Unit 7, Riverside Studios, Amethyst Road, Newcastle upon Tyne NE4 7YL

Flood Risk Assessment & Drainage Strategy

Haugh Lane, Hexham

for

Hexham Studios

JK-6165

January 2021

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Revision	Date of issue	Comments	Prepared By	Checked By
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Executive Summary

Description
Jasper Kerr Consulting Engineers Ltd were commissioned by Hexham Studios to undertake a Flood Risk Assessment (FRA) and Drainage Strategy for the proposed extension of an existing industrial unit on Haugh Lane, Hexham, Northumberland.
Site Parameters
Area of land to be developed: 1,050m² (0.105ha) Greenfield: ✗ Brownfield: ✓ Mixed Green and Brownfield: ✗ Existing Runoff: Currently no formal drainage draining the proposed development area which is currently loose gravel hardstanding Ground Conditions: Made ground above clay Ground Contamination: Hydrocarbon contamination discovered at the south of the site Ground Infiltration Potential: Poor
Flood Risk Assessment
Fluvial: Flood Zone 3 (Low on Flood Warning Information Service) Pluvial: High Groundwater: Low Other sources: Low
Flood Mitigation Measures
To mitigate the issues of flooding and ensure that no additional flooding will occur anywhere else as a result, the existing levels will be maintained and surface water run-off from the site will be managed within the extents of the site. This proposed building extension will have the same flood risk as the existing building which is owned and used by the developer for the same purposes as the proposed development. The developer accepts that the development is in a flood risk area and will only store low risk items on the lower shelves of this storage facility which will not be damaged by flood water. In addition, electrical supply sockets and electrical appliances should be raised 600mm above the 1 in 100 year plus climate change flood level plus an additional 600mm freeboard, equating to 35.878 (35.278 + 0.6m). This is 728mm above the proposed FFL of 35.15. This flood risk assessment should also be provided to any future buyers of the site to ensure that they understand the flood risk posed to the development site. The development is within a flood warning area and the owner of the building will receive flood warning messages from the EA when a flood event is likely to occur.
Conclusions
This Less Vulnerable development is appropriate in a Flood Zone 3a area without the need for an exception test and this Flood Risk Assessment has confirmed that the proposed development is appropriate and sustainable in the terms as set out in NPPF. Infiltration and discharge to a watercourse are unfeasible options and therefore surface water flows are proposed to connect into the surface water sewer system. Discharge rates will be restricted and attenuated on site using the smallest advisable flow control device and these flows can be accepted into the Northumbrian Water sewers within Haugh Lane.

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Appendices

1.0 Introduction

Jasper Kerr Consulting Engineers Ltd were commissioned by Hexham Studios to undertake a Flood Risk Assessment (FRA) and Drainage Strategy for a proposed extension to an existing industrial unit on Haugh Lane, Hexham. This report will be provided as supporting documentation as part of a detailed planning application.

The objective of this report is to identify flooding or surface water management issues relating to the development site and identify suitable flood mitigation measures if required. The assessment will be based upon existing available information and will aim to identify if the site is affected by current or future flooding and whether the development will increase flood risk elsewhere.

The objectives of this report are as follows:

- Describe the development site
- Identify existing site drainage characteristics
- Assess the flood risk in accordance with the Ministry of Housing, Communities & Local Government Technical Guidance and the National Planning Policy Framework (NPPF) - February 2019.
- Develop a water management strategy

2.0 Existing Site Information

2.1 Site Location

The proposed development is located at Unit 21, Haugh Lane Industrial Estate, Hexham, Northumberland NE46 3HJ and is sited within a mainly industrial area.

The subject site is centred on National Grid Reference 393476mE, 564631mN and covers an area of approximately 0.315 hectares and the portion of the site that will be developed is 0.105Ha

Nearby water features include the following;

- River Tyne (Main River) - approximately 0.35km to the north of the site.
- Cockshaw burn (culverted burn) - approximately 0.18km to the west of the site.
- Kielder Water – approximately 33 km to the north west of the site.

Please refer to the Site Location Plan in **Appendix A**.

2.2 Site Description

Approximately half of the existing site is occupied by industrial units used primarily for storage, with 25% of the site being a concrete surface with positive drainage and the remaining 25% is loose gravel hardstanding with no known positive drainage.

Existing Site

The site is bounded by a perimeter fence with access points for vehicles that separates it from the other industrial units and Haugh Lane.

A topographical survey of the site has been carried out and is included within **Appendix B**. A review of the existing site levels at the location of the proposed development confirms that the site is flat with all recorded levels at circa 35.00m AOD.

2.3 Existing Ground Conditions

A ground investigation has been undertaken by Roberts Environmental Ltd and contains a number of statements with respect to the site geology and environmental setting.

Made ground has been identified on the site with a general depth of between 0.45m to 0.70m below current ground level (bcgl). Natural deposits have been identified across the site comprising of gravelly clay at a maximum proven depth of 1.40m bcgl. Sand and gravel interbred was identified to depths of 29.00m at the base of the windowless sampling. The bedrock below has been identified as mudstone and sandstone with bands of limestone.

The Roberts Report (Reference 201017.R.001) has been submitted with the application and can be referred to for further information.

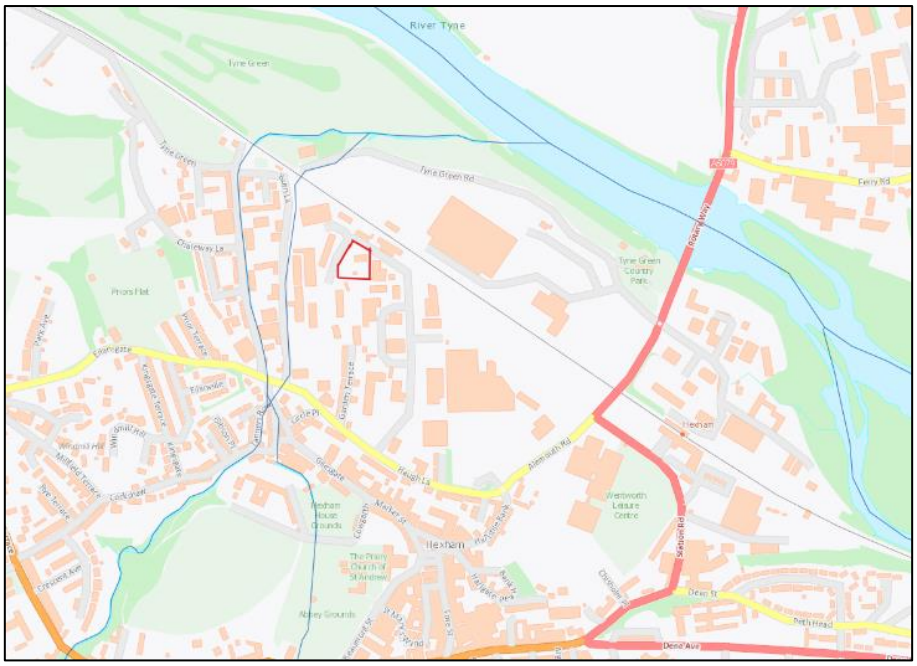
2.4 Hydrogeology

The aquifer designation for the superficial deposits, named as Alluvium is unknown. The solid geology is classified as Secondary A Aquifer. The site is not located within a Ground Water Source Protection Zone, however there is a potable water abstraction point located 466m to the north west and therefore the site location is considered to be of Low to Medium environmental sensitivity.

When considering the anticipated ground conditions below the site, a shallow continuous groundwater surface (water table) is not anticipated to be present. Samples were recovered wet / damp from approximately 2.40 – 2.80m below existing ground levels and subsequent monitoring has identified ground water levels between 2.60 – 2.72m below existing ground level.

2.5 Hydrology

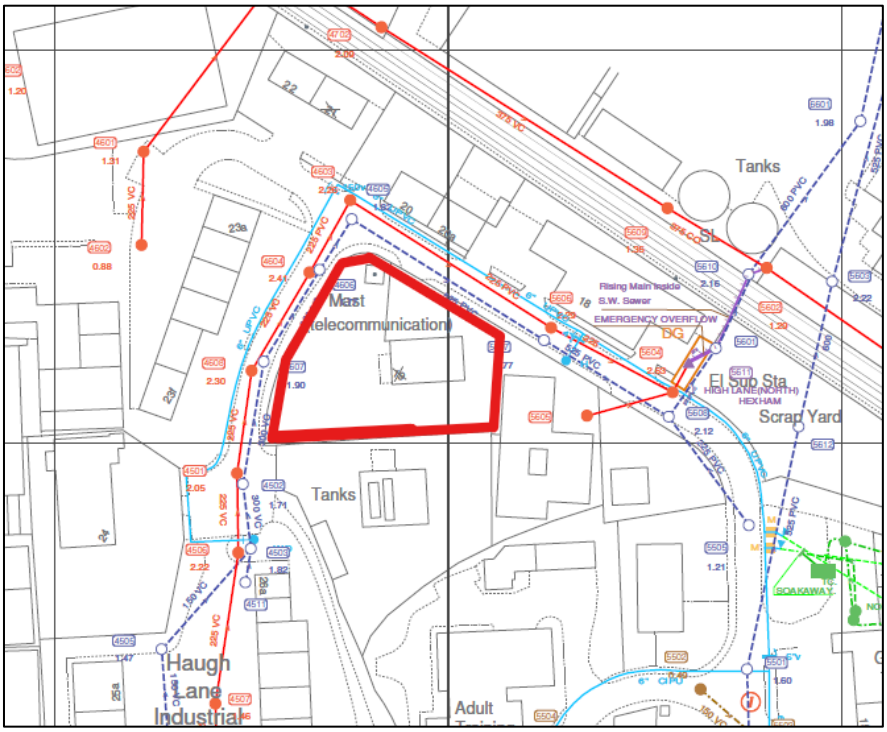
The nearest main river to the site is the River Tyne which is approximately 0.35km north of the site. A culverted section of Cockshaw Burn is located approximately 0.26km to the west of the site. The EA Catchment Data Explorer shows the site to be within the Hexham operational catchment area.



EA Main River Water Map

2.6 Existing Sewer Infrastructure

Northumbrian Water Ltd sewer record plans have been obtained for the site and can be found in **Appendix C**. The extract below shows that there are a number of public sewers near the site that run within Haugh Lane including both foul and surface water sewers. The developed part of the site also has multiple private surface water and combined water drainage networks within the site boundary that connect into the adoptable network below Haugh Lane.



Sewer Plan – Northumbrian Water

A drainage survey has been completed which identifies existing private drainage within the site boundary and also confirmed the location and depth of the public sewers. The area that is proposed to be developed is currently free draining gravel hardstanding. Based on the current use of the site it is assumed that no formal drainage is present below the area proposed for development. The drainage survey results can be viewed in **Appendix B**.

3.0 Flood Risk Assessment

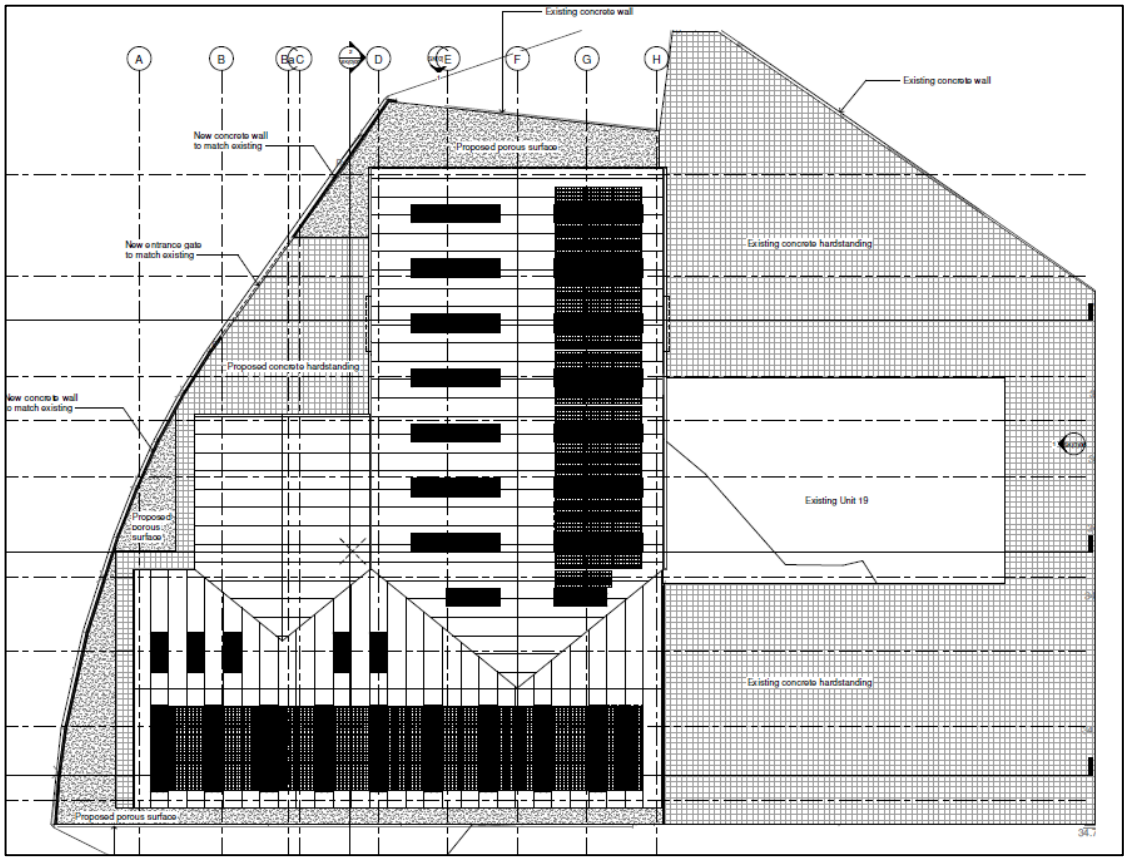
3.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF) aims to avoid inappropriate development in areas at risk of flooding, directing development away from high risk areas and avoiding increasing or reducing the risk of flooding elsewhere.

The FRA will use a sequential approach to assess the site to attempt to avoid development in flood risk areas and to manage the residual risks and take into account the effect of climate change. The 'Sequential Test' will start with consideration of the Flood Zones in the vicinity of the site. Where development is proposed within a flood zone an 'Exception Test' may also be necessary in accordance with the NPPF guidance.

3.2 The Proposed Development

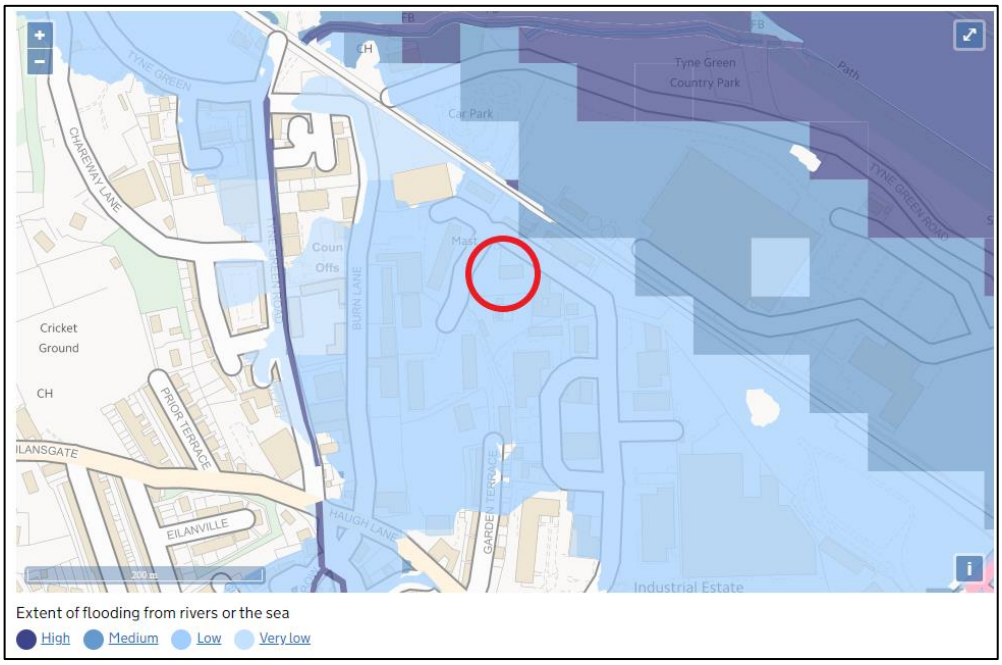
The proposed development is an extension of the existing industrial unit situated on Haugh Lane. The proposed unit will be used for storage purposes. An area of concrete hardstanding is proposed adjacent to the site entrance and hardstanding footpaths are proposed along the western perimeter of the building. Refer to **Appendix D** and the illustration below for the proposed site layout.



Proposed Site Layout – Sadler Brown Architecture

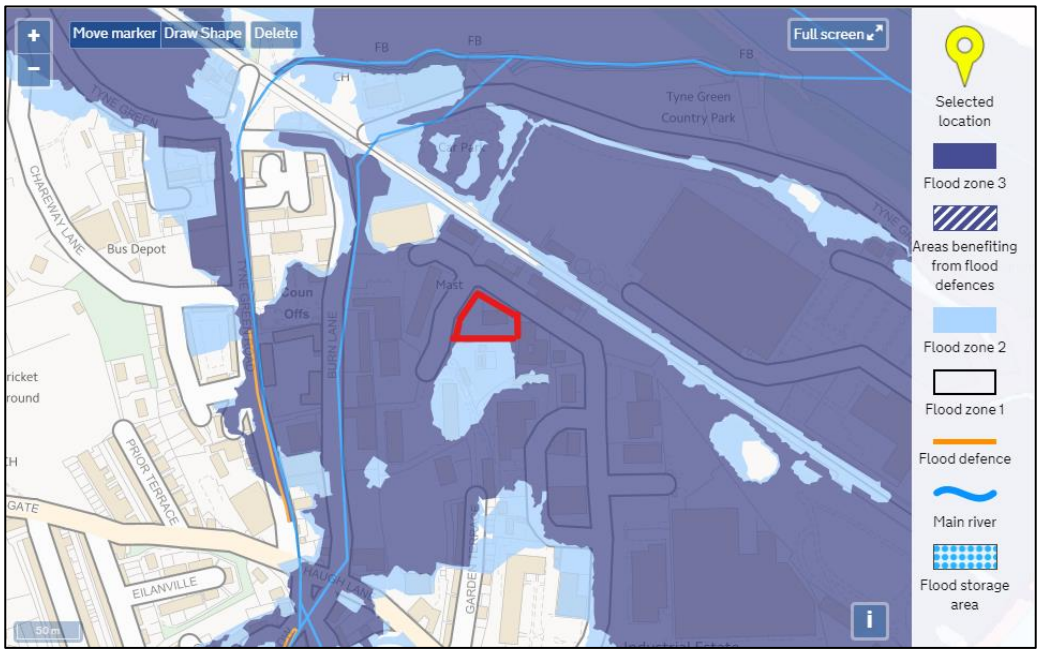
3.3 Fluvial and Tidal Flood Risk

The flood maps for planning provided by the EA indicate the extent of the extreme flooding from surface water, rivers or the sea and reservoirs that would occur without the presence of flood defences. The 'Extent of flooding from rivers and sea flood map' which is published as part of a 'flood warning information service' shows that the development site is within a 'Low Risk' fluvial flood risk area as shown below. This takes into account existing flood defences.



Flood Warning Information Service - Flood Risk Zones (Fluvial and Tidal) – EA

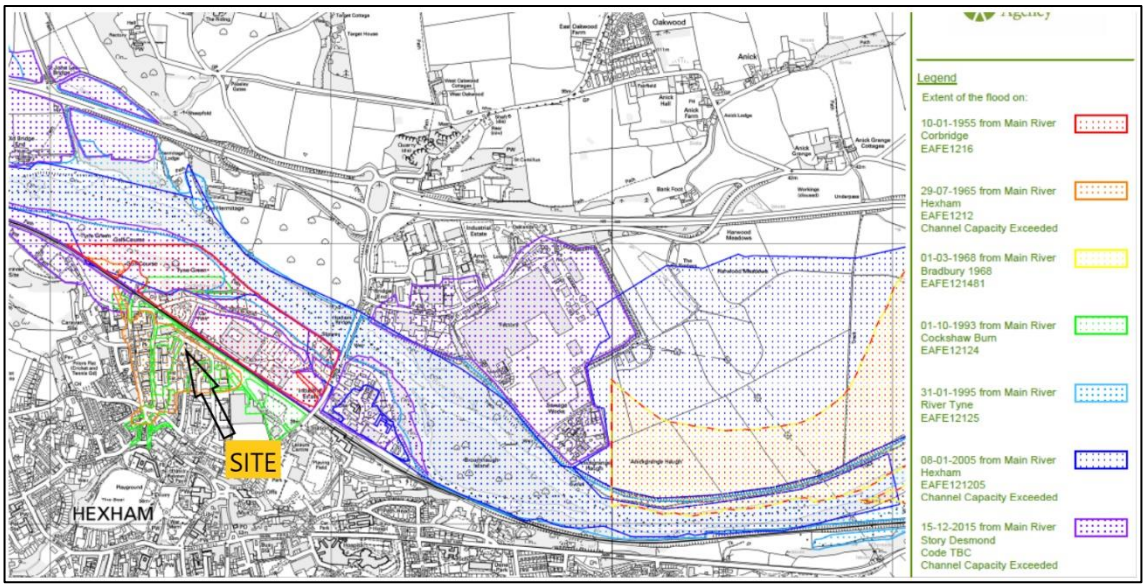
Fluvial Flood Maps for planning are also available which indicate areas of land that are designated as Flood Zone 2, Flood Zone 3, main rivers, flood defence structures and areas benefiting from flood defences. This map shows that the site is entirely within **Flood Zone 3**.



Flood Maps for Planning - Flood Risk Zones (Fluvial and Tidal) – EA

The Flood Maps for Planning are based upon the approximate extent of floods with a Flood Zone 2 having between a 1% and 0.1% annual probability of flooding from rivers or between 0.5% and 0.1% annual probability of flooding from the sea and tidal rivers in any year. Flood Zone 3 has a greater than 1% annual probability of flooding from rivers and greater than 0.5% annual probability of flooding from the sea and tidal rivers under present expectations, or where this is greater, the extent of the highest known flood. It should be noted that these flood map areas assume no defences and does not consider the likelihood that flood risk will be increased by climatic change.

The EA have provided the plan below which shows historic flooding around Hexham which has been caused by fluvial flood events. This shows that the development area was affected by flooding during events in 1965 and 1993 but not during the other listed events.



Historic flood events – EA

Hydraulic modelling information received from the EA for the site confirms the following flood levels for the location of the proposed extension;

Event	Flood Level (taking into account existing flood defences)
1 in 100 year	No Flooding
1 in 100 year plus climate change *	35.278
1 in 200 year	No Flooding
1 in 200 year plus climate change *	35.615
1 in 1000 year	35.686

Defended Flood Levels – EA

(* The EA have confirmed that the climate change allowances correlate with the Central Estimate (+20%) 2080's epoch based in 2016 guidance)

The information provided by the EA 10 November 2020 stated,

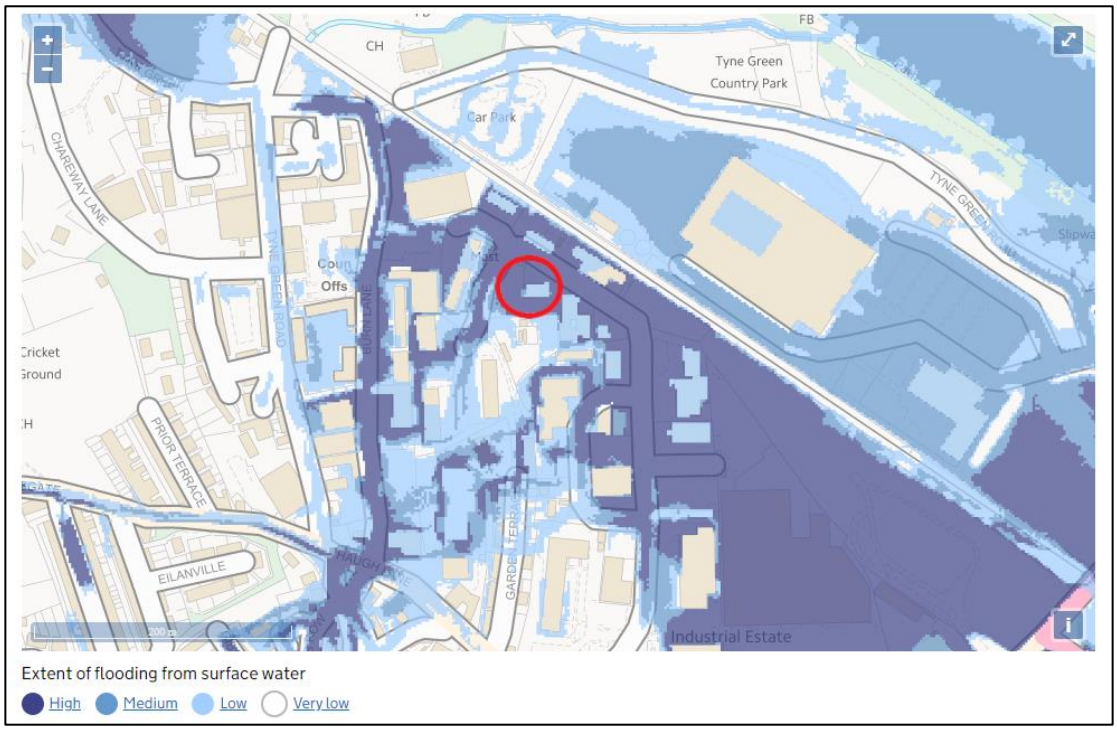
"Our latest modelling is shown in the attached Modelled Outline Defended Plans and Node Level (defended). However the Flood Map for Planning (undefended outlines) is based on the previous model, this is because our current modelling is associated with ongoing investigations into flood alleviation scheme options at Hexham so we are in the process of updating it with newer survey and considerations for gravel build up in the river. We don't expect to have these results back for another six months. We therefore won't be making any updates to our Flood Zone mapping until all modelling has been complete"

Therefore, flood levels have not been provided for the undefended scenario but upon inspection of the Flood Map for Planning, the area to the south of the side on the other side of the boundary wall is within Flood Zone 2. The north west corner of this Flood Zone 2 area is approximately at the south west corner of the development where the ground level has been confirmed to be 35.5mAOD. Flood Zone 2 areas have a risk of flooding during 1 in 100 to 1 in 1000 year events and therefore it can be deduced from this information that the **undefended 1 in 100 flood level for the site is approximately 35.5mAOD**.

3.4 Surface Water Flood Risk

The plan below is an extract from the EA surface water flood risk map which shows that the vast majority of external areas at the site have a high risk of surface water flooding. The existing building footprints have a low risk of surface water flooding and the western portion of the site has a medium flood risk.

The EA flood plans represent the best available current information on the extent of flood risk. However, it should be noted that unless specific historical events are recorded these maps are indicative only, and are to be used as a basis of consultation and not as the sole basis for decisions on where planning policies apply. This report makes reference to this information together with other site specific record details and ground investigation results in order to accurately assess flood risk.



Surface Water Flood Risk - EA

The way in which the Environment Agency categorises Surface Water Flood Risk is summarised in the table below:-

High	Flooding occurring as a result of rainfall with a greater than 1 in 30 chance in any given year (annual probability of flooding 3.3%)
Medium	Flooding occurring as a result of rainfall of between 1 in 100 (1%) and 1 in 30 (3.3%) chance in any given year
Low	Flooding occurring as a result of rainfall of between 1 in 1000 (0.1%) and 1 in 100 (1%) chance in any given year
Very Low	Flooding occurring as a result of rainfall with less than 1 in 1000 (0.1%) chance in any given year

Surface Water Flood Risk Zone Definitions - EA

Surface water flood maps use LIDAR information to identify low areas of topography where surface water can become trapped. In the case of this site, it is possible that the surface water flood risk is a direct result of fluvial flooding which if occurred, these areas would be unable to drain. It is notable that the extent of surface water flooding in the industrial estate is not as extensive as flooding shown on the fluvial flood maps and therefore it is very likely that surface water flooding is already taken into account in the fluvial flood models as these include flows from the catchments that drain to the main rivers.

The EA also produce predicted pluvial flood depths and velocities and the information shown for this site is summarised below.

Chance of Occurrence	Flood Depth Range	Velocity of Flow (m/s)
Low	300 to 900mm	Mainly less than 0.25 m/s but over 0.25 m/s at the north
Medium	Mainly 300 to 900mm but below 300mm at south east	Mainly less than 0.25 m/s but over 0.25 m/s at the north
High	Mainly below 300 but 300 to 900mm at north east	Mainly less than 0.25 m/s but over 0.25 m/s at the north

Surface Water Flood Depth and Velocity – EA

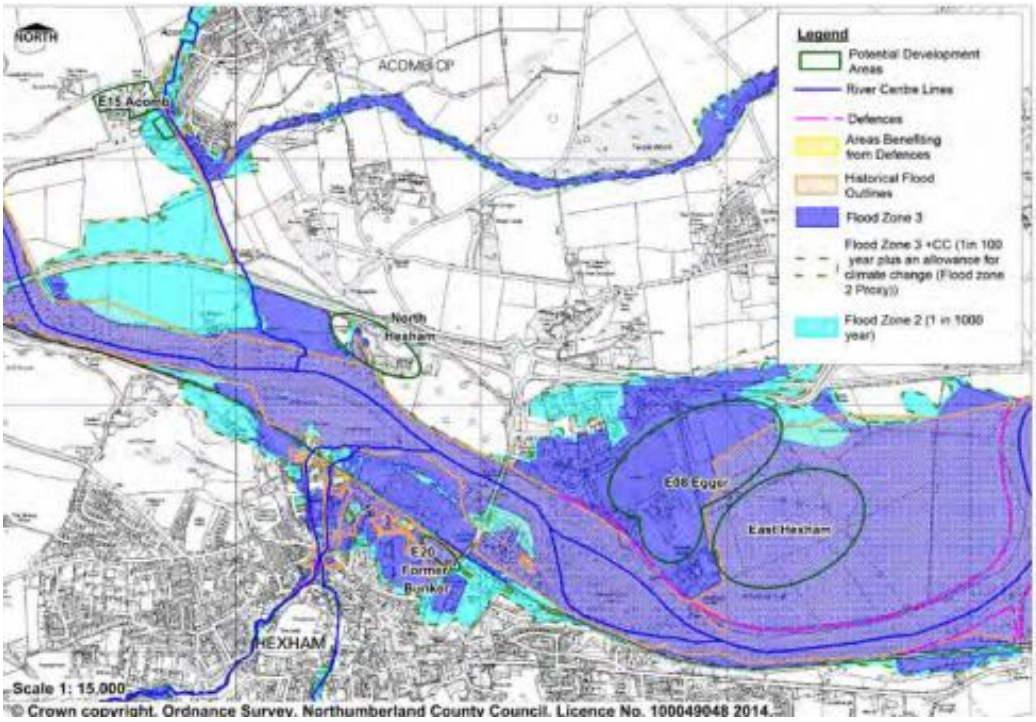
3.5 Groundwater Flood Risk

The Phase 1 and 2 ground investigation report states that groundwater during monitoring was recorded 2.60 – 2.72m below existing ground level and therefore significant groundwater flooding is considered unlikely.

3.6 Historic Flood Events from Northumberland Level 2 Strategic Flood Risk Assessment - SFRA

The 2015 SFRA provides flood risk information for Northumberland and is broken down into several areas.

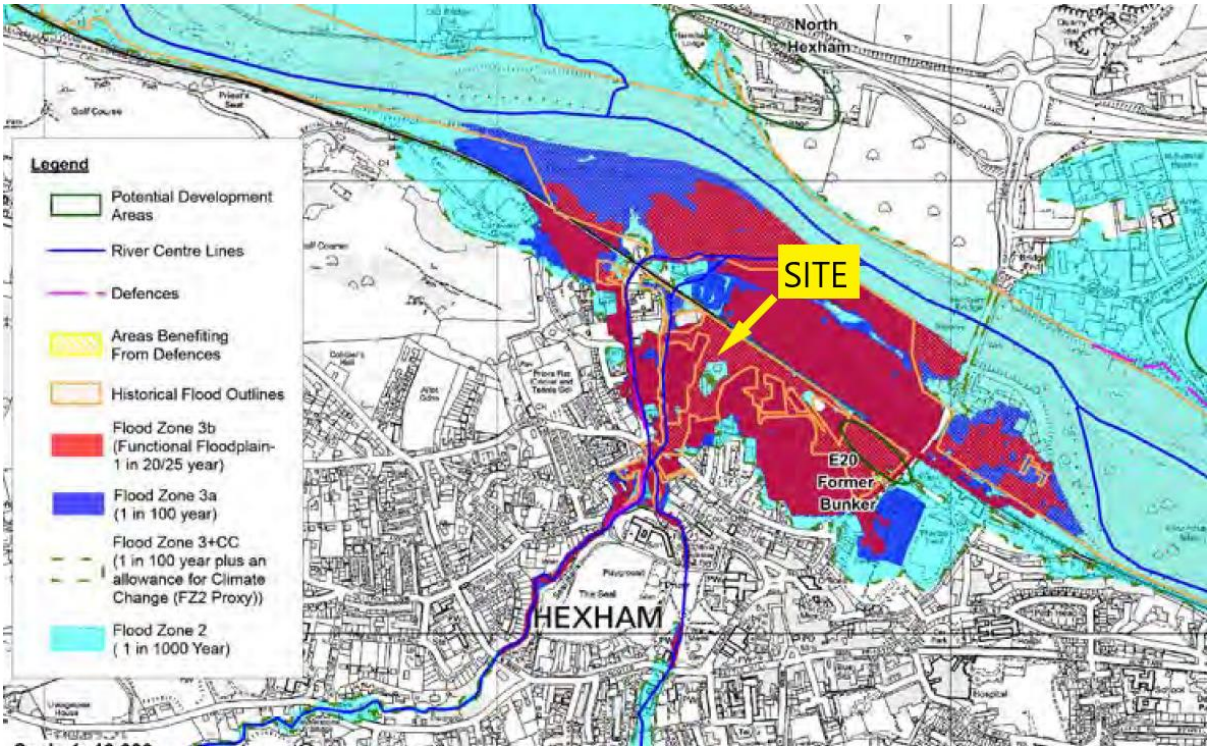
The SFRA includes a series of maps which illustrate detailed flood risk in a number of catchments including Hexham and its surrounding areas. Extents of Flood Zones and 2 and 3 in this document are similar to those shown on the current EA Flood Plans but do not take into account more detailed and recent flood modelling works which the EA plans do reflect.



Fluvial Flood Extents - Northumberland Level 2 SFRA

This closest 'designated development area' to this development site is named 'Former Bunker' where a Mixed-Use development (consisting of retail and hotel accommodation) was recently approved.

In accordance with paragraph 0.65 reference ID: 7-065-20140306 of the Flood Risk and Costal Change online Guidance, the Local Planning Authority is responsible in consultation with the EA for designating the portion of Flood Zone 3 areas that are categorised as Flood Zone 3a or Flood Zone 3b. The extract below from the Northumberland Level 2 SRFA suggests that the development is within Flood Zone 3b which is defined as 'functional flood plain' where water has to flow or be stored in times of flood.



Fluvial Flood Extents with Flood Zone 3 Designations - Northumberland Level 2 SFRA

The key on this plan states that this area acts as a functional floodplain during a 1 in 20/25 year event. However, flood level data recently received from the EA shows that this site will not flood during a 1 in 25 year fluvial flood event or even during a 1 in 75 year fluvial flood event. The aforementioned development within the 'Former Bunker' development area is also shown to be within Flood Zone 3b on this SFRA plan, but the approved FRA associated with that application stated that the site is within Flood Zone 3a.

In addition, the Pre-application consultation with the Local Authority also did not state that the site is within Flood Zone 3b and more recent consultations with the EA and LLFA did not confirm that the site is still designated as Flood Zone 3b 'functional floodplain'. Therefore, for the purposes of this assessment it is assumed that the proposed development is within **Flood Zone 3a.**

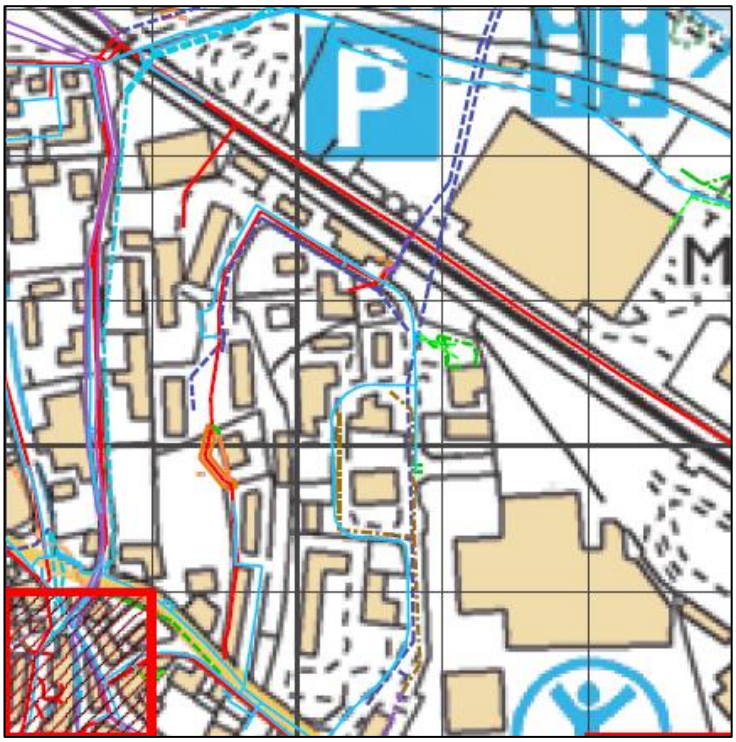
3.7 Flood Risk from Artificial Sources

The site is shown to be at risk of flooding from reservoirs during a worst-case failure scenario. However, reservoir regulations ensure that reservoirs are stringently inspected and that any required maintenance or upgrade works are carried out urgently. This helps ensure that the likelihood of reservoir failing is extremely low.

The closest canal waterway is more than 50 kilometres away and therefore does not pose a flood risk. The below map shows the extent of the flooding.

Reservoir Flood Extends - EA

Where infrastructure exists that retains, transmits or controls the flow of water, flooding may result if there is a structural, hydraulic, geotechnical or mechanical failure of the infrastructure. The Northumbrian Water Ltd asset plans show that there are a number of sewers surrounding the site and that there is recorded flooding associated with some of those sewers. However, the closest area of recorded sewer flooding is 200m south west of the site.



NWL Sewer Flooding Record Plan

4.0 Flood Risk Posed to Development

4.1 NPPF and PPG

The NPPF states that the vulnerability of a proposed development should be assessed against the flood risk posed to the site. This is detailed in the on-line Planning Practice Guidance "Flood Risk and Coastal Change" which states in *Table 2* of the guidance that "Buildings used for general industry, storage and distribution" have a "Less Vulnerable" flood vulnerability classification. *Table 3* of the guidance (shown below) confirms flood risk vulnerability and flood zone compatibility. As the site falls entirely within Zone 3a, it is considered that an **Exception Test is not required**. As the development forms an extension to an existing building and is located for operational purposes, the **Sequential Test is deemed to have been passed** as it is not appropriate to consider alternative development sites.

Table 3: Flood risk vulnerability and flood zone 'compatibility'

Flood risk vulnerability classification (see table 2)		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone (see table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	×	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	×	×	×

Key: ✓ Development is appropriate.
× Development should not be permitted.

4.2 Sources of Potential Flooding

The table below identifies the potential sources of flood risk to the development.

Flood Source	Potential Risk				Description
	High	Med	Low	V Low	
Fluvial			X		The site is not affected by tidal flooding. Risk based on the flood warning information service fluvial flood plan.
Tidal				X	
Canals				X	No canals nearby
Groundwater			X		Groundwater depth is recorded as 2.60 – 2.72m below ground level during monitoring.
Reservoirs				X	Site is within a reservoir flood zone but this would be an extremely rare occurrence
Sewers				X	There is no record of sewer flooding within or around the perimeter of the site.
Pluvial	X				The site is mainly within a high surface water flood risk area and the eastern part of the site has a medium surface water flood risk.
Development Drainage			X		Design process will minimise risks

4.3 Existing Structures Affecting Flooding

There are no known existing structures on site that may affect flooding other than the EA maintained flood defences off site.

4.4 Climate Change Allowance

The NPPF sets out how the planning system should help minimise vulnerability and provide resilience to the impacts of climate change. Consideration should be given to how climate change will affect peak river flow, sea levels and peak rainfall intensity.

Peak River Flows

Guidance provided by the EA entitled Flood Risk Assessments: Climate Change Allowances recommends suitable climate change allowance to be applied to peak river flows by river basin district. Based on the river basin district of this development (Northumbria), the design life of the development which is in excess of 30 years (2040 to 2069 epoch) and this being a "less vulnerable" development, 15% to 20% should be applied to peak river flows.

The proposed finished floor level (FFL) of the building is 35.15 to match the existing building FFL and levels around the outside of the building will be 35.00. The average existing ground level under the footprint of the proposed building is 35.00.

Based on the modelled defended flood levels provided by the EA, the expected flood water depth during a 1 in 100 year plus climate change event is 35.278 and therefore flood water would be 128mm deep across the building. The EA have incorporated a 20% climate change allowance in their modelling. During a 1 in 1000 year event the expected river flood level is 35.686 in which case the flood depth would be 536mm.

Raising the building above the expected flood levels is not proposed as the client accepts this risk and the development will be at no greater risk than the existing building. There is also no space within the development to provide flood compensation if ground levels were raised to protect the development. Therefore, no ground raising will occur and the onsite and offsite flood risk will not be affected by the development.

Sea Levels

The site is sufficiently elevated not to be affected by sea level rises.

Peak Rainfall Intensity

The proposed drainage system will be designed with a check made to ensure that the 40% climate change allowance, which is applicable to this development, results in no flooding of the on-site buildings and that flood water from this event is retained on site.

SFRA

The SFRA includes a map identifying the areas of Hexham catchment that currently have a significant flood risk. This development site is located in an area which is identified to be a high flood risk as records shows that this area floods regularly.

4.5 Flood Risk Mitigation Measures

The proposed development is to be located within the extent of Flood Zone 3 and is mainly within a high risk surface water flood area. To mitigate the issues of flooding and ensure that no additional flooding will occur anywhere else as a result, the existing levels will be maintained and surface water run-off from the site will be managed within the extents of the site.

The client will only store low risk items on the lower shelves of this storage facility which will not be damaged by flood water. In addition, electrical supply sockets and electrical appliances should be raised 600mm above the 1 in 100 year plus climate change flood level plus an additional 600mm freeboard, equating to 35.878 (35.278 + 0.6m). This is 728mm above the proposed FFL.

This flood risk assessment should also be provided to any future buyers of the site to ensure that they understand the flood risk posed to the development site.

The development site is within a flood warning area and the owner of the building will receive flood warning messages from the EA when a flood event is likely to occur.

5.0 Surface Water Drainage

5.1 Discharge Location

Infrastructure protocol states that a designer should consider the following in order of preference before finalising a surface water design statement for the development.

1. Discharge via infiltration, or where this is not reasonably practicable,
2. Discharge to a watercourse, or where this is not reasonably practicable,
3. Discharge to a public sewer network.

Method 1 – Discharge via infiltration

The ground investigation indicates that the ground conditions will not be suitable for surface water discharge via infiltration. In addition, hydrocarbon contamination was found at the south of the site and the extent of this is to be determined. Drainage via infiltration is not appropriate due to the risk of mobilising contaminates, particularly on this low to medium environmentally sensitive site which is relatively close to a potable water abstraction point.

Therefore, it is considered that this method of discharge is unlikely to be adopted as the preferred solution.

Method 2 – Discharge to a watercourse

The nearest open watercourse is approximately 0.35km away from the site. Any discharge directly into the watercourse would require a new drain to be laid under third party land ownership and extensive lengths of public highway which would cause major disruption. Therefore, this is not considered to be a feasible solution.

Method 3 – Discharge to a public sewer network

An existing public surface water sewer lies under Haugh Lane which is approximately 3m west of the site. It is proposed that the new surface water drainage system will connect in to the surface water sewer within below Haugh Lane subject to NWL approval.

Method 3 offers the only practical option for the discharge of surface water run-off for the proposed development.

5.2 Proposed Drainage Design Strategy

5.2.1 Existing Drainage

Before considering the proposed drainage strategy it is important to consider how surface water from the site currently drains. The portion of land that is to be development covers an area of 1050m^2 and the vast majority of this area is currently surfaced with loose gravel hardstanding that is not positively drained and storage containers with no formal surface water drainage.

To find the greenfield run off rates for the site which would have occurred prior to any development the ICP SUDS method within Microdrainage software has been used and is summarised in the table below;

Storm Event	Greenfield run off rate based on 1 hectare (l/s)	Greenfield run off rate based on 0.105 hectares (l/s)
1 in 1 year	4.3	0.4
1 in 30 year	8.7	0.9
1 in 100 year	10.3	1.1
QBAR	5.0	0.5

Greenfield Run off Rates

Micro Drainage greenfield run off summary files can be found in **Appendix G** which correspond with the information above.

Separate foul and surface water networks drain the existing building and external concrete areas and these ultimately discharge into the existing NWL adopted sewers within Haugh Lane to the north.

5.2.2 Proposed Drainage

The proposed development will comprise a 815m^2 building, 100m^2 of external concrete hardstanding areas and the remaining 135m^2 will remain as loose gravel hardstanding. The existing storage building will remain along with the existing surrounding hardstanding areas and the private drainage serving these areas will be retained without any additional flows being directed towards them from the proposed development. The reason for this is to retain the existing concrete hardstanding areas.

Separate foul and surface water drainage will be provided to service the building extension and the small new concrete hardstanding areas that are proposed. Surface water flows from the development will be attenuated and surface water storage provided in a below ground cellular tank system which will be installed under the proposed building extension. Surface water flows will be restricted through the use of a hydro-brake flow control device and will restrict discharges to a maximum rate of 2.6 litres/second during a 1 in 100 year +40% CC event which is the lowest rate that can be discharged using a 75mm orifice flow control device which is the smallest advisable orifice to minimise the risk of blockage.

A pre planning enquiry has been submitted to NWL and their response states that if infiltration and connection to a watercourse are not reasonably practicable then a surface water connection can be made into the 450 dia public surface water sewer within Haugh Lane. Refer to Appendix C for NWL Correpondence.

The drainage strategy general arrangement can be found in **Appendix F** and this confirms the following proposed discharge rates;

Storm Event	Proposed Discharge (l/s)
1 in 1 year	1.9
1 in 30 year	2.1
1 in 100 year	2.6

Proposed Discharge Rates

Exceedance flows generated by the development are required to be managed on site. National Standards and Core Strategic Policy CS17 and UDP Policy POL14 require surface water drainage systems to be designed to meet the following requirements:

- No surcharge for a 1 in 2-year return period event
- No flooding for a 1 in 30-year return period event
- No flooding of buildings or third-party land for a 1 in 100 year return period event with an allowance for climate change.

Modelling undertaken for this development demonstrates that no flooding will occur during a 1 in 100 year +40%CC event.

5.2.3 Water Quality

CIRIA Document C753 – The SuDS Manual provides guidance on the required Water Quality Management. For sites which will drain to a surface water system, a table is provided containing pollution hazard indices for different land use classifications (see below).

TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways[1]	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways[1]	High	0.8[2]	0.8[2]	0.9[2]

Pollution Hazard Indices – C753

For the building, the 'pollution hazard level' is adjudged to be 'Low'. This is because there is less risk of pollutants washing into the surface water drainage system compared to heavily used roads or industrial premises. The new hardstanding paths will drain towards porous gravel areas but the main hardstanding at the building entrance will connect into the new surface water drainage system and this is adjudged to have a 'Medium' pollution hazard level. The anticipated pollution hazard indices comprise of Total Suspended Solids (TSS), Heavy metals (Metals) and Hydrocarbons. The table confirms the following mitigation indices for this development.

Area	Hazard Level	TSS	Metals	Hydrocarbons
Roofs	Low	0.3	0.2	0.05
Main External Hardstanding Area	Medium	0.7	0.6	0.7

C753 provides indicative SuDS mitigation indices that can be achieved for a range of SuDS components.

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters

	Mitigation indices[1]		
Type of SuDS component	**TSS**	**Metals**	**Hydrocarbons**
Filter strip	0.4	0.4	0.5
Filter drain	0.4[2]	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond[4]	0.7[3]	0.7	0.5
Wetland	0.8[3]	0.8	0.8
Proprietary treatment systems[5,6]	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

SuDS Mitigation Indices – C753

The new paths that will drain to the porous material will recievce treatment via some infiltration through granular material. The main hardstanding area is only 70m^2 and is adjudged too small to require a petrol interceptor. Therefore it is prooposed that silt traps will be used to store siltation on site.

5.2.4 Maintenance

The surface water drainage must be maintained to ensure that it will continue to perform as designed. The drainage within the curtilage of the site and prior to the connection, with either the existing private sewers or the public networks, will be maintained by the owner/occupier.

C753 provides typical maintenance activities and required frequency for a range of drainage components. Those listed below are applicable to the drainage system proposed at this development.

Drainage Component	Comments	Regular Maintenance	Occasional Maintenance	Remedial Maintenance
Flow Control Chamber	Positioned within road junction but to one side to facilitate access	Inspect monthly for 3 months then annually and after every significant rainfall event.	Ensure pivoting by-pass door is in good working order using the operating rope which should be within reach of the chamber cover. Remove silt from chamber when it exceeds 100mm.	Ensure unit is securely fixed to chamber wall and fix any broken parts
Silt Trap chambers / Gullies with silt traps	These have positioned prior to flows entering the piped drainage system	Inspect monthly for 3 months to check silt accumulation and establish silt removal frequencies.	Remove silt from chamber every 2 years or when it exceeds 100mm.	Repair physical damage if necessary
Pipes drainage system and manholes	These have been positioned where there is good access	Inspect monthly for 3 months and then annually. Identify any areas that are not operating correctly and if necessary, take remedial action.	Every 5 years or as required survey inside pipes using CCTV to check for sediment build up and remove if necessary.	Repair physical damage if necessary

Drainage System Maintenance Schedule

6.0 Foul Water Drainage

The existing 225mm diameter NWL foul sewer runs within Haugh Lane. The existing private drainage servicing the existing building is below existing hard standing areas and therefore rather than excavate the existing surfacing a new foul connection is proposed to connect directly into the foul sewer in Haugh Lane.

There will be no manufacturing process flows from the proposed development or discharge of foul effluent. Foul flows are anticipated to be less than 1 litre/second but will be calculated during the detailed design phase of the scheme.

NWL have confirmed that unrestricted foul flows can connect into the combined public sewer within Haugh Lane (refer to NWL correspondence in **Appendix C**)

All private foul water drainage should be designed in accordance with the current Building Regulations Part H and will be maintained by the owner/occupier.

7.0 Conclusions

7.1 Flood Risk

Jasper Kerr Consulting Engineers Ltd were commissioned by Hexham Studios to undertake a Flood Risk Assessment (FRA) and Drainage Strategy to be submitted with the full Planning Application for the proposed development at Unit 21, Haugh Lane Industrial Estate, Hexham. The development comprises the construction of a portal frame storage facility to increase the size of an existing building.

The EA's Flood Zone Maps shows that the site is located within Flood Zone 3 so has a greater than 1% annual probability of flooding from rivers if the presence of flood defences is ignored. In accordance with Planning Policy Guidance, as the site is within Flood Zone 3a, incorporating "Less Vulnerable" development, the development is deemed appropriate without the need for an Exception Test.

The long term flood risk plans provided by the Flood Warning Information Service shows that the site has a low risk of fluvial flooding which takes into account the defences which provide some protection.

Detailed fluvial flood information has been obtained from the EA and flood levels have been provided for the 'defended' scenario. These show that the site will not flood during a 1 in 100 year event or a 1 in 200 year event but the flood level during a 1 in 100 year event with 20% climate change allowance will result in a flood level of 35.278 which is approximately 250 – 300mm above existing ground levels. The 1 in 1000 year fluvial flood level is 35.615.

The proposed FFL of the new building is proposed to be 35.15 to match the existing building level. External areas around the building will be 35.00 to match existing ground levels.

The EA surface water flood risk map shows that the vast majority of external areas at the site have a high risk of surface water flooding. The existing building footprints have a low risk of surface water flooding and the western portion of the site has a medium flood risk. It is understood that this flood risk is caused by surface water being able to drain to the watercourses during times of fluvial flooding.

It is notable that the extent of surface water flooding in the industrial estate is not as extensive as flooding shown on the fluvial flood maps and therefore it is very likely that surface water flooding is already taken into account in the fluvial flood models as these include flows from the catchments that drain to the main rivers.

To mitigate the issues of flooding and ensure that no additional flooding will occur anywhere else as a result, the existing levels will be maintained and surface water run-off from the site will be managed within the extents of the site.

The client will only store low risk items on the lower shelves of this storage facility which will not be damaged by flood water. In addition, electrical supply sockets and electrical appliances should be raised 600mm above the 1 in 100 year plus climate change flood level plus an additional 600mm freeboard, equating to 35.878 (35.278 + 0.6m). This is 728mm above the proposed FFL.

This proposed building extension will have the same flood risk as the existing building which is owned and used by the developer for the same purposes.

This flood risk assessment should also be passed to any future buyers of the site to ensure that they understand the flood risk posed to the development site.

The development site is within a flood warning area and the owner of the building will receive flood warning messages from the EA when a flood event is likely to occur.

This Less Vulnerable development is appropriate in a Flood Zone 3a area without the need for an exception test and this Flood Risk Assessment has confirmed that the proposed development is appropriate and sustainable in the terms as set out in NPPF.

7.2 Drainage Strategy

Site investigation results indicate that the sub-grade material is unlikely to be sufficiently permeable to offer a viable point of discharge for surface water discharge. In addition, hydrocarbon contamination was found at the south of the site and the extent of this is to be determined. Drainage via infiltration is not appropriate due to the risk of mobilising contaminates, particularly on this low to medium environmentally sensitive site which is relatively close to a potable water abstraction point.

The nearest open watercourse is approximately 0.35km away from the site. Any discharge directly into the watercourse would require a new drain to be laid under third party land ownership and extensive lengths of public highway which would cause major disruption. Therefore, this is not considered to be a feasible solution.

There are public sewers within the highways to the north and west of the development. The sewers are located under Haugh Lane and are approximately 3 metres from the boundary of the site.

The drainage strategy presented in **Appendix E** shows that surface water will be discharged to an attenuation tank/basin which will be suitably sized to accommodate run-off for all events up to and including the 1 in 100 plus 40% climate change event. Discharge rates will be restricted to rates as close as possible to greenfield run off rates while using a minimum flow control orifice of 75mm as recommended to reduce the risk of blockages.

A pre planning enquiry has been submitted to NWL and their response states that if infiltration and connection to a watercourse are not reasonably practicable then a surface water connection can be made into the 450 dia public surface water sewer within Haugh Lane. The response also confirms that unrestricted foul flows can connect into the combined water public sewer within Haugh Lane.

8.0 Report Conditions

The report is based on the information that has been acquired and/or made available to Jasper Kerr Consulting Engineers Ltd via the various searches and consultations undertaken as part of this assessment. In some cases, anecdotal information has been relied upon, where documented evidence has been lacking.

The conclusions drawn in the above report are considered correct although any subsequent additional information may allow refinement of the conclusions.

All work carried out in preparing this report has utilised and is based upon Jasper Kerr Consulting Engineers Ltd professional knowledge and understanding of current UK standards and codes, technology and legislation. Changes in this legislation and guidance may occur at any time in the future and cause any conclusions to become inappropriate or incorrect.

This report has been prepared using information contained in maps and documents prepared by others. Jasper Kerr Consulting Engineers Ltd can accept no responsibility for the accuracy of such information.