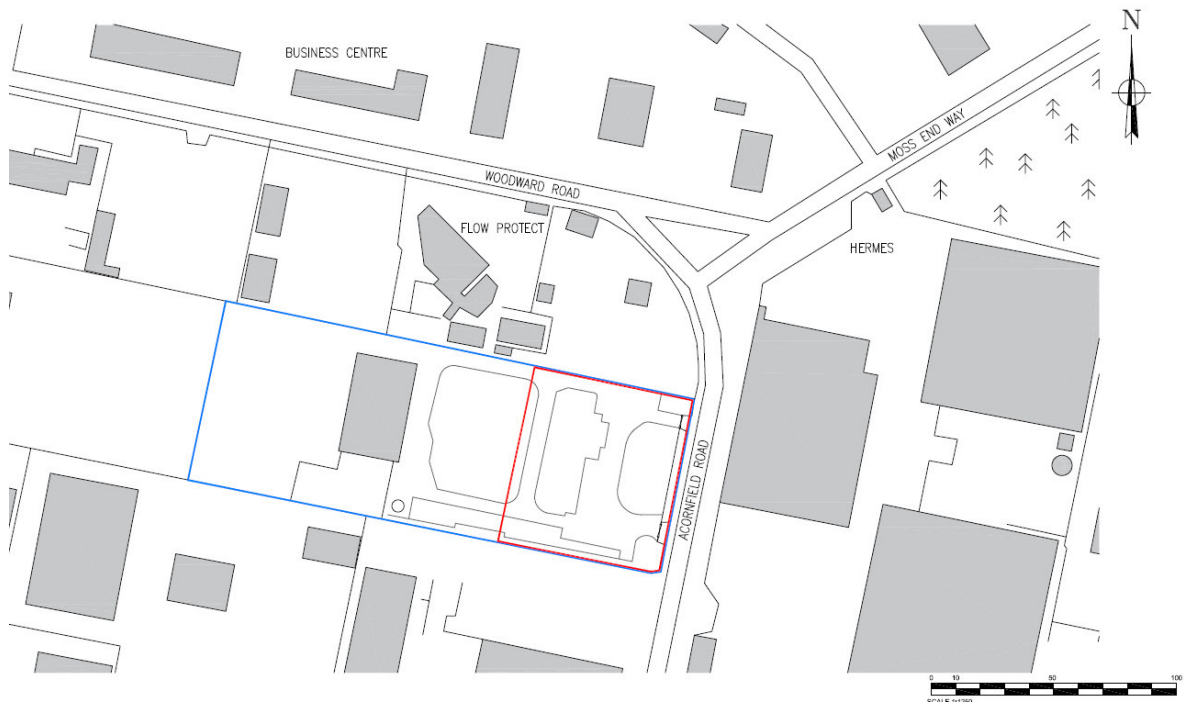


Figure 1: Location of the Acornfield gas-peaking site [ref.18].

2.2 Current Use

The site is vacant undeveloped brownfield land surrounded by industrial units within the Knowsley Industrial Estate. The site is a former oil/chemical works which ceased production in 2005 [ref.20].

2.3 Flood Zone

The site is located mostly across both level 1 and level 2 flood zone areas (see Figure 2) according to information gathered by the Environment Agency (EA) [ref.2]. However, a small section (approx. 0.002 ha) of the north-eastern side of the site is in a flood zone 3 area, where the development meets Acornfield Road.

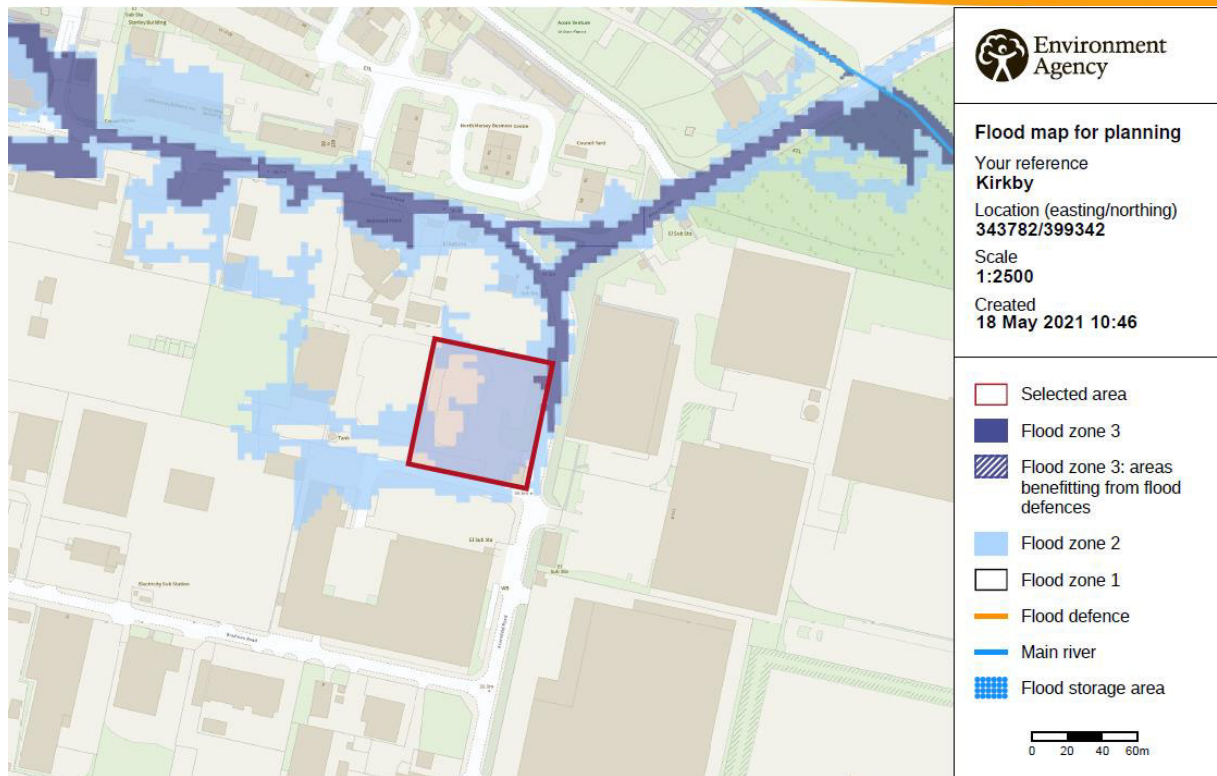


Figure 2: Environment Agency flood map for planning [ref.2].

3 Development Proposals

3.1 Development Proposals

A proposed site plan is provided in Appendix I.

It is proposed that the vacant land be used to build a gas-peaking facility, including:

- Six 2 MWe class gas engines (Figure 3) (Appendix I) housed within container units measuring 12 x 3 x 3 m, 9.04 m tallest point from ground level, mounted on 1,250 mm tall steel frames.
- Gas engines located within a raised bunded area.
- Security cabin.
- Three parking spaces.
- Refurbished security fencing and gates.
- Utilisation of existing site drainage network, hardstanding, and access to Acornfield Road.

The facility will be compliant with the operational requirements specified for Medium Combustion Plant/Specified Generator installations and will be regulated by the Environment Agency in line with the requirements of the Environmental Permitting Regulations (England and Wales), 2016.

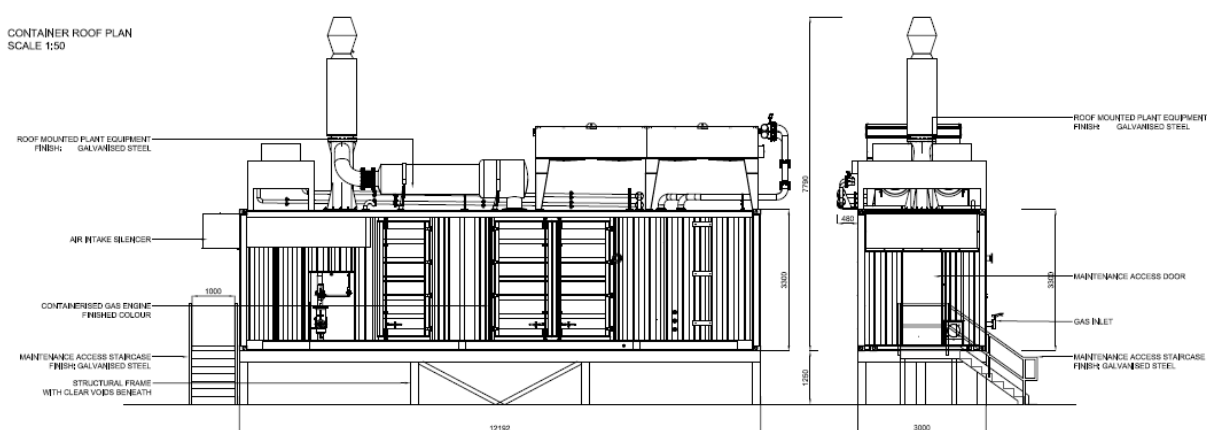


Figure 3: Proposed 2 MWe natural gas engines and associated equipment housed within a container unit, mounted on a frame [ref. 19].

3.2 Vulnerability Classification

Based on the vulnerability classification in Table 2 of the guidance [ref.3], PPG defines the development as 'General Industry' and classifies this use as 'Less Vulnerable.' Table 3 of the PPG considers this an appropriate use within Flood Zone 3.

3.3 Lifetime of Development

The proposed lifetime of the development is 20 years.

4 Sequential Test

The Sequential Test steers development preferentially towards Flood Zone 1 (Low Risk), considering Flood Zone 2 (Medium Risk) and then Flood Zone 3 (High Risk) only if land cannot be identified as available for development in zones at lower risk from flooding. [ref.3]. Within each flood zone, surface water and other sources of flooding also need to be taken into account in applying the sequential approach to the location of development.

The proposed application area is allocated for Class B1, B2, B8 development within the Local Plan for the Knowsley Industrial Estate [ref.14], which was informed by the Knowsley Strategic Flood Risk Assessment (SFRA) [ref.7]. In accordance with paragraph 162 of the NPPF, 'Where planning

applications come forward on sites allocated in the development plan through the sequential test, applicants need not apply the sequential test again.' It is therefore considered that the Sequential and Exception Tests need not be revisited, nevertheless element two of the Exception Test, that the proposed development will be safe for its lifetime, without increasing flood risk elsewhere and where possible reduce flood risk overall [3], is addressed within this FRA.

5 Climate Change

As the effects of climate change are being realised it becomes increasingly important to reduce and mitigate flood risk. It is essential that new developments are safe from flooding and incorporate strategies to reduce risk to ensure sustainable economic growth. Kirkby falls under the governorship of Knowsley Metropolitan Borough Council (MBC). In the borough the main issues associated with flooding have been caused by culverted watercourses from the River Alt outflow. Highway flooding due to this reason has occurred during extreme rainfall periods in 2000, 2005, 2008, 2010, 2011 and 2012. Internal flooding to one property in 2011 and to two properties in 2012 also occurred due to this [ref.4].

5.1 Peak River Flow

The site is situated in the North-West river basin district [ref.5]. As the site has a life expectancy of 20 years, changes to peak river flow allowances for climate change (North-West) were reviewed for up to the year 2041 [ref.6] (see Table 1). As the site is classified as 'less vulnerable' the higher central allowances will be used.

Table 1: Peak river flow allowance for the North-West river basin district (based on 1961 to 1990 baseline) [ref.6].

Allowance Category	Total potential change anticipated for the '2050s' (2040 to 2069)
<i>Higher central</i>	30%

5.2 Peak Rainfall

Rainfall allowances can be used to provide a more accurate estimation for fluvial uplifts in small 'flashy' catchments. Small watercourses are impacted because of the high volume of runoff relative to their channel capacity. Increases in rainfall intensity due to climate change are likely to result in an increase in the severity and frequency of flooding incidents on small watercourses. Rainfall

allowances should also be applied when considering surface water flooding and drainage assessments.

Increased rainfall affects river levels and land and urban drainage systems. The EA also has predictions for anticipated changes in peak rainfall intensity in small catchments (less than 5 km²), or urbanised drainage catchments (see Table 2). For flood risk assessments both the central and upper end allowances are assessed to understand the range of impact.

The modelled potential change for the Central allowance category for 2040-2069 is 10%, compared to a 20% increase modelled in the Upper End allowance category.

The site developer has reported to Stopford that the on-site drainage system is of a state and capacity to ensure there is no increase in the rate of runoff discharged from the site for the Upper End allowance so that during high periods of rainfall and high river levels, backup does not occur.

Table 2: Peak rainfall intensity allowance in small catchments (less than 5km²) or urban drainage catchments (based on a 1961 to 1990 baseline) [ref.6].

<i>Allowance</i>	<i>Total potential change anticipated for the '2050s' (2040 to 2069)</i>
<i>Upper end</i>	<i>20%</i>
<i>Central</i>	<i>10%</i>

6 Site Specific Flood Risk

There are five key types of flooding which are identified in the Local Flood Risk Management Strategy. These are river flooding (fluvial), surface water flooding (pluvial), sewer flooding, groundwater flooding and reservoir flooding [ref.4].

6.1 Main Sources of Flood Risk

6.1.1 Fluvial

The proposed site is located in a flood risk zone 2 or 3 from Simonswood Brook 2 (the brook), flowing northwest, located approximately 240 m northeast of the proposed site.

Product 4 modelled flood risk 2D mapping data from the Environment Agency (Appendix III) shows the brook, termed a main river, as a source of undefended flood zone 2 and 3 fluvial flooding to the Knowsley Industrial Park and the proposed site.

The proposed site is shown not at risk from 5% Annual Exceedance Probability (AEP) fluvial flooding, with flooding limited to fields east of Perimeter Road.

The proposed site is shown at risk from 1% AEP fluvial flooding (without climate change allowance, and with +30%, 35% and 70% climate change allowances) from the brook. From the maps for 1% AEP fluvial flooding, it is expected that flood water would travel from the brook, following local topography, along Moss End Way in a southwest direction, onto the local highways and towards the proposed site. The 1% AEP flood risk +CC data shows the extent of fluvial flooding on the proposed site for the following elevations:

- 1% AEP No CC = 39.40 mAOD
- 1% AEP +CC (+30%) = 39.53 mAOD
- 1% AEP +CC (+35%) = 39.56 mAOD
- 1% AEP +CC (+70%) = 39.60 mAOD

As per Table 1 the climate change allowance for 1% AEP peak river flow is +30% for the lifetime of the proposed development, with fluvial flooding modelled to reach an elevation of 39.53 mAOD on the proposed site.

The proposed site is also shown at risk from 0.1% AEP fluvial flooding (without climate change allowance and with +30% climate change allowances) from the brook.

- 0.1% AEP No CC = 39.60 mAOD
- 0.1% AEP +CC (+30%) = 39.64 mAOD

6.1.2 Surface Water

Surface water flooding caused because of sewer infrastructure blockage, failure or insufficient capacity, groundwater, pluvial and overland flow all have the potential to contribute to significant flood risk in urban areas. This is due to rapid run-off rates associated with urban land-use and the subsequent volumes of water flowing through infrastructure and overland in relatively short-periods of time [ref.7]. Reported surface water flooding incidents within the Borough are generally associated with highway flooding and are prevalent as with all major conurbations within the Council's boundaries [ref.7]. Pockets of surface water flooding are evident across Knowsley Industrial Estate as can be seen in Figure B5 of the Level 2 SFRA (see Appendix III) [ref.9].

Insynch state that the site has so far not flooded, according to the landowners.

From the EA's flood risk maps (ref. 8), the site is shown at low (0.1-1% per year), medium (1-3.3% per year) and high risk (>3.3%) of surface water flooding (Figure 6). From analysis of the low risk surface water flooding, surface water originates along Acornfield Road flowing in a northward direction past the site (Figure 7). Surface water flood depths on site are predicted at 300-900 mm for an area at the southern entrance to the site, with <300 mm depth predicted across the majority of the site (Figure 8).

Annual rainfall in 2020 for the North-West was 1,302 mm [ref. 16] which equates to 3.6 mm per day.

Existing methods for managing surface water runoff include hardstanding areas, surface and buried drains remaining from the former use as a chemical works. From the Utility Mapping Survey in 2015 (ref. 20) buried drains, noted as 150 and 225 mm diameter, fall towards an interceptor located at the southern site entrance and taken to flow to a public combined sewer running along Acornfield Road at approx. grid reference 343814,399319. The buried drains are estimated to have a capacity of 2 m³.

The 1% AEP rainfall event for the site equates to a discharge rate of 3.9 litres/second (approx. 14 m³ in 1 hour discharge for 3 mm/hour rainfall over the site area) based on UK SuDS surface water storage tool [ref. 17]. This is based on the tool's IH124 method, 100% impermeable site area (based on existing ground conditions), and 20% upper end climate change allowance (Table 2). The estimated site discharge is discussed in the drainage strategy (Section 10.2). The estimated 2 m³ capacity of the buried drains provides storage for approximately 10 minutes of rainfall at the above rates.

6.1.3 Ground Water

DEFRA has compiled a scoping study report and emergence maps which show areas where groundwater is rising and therefore, where increased flood risk via groundwater is prevalent [ref.7]. The geology of the North-West river basin district means that it has significant aquifers [ref.10]. A decline in industry in the region, leading to reduced water abstraction has also meant that regional groundwater levels are rising [ref.10]. Figure E1 of the SFRA and maps from the British Geological Survey [ref.11] shows that the site is located on bedrock composed of Triassic sandstone (Chester formation), a Principle Aquifer (see Appendix III). Sandstone is relatively porous and so would allow

for the percolation of water throughout the bedrock. Superficial deposits on the site comprise of sand (Shirdley Hill) that forms part of a Secondary A Aquifer (see Appendix III) [ref.11].

Despite the information stated above, the level 1 SFRA concludes that based on all the information available, groundwater flooding is not a significant and current risk to the region [ref.7].

6.1.4 Sewers

Private foul and surface water sewers are noted to be located within and adjacent the proposed site. There is, therefore, potential for sewer surcharge flood risk from connections of these private sewers with the relevant public sewer networks on the industrial estate (i.e., United Utilities public foul and surface water sewers).

The sewerage infrastructure of many of the older, urban areas of the Borough is based on Victorian sewers and there is a risk of localised flooding associated with this as the system will be susceptible to blockages [ref.7].

6.1.5 Reservoirs

There are relatively few reservoirs in the Borough, although areas in the south of the Borough are affected by flooding from reservoirs located outside the Borough [ref.9]. As Kirkby is in the north of the Borough it is not at risk from this source of flooding.

6.2 Site Topography and Flood Risk

The modelled flood zones provided by the EA [ref.2] show the proposed site to be in a mainly flood zone 1 and flood zone 2 area. However, a small portion of the north-eastern side of the site is in flood zone 3 (Figure 2).

Using LiDAR data from 2019 [ref.15] a digital terrain model at 2m resolution was created, allowing the topography of the proposed site, to be compared to the topography of the surrounding land (see Figure 4) In general, the land to the east of the site is higher, and generally decreasing as you look west. The height of the site can be seen to be between 38.2-42.2 m Above Ordnance Datum (AOD). The flood zone 3 area outlined in Figure 2 to the north-east of the site is approximately at a level 39.4m AOD based on topographic data for the site [20].

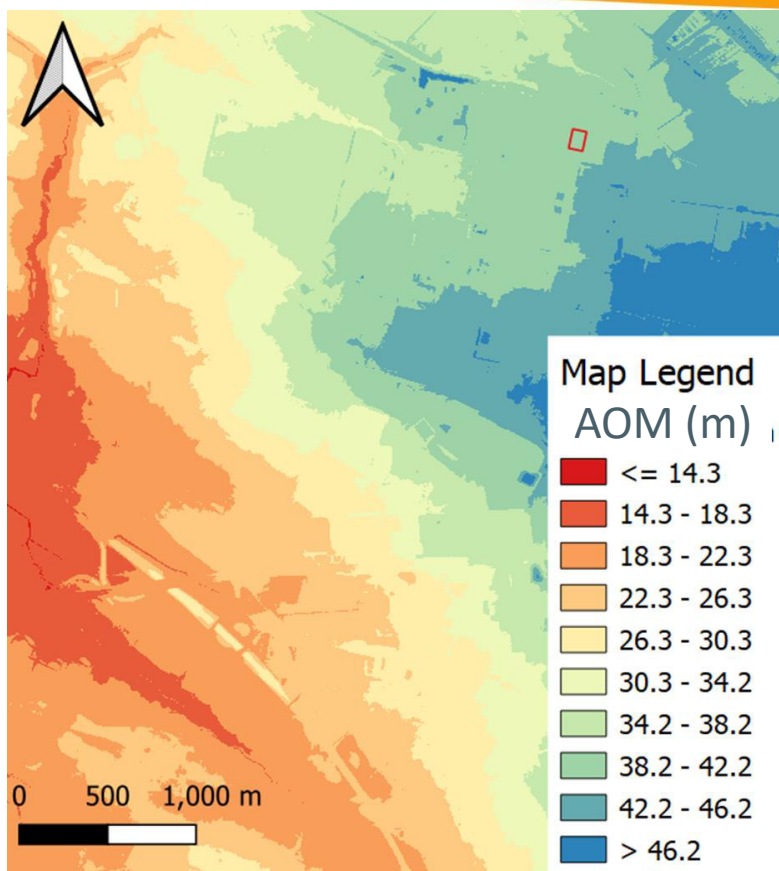


Figure 4: 2019 LiDAR data rendered into a DTM in QGIS [ref.15].

The LiDAR data from 2019 [ref.15] was then used to construct a digital surface model at 2m resolution (see Figure 4). The DSM shows roads and buildings and so gives more detail and point of reference to the site. Here it can be seen that the land immediately east of the site, Acornfield Road is on higher ground (39.6-43m AOD) compared to much of the eastern section of the site, which is between (36.3-39.6m) (although known to be 38.2 to 39.6m due to Figure 4). Therefore, there is a potential surface-water flood-pathway from Acornfield Road to the site as the surface water travels from high to low ground.

The water velocity in a low-risk surface water scenario can also be seen to travel in a northerly direction before entering the south-east area of the site and then travelling through the site in a northerly direction (see Appendix III). It is also likely that flood water from Acornfield Road flowing north may back up as it travels north and as a result cause further flooding.

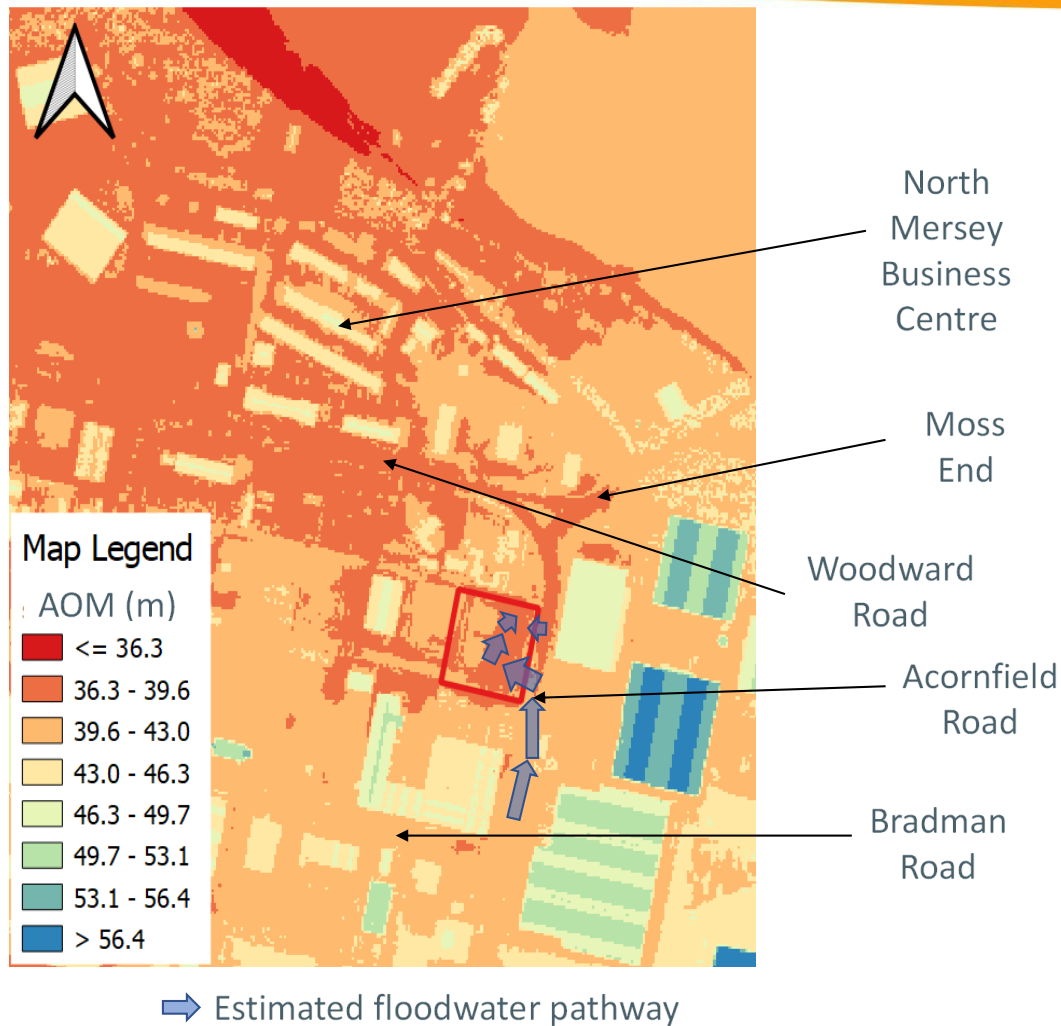


Figure 5: 2019 LiDAR data rendered into a DSM in QGIS.

From a 2015 topographic survey of the site, ground level in Flood Zone 3 is approximately 39.3 m AOD [ref. 20], validating the LIDAR data above.

6.3 Displacement of Flood Water

6.3.1 On-site Impacts

The proposed development will not raise the existing land surface. The proposed gas engines will be mounted on structural steel frames which would take up negligible volume of floodwater. The security cabin on site will also be placed on a frame to allow for services to enter the building.

The levels and topography of the existing site will be altered minimally and, therefore, have no impact on the modelled flood extent from river and surface water flooding [ref. 2 and Appendix III].

6.3.2 Wider Impacts

As above, the levels and topography of the existing site will not be raised, and frames will be used to locate site units. There is, therefore, low risk of displacing flood water from the proposed development [ref. 2 and Appendix III]. Flood risk will not be increased elsewhere, from increased flood depth or larger flood extents, particularly to existing development such as neighbouring commercial properties and highways. This is because the proposed development will still retain a degree of flood water storage during a flood event and likely into flood recovery. Maintenance of surface water drains and gravel areas will provide a degree of improved flood water management as discussed in Section 6.1.2, especially with regards to slowing surface water discharge from the proposed development into the local public combined sewer.

7 Surface Water Management

SUDS measures at the lower end of the SUDS Hierarchy is proposed to be implemented for this site. It is planned that the site will utilise the current drainage system in place with alterations. Gravel areas for around the gensets (see Site Plan in Appendix I) will provide a degree of surface water storage discussed below. These alterations are detailed in the drainage strategy section of this report (see 10.2).

The compacted gravel area of the site are estimated to cover 0.4 ha of the site. It is estimated the gravel will delay (e.g. >1 hour) the discharge of 4-8 m³ of surface water that will drain to the site buried surface water drainage network. The buried surface water drainage network is estimated to have a capacity of 2 m³ (Section 6.1.2).

The estimated 10 m³ capacity of the proposed gravel area (8 m³) and in-situ buried drains (2 m³) provides temporary storage for 50 minutes of rainfall at 3 mm/hour (1% AEP + 20% CC).

8 Occupants and Users of the Development

Flooding of the site off Acornfield Road is predicted but the site would not be routinely staffed and can be operated remotely during a flood event.

9 Exception Test

As the proposed development is within a flood zone 3 area, the exception test must be applied.

The UK power mix moving rapidly away from fossil fuels to include renewables and nuclear presents a continuity and capacity problem for the National Grid at peak consumption and when it is cloudy and still. The solution is the strategic development of local short-term balancing reserves that can smooth the peaks, generating between 10-50 MW. The proposed gas peaking plant will help to provide these reserves through a high-power output and high electrical efficiency with low levels of emissions.

Regarding social impacts, the development will create 4 full-time equivalent jobs in support roles and supplement further work for maintenance of the gas engines.

As discussed earlier in the document the site has been designed to be safe over its lifetime.

10 Flood Risk Mitigation

10.1 Finished Floor Levels

It is proposed that the finished floor levels of the development will be a minimum of whichever is higher of:

- 300 mm above the general ground level of the site
- 600 mm above the estimated river flood level on site
- 300 mm above modelled surface water flood depths

10.1.1 Fluvial Flooding

As per Environment Agency guidance, the finished floor levels of the proposed development shall be at least 600 mm above the river flood level [ref. 13]. For Flood Zone 3 the 1% AEP +CC (+30%) river flood level] is used:

- The modelled 1% AEP +CC (+30%) = 39.53 mAOD
- Standing Advice Freeboard = 0.6 m
- **Minimum ground floor levels for river flooding = 39.53 + 0.6 = 40.13 mAOD**

10.1.2 Surface Water Flooding

It is proposed that the finished floor levels of the proposed site, where the engines are positioned shall be above Flood Zone 3 flood depths of 900 mm as worst case [ref.13] with reference to site topography based on 2015 surveys [ref. 20]:

- The approximate level of the current level 3 flood zone = $39.3 + 0.9 = 40.2$ mAOD
- Standing Advice Freeboard = 0.3 m
- **Minimum ground floor levels for surface water flooding = $40.2 + 0.3 = 40.5$ mAOD**

Equipment should be installed at or above this elevation.

10.2 Drainage Strategy

A section of the local development order for Knowsley Industrial and Business Park [ref.14] states the following:

'SC6: Drainage: No development shall commence until a scheme for the provision and implementation of a surface water regulation system to manage the risk of flooding from both overland flow and from the sewer network has been submitted to and approved in writing by the Local Planning Authority. The development shall not be brought into use until the approved scheme has been implemented in its entirety'. [ref.14].

It is proposed that the current drainage system in place on the site will be utilised. From the utilities plan in the remediation report (ref. 20), surface water drainage on the site flows by gravity away from the site boundary towards buried drains (150 and 225 mm diameter) inside the site to an interceptor and public combined sewer on Acornfield Road. However, it is important that the status of the drains on the site are checked and verified before work progresses. As mentioned in the local development order, it is necessary that the site has a detailed drainage management system in place where the design flow for floodwater has been put in place. The drains put in place will need to be able to handle the design flow of 3.9 litres/second (Section 5.2) and be accessible for inspection and maintenance.

10.3 Safe Access and Egress

- Flooding of the access and egress route off Acornfield Road is predicted but the site would not be routinely staffed and can be operated remotely during a flood event.

- In the event of flooding the plant will be subject to remote shut down/isolation.
- No significant effects on the existing surface water drainage regime are anticipated as a result of the development proposal. However, the existing regime will likely need to be redeveloped due to damage caused through the remediation works.
- All on-site controls and critical infrastructure will be raised to at least 40.5 m AOD elevation. This is to reduce residual risks associated with flooding and increased flood warning time in this event.

11 Residual Risk

A review of residual risk was required as part of this FRA process and appropriate mitigation measures considered. The risks that remain after risk management and mitigation as per Environment Agency guidance [ref. 13] have also been presented (Appendix II).

In summary, there is a low residual risk of flooding on site.

12 Conclusions

The proposed 0.4882 ha development of a gas peaking plant at the Knowsley Industrial Estate site, off Acornfield Road, Kirkby, is a low residual risk from flooding. The proposed site is located within a modelled Flood Zone 3a. Finished floor levels of at least 40.5 mAOD elevation will mitigate against river flood levels from Simonswood Brook 2 and surface water flood levels from Acornfield Road.

Flood impact to the surrounding area is considered low risk.

A drainage management system needs to be installed which will manage surface water flooding from Acornfield Road.

Flooding of the access and egress route off Acornfield Road is predicted but the site would not be routinely staffed and can be operated remotely during a flood event. In the event of flooding the plant will be subject to remote shut down/isolation.

13 Recommendations

- Drainage management that can handle a design flow of 3.9 litres/sec.
- Final floor levels for all site controls and critical infrastructure at least 40.5 mAOD elevation to mitigate against potential river flooding and surface water flooding.

- Flood Management and Recovery Plan outlining the procedures to be followed in the event of flooding, including site evacuation – the site operator should develop and maintain such plans under their site management plan. This will ensure the business is prepared for flooding and what to do in an emergency. Collaboration with neighbouring businesses and community for flood resilience and recovery should be an aspect of these plans.
- Flood Alerts – the site operator should sign up for alerts from the local flood authority, Met Office, and Environment Agency. This will provide further resilience to the business and further safety benefits in terms of potential evacuation and execution of the Flood Management Plan
- Raised electrical sockets, wires, and other services of the proposed development, making buildings and/or plant more resilient to flooding by reducing the risk of having to replace services following flooding (e.g. security cabin, plant and distribution control panels, lighting, substation etc.).
- Using paints/plasters, floor finishes and insulation in buildings that are resilient to water.
- As best as practicable, the proposed development should be designed for ease of drying and cleaning of building and plant areas following flooding. For example, making sure there is access to all spaces to enable drying and/or cleaning.

I4 Flood Risk Assessment Credentials

Dr Peter Shanahan is a member of the Chartered Institution of Water and Environmental Management (CIWEM), with experience of completing industrial flood risk assessments. He has completed flood risk training with CIWEM and Symmons Madge.

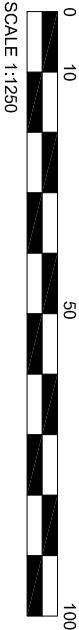
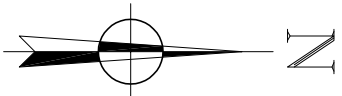
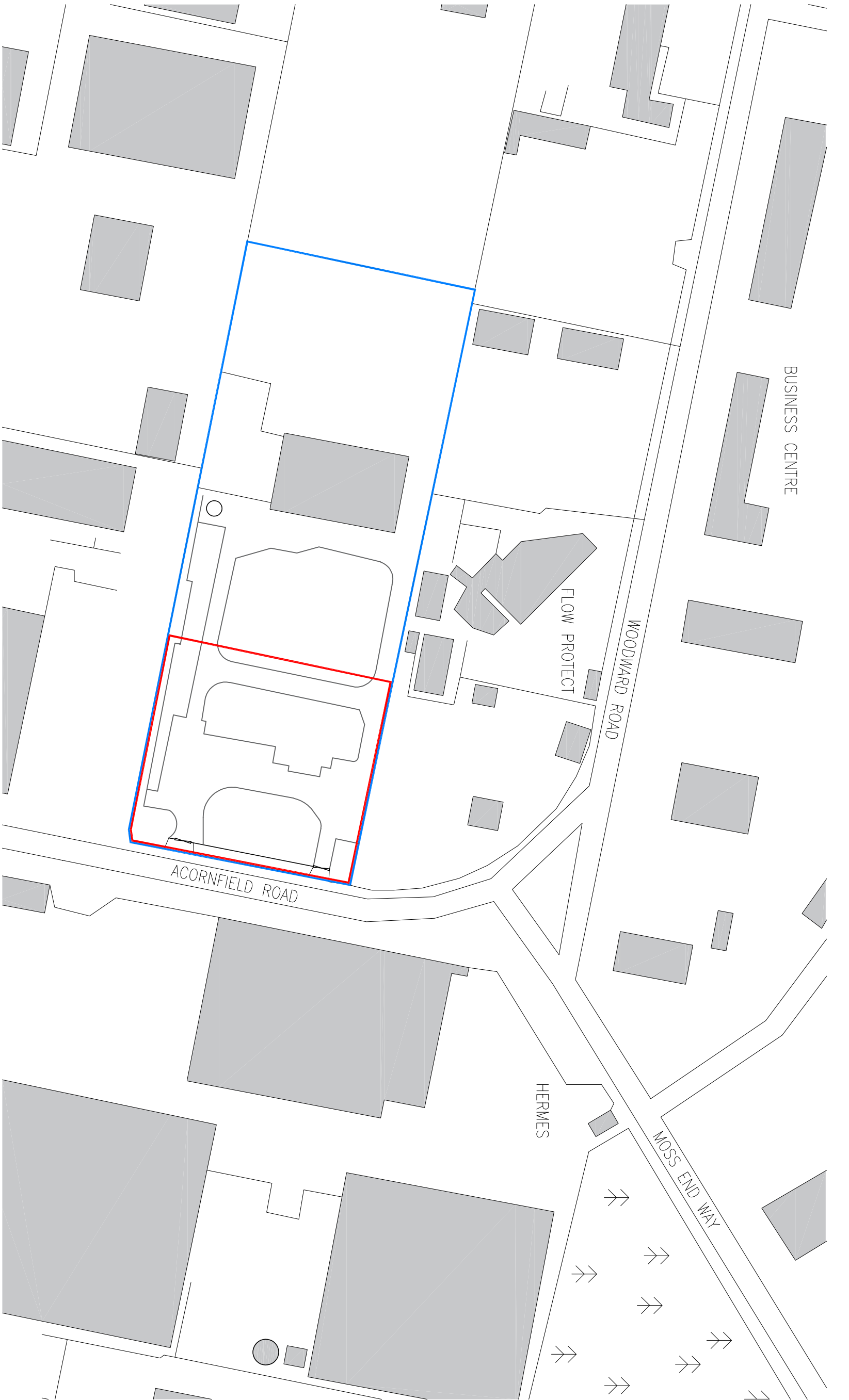
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- 13 Environment Agency (2019), Preparing a flood risk assessment: standing advice (<https://www.gov.uk/guidance/flood-risk-assessment-standing-advice#extra-flood-resistance-and-resilience-measures>).
- 14 Knowsley Council (2021), Knowsley Industrial and Business Park Local Development Order (www.knowsley.gov.uk/pdf/Adopted%20Knowsley%20Industrial%20Park%20LDO.pdf#:~:text=1.1).
- 15 Department for Environment, Food & Rural Affairs (DEFRA) (2021), Defra Survey Data Download (<https://environment.data.gov.uk/DefraDataDownload/?Mode=survey>).

- 16 Met Office (2021), Monthly Northwest England & Wales precipitation. Hadley Centre observations datasets. (<https://www.metoffice.gov.uk/hadobs/hadukp/>)
- 17 UK SUDS (2021), Surface water storage volume estimation tool (<https://www.uksuds.com/drainage-tools-members/surface-water-storage-tool.html>)
- 18 DAY Architectural (2021), Location Plan, Gas Peaking Plant Acornfield Road, Kirkby, 1:2500, 1185-21-XX-00-DR-A-0001 Rev A.
- 19 DAY Architectural (2021), Gas Engine Container Plans and Elevations, Gas Peaking Plant Acornfield Road, Kirkby, 1185-21-XX-00-DR-A-0005 Rev A.
- 20 AMEC (2016), Syntor Acornfield Road Remediation Verification Final Report 17223i2.
- 21 DAY Architectural (2021), Gas Engine Container Plans and Elevations, Gas Peaking Plant Acornfield Road, Kirkby, 1185-21-XX-00-DR-A-0004 Rev A.

Appendices

Appendix I. Plans



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CLIENT																																													
Insynch Energy Services LTD																																													
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PLANNING																																													

CRUSHED GRANULES

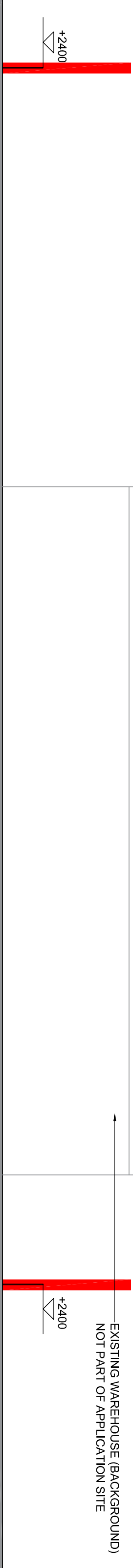
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CRUSHED GRANULES

CONCRETE ROAD

CRUSHED GRANULES

CONCRETE ROAD



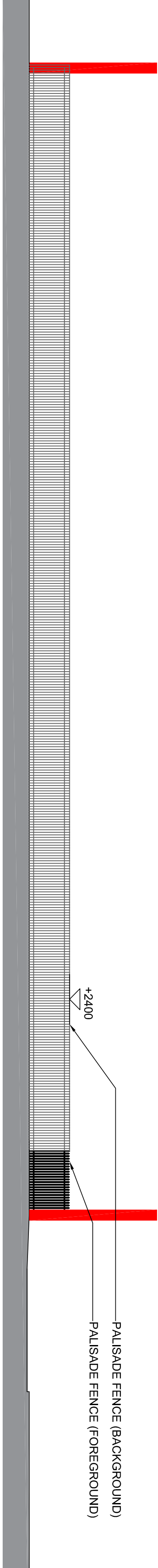
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A-A
SCALE 1:200

CRUSHED GRANULES

CONCRETE ROAD

CONCRETE ROAD

ENTRANCE ROAD



EXISTING NORTH EAST FACING SITE SECTION
B-B
SCALE 1:200

CRUSHED GRANULES

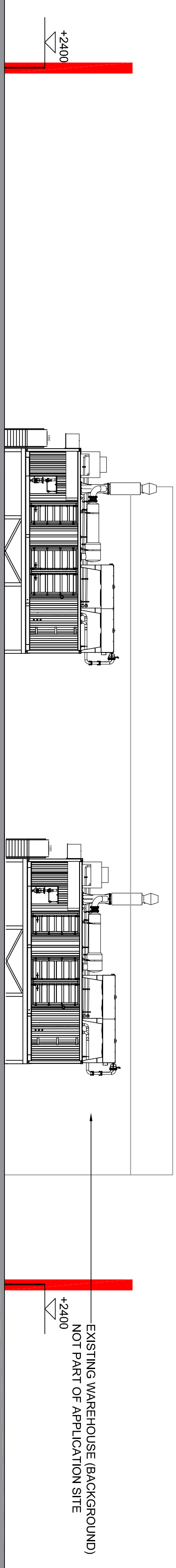
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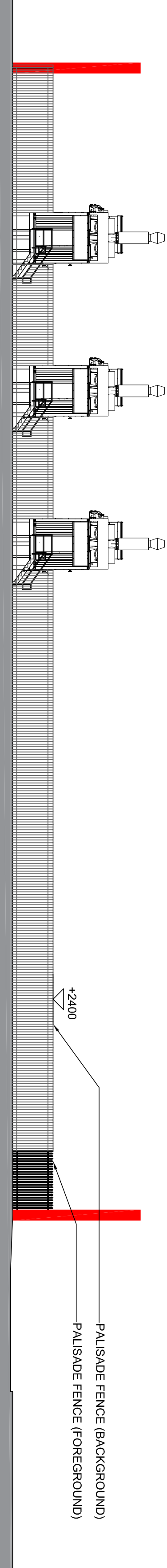
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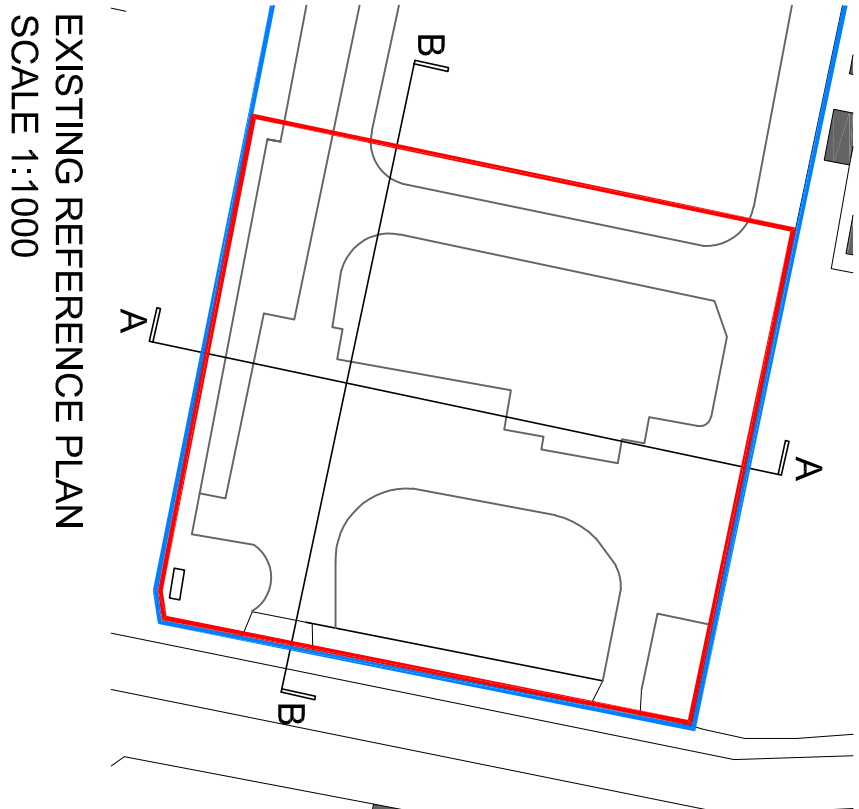
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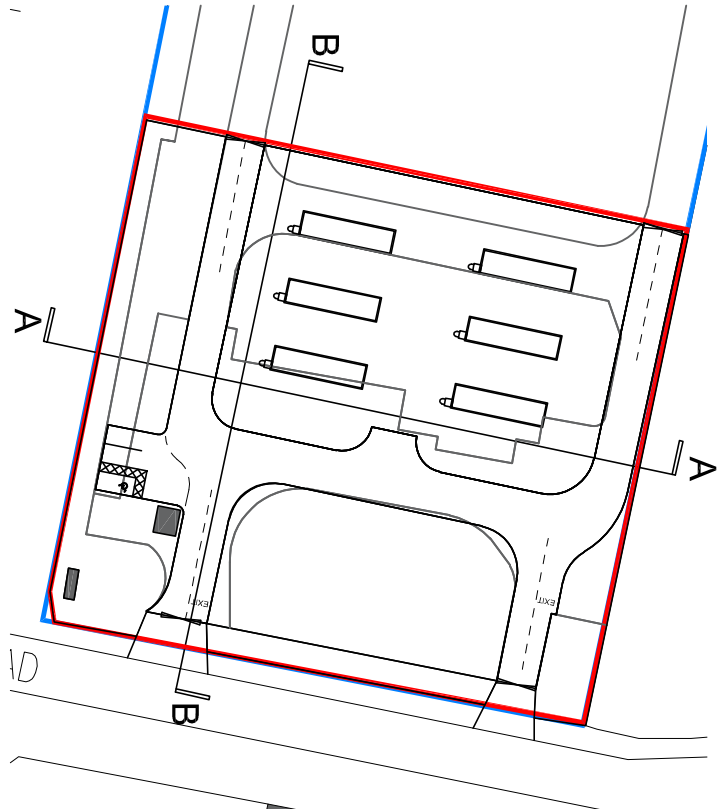
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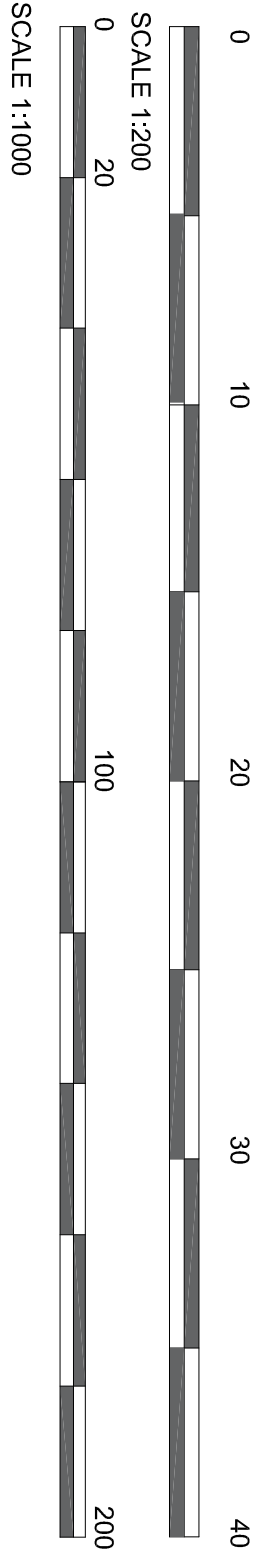
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B-B
SCALE 1:200



EXISTING REFERENCE PLAN
SCALE 1:1000



PROPOSED REFERENCE PLAN
SCALE 1:1000



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CLIENT					DRAWING				
Insynch Energy Services LTD					Existing and Proposed Site Sections				
PROJECT Acomfield Road, Killybeg					SCALE AS SHOWN		PAPER SIZE A1		
					DATE 15/04/2021		DRAWN BY MDB		
					DRAWING NO. 1185-21-XX-QD-DR-A-0001		REVISION A		
					PROJECT NO. 1185-21				
DRAWING STATUS									
PLANNING									
A					Initial Issue				
REV DESCRIPTION					DATE REV BY CHKD BY				
15/04/21					MDB				

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Appendix II. Residual Flood Risk

No.	Hazard	Cause	Before controls			Consequence	Response	After controls		
			P	I	Risk =PxI			P	I	Risk=PxI
1	Flooding of property.	Surface water runoff from extreme rainfall above design standards.	4	2	8	Damage to gas engines. Cleaning of installation and subsequent building work for repairs.	Developer: suitably maintained drains, grids, and guttering. Final floor level 40.5 m AOD (300 mm above FZ3 flood depth 900mm)	4	1	4
2	Flooding of property.	River flooding from Simonswood Brook 2.	4	2	8	Damage to gas engines. Cleaning of installation and subsequent building work for repairs.	Developer: suitably maintained drains, grids, and guttering. Final floor level at least 40.5 m AOD (600 mm above 1% AEP +30%CC flood level of 39.53 m AOD)	4	1	4
3	Flooding of property.	Failure of site drains.	4	2	8	Damage to gas engines. Cleaning of installation and subsequent building work for repairs.	Developer: suitably maintained drains, grids, and guttering. Final floor level 40.5 m AOD (300 mm above FZ3 flood depth 900mm) Site drainage management plan incorporated into Environmental Management System.	4	1	4
4	Road flooding.	Extreme rainfall.	2	5	10	Impeded access/egress to the site. Delayed emergency response.	Final floor level 40.5 m AOD (300 mm above FZ3 flood depth 900mm) Assumed management of highways drainage by local authority. Proposed flood management and recovery plans of site operator.	2	2	4

Appendix III. Maps

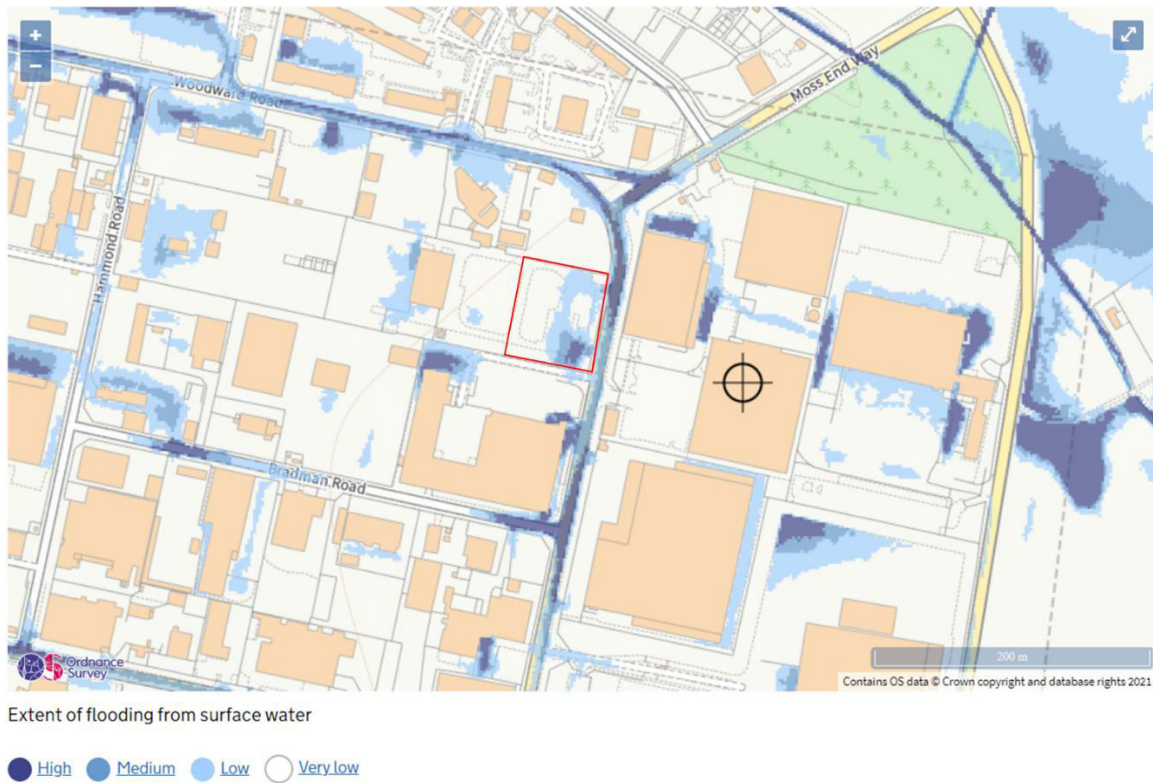
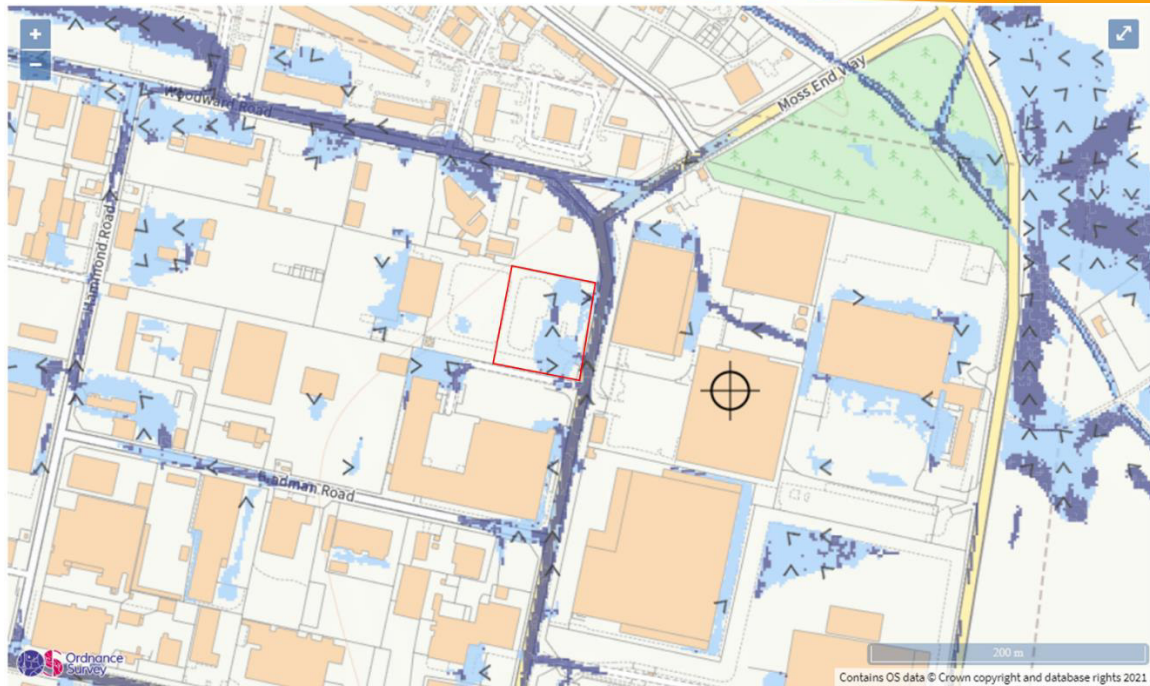


Figure 6: Risk of flooding from surface water [ref.8].

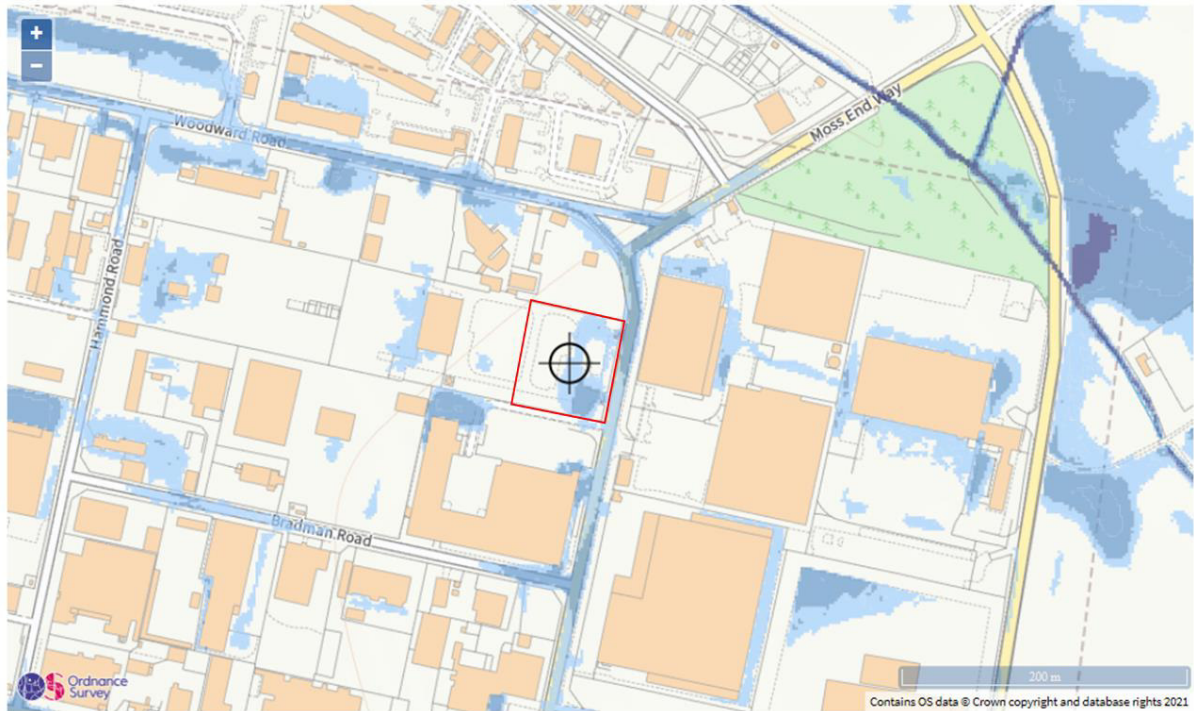


Surface water flood risk: water velocity in a low risk scenario

Flood velocity (metres/second)

● Over 0.25 m/s ● Less than 0.25 m/s ↖ Direction of water flow

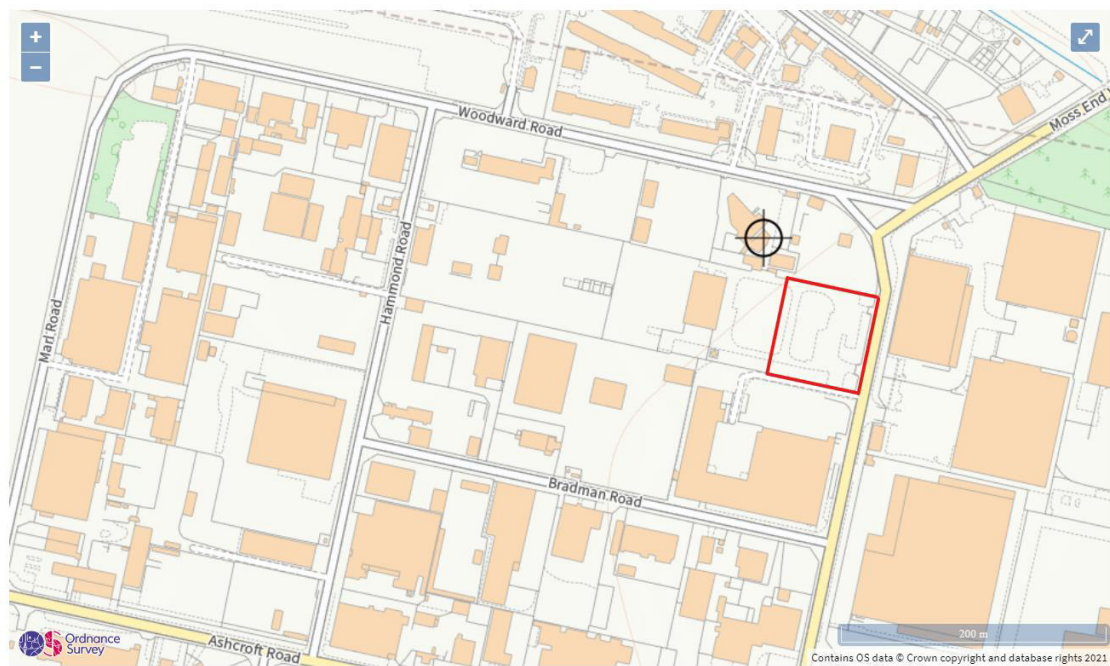
Figure 7: Surface water flood risk: water velocity in a low-risk (0.1-1% per year) scenario [ref.8].



Surface water flood risk: water depth in a low risk scenario
Flood depth (millimetres)

Over 900mm 300 to 900mm Below 300mm Location you selected

Figure 8: Surface water flood risk: water depth in a low-risk (0.1-1% per year) scenario [ref.8].



Extent of flooding from rivers or the sea

High Medium Low Very Low Location you selected

Figure 9: Extent of flooding from rivers or the sea [ref.8].

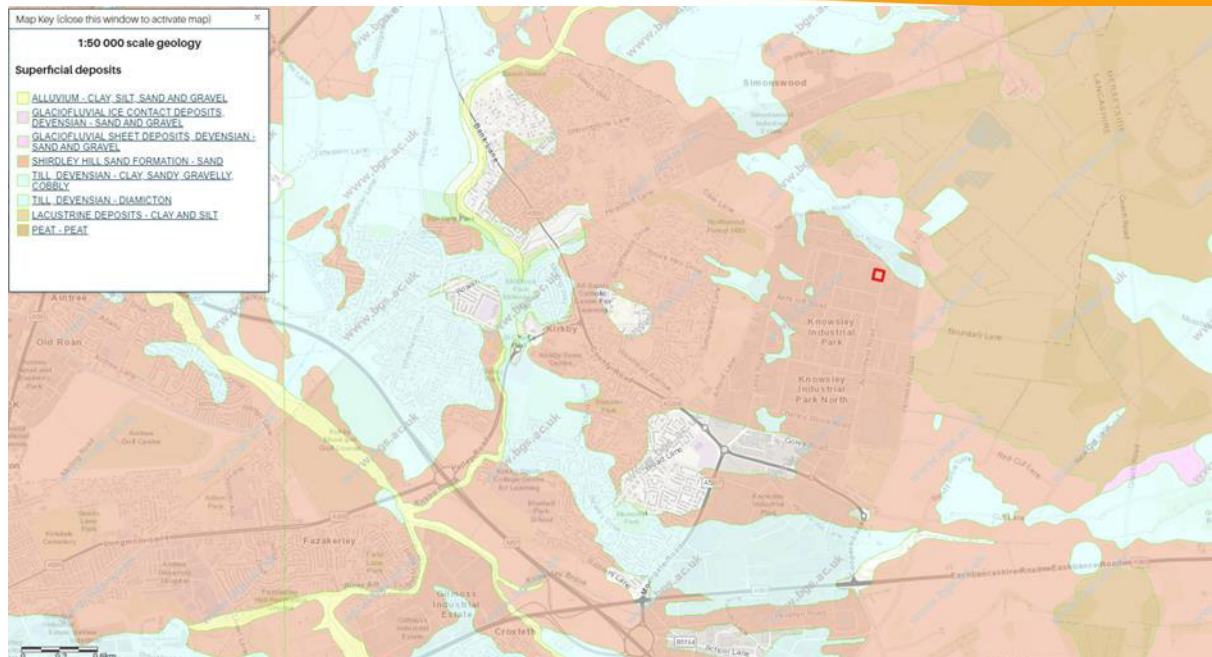


Figure 10: Superficial deposits at the site and the surrounding area [ref.11].

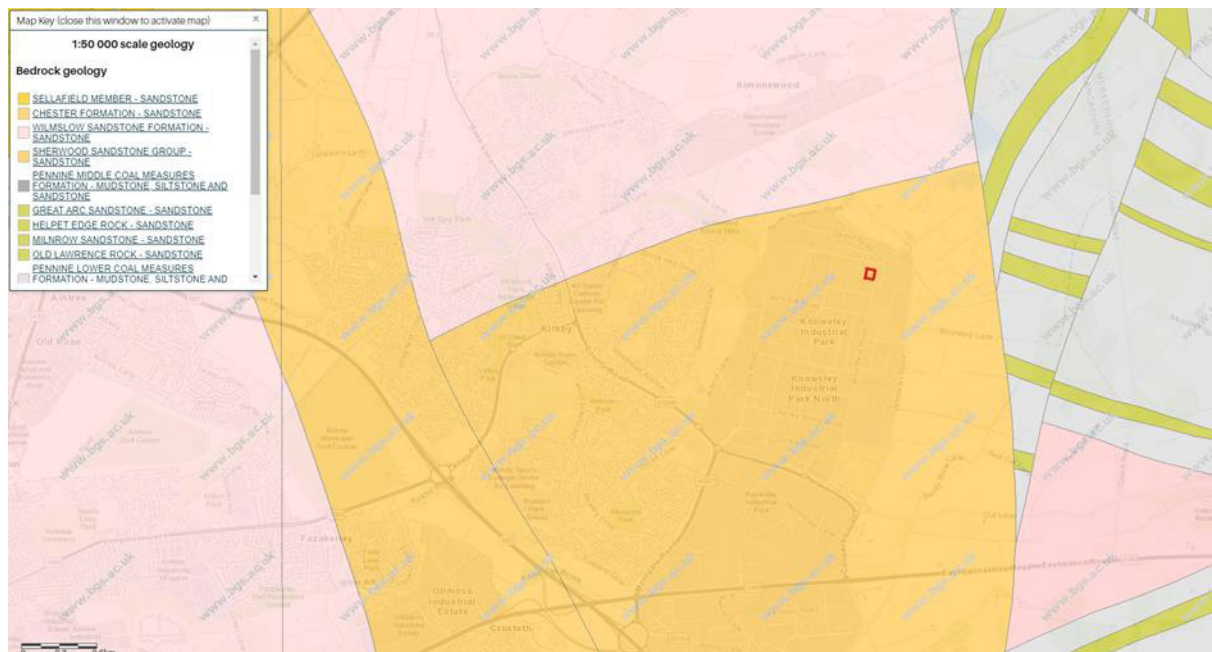


Figure 11: Bedrock geology at the site and surrounding area [ref.11].

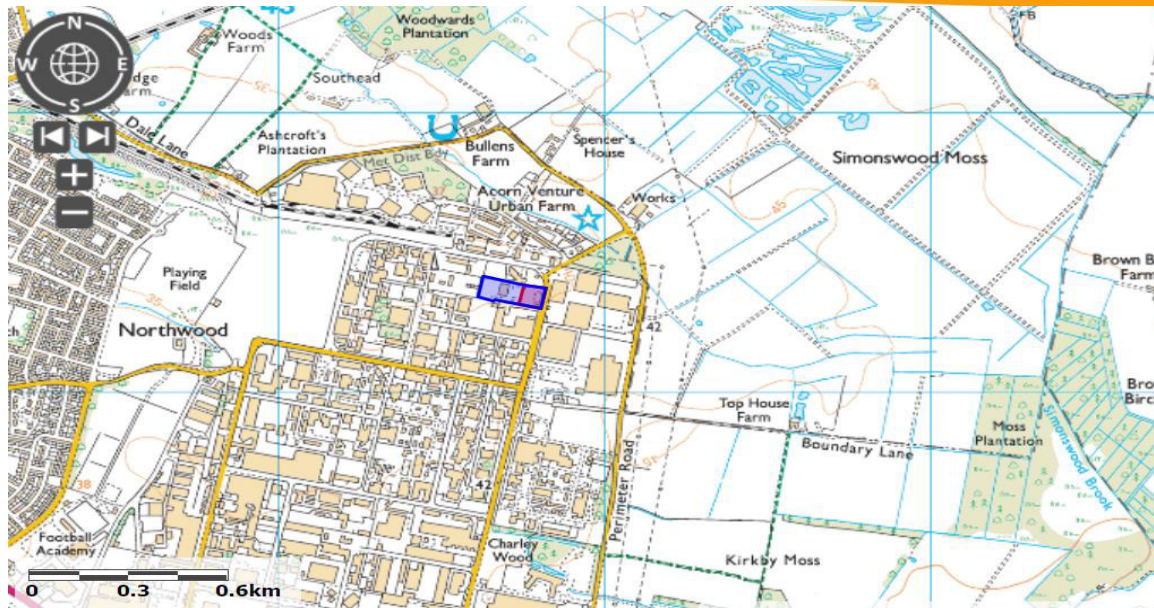


Figure 12: Map of the site and surroundings [ref.1].

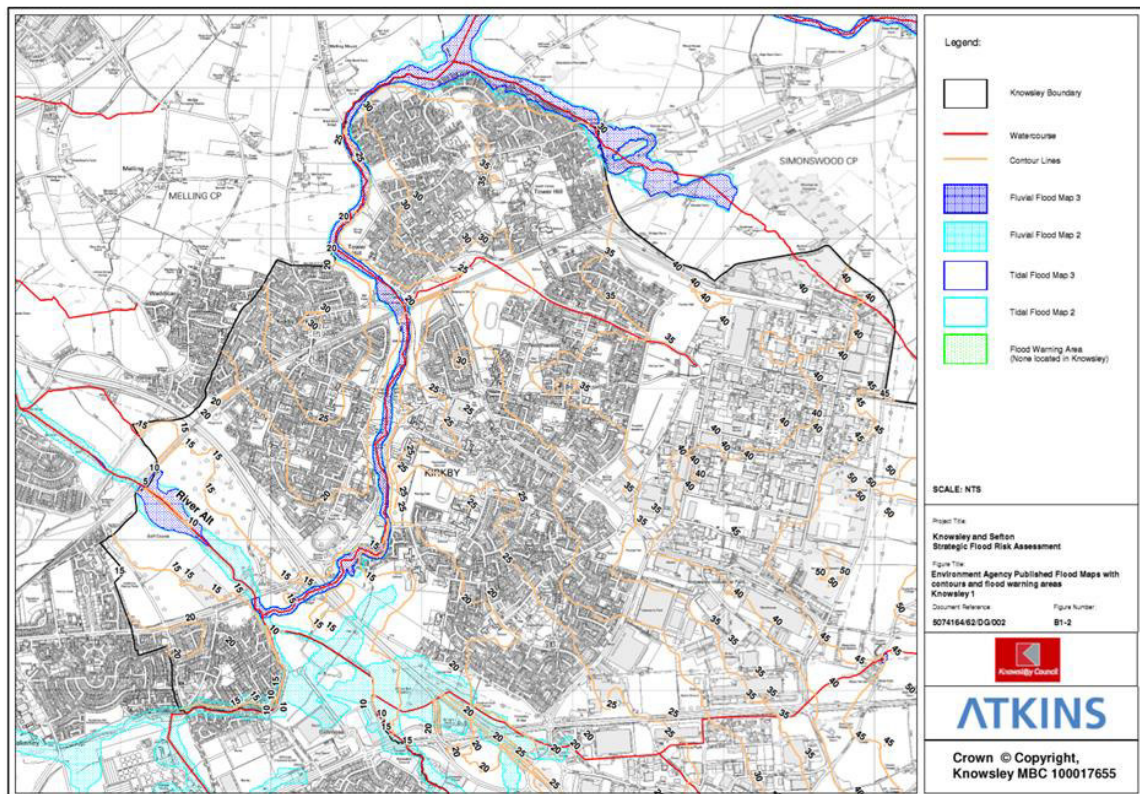


Figure 13: Fluvial flood map of Knowsley with contours [ref.7].

Flood Map for Planning

Acornfield Road, Kirkby, L33 7UZ

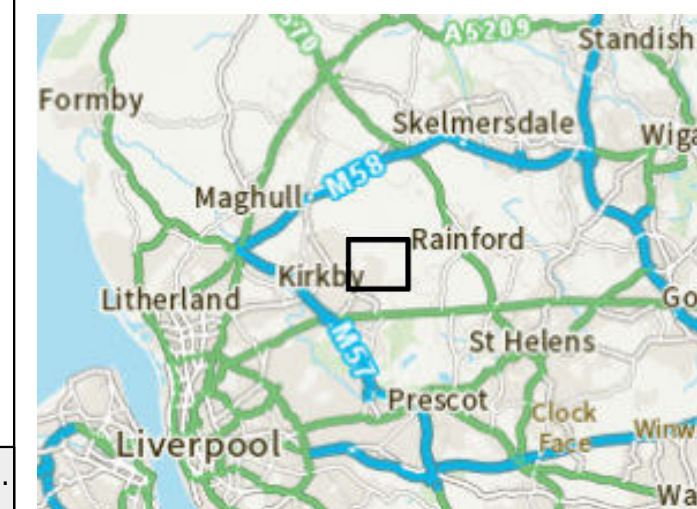
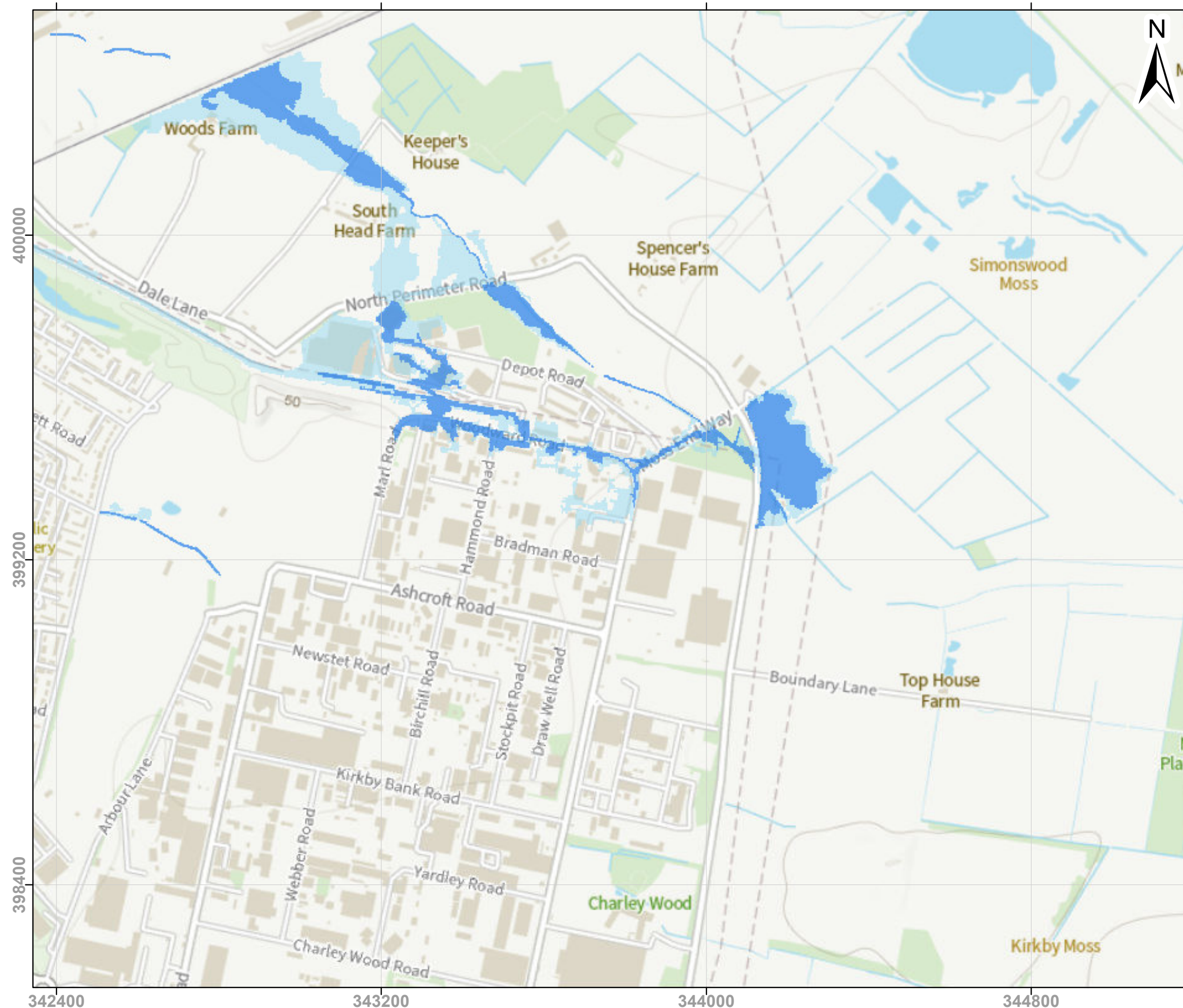
Produced: 03 Nov 2021

Our Ref: CL237141

NGR: SJ4375399354

Key

-  Main River
-  Areas Benefiting from Defences
-  Flood Zone 3
-  Flood Zone 2



Node Points Map

Acornfield Road, Kirkby, L33 7UZ

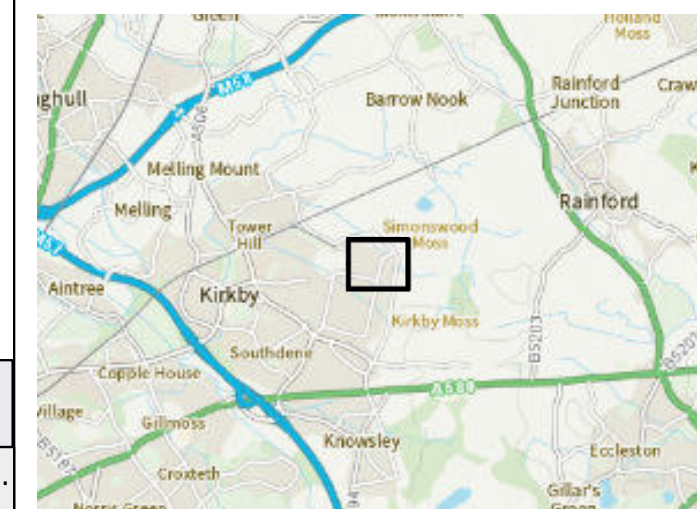
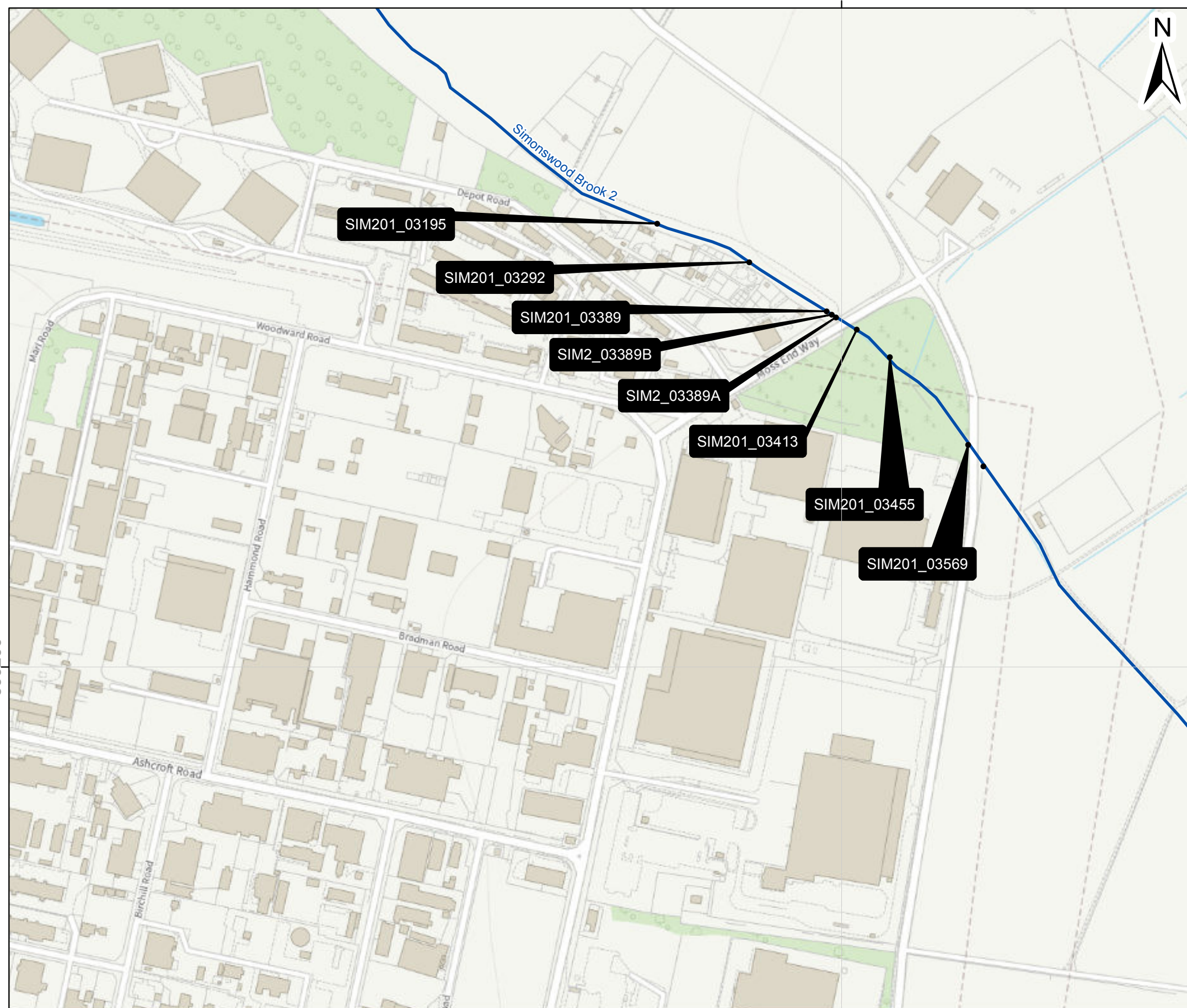
Produced: 03 Nov 2021

Our Ref: CL237141

NGR: SJ4375399354

Key

 Main River



Modelled water levels with climate change using +20% flow allowances are not suitable for the majority of planning purposes. New climate change allowances can be checked on the following website; www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances.

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Node Point	Flood Flow (m³s-1) and Level (mAOD) data for a range of annual probability of flooding													
	0.1%+Climate Change (+30%)		0.1%		1%+Climate Change (+70%)		1%+Climate Change (+35%)		1%+Climate Change (+30%)		1.0%		5.0%	
	Undefended		Undefended		Undefended		Undefended		Undefended		Undefended		Undefended	
Map ID	Levels	Flows	Levels	Flows	Levels	Flows	Levels	Flows	Levels	Flows	Levels	Flows	Levels	Flows
SIM201_03569	40.81	1.36	40.76	1.36	40.77	1.36	40.72	1.37	40.71	1.37	40.6	1.32	40.38	1.1
SIM201_03455	40.78	4.3	40.75	3.23	40.75	3.3	40.71	2.42	40.7	2.26	40.6	1.39	40.38	1.16
SIM201_03413	40.79	1.29	40.75	1.28	40.75	1.28	40.71	1.27	40.7	1.27	40.6	1.25	40.38	1.18
SIM2_03389A	38.48	1.29	38.48	1.28	38.48	1.28	38.48	1.27	38.48	1.27	38.47	1.25	38.46	1.18
SIM2_03389B	38.47	1.29	38.47	1.28	38.47	1.28	38.47	1.27	38.47	1.27	38.46	1.25	38.45	1.18
SIM201_03389	37.88	1.29	37.68	1.28	37.66	1.28	37.62	1.27	37.62	1.27	37.6	1.25	37.58	1.18
SIM201_03292	37.82	1.53	37.53	1.44	37.49	1.43	37.38	1.38	37.37	1.37	37.33	1.32	37.29	1.24
SIM201_03195	37.78	1.73	37.45	1.59	37.39	1.57	37.21	1.49	37.18	1.47	37.12	1.41	37.04	1.29
Level data in mAOD (metres above ordnance datum). Flow data in m³ per second														
Data taken from Kirkby Brook 2017 (Upper Alt Tributaries 2017)														

Modelled 2D Data Map

Acornfield Road, Kirkby, L33 7UZ

Produced: 03 Nov 2021

Our Ref: CL237141

NGR: SJ4375399354

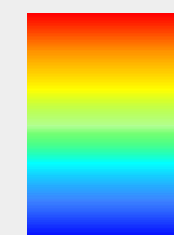
Key



Main River

Fluvial 5% Annual Exceedance Probability Undefended Scenario

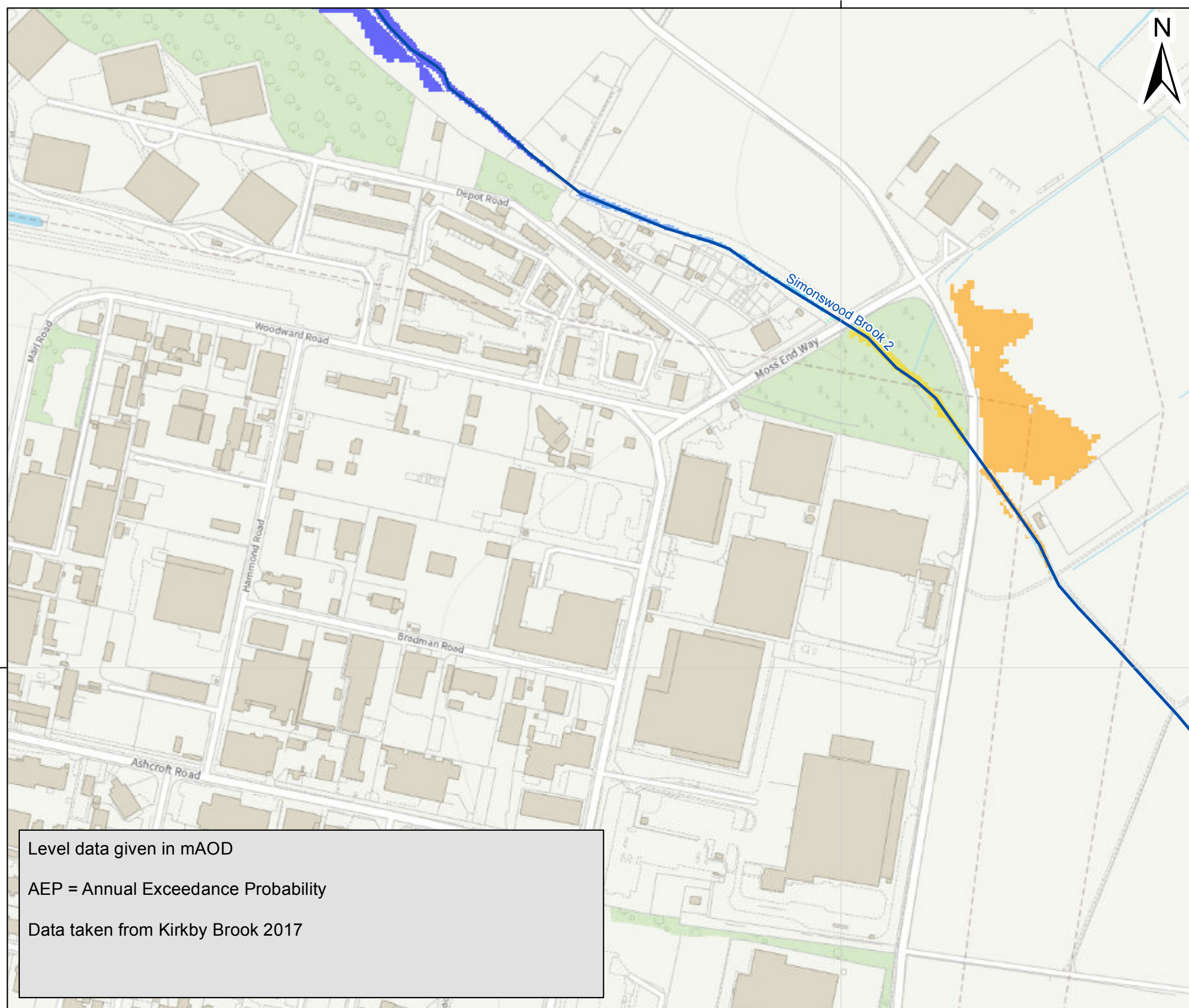
mAOD



High : 42

Low : 36

399200



344000

Level data given in mAOD

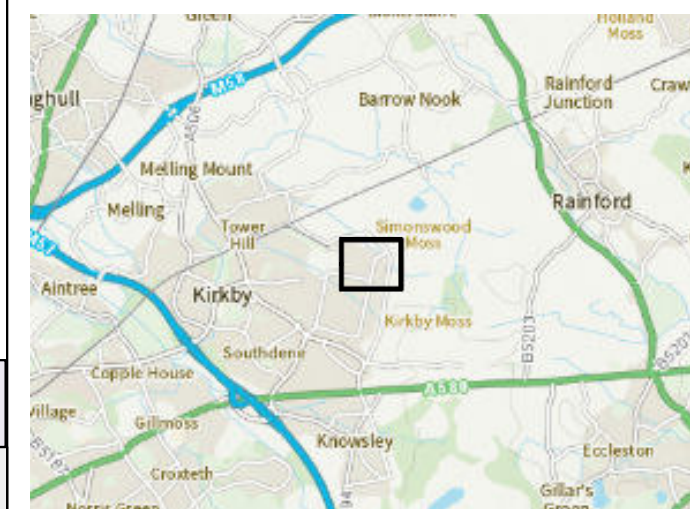
AEP = Annual Exceedance Probability

Data taken from Kirkby Brook 2017

Modelled water levels with climate change using +20% flow allowances are not suitable for the majority of planning purposes. New climate change allowances can be checked on the following website; www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances.

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Modelled 2D Data Map

Acornfield Road, Kirkby, L33 7UZ

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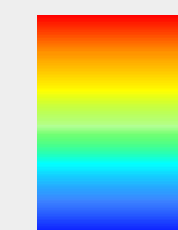
Key



Main River

Fluvial 1% Annual Exceedance Probability Undefended Scenario

mAOD



High : 42

Low : 36

399200

1% AEP Undefended = 39.40 mAOD

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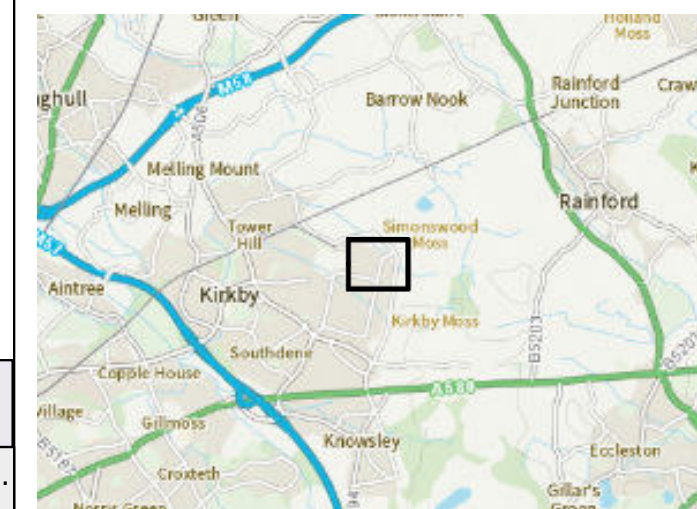
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Modelled 2D Data Map

Acornfield Road, Kirkby, L33 7UZ

Produced: 03 Nov 2021

Our Ref: CL237141

NGR: SJ4375399354

Key



Main River

**Fluvial 1%+Climate Change(+30%)
Annual Exceedance Probability
Undefended Scenario**

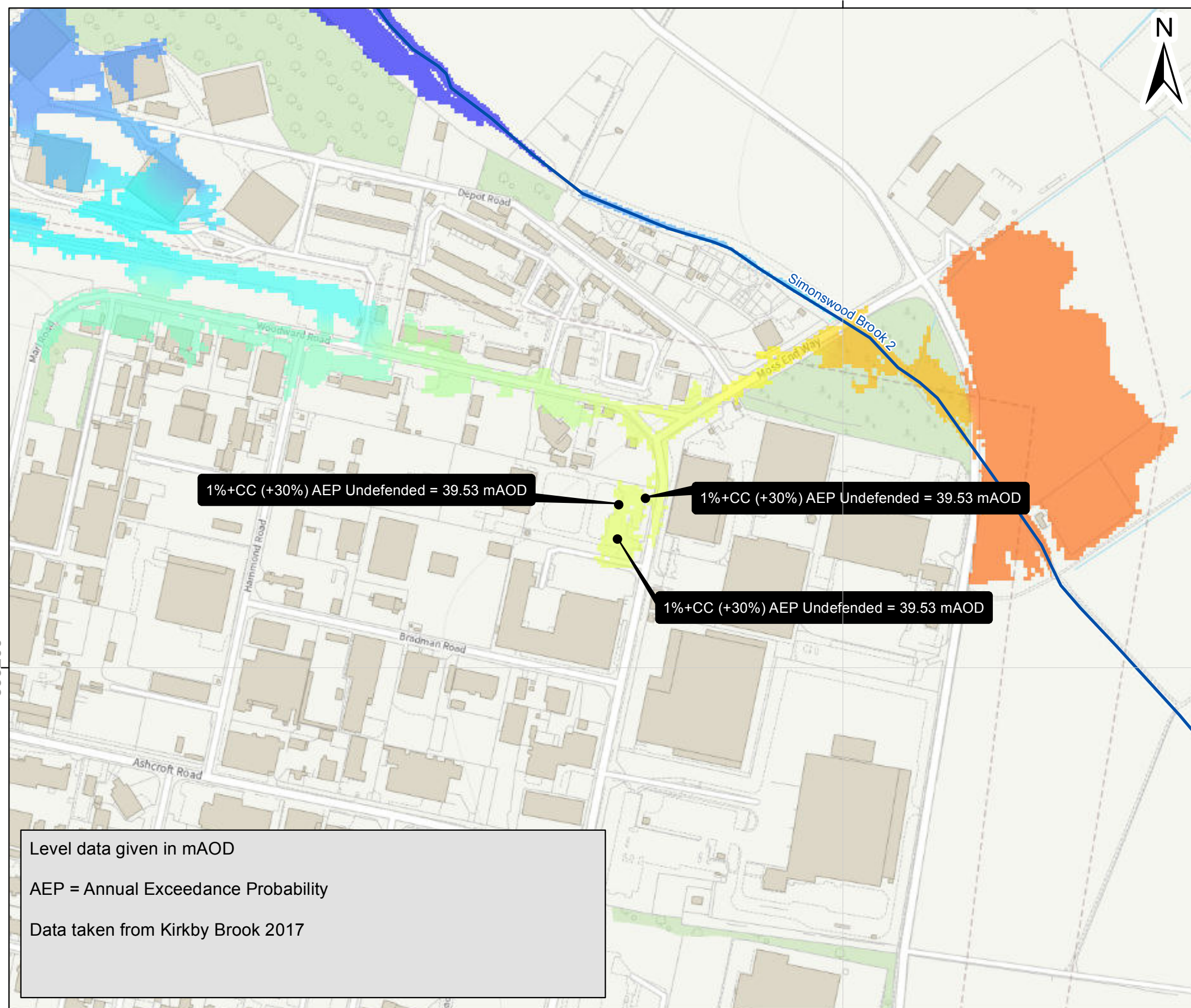
mAOD



High : 42

Low : 36

399200



Level data given in mAOD

AEP = Annual Exceedance Probability

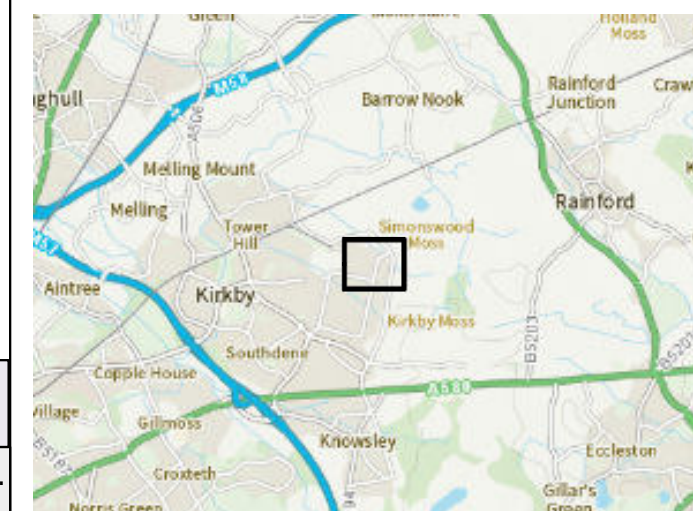
Data taken from Kirkby Brook 2017

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Our Ref: CL237141

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 Main River

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Annual Exceedance Probability
Undefended Scenario

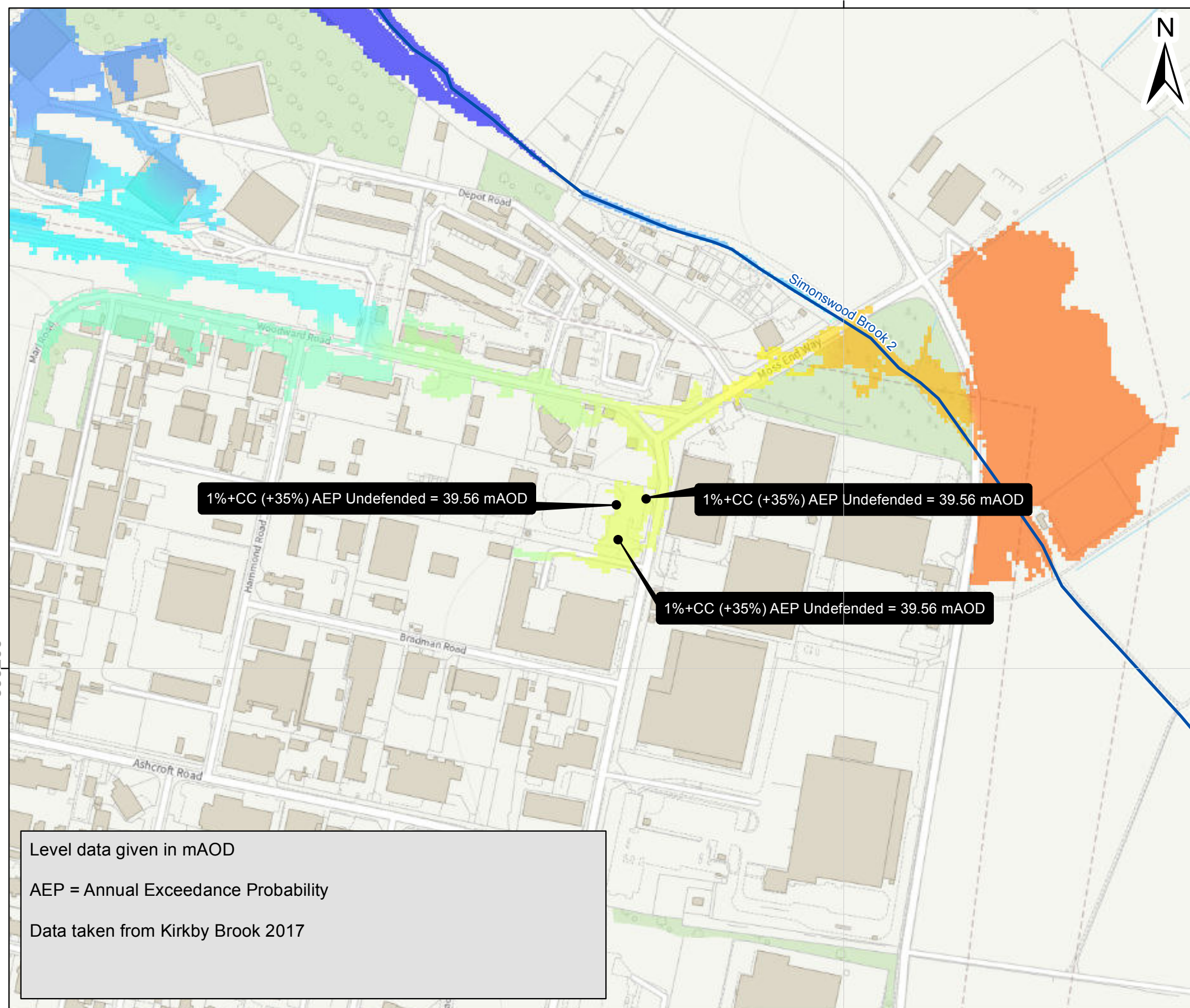
mAOD



High : 42

Low : 36

399200



344000

Level data given in mAOD

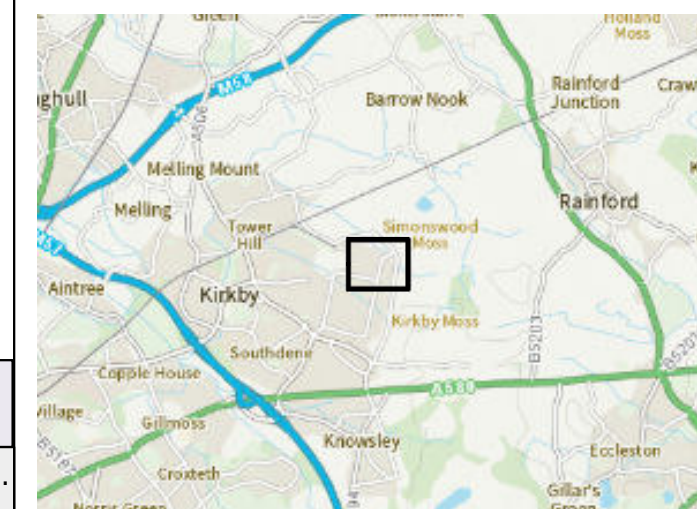
AEP = Annual Exceedance Probability

Data taken from Kirkby Brook 2017

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Modelled 2D Data Map

Acornfield Road, Kirkby, L33 7UZ

Produced: 03 Nov 2021

Our Ref: CL237141

Key SJ4375399354

 Main River

Fluvial 1%+Climate Change(+70%)
Annual Exceedance Probability
Undefended Scenario

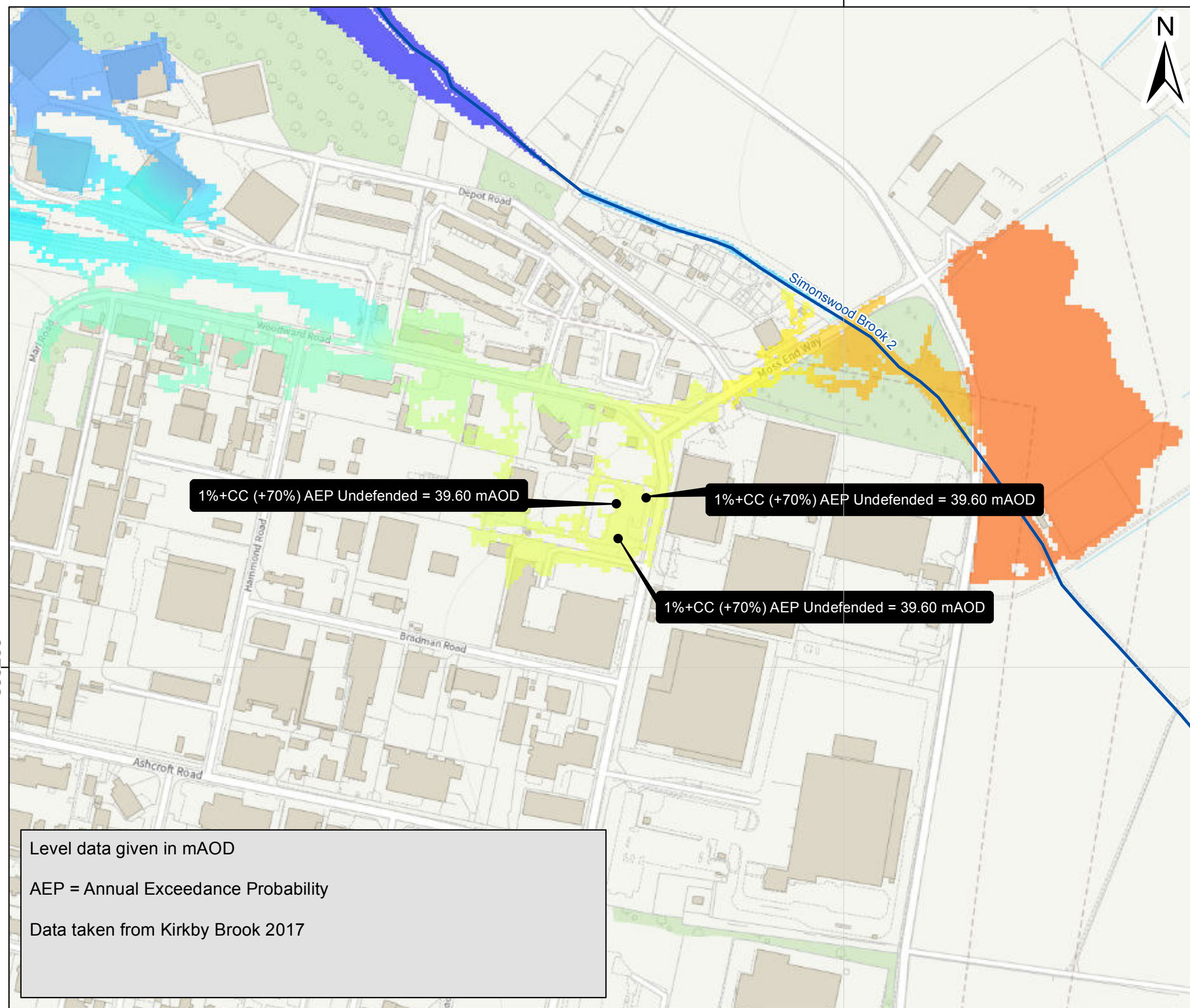
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Low : 36

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344000

Level data given in mAOD

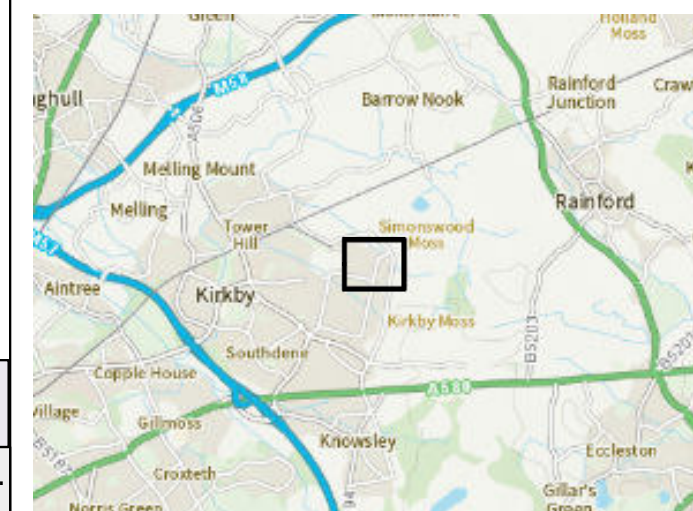
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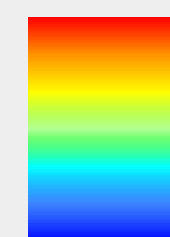
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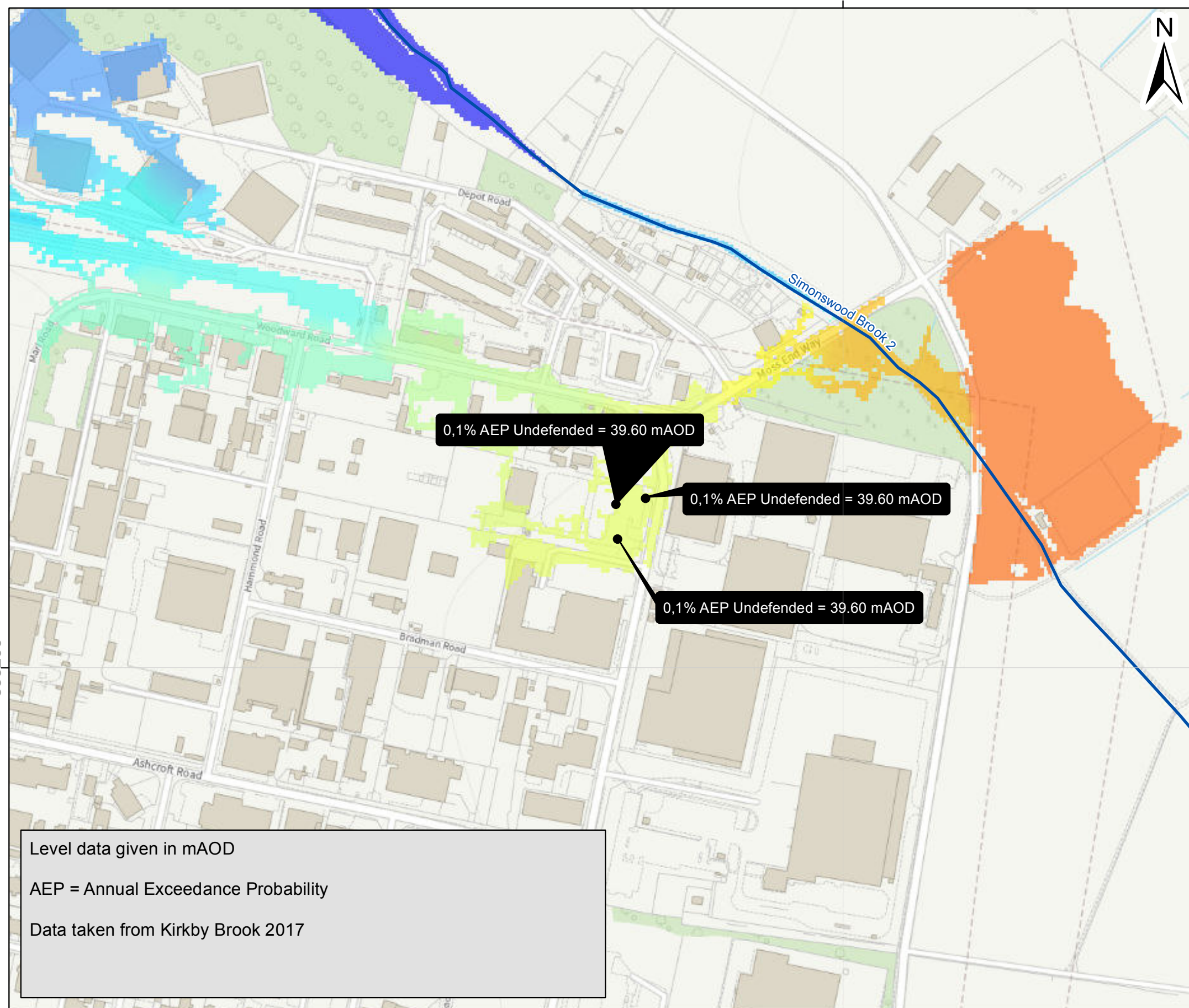
mAOD



High : 42

Low : 36

399200



344000

Level data given in mAOD

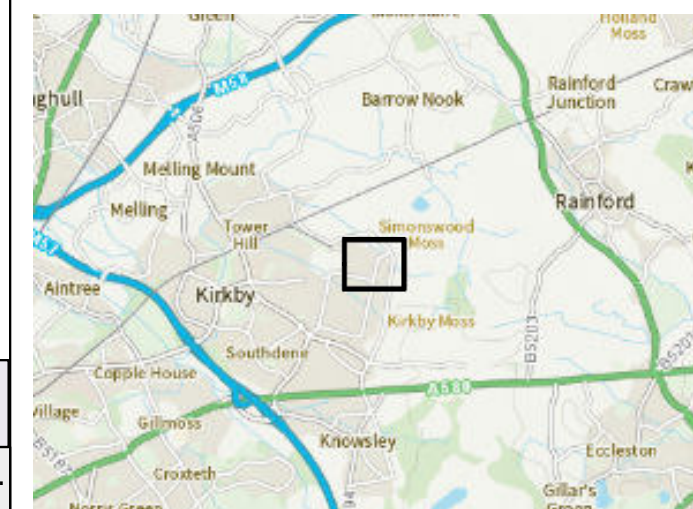
AEP = Annual Exceedance Probability

Data taken from Kirkby Brook 2017

Modelled water levels with climate change using +20% flow allowances are not suitable for the majority of planning purposes. New climate change allowances can be checked on the following website; www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances.

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Modelled 2D Data Map

Acornfield Road, Kirkby, L33 7UZ

Produced: 03 Nov 2021

Our Ref: CL237141

NGR: SJ4375399354

Key



Main River

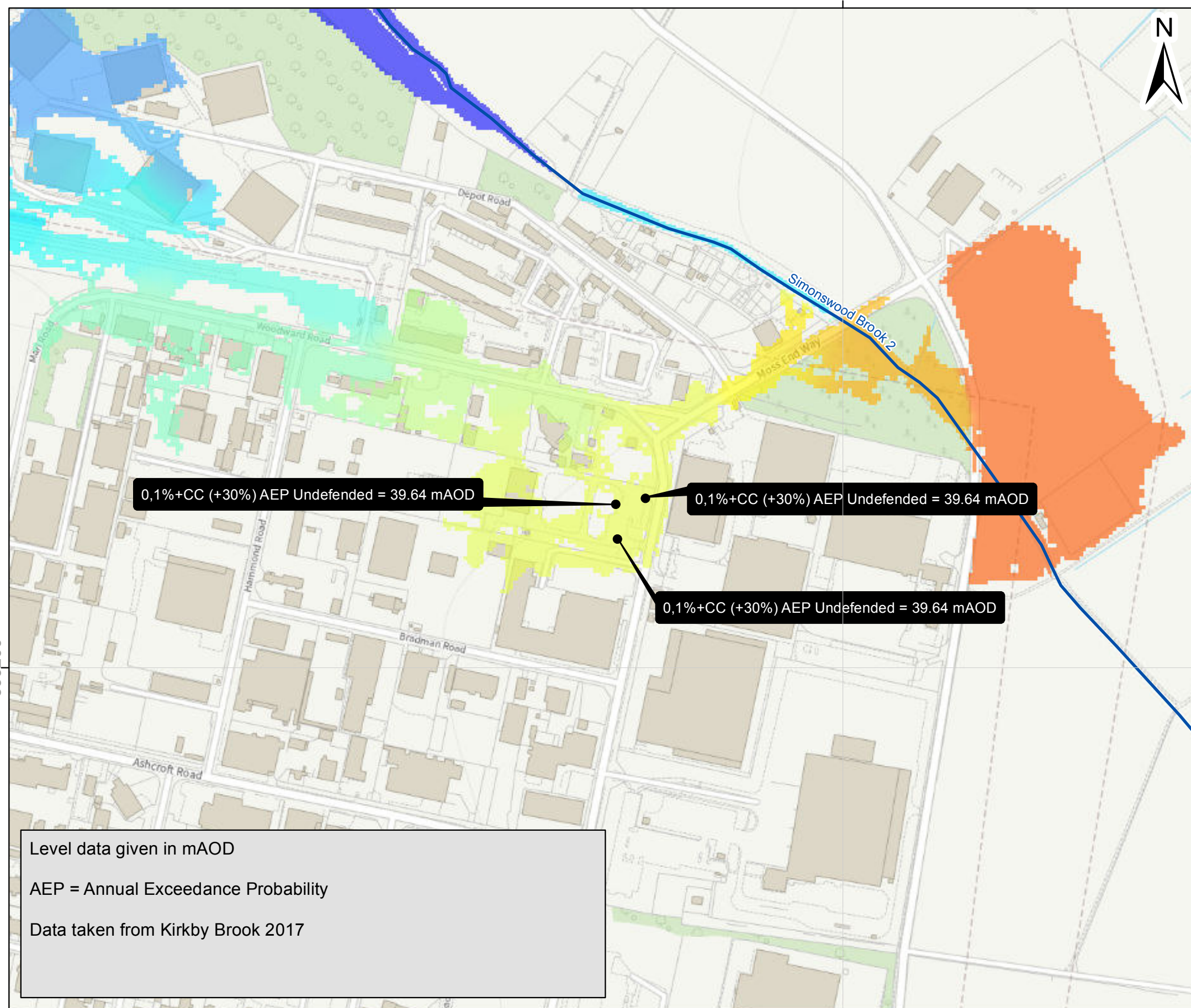
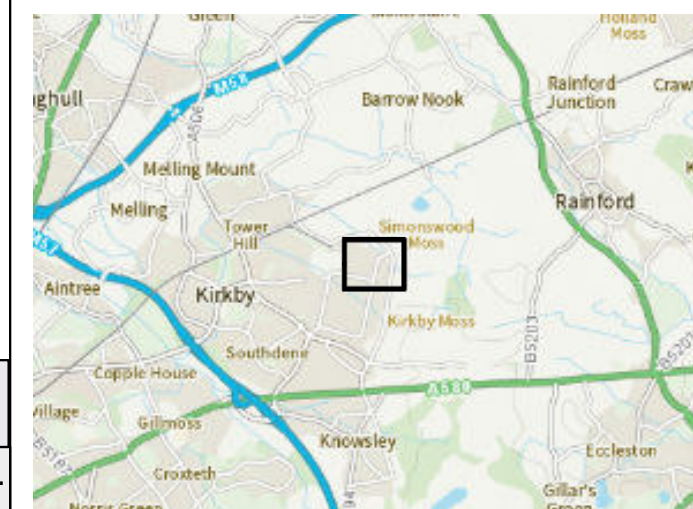
**Fluvial 0.1%+Climate Change(+30%)
Annual Exceedance Probability
Undefended Scenario**

mAOD



High : 42

Low : 36



Level data given in mAOD

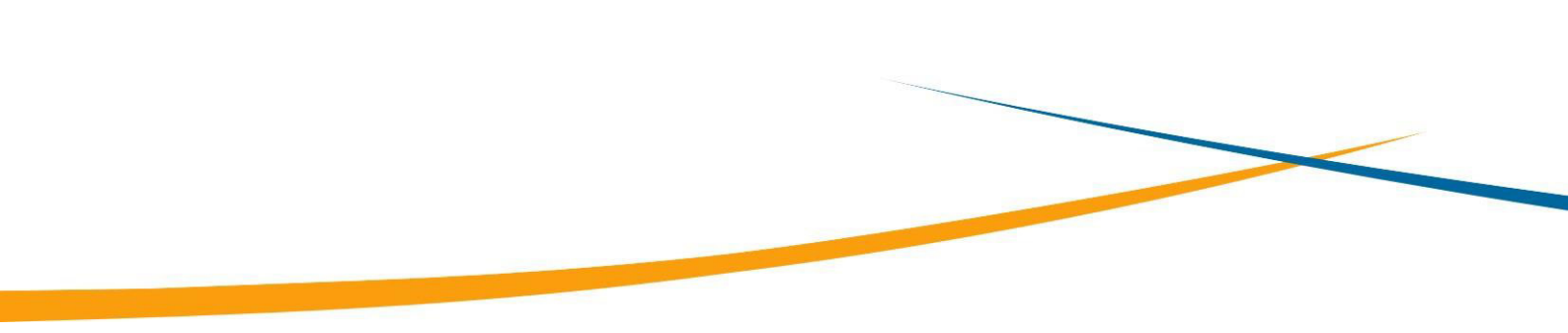
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Flood Risk Assessment
for
Insynch Energy Services
16th November 2021
Project 6623
Document number: R6623-IE-0001

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