Syngenta Huddersfield

Flood Risk Assessment

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Syngenta Huddersfield

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CONTENTS

1 Introduction

1.1 Overview

Arcadis Consulting (UK) Limited ("Arcadis") was instructed by Syngenta Limited to prepare a Flood Risk Assessment (FRA) to support a planning application for the expansion of an existing manufacturing plant at Syngenta Huddersfield Manufacturing Centre, HD5 9TE.

This FRA also assesses the flood risk to a proposed chemical storage tank farm; however, this is permitted development and does not form part of the planning application.

The Environment Agency (EA) Flood Map for Planning (Rivers and Sea)[1] shows that the proposed development sites are both located within Flood Zone 3 (land assessed as having a 1 in 100 or greater annual probability of river flooding). In line with requirements of the National Planning Policy Framework (NPPF)[2] all proposals for new development within Flood Zones 2 or 3 should be supported by an appropriate FRA that considers the risk of flooding from all sources.

1.2 Aims and Objectives

The aim of this FRA is to address the requirements of national and local planning policy with respect to flood risk. These policies advise that FRAs should be prepared to a level of detail proportionate to both the risk of flooding and the scale of the development proposed. Specific objectives of this FRA are therefore to:

- Assess the risk of flooding to the proposed development from all potential sources and demonstrate how the proposed development is designed to be safe from flooding over its lifetime whilst not increasing flood risk to third party land.
- Review the development proposals for compliance with the NPPF and local flood risk management policies.

1.3 Terminology

Flood risk is a product of both the likelihood and consequences of flooding. Throughout this document, flood events are defined according to their likelihood of occurrence. Floods are described according to an 'annual chance', meaning the chance of a particular flood occurring in any one year. This is directly linked to the probability of a flood. For example, a flood with an annual chance of 1 in 100 (a 1 in 100 chance of occurring in any one year), has an annual probability of 1%.

1.4 Limitations

This report has been compiled from a number of sources which Arcadis believes to be trustworthy. However, Arcadis is unable to guarantee the accuracy of information provided by others. The report is based on information available at the time of writing. Additional information may become available in the future which may have a bearing on the conclusions of this report and for which Arcadis cannot be held responsible.

[1] Flood Map for Planning (Rivers and Sea), accessed June 2022, Environment Agency https://flood-map-for-planning.service.gov.uk
[2] Ministry of Housing, Communities and Local Government, July 2021, National Planning Policy Framework https://www.gov.uk/government/publications/national-planning-policy-framework--2

2 Background

2.1 Site Location

The proposed development sites are located at the southern end of the Syngenta Huddersfield Manufacturing Centre, off Nettleton Road in the Dalton District of Huddersfield, West Yorkshire, at National Grid Reference (NGR) SE169177 (Figure 1).

The proposed development comprises two areas next to an existing manufacturing plant. A warehouse is proposed on the hardstanding area to the east of the manufacturing plant, and a chemical storage tank farm is proposed on the brownfield land to the west of the manufacturing plant. The development sites are connected to the wider Syngenta site by Nettleton Avenue and Main Avenue. Across the wider area there is woodland to the south and east, and a mix of industrial and brownfield land to the north and west. The proposed warehouse red line boundary is circa 0.3ha and the proposed tank farm black line boundary is circa 0.5ha.

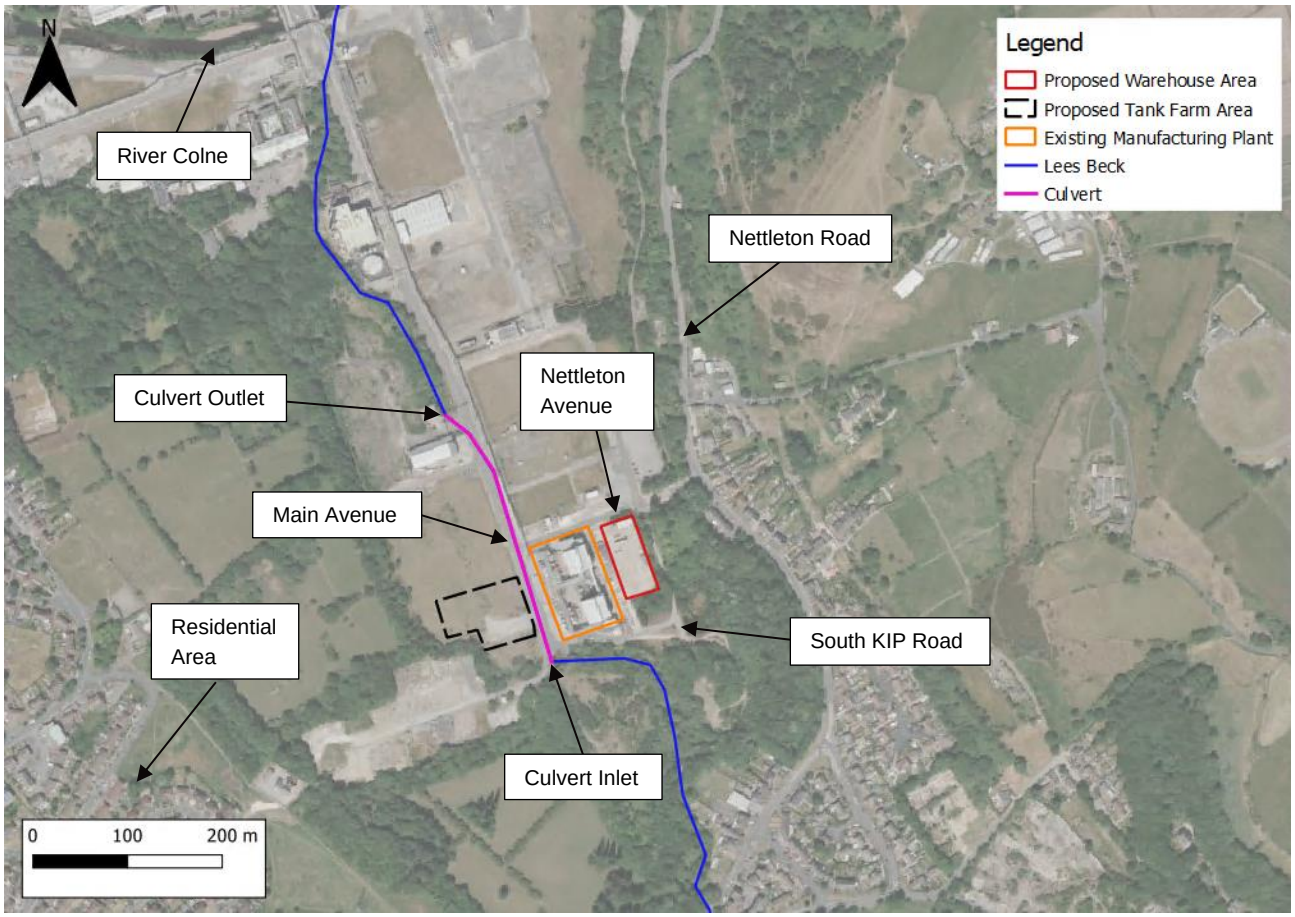

Figure 1: Site Location Plan

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The proposed development sites are located immediately east and west of the Lees Beck (classed as a 'Main River'), which flows south to north through the Syngenta site before discharging into the River Colne (also classed as a 'Main River)' approximately 650m to the north of the site. The Lees Beck flows through an area of woodland to the south before it is culverted under Main Avenue between the existing manufacturing plant and the proposed tank farm (Figure 1).

There are no other watercourses within the vicinity of the proposed development sites.

2.2 Topography

The Environment Agency (EA) Lidar data (Figure 2 shows that the Site is located within the valley of the Lees Beck.

Across the proposed warehouse development site, LiDAR indicates that ground levels fall south to north, ranging between approximately 58.0m and 59.0m AOD. Ground levels in the area of the proposed warehouse are elevated approximately 1.0-1.5m above the surrounding access roads (Nettleton Avenue and South KIP Road). Offsite, to the east of the proposed warehouse, ground levels along Nettleton Road are also elevated, typically exceeding 59.3mAOD. East of Nettleton Road, ground levels slope steeply upward.

Ground levels across the proposed tank farm are relatively flat and are at a similar level to the brownfield land to the north, with levels ranging between approximately 58.0m and 59.0m AOD. Ground levels across the industrial land to the south and southwest of the proposed tank farm are elevated above the proposed tank farm, ranging between approximately 62.0 and 64.0m AOD. To the west of the proposed tank farm, ground levels rise steeply away from the Lees Beck, exceeding 75.0m AOD.

The LiDAR indicates that the bed level of the Lees Beck to the south of the proposed warehouse and tank farm areas is approximately 54.5m AOD.

The topographic survey of the Site (see Drawing 999 in Appendix C) in consistent with the LiDAR data and shows that ground levels across the Site range between 58.12m AOD and 59.00m AOD.

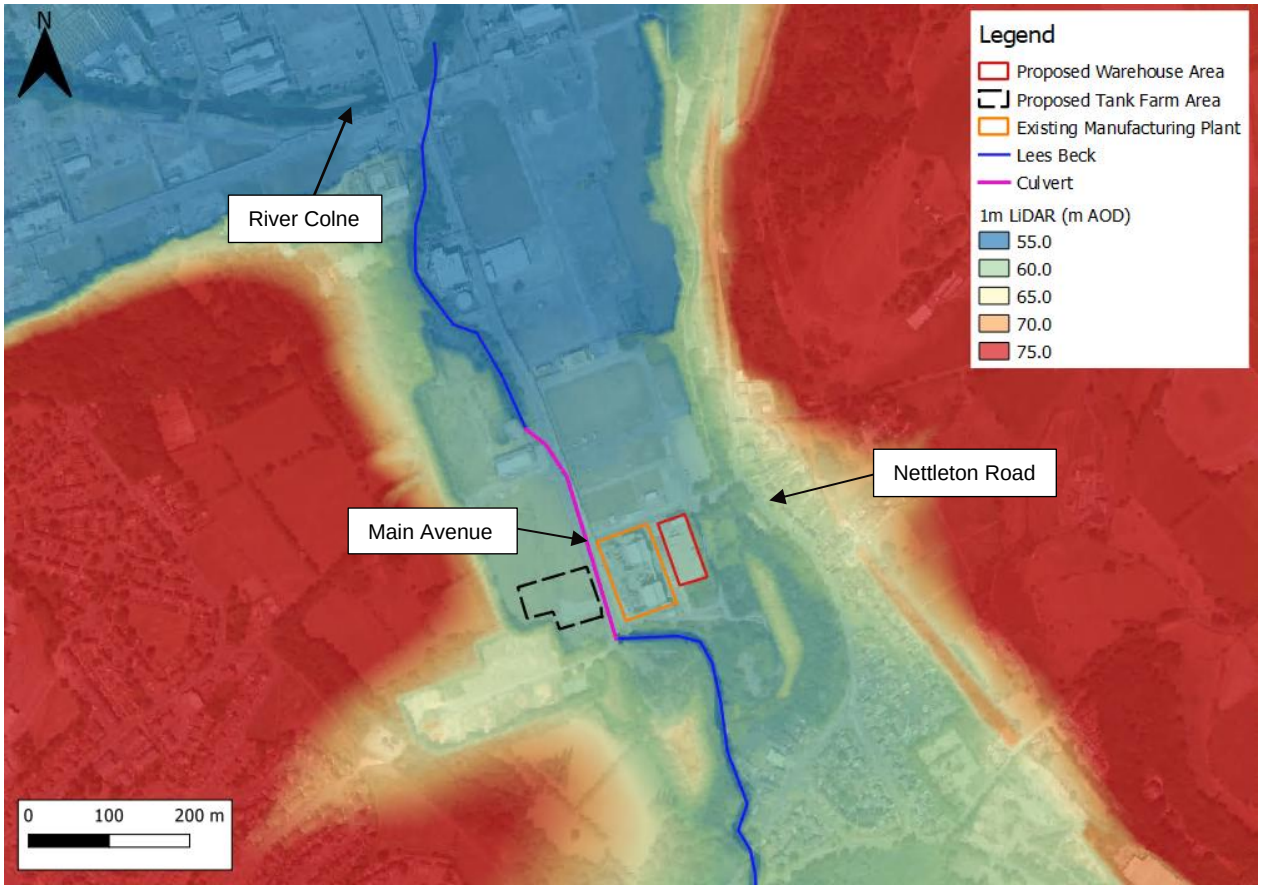

Figure 2: Site Topography (filtered lidar)

2.3 Catchment Hydrology

The Site is located in the catchment of the Lees Beck[3] which drains an area of approximately 51km² upstream of the Site[4]. The underlying soils across the Dalton District are generally freely draining, although some soils close to the watercourses are loamy and clayey with naturally high groundwater[5].

2.4 Proposed Development

The proposals for the warehouse development (Figure 3) comprise a new warehouse building located in the southern area of the red line boundary shown in Figure 1, with a footprint of approximately 300m². The warehouse is to be located on an existing hard standing to the east of the existing manufacturing plant. The proposed warehouse will have a slab level of 58.90m AOD, which is approximately 100mm above existing ground levels at this location. A new access ramp will be formed as part of the works on the western side of the building, to allow level access into the building via a roller shutter door.

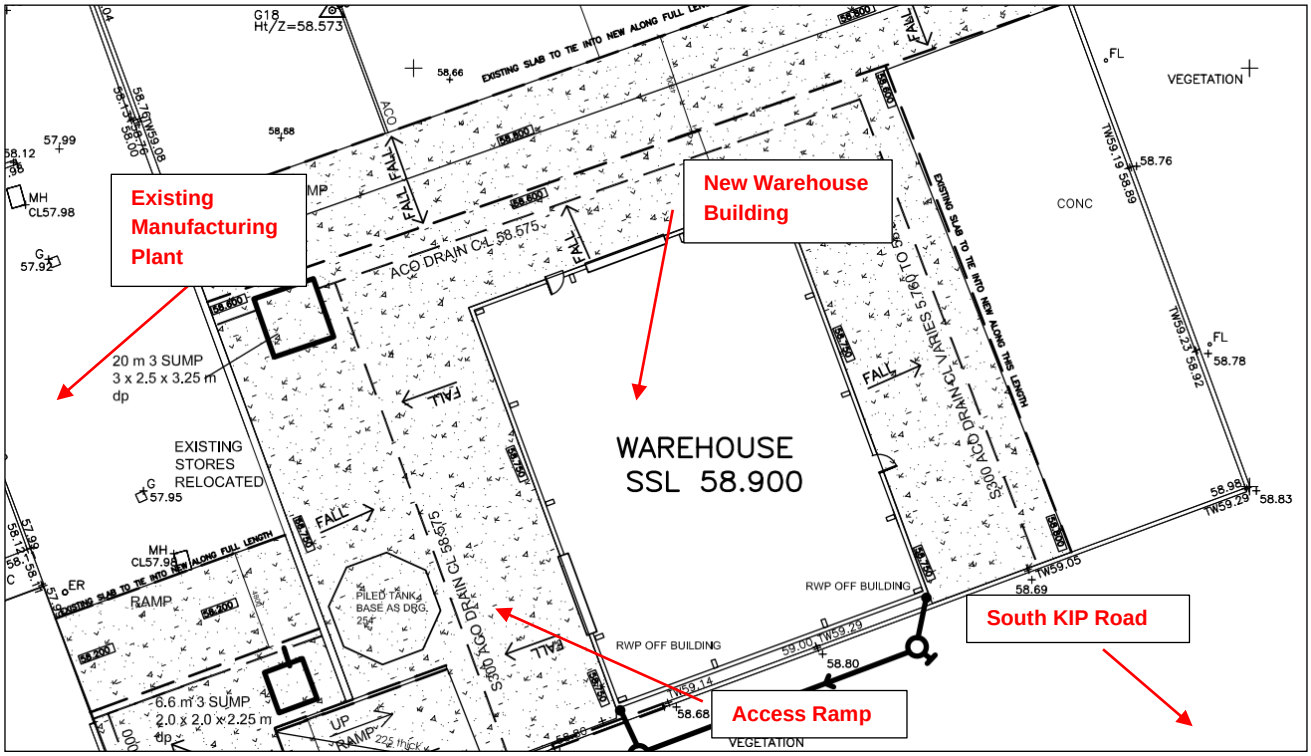

Figure 3: Preliminary Floor Levels (see Appendix C)

No detailed design drawings have been supplied for the proposed chemical storage tank farm; however, it has been estimated that it will cover an area of approximately 0.50ha.

[3] The watercourse changes name from the Fenay Beck to the Lees Beck upstream of the Syngenta Site. The EA has provided a hydraulic model of the Fenay Beck, which includes the Lees Beck.

[4] Flood Estimation Handbook Web Service, accessed May 2022, UK Centre for Ecology & Hydrology. https://fehweb.ceh.ac.uk/GB/map

[5] Cranfield Soilscapes http://www.landis.org.uk/soilscapes/

3 Planning Policy Context

3.1 NPPF and Flood Risk

The NPPF was first published in 2012 and most recently updated in 2021. Along with its accompanying Planning Practice Guidance (PPG)[6], the NPPF sets out the government's planning policies for England and how these are expected to be applied. The principal aim of the NPPF is to achieve sustainable development. This includes ensuring that flood risk is taken into account at all stages of the planning process, avoiding inappropriate development in areas at risk of flooding and directing development away from those areas where risks are highest. Where development is necessary in areas of flooding, the NPPF aims to ensure that it is safe, without increasing flood risk elsewhere.

Early adoption of, and adherence to, the principles set out in the NPPF and its Technical Guidance, with respect to flood risk, should ensure that detailed designs and plans for developments take due account of flood risk and the need for appropriate mitigation, if required.

3.2 The Sequential and Exception Test

The NPPF identifies four Flood Zone classifications, detailed in Table 1.

Table 1: Flood Zones (PPG, Flood Risk and Coastal Change, Table 1)

Flood Zone	Annual Probability of Flooding (%)
1 Low Probability	Fluvial and Tidal <0.1%
2 Medium Probability	Fluvial 0.1 – 1.0 % Tidal 0.1 – 0.5 %
3a High Probability	Fluvial >1.0 % Tidal >0.5 %
3b The Functional Floodplain	Land where water has to flow or be stored in times of flood, identified by local authorities in Strategic Flood Risk Assessments. Fluvial and Tidal >5.0 % is recommended as a starting point for consideration, but it should not be defined solely by rigid probability parameters.

The NPPF specifies that the suitability of all new development in relation to flood risk should be assessed by applying the Sequential Test to demonstrate that there are no reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development proposed. The PPG provides further guidance on the compatibility of each land use classification in relation to each of the Flood Zones as summarised in Table 2.

[6] Ministry of Housing, Communities and Local Government, June 2021. Planning Practice Guidance. https://www.gov.uk/government/collections/planning-practice-guidance

Table 2: Flood Risk Vulnerability Classification (Source: PPG, Flood Risk and Coastal Change, Table 3)

Flood Zone	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a	Exception Test required	×	Exception Test required	✓	✓
Zone 3b	Exception Test required	×	×	×	✓
Key:	✓ Development is appropriate		× Development should not be permitted		

When a development site falls partly within multiple Flood Zones, the highest risk Flood Zone should be used when assessing development vulnerability, as shown in Table 2.

If it is not possible for development to be located in zones with a lower risk of flooding, the Exception Test may have to be applied. For the Exception Test to be passed, it should be demonstrated that:

a) the development would provide wider sustainability benefits to the community that outweigh flood risk; and

b) the development would be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, reduce flood risk overall.

3.3 Flood Zone Classification

The EA 'Flood Map for Planning (Rivers and Sea)' in Figure 4 shows that the proposed warehouse and tank farm areas are located entirely within Flood Zone 3 (land assessed as having a 1 in 100 or greater annual probability of river flooding). The EA Flood Zones are consistent with the Calder Catchment Strategic Flood Risk Assessment (SFRA)[7] mapping, which shows that both areas are located entirely within Flood Zone 3a.

[7] Calder Catchment SFRA for Kirklees Council https://www.kirklees.gov.uk/beta/planning-policy/strategic-flood-risk-assessment.aspx

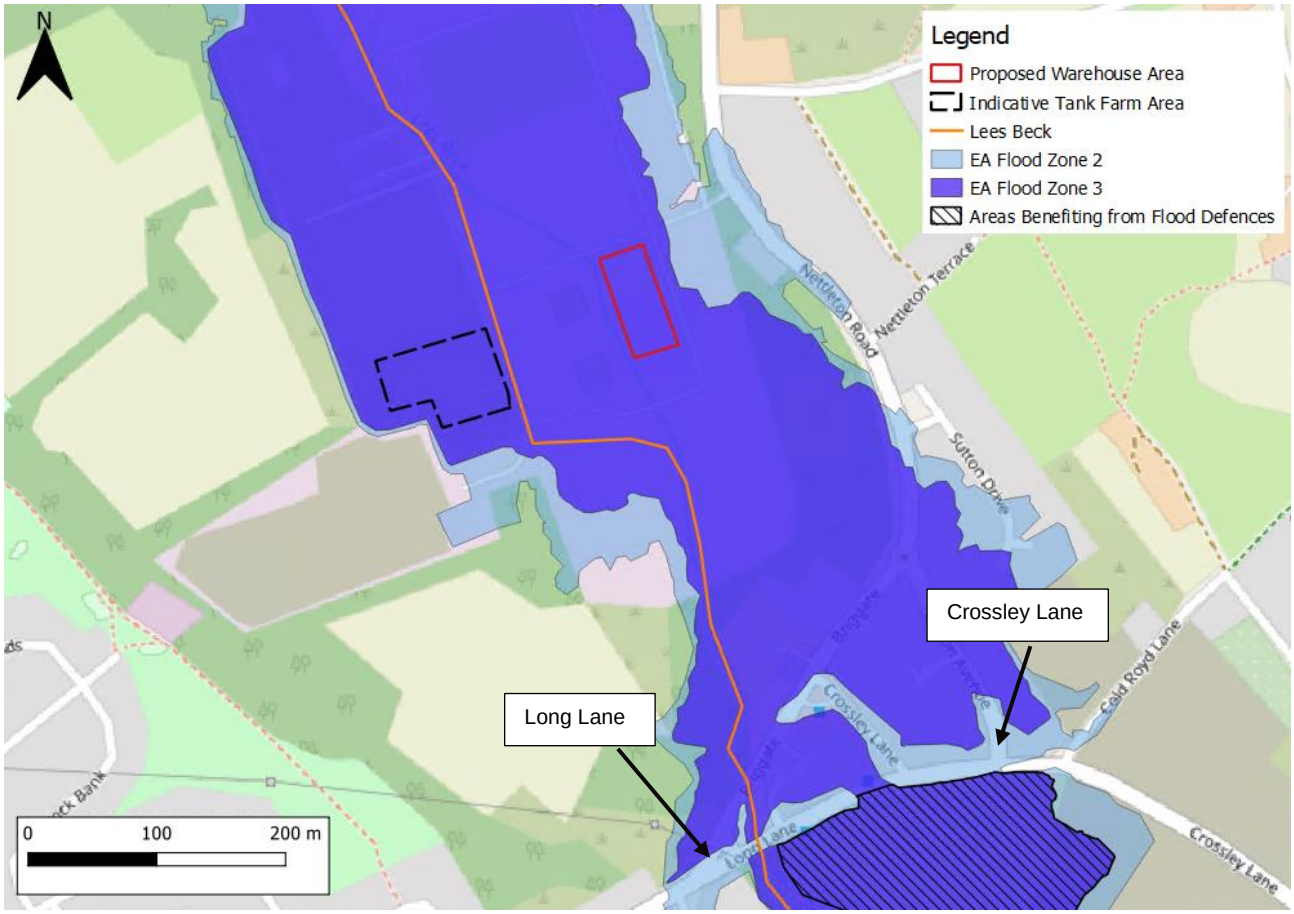

Figure 4: Flood Map for Planning (Rivers and Sea)

3.4 Application of the Sequential Test and Exception Test

The proposed development is classified as 'Less Vulnerable' in accordance with the NPPF, falling within the category of 'general industry'. 'Less Vulnerable' development is deemed appropriate in Flood Zone 3a, with reference to Table 2, subject to application of the Sequential Test. Table 2 shows that an Exception Test is not required for 'Less Vulnerable' developments in Flood Zone 3a and this has also been confirmed by Kirklees Council in their consultation response (see Appendix B).

The aim of the Sequential Test is to steer new development to areas with the lowest risk of flooding. The proposed development is for the expansion of existing industrial facilities which have been operational for a long period of time. For operational reasons, it is not feasible to situate the proposed development at an alternative site outside of Flood Zone 3. Therefore, the proposed development satisfies the requirements of the Sequential Test.

3.5 Local Planning Policy

The Kirklees Local Plan[8], adopted February 2019, outlines the key measures which should be adopted to avoid and manage flood risk.

Policy LP27 'Flood Risk' states that development proposals must be supported by a site-specific FRA to demonstrate that the proposals will be safe throughout the lifetime of the development, taking account of

[8] Kirklees Local Plan https://www.kirklees.gov.uk/beta/planning-policy/pdf/local-plan-strategy-and-policies.pdf

climate change. Proposals must not increase flood risk elsewhere, and where possible should reduce flood risk. Mitigation measures, where necessary, should be proposed.

Policy LP28 ‘Drainage’ states that Sustainable Drainage Systems (SuDS) should be used to achieve a minimum 30% in reduction in surface water run-off across brownfield sites where previous positive surface water connections from the site can be proven. New connections will be subject to at least greenfield restrictions. SuDS should also be adopted to ensure that there is no negative impact on local water quality. It must also be demonstrated that the surface water management solution is designed to meet requirements over the lifetime of the development including evidence that management and maintenance arrangements have been secured to cover that period.

4 Potential Sources of Flooding

4.1 Overview

In line with best practice, this section considers flood risk from the range of possible sources listed in Table 3 and identifies where further appraisal and/or mitigation measures are required.

Table 3: Sources of Flooding

Source of Flooding	Description
Flooding from rivers (fluvial)	Floodwater originating from a nearby watercourse when the amount of water exceeds the channel capacity of that watercourse.
Flooding from the sea (tidal)	Flooding originating from the sea or a connected waterbody when seawater overflows onto land through extreme tidal conditions, storm surge or breach.
Flooding from surface water (pluvial)	Flooding caused by intense rainfall exceeding the available infiltration and/or drainage capacity of the ground.
Flooding from groundwater	Flooding caused when groundwater levels rise above ground level following prolonged rainfall.
Flooding from sewers	Flooding originating from surface water, foul or combined drainage systems, typically caused by limited capacity or blockages.
Flooding from reservoirs, canals, and other artificial sources	Failure of infrastructure that retains or transmits water or controls its flow.

4.2 Historical Flooding

The SFRA states that Kirklees Council holds limited and incomplete records of past flood events. The EA Recorded Flood Outlines Map (Figure 5) shows that a flood event in April 1970 resulted in flooding approximately 400m to the north of the Site, and an area adjacent to Long Lane and Crossley Lane approximately 450m to the south of the proposed development sites. However, no flooding was reported in the area of the proposed development.

In the EA flood information data request response (Appendix A), the EA state that flooding was recorded in the wider area between February and March 2020, however, the proposed development sites were not impacted.

Syngenta has provided flood outlines for historic flood events at the Syngenta Site in November 2000, 30 July 2002, June 2007, 2008, 2012, February 2020 and February 2022 (see Appendix D). The flood outlines show that the proposed development sites were not inundated during any of these flood events, with the edge of the flood extents located approximately 300m to the north.

A previous FRA prepared for Syngenta in July 2013 refers to a number of historic flood events between 2000 and 2012. The FRA states that flooding occurred along the Lees Beck in 2000, 2007 and 2008 after the watercourse breached its banks to the north and south of the CHP Plant, which is located approximately 400m to the northwest of the proposed development (Figure 5). The FRA also states that the maximum flood level recorded along the River Colne during any of these events was 54.4m AOD which is at least 3.6m lower than

the ground levels across the proposed development sites. It is therefore considered unlikely that the sites would have been impacted by these flood events.

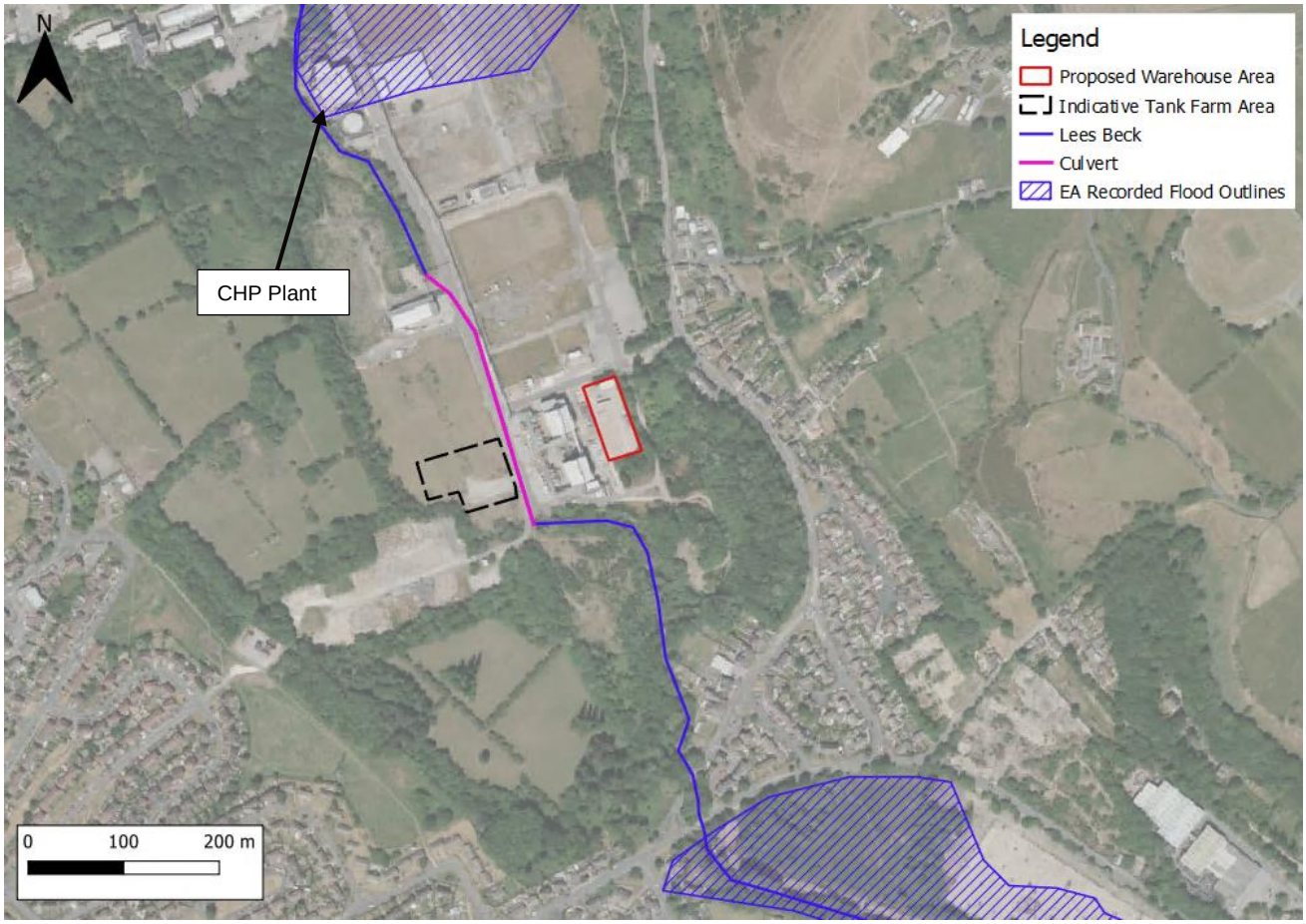

Figure 5: EA Recorded Flood Outlines Map

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4.3 Flood Defences

The EA's Spatial Flood Defences layer[9] provides details of flood defences including location, type, ownership, and maintenance details. The layer is displayed in Figure 6 and shows that there are informal defences along the Lees Beck to the north and south of the Site in the form of 'naturally high ground'. A review of the LiDAR shows that the levels along the right bank of the Lees Beck to the south of the Site are approximately 57.5m – 58.5m AOD. Ground levels along the western bank of the Lees Beck upstream of the culvert slope up from the watercourse bank, with levels typically in excess of 58.5m AOD. The EA data states that the standard of protection provided by the high ground in this area is 1 in 20 (5%).

[9] EA Spatial Flood Defences Layer https://data.gov.uk/dataset/cc76738e-fc17-49f9-a216-977c61858dda/aims-spatial-flood-defences-inc-standardised-attributes

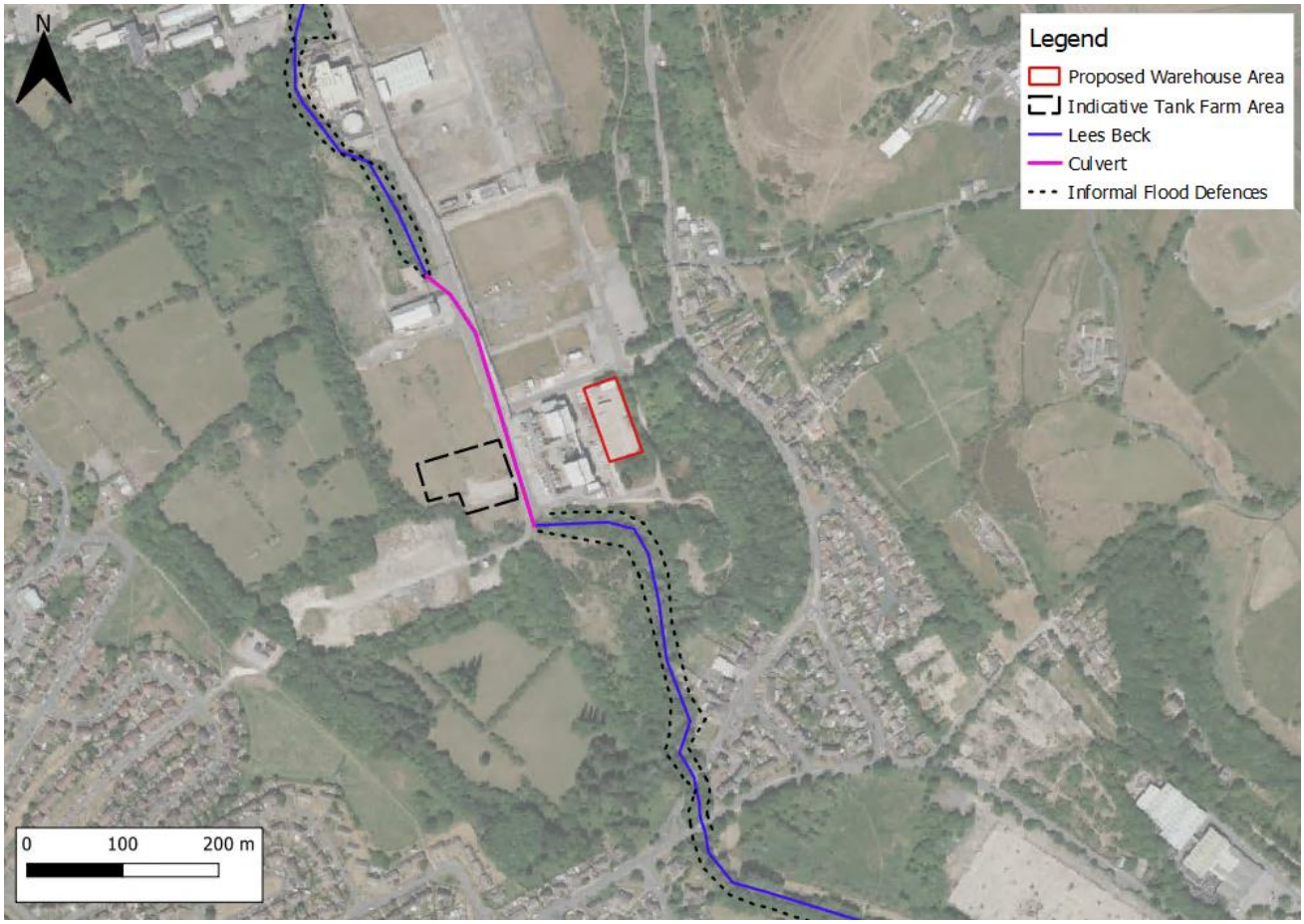

Figure 6: EA Spatial Flood Defences Layer

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4.4 Flooding from Rivers

The EA 'Flood Map for Planning (Rivers and Sea)' in Figure 4 shows that the entire Site is located within Flood Zone 3 (land assessed as having a 1 in 100 (1%) or greater annual probability of river flooding). The EA Flood Zones are consistent with the Calder Catchment SFRA mapping, which shows that the entire Site is located within Flood Zone 3a (land at a 'High' risk of flooding from rivers and the sea). Detailed hydraulic modelling information for the Lees Beck has been provided by the EA, and the fluvial flood risk to the Site is discussed in more detail in Section 5.

The EA and SFRA flood mapping show that the proposed development sites are at a 'High' risk of flooding from rivers.

4.5 Flooding from the Sea

The Site is situated inland, approximately 80km from the coast, and has an elevation of circa 58.0m AOD. Therefore, the proposed development sites are not at risk of flooding from the sea.

4.6 Flooding from Surface Water

The Environment Agency Risk of Flooding from Surface Water Map (RoFSW)[10] is informed by 'direct rainfall' modelling undertaken at a high (2m) spatial resolution. It illustrates those areas at elevated risk of surface water flooding, in low spots down-gradient of sloping ground or in the topographic valleys associated with current or former watercourses.

The EA RoFSW map assesses flooding resulting from severe rainfall events based on the following three scenarios:

- 1 in 30 (3.3%) annual probability rainfall event ('High' risk).
- 1 in 100 (1%) annual probability rainfall event ('Medium' risk).
- 1 in 1000 (0.1%) annual probability rainfall event ('Low' risk).

Land with less than a 1 in 1000 (0.1%) annual probability of surface water flooding is considered to be at a 'Very Low' risk.

The EA RoFSW map (Figure 7) shows that the proposed warehouse is at a 'Low' risk of surface water flooding. The predicted flood depths across the proposed warehouse range between approximately 0.15m and 0.60m in the extreme 1 in 1000 (0.1%) annual probability rainfall event. The access roads surrounding the proposed warehouse are at a 'High' risk of surface water flooding, however a review of the LiDAR shows that this area is elevated above the access roads. Therefore, it is unlikely that surface water flow along these roads that would impact on the proposed warehouse.

The proposed tank farm is largely at a 'Low' to 'Very Low' risk of surface water flooding, with some 'Medium' to 'High' risk areas around the site boundary. A review of the LiDAR shows that these areas of 'High' risk are at the base of higher ground to the south and west of the proposed tank farm, and therefore surface water runoff is to be expected. The RoFSW flood extents show that predicted flood depths across the proposed tank farm range between approximately 0.15m and 0.60m during the extreme 1 in 1000 (0.1%) annual probability rainfall event, although flood depths of up to 0.9m are predicted in the southeast corner adjacent to Main Avenue during the 1 in 30 (3.3%) annual probability rainfall event.

Figure 7 indicates that there is a surface water flow route leading from a residential area to the west of the Syngenta site, which flows in an easterly direction across some industrial land, before flowing down towards the Lees Beck and the proposed tank farm. This surface water flow route could potentially impact on the proposed tank farm.

The Site is considered to be at a 'Low' risk of surface water flooding, and it is understood that both the proposed warehouse and tank farm areas are underlain by impermeable surfaces, meaning the proposed development is unlikely to increase current surface runoff rates and volumes. However, this needs to be confirmed as part of a detailed surface water management strategy for the Site to ensure that there is no increase in the risk of surface water flooding to third party land.

The SFRA mapping does not include any records of historic surface water flooding at the Site.

Overall, the proposed development sites are considered to be a 'Low' risk of surface water flooding. Details about the proposed management of surface water are included in Section 6.

[10] Check your long term flood risk, accessed December 2020, Environment Agency https://flood-warning-information.service.gov.uk/long-term-flood-risk

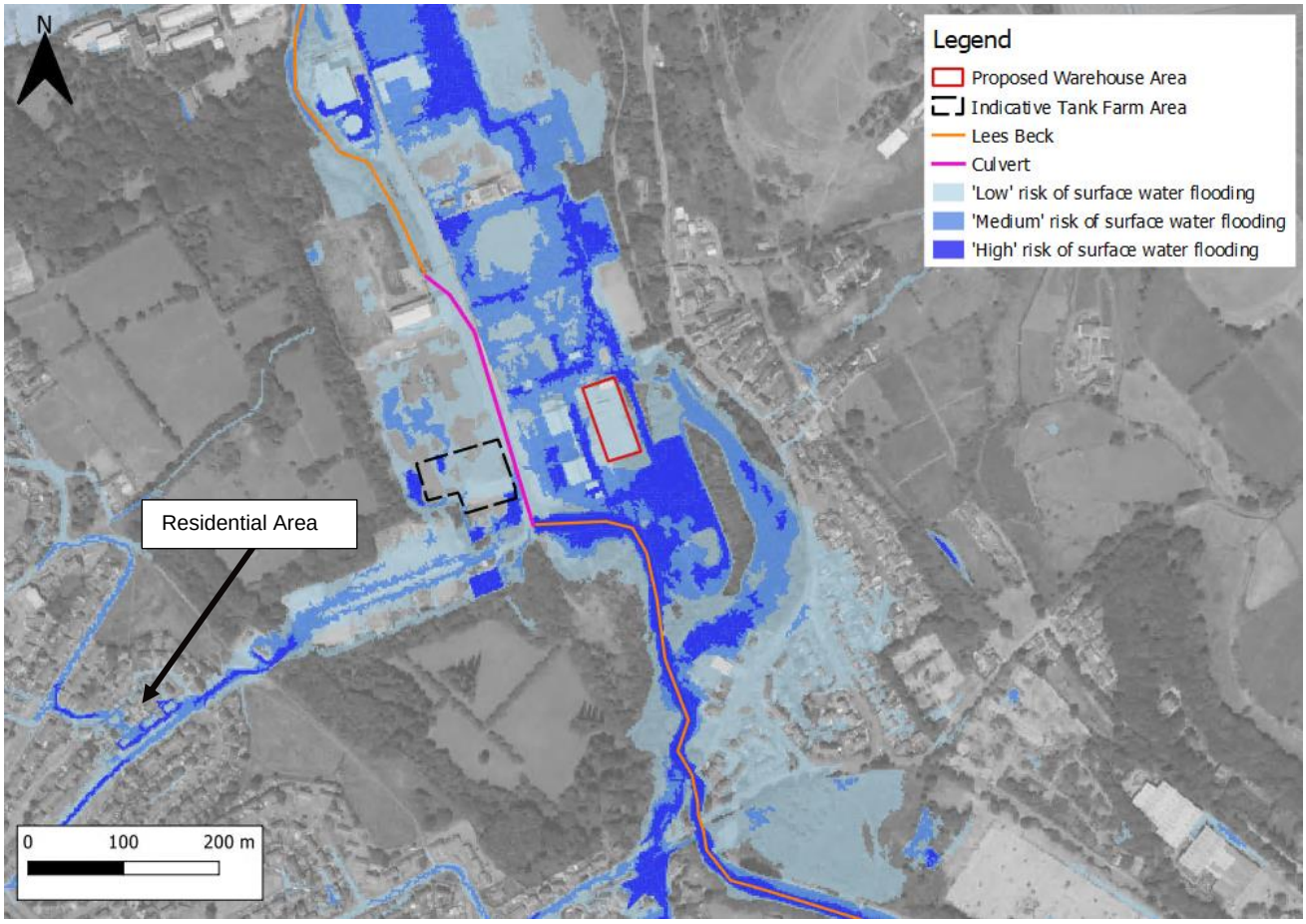

Figure 7: EA Risk of Flooding from Surface Water Map

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4.7 Flooding from Groundwater

Groundwater flooding is not as well-defined as other sources of flooding, and an assessment of risk often requires consideration of geological conditions. Groundwater flooding occurs when groundwater rises to the ground surface. This may happen during winter and/or after prolonged or heavy rainstorms. There are generally two forms of groundwater flooding (i) 'clearwater flooding' associated with the water table rising to the surface in areas of permeable bedrock geology such as chalk; and (ii) 'river-groundwater interaction' where river levels interact with permeable superficial deposits within river valleys, flooding areas far from the river without necessarily overtopping raised river banks.

According to British Geological Survey (BGS) mapping[11], both the proposed warehouse and proposed tank farm are underlain by mudstone, siltstone and sandstone (Pennine Lower Coal Measures Formation), along with superficial deposits of clay, silt, sand and gravel. The DEFRA Magic Map[12] indicates that the bedrock underlying the Site is a Secondary A aquifer. Given the absence of principal aquifers, the risk of 'clearwater flooding at the Site is considered to be low.

A review of the LiDAR shows ground levels across the Site are generally higher than the raised bank levels of the Lees Beck, suggesting that groundwater is likely to drain away from the Site towards the Lees Beck. There are no low spots within the Site where groundwater is likely to emerge. As such, the risk of groundwater flooding at the Site through 'river-groundwater interaction' is considered to be low.

[11] BGS Geology of Britain viewer https://mapapps.bgs.ac.uk/geologyofbritain/home.html
[12] DEFRA Magic Map https://magic.defra.gov.uk/magicmap.aspx

The SFRA states that Kirklees Council has not specified any significant issues associated within groundwater flooding in the borough, and the Kirklees Local Flood Risk Management Strategy[13] states "it is very unusual to see groundwater breaking through the surface of the ground" in the borough.

The proposed development sites are considered to be at a 'Low' risk of groundwater flooding.

4.8 Flooding from Sewers

Flooding from sewers can result from lack of sewer capacity, blockages within the sewer network or failure of infrastructure such as pumps. Any area that benefits from sewerage infrastructure has a potential risk of flooding, but the likelihood and consequences are most likely increased by topographic constraints such as low spots or flow paths that could influence the behaviour of floodwater originating from sewers.

A review of the drainage network across the Site shows that there are two 225mm diameter sewer pipes beneath the proposed warehouse which drain north to Nettleton Avenue. These sewers connect to the wider sewer network which flows east to west under Nettleton Avenue. There is also a 600mm diameter surface water drain beneath Nettleton Avenue which flows east to west. There is an abandoned surface water drain under the proposed warehouse which previously drained towards South KIP Road to the east of the site.

In the absence of site-specific information on sewer flooding, the EA RoFSW map can aid understanding of potential overland flow routes in the event of a sewer network failure. The RoFSW map shows that the access roads surrounding the site of the proposed warehouse are at a 'Medium' to 'High' risk of surface water flooding, however a review of the LiDAR shows that the proposed warehouse area is raised 1 to 2m above these roads. Therefore, in the event of a sewer network failure the roads would act as preferential flow paths. As such, the risk of flooding from sewers to the proposed warehouse is considered to be 'Low'.

There are several sewer pipes located in the residential area to the west of the Syngenta site, including a large 825mm diameter pipe. Available data indicates that there is a potential surface water flow route leading from this area towards the proposed tank farm. However, the surface water flood map (Figure 7) indicates that the main flow route would likely be to the south of the site and, therefore, a sewer breach would be unlikely to pose a significant risk to the proposed tank farm.

The SFRA mapping does not show any records of sewer flooding at the proposed development sites.

Based on the available information, the proposed development sites are considered to be at a 'Low' risk of flooding from sewers.

[13] Kirklees Local Flood Risk Management Strategy https://www.kirklees.gov.uk/beta/flooding-and-drainage/pdf/FloodRiskStrategy.pdf

4.9 Flooding from Reservoirs, Canals and other Artificial Sources

The EA 'Risk of Flooding from Reservoirs' Map[5] illustrates the potential flood extent if large, embanked reservoirs were to fail and release the water that they hold. Figure 8 shows that the proposed warehouse and tank farm areas are both located outside the extents of this flood envelope.

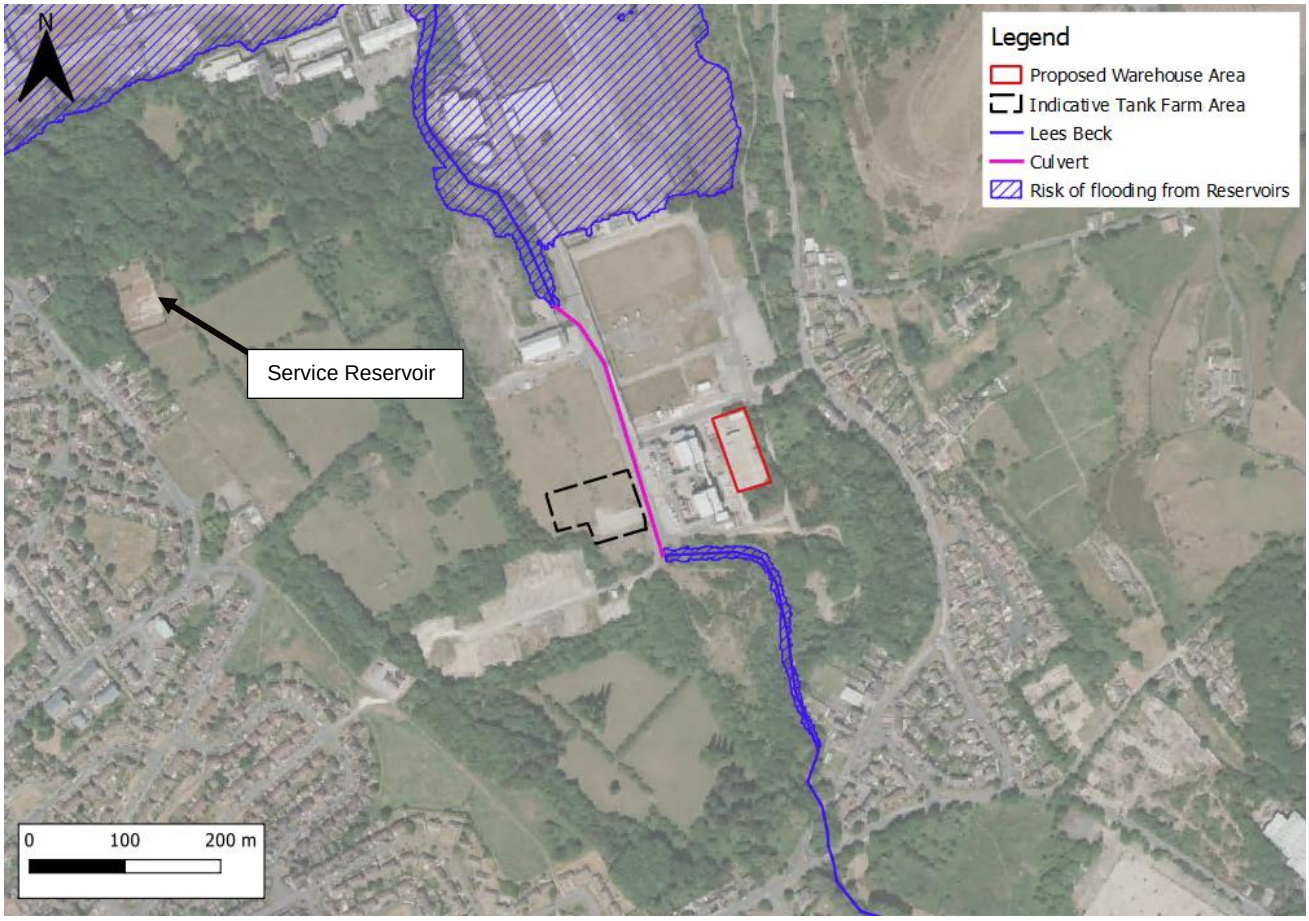

Figure 8: EA Reservoir Flood Risk Map

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There is a small, covered service reservoir located within the western boundary of the Syngenta site, approximately 600m northwest of the proposed tank farm area (see Figure 8). The LiDAR indicates that in the event of a reservoir breach, water is likely to flow west towards the Lees Beck downstream of the Lees Beck culvert which sits at a lower elevation than the proposed warehouse and tank farm. Therefore, this reservoir is considered to pose a 'Low' risk to the Site.

No canals or other artificial water sources that could pose a risk to the proposed developments have been identified.

Flooding from these sources is considered to pose a 'Low' risk to the proposed development sites.

5 Fluvial Flood Risk – Detailed Assessment

The Environment Agency has provided modelled flood levels and extents for the 2007 Fenay Beck model (including the Lees Beck) and the 2019 Colne Model (Appendix A).

The 2019 Colne Model mapping shows that the proposed warehouse and tank farm are both located outside of the River Colne flood extents in the 1 in 100 (1%) including a 50% allowance for climate change flood and in the extreme 1 in 1000 (0.1%) plus 20% climate change allowance flood events. Therefore, flooding from the River Colne is not considered to pose a risk to the proposed development sites.

The 2007 Fenay Beck model data includes modelled flood levels along the Lees Beck for a range of return periods. Whilst the Fenay Beck model is old, the data from the model is considered relevant and is currently the best available information to define fluvial flood risk in the study area. Figure 9 shows the location of the model nodes and Table 4 shows the modelled flood levels at Nodes 4 and 5 (i.e., the nearest nodes to the proposed development sites). Figure 10 shows the Fenay Beck modelled flood extents.

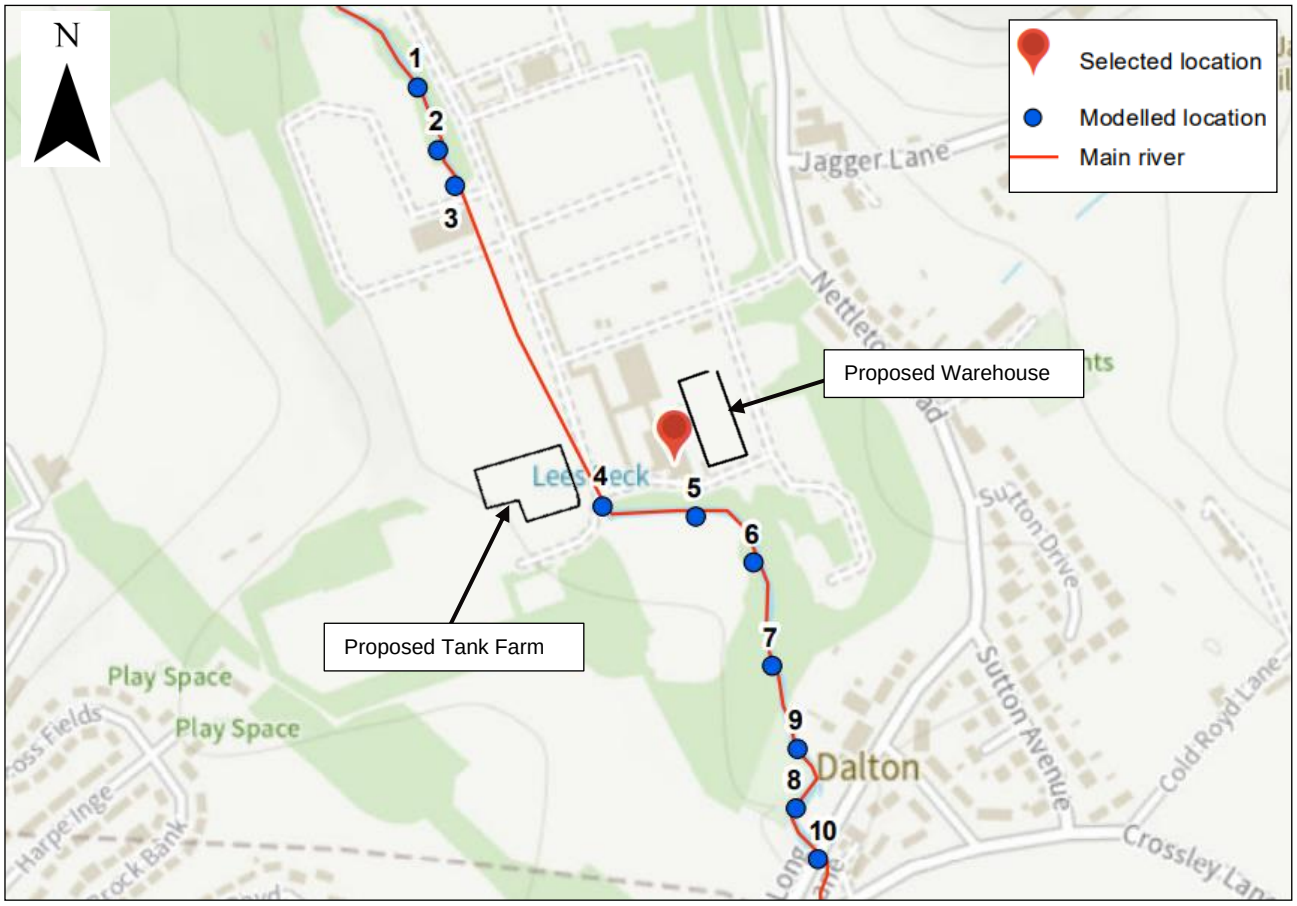

Figure 9: Fenay Beck Model Node Locations

Table 4: Peak Modelled Flood Levels along the Lees Beck

Model Node	Modelled Flood Level (mAOD)					
	1 in 25 (4%)	1 in 50 (2%)	1 in 75 (1.33%)	1 in 100 (1%)	1 in 100 (1%) +20% climate change	1 in 1000 (0.1%)
4	57.37	57.69	58.05	58.77	59.02	59.46
5	57.91	58.32	58.71	58.95	59.12	59.52

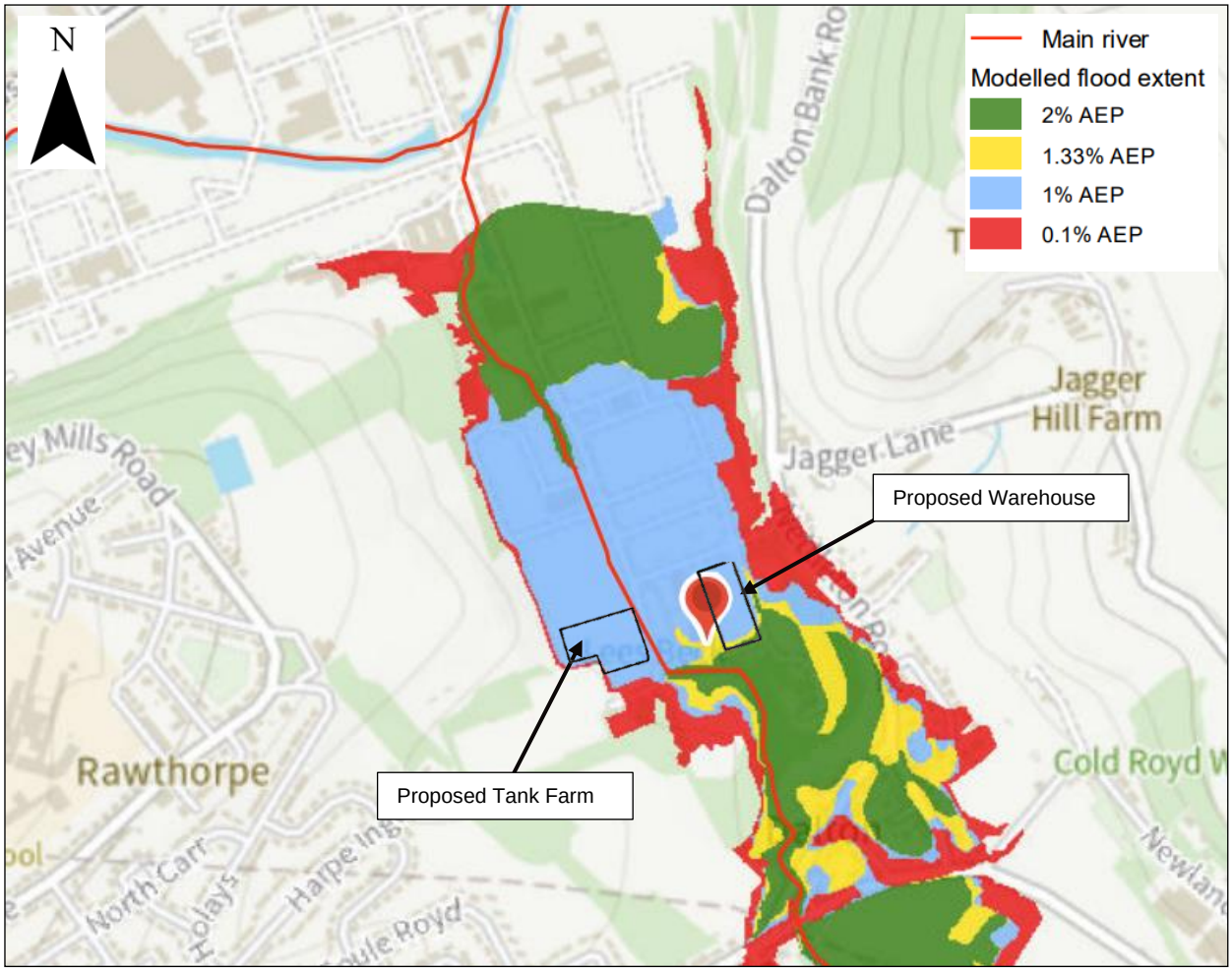

Figure 10: Fenay Beck Modelled Flood Extents

The flood extents in Figure 10 show that the proposed warehouse and tank farm areas are both predicted to be impacted by flooding during the 1 in 100 (1%) and 1 in 1000 (0.1%) annual probability events, which is consistent with the EA Flood Zones.

The flood extents show that the southern and eastern boundaries of the proposed warehouse may be impacted by flooding during events as frequent as the 1 in 50 (2%) annual probability event. However, a comparison of the modelled flood levels and the LiDAR indicates that any flooding in this area would be restricted to the surrounding access roads and would not impact on the proposed warehouse itself.

The available flood modelling data confirms that the fluvial flood risk to the Site is high during extreme events. The Fenay Beck model data includes modelled flood levels for the 1 in 100 (1%) +20% climate change

allowance event. Whilst this is not based on the latest EA climate change allowances guidance[14], it is very similar. The current relevant climate change allowance for the Site (Aire and Calder Management Catchment, Central Allowance to 2080) is 23%.

Detailed flood depth grids have not been provided for the Fenay Beck model and therefore it is not possible to confirm flood depths across the proposed development sites for the modelled flood events. The proposed warehouse area slopes south to north and the warehouse is to be located at the highest point within the Site boundary. Floodwaters would therefore be expected to flow away from the warehouse. However, assuming that flood levels at the warehouse are similar to those modelled along the Lees Beck upstream of the culvert, flood depths within the proposed warehouse would range between approximately 0.12-0.22m which is considered to be a conservative estimate. Potential flood mitigation measures for the proposed development are discussed in Section 7.

A comparison of the LiDAR and the modelled flood levels in Table 4 indicates that in the 1 in 100 (1%) +20% climate change allowance event, flood depths would range between approximately 0.1-0.7m across the tank farm area.

[14] EA Climate Change Allowances https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

6 Surface Water Management

6.1 Overview

The NPPF states (in para. 165) that *"Major developments should incorporate sustainable drainage systems [SuDS] unless there is clear evidence that this would be inappropriate"*.

Surface water should, as far as is practicable, be managed in a sustainable manner to mimic the surface water flow regime prior to the proposed development. Opportunities to reduce flood risk to the Site itself and elsewhere, taking climate change into account, should be investigated.

6.2 Local Policy

Policy LP28 of the Kirklees Local Plan states that SuDS should be used to achieve a reduction in surface water run-off rates and prevent pollutants from entering watercourses and drainage systems. Kirklees Council, the relevant Lead Local Flood Authority (LLFA), have advised that attenuation must store runoff from the critical duration 1 in 30 (3.3%) storm. Volumes generated by storms up to and including the 1 in 100 (1%) plus 30% climate change allowance critical storm event also need to be stored on site. Brownfield sites are required to provide a betterment to the current discharge rate of 30%. SuDS features designed to prevent polluted sediments from entering the Lees Beck and on-site drainage systems will therefore be required, as confirmed by the LLFA (Appendix B).

6.3 SuDS Guidance

The Kirklees Council website refers developers to the West Yorkshire Combined Authority Sustainable[15] Drainage Systems Guidance for information on how to incorporate SuDS into new developments.

Whilst the proposed warehouse area is currently entirely hardstanding, the proposed development (Figure 3) shows that there is a strip of vegetation along the eastern and southern boundary which could potentially be used to incorporate SuDS features such as filter strips or swales to achieve reductions in surface water runoff post-development.

Whilst SuDS can be very effective on brownfield sites, SuDS features need to be selected with careful consideration, particularly where there is the risk of environmental damage from land contamination. The LLFA have advised that soakaways would not be a viable option for the proposed development due to the potential for one or more geohazards associated with infiltration (Appendix B).

The LLFA have confirmed that connecting SuDS features to the Lees Beck or a Yorkshire Water sewer would be a viable surface water management option (Appendix B).

6.4 Surface Water Runoff across the Site

It is understood that both the proposed warehouse and tank farm are underlain by impermeable surfaces, albeit some vegetation cover has established in the tank farm area. Therefore, the proposed development would not be expected to increase the risk of surface water flooding to third party land through introducing new areas of impermeable land cover. As discussed above, there is a potential for the proposed development to achieve the required 30% reduction in runoff rates, in line with policy requirement for brownfield sites, through incorporating SuDS features. However, this would need to be confirmed as part of a detailed surface water drainage assessment.

[15] West Yorkshire Combined Authority SuDS Guidance https://www.westyorks-ca.gov.uk/media/5397/lcr-suds-guidance-final-february-2020-1.pdf

A detailed surface water management strategy should be developed detailing how surface water will be managed over the development lifetime.

7 Flood Mitigation and Management

Syngenta has an existing flood risk management strategy in place to manage on-site flood risk, including an early warning system, emergency procedures and flood resilience measures. It is assumed that these measures will also be applied to the proposed development. Further details of the existing flood risk management strategy are outlined below.

7.1 Existing Early Warning System and Emergency Procedures

The study area is located within an EA Flood Warning Area and the Syngenta site is registered to the EA's Flood Warning Service. The early warning system is based on monitored water levels along the River Colne, known as "Action Levels", which were established by Syngenta following the 30 July 2002 flood event.

Syngenta has existing site-wide procedures in place which are triggered by the "Action Levels" to ensure that critical infrastructure is protected, flood sensitive materials are protected or moved to safer locations, and staff are evacuated before flood waters reach sensitive areas of the site.

7.2 Existing Flood Resilience Measures

Syngenta has implemented a number of flood resilience measures over the years, and it is recommended that these measures are also applied to the proposed development, where appropriate. Existing measures include:

- Raising critical equipment such as control equipment and sensitive electrical equipment to provide a suitable freeboard above the modelled flood levels shown in Table 4; and
- Using water-resilient finishes to walls and floors.
- The deployment of temporary flood defences to protect critical infrastructure and facilities on the Site.
- Permanent concrete flood walls to protect certain installation, such as electrical generators.

The July 2013 FRA states that the provision of formal flood defences to contain flood water from the River Colne and the Lees Beck is not an option due to the consequential increase in the risk of flooding off-site. The existing Syngenta flood risk management strategy has therefore been developed to ensure that there is no increase in flood risk to third parties and enable the site to resume normal operations within 2 days of flood waters subsiding.

7.3 Recommended Finished Floor Levels

Whilst it is typically recommended that finished floor levels are set a minimum of 300mm above the modelled 1 in 100 (1%) flood level plus an allowance for climate change, this would involve raising the finished floor level of the warehouse to 59.42m AOD – half a metre above existing ground levels – which is not feasible. For context, the existing manufacturing plant to the west of the Site has a finished floor level of 58.0m AOD. Given that it is not possible to raise the finished floor level of the warehouse above the modelled 1 in 100 (1%) plus climate change flood level, it is recommended that flood risk to the warehouse is managed by incorporating flood resilience measures into the development (Section 7.2) and monitoring flood levels along the Lees Beck (Section 7.4).

7.4 Lees Beck Water Level Monitoring

The current flood warning system is triggered by water levels along the River Colne, however, the main risk to the proposed development sites is flooding from the Lees Beck. Therefore, the flood warning system could be

enhanced by undertaking water level monitoring in the Lees Beck upstream of the culvert. The existing flood risk management strategy should be updated with actions which need to be taken to when flood waters reach defined trigger levels to ensure that the proposed development and site personnel are safe.

7.5 Culvert Blockage Risk

It is recommended that the upstream face of the Lees Beck culvert to the south of the Site is monitored regularly to check for any debris related blockages which could restrict flow and increase the risk of flooding to the Site. It is further recommended that a management plan is developed for clearing blockages safely.

7.6 Third Party Flood Risk

The proposed warehouse will have a slab level of 58.90m AOD, which is approximately 100mm above existing ground levels at this location. Raising the development above existing ground levels would result in some displacement of floodwaters which could impact flood risk elsewhere. Based on the footprint of the proposed warehouse and the EA modelled flood levels, it is estimated that approximately 30m³ of floodwater could be displaced during the 1 in 100 (1%) +20% climate change allowance event. This volume is based on the warehouse having an area of circa 300m² and approximately 100mm depth of floodwater being displaced by the development.

The LiDAR indicates that any displaced floodwater will flow away from the warehouse area along the surrounding access roads before flowing north across the wider Syngenta site. Given that only a relatively small volume of floodwater is likely to be displaced, any flood risk impacts across the wider Syngenta site would likely be negligible. If it is assumed that floodwater is displaced across Flood Zone 3 within 100m of the proposed warehouse, then 30m³ of floodwater will be distributed across an area of circa 73,500m². This would result in less than a 1mm increase in flood levels across the wider area.

No vulnerable receptors have been identified in the surrounding area which will be impacted by the displaced floodwaters. As such, the proposed warehouse will not increase off-site third-party flood risk.

8 Conclusions and Recommendations

8.1 Conclusions

This FRA has been prepared to support a planning application for a new warehouse as part of the expansion of the existing manufacturing plant at the Syngenta Huddersfield Manufacturing Centre.

This FRA has also assessed flood risk to a proposed tank farm; however, this is permitted development and does not form part of the planning application.

This FRA concludes the following:

- The development sites are located in Flood Zone 3a (land assessed as having a 1 in 100 (1%) or greater annual probability of river flooding) and are therefore at a 'High' risk of flooding from rivers.
- In accordance with the NPPF, the proposed development is considered to be appropriate, on flood risk grounds, for the type of development proposed.
- No historical records of flooding have been identified in the proposed development areas.
- Development within the fluvial floodplain has the potential to increase flood risk elsewhere due to the displacement of floodwaters. However, given the relatively small footprint covered by the proposed development and the small volume of floodwater which will be displaced by the proposed warehouse, the development will have a negligible impact on third party flood risk.
- The proposed development sites are considered to be a 'Low' risk of surface water flooding and as both sites are currently underlain by impermeable surfaces, development would not be expected to result in increased surface water runoff.
- The entire Site is considered to be at a 'Low' risk of flooding from all other sources considered within this FRA.

8.2 Recommendations

- It is recommended that a detailed surface water management strategy is developed describing how surface water will be managed over the development lifetime.
- It is recommended that flood resilience measures are incorporated into the proposed warehouse development, such as raising critical equipment to provide a suitable freeboard and using water-resilient finishes to walls and floors.
- The current flood warning system is triggered by water levels along the River Colne, however, the main risk to the proposed development sites is flooding from the Lees Beck. Therefore, it is recommended that the flood warning system is enhanced by undertaking water level monitoring in the Lees Beck upstream of the culvert. The existing flood risk management strategy should then be updated with actions which need to be taken to when flood waters reach defined trigger levels to ensure that the proposed development and site personnel are safe.
- A blockage of the Lees Beck culvert could pose a flood risk to the site; therefore, it is recommended that the culvert is monitored regularly to check for any debris. It is further recommended that a management plan is developed for clearing blockages safely.

Appendix A

Environment Agency Flood Maps and Data

Appendix B

LLFA Correspondence

Consultation Response – 2021_20588 Syngenta Ltd, 572 Leeds Road, HD2 1FF.doc

Appendix C

Preliminary Floor Levels

4/7901 – Drawing 999 – Revision 1

Appendix D

Syngenta Historic Flood Maps

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