



MILLFIELD WORKS, GRANGFIELD ROAD, STOCKTON-ON-TEES

FLOOD RISK ASSESSMENT
Final Report v1.0

June 2018

**Weetwood Services Ltd
Suite C22
Joseph's Well
Hanover Walk
Leeds
LS3 1AB**

t: 0113 244 1377
e: info@weetwood.net
w: www.weetwood.net

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Flood Risk Assessment
Final Report v1.0

Client: TJ Thomson and Son Ltd

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Prepared by: Keely Bonser BSc MSc PhD
Principal Project Manager

Checked and
Approved by: Kevin Tilford BSc MSc PhD MBA MCIWEM C.WEM CEnv
Managing Director

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1 INTRODUCTION

1.1 PURPOSE OF REPORT

Weetwood Services Ltd ('Weetwood') has been instructed by TJ Thomson and Son Ltd to prepare a Flood Risk Assessment (FRA) report to accompany an outline planning application for the proposed redevelopment of the Millfield Works, Stockton-on-Tees.

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

The report should be read in conjunction with the Drainage Assessment report prepared by Weetwood which addresses foul and surface water drainage for the proposed redevelopment (ref: '*Drainage Assessment – Millfield Works, Grangefield Road, Stockton-on-Tees; Final Report v1.0, June 2018*').

1.2 STRUCTURE OF THE REPORT

The report is structured as follows:

- Section 1** Introduction and report structure
- Section 2** Presents national and local flood risk and drainage planning policy
- Section 3** Provides background information relating to the development site, the development proposals, ground conditions and existing site access arrangements
- Section 4** Assesses the potential sources of flooding to the development site
- Section 5** Presents flood risk mitigation measures based on the findings of the assessment
- Section 6** Presents a summary of key findings
- Section 7** Presents the recommendations

2 PLANNING POLICY AND GUIDANCE

2.1 NATIONAL PLANNING POLICY

The aim of the NPPF is to ensure that flood risk is taken into account at all stages in the planning process and is appropriately addressed.

2.1.1 Sequential Test

Paragraph 100 of the NPPF states that *'inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk but where development is necessary, making it safe without increasing flood risk elsewhere'*.

This policy is implemented through the application of the flood risk Sequential Test which aims to steer new development to areas with the lowest probability of flooding.

2.1.2 Exception Test

If, following application of the Sequential Test it is not possible for the development to be located in zones with a lower probability of flooding, the Exception Test can be applied, if appropriate.

As detailed in paragraph 102 of the NPPF, for the Exception Test to be passed:

- It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment (SFRA) where one has been prepared; and
- A site-specific FRA must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

2.2 LOCAL PLANNING POLICY AND GUIDANCE

Stockton-on-Tees Borough Council's Publication Draft Local Plan (September 2017) was submitted to the Planning Inspectorate on 21 December 2017, and is currently under examination to determine whether the Local Plan is sound. The following policies are relevant in respect of flood risk:

'Policy SD5 – Environment and Climate Change Strategy' states, in part, that new developments should be directed towards areas of low flood risk (Flood Zone 1), ensuring flood risk is not increased elsewhere, and working with developers and partners to reduce flood risk.

'Policy ENV4 – Reducing and Mitigating Flood Risk' states, in part:

1. *New development will be directed towards areas of low flood risk (Flood Zone 1). In considering proposals elsewhere, the sequential and exception tests will be applied. Site specific FRAs and drainage strategies will be required in accordance with national policy.*
2. *In exceptional circumstances developments may be permitted in higher flood risk areas to meet strategic regeneration objectives within the Regenerated River Tees Corridor as identified within Policy SD3 or to provide essential infrastructure. Where necessary mitigation measures would have to be identified through a detailed FRA.*

3. *Development proposals will be designed to ensure:*
 - a. *They will be safe over the lifetime of the development, taking account of climate change;*
 - b. *Flood risk is not increased elsewhere and will where possible, reduce flood risk overall;*
4. *Within critical drainage areas or other areas identified as having particular flood risk issues the Council may:*
 - a. *Support reduced runoff rates.*
 - b. *Seek contributions, where appropriate, towards off-site enhancements directly related to flow paths from the development, to provide increased flood risk benefits to the site and surrounding areas.*
5. *Through partnership working the Council will work to achieve the goals of the Stockton-on-Tees Local Flood Risk Management Strategy and Northumbria Catchment Flood Management Plan. This will include the implementation of schemes to reduce the risk of flooding to existing properties and infrastructure. Proposals which seek to mitigate flooding, create natural flood plans or seek to enhance and/or expand flood plains in appropriate locations will be permitted.*
6. *To reduce the risk of flooding the Council is working in partnership with the Environment Agency (EA) to deliver a Flood Alleviation Scheme on Lustrum Beck.*

Stockton-on-Tees Borough Council's Core Strategy Development Plan Document was adopted on 24 March 2010. The following policy is relevant in respect of flood risk:

'Core Strategy Policy 10 (CS10) – Environmental Protection and Enhancement' states, in part, that new development will be directed towards areas of low flood risk, that is Flood Zone 1, as identified by the Borough's SFRA. In considering sites elsewhere, the sequential and exceptions tests will be applied, as set out in Planning Policy Statement 25: Development and Flood Risk, and applicants will be expected to carry out a FRA.

2.3 CONSENTS

An Environmental Permit for Flood Risk Activities may be required from the Environment Agency (EA) for work:

- In, under, over or near a main river (including where the river is in a culvert)
- On or near a flood defence on a main river
- In the flood plain of a main river
- On or near a sea defence

Further information can be found at the .GOV website¹.

Land drainage consent may be required from the Lead Local Flood Authority or Internal Drainage Board for work to an Ordinary Watercourse. Undertaking activities controlled by local byelaws (made under the Water Resources Act 1991) also requires the relevant consent.

¹ <https://www.gov.uk/guidance/flood-risk-activities-environmental-permitS>

2.4 RELEVANT DOCUMENTS

The FRA has been informed by the following documents:

- SFRA Level 1, Stockton-on-Tees Borough Council, June 2010
- Preliminary Flood Risk Assessment (PFRA), Stockton-on-Tees Borough Council, April 2011 and Addendum December 2017
- Stockton-on-Tees Local Flood Risk Management Strategy (FRMS), Stockton-on-Tees Borough Council, June 2015
- Lustrum Beck Flood Warning Improvements, Draft Report, JBA Consulting, February 2016

3 SITE DETAILS AND PROPOSED DEVELOPMENT

3.1 SITE LOCATION

The former Millfield Works is located at Ordnance Survey National Grid Reference NZ 437 191 as shown in **Figure 1**.



Figure 1: Site Location

3.2 EXISTING AND PROPOSED DEVELOPMENT

The 19.9 ha site is occupied by a former scrap metal merchant and processing facility (the Millfield Works). The industrial warehouses and former railway lines utilised for the transportation of materials on and off site have recently been demolished/removed; the main office buildings are still erect. The northern boundary, western and southern parts of the site comprise of dense vegetation and trees.

The development proposals (**Appendix A**) entail the demolition of the remaining office buildings and the erection of up to 600 residential dwellings with means of site access. The extent of the development platform is shown on **Figure 1**; the vegetated areas to the west of the site will remain as existing.

The proposed primary access is off Grangefield Road via the existing works entrance, with two potential secondary access points (pedestrian, cycle and emergency vehicles only) off Riley Street and Britannia Road.

The PPG classifies residential development as 'more vulnerable' land use.

3.3 WATERBODIES IN THE VICINITY OF THE SITE

The River Tees flows in a predominantly north-easterly direction approximately 800 m east of the site.

Lustrum Beck flows in a northerly direction through the western portion of the site. The beck flows into the River Tees approximately 3.5 km east of the site.

The River Tees and Lustrum Beck are designated main rivers meaning that the EA has permissive powers, but not a duty, to carry out maintenance, improvement or construction works and has powers to regulate the activities of others.

A culverted watercourse crosses the site in a northerly direction before outfalling via a public sewer to Lustrum Beck at Brown's Bridge. The alignment of the watercourse, as determined from drainage records, surveys and historical mapping, is shown on **Figure 2**. Historical mapping suggests that the watercourse was culverted to facilitate development of the site during the late 1800's (see **Section 4.3.2**).



Figure 2: Location of Waterbodies

3.4 GROUND CONDITIONS

A geoenvironmental appraisal report² of the site issued in September 2017 indicates that the site is underlain by made ground to a depth of 6.5 metres below ground level (m bgl) underlain by Glaciolacustrine clays to 10.0 m bgl.

² Geoenvironmental Appraisal Report of Former Millfield Works, Stockton-on-Tees, Sirius Geotechnical and Environmental Ltd, Report C7333, September 2017

According to British Geological Survey (BGS) mapping, ground conditions at the site comprise of clay and silt (Glaciolacustrine Deposits, Devensian) underlain by Sandstone bedrock (Sherwood Sandstone Group).

3.5 SITE LEVELS

A topographic survey of the site is provided in **Appendix B**. The survey data and LiDAR data have been used to develop a digital terrain model (DTM) of the site and wider area respectively (as illustrated in **Figure 3** and **Figure 4**).

The DTM indicates that ground levels are highest in the north-eastern, eastern and central portions of the site, with levels sloping down towards the north, south and west. Site levels generally range between approximately 10.4 – 14.3 metres Above Ordnance Datum (m AOD); levels within the western portion of the site range between 4.7 – 22.1 m AOD. Levels adjacent to the northern boundary of the site steeply slope down to approximately 7.5 m AOD.

3.6 ACCESS AND EGRESS

Primary access to the site is via Grangefield Road. Levels along Grangefield Road to the south-west of the site range between approximately 9.2 – 13.9 m AOD with levels sloping down in a north-westerly direction.

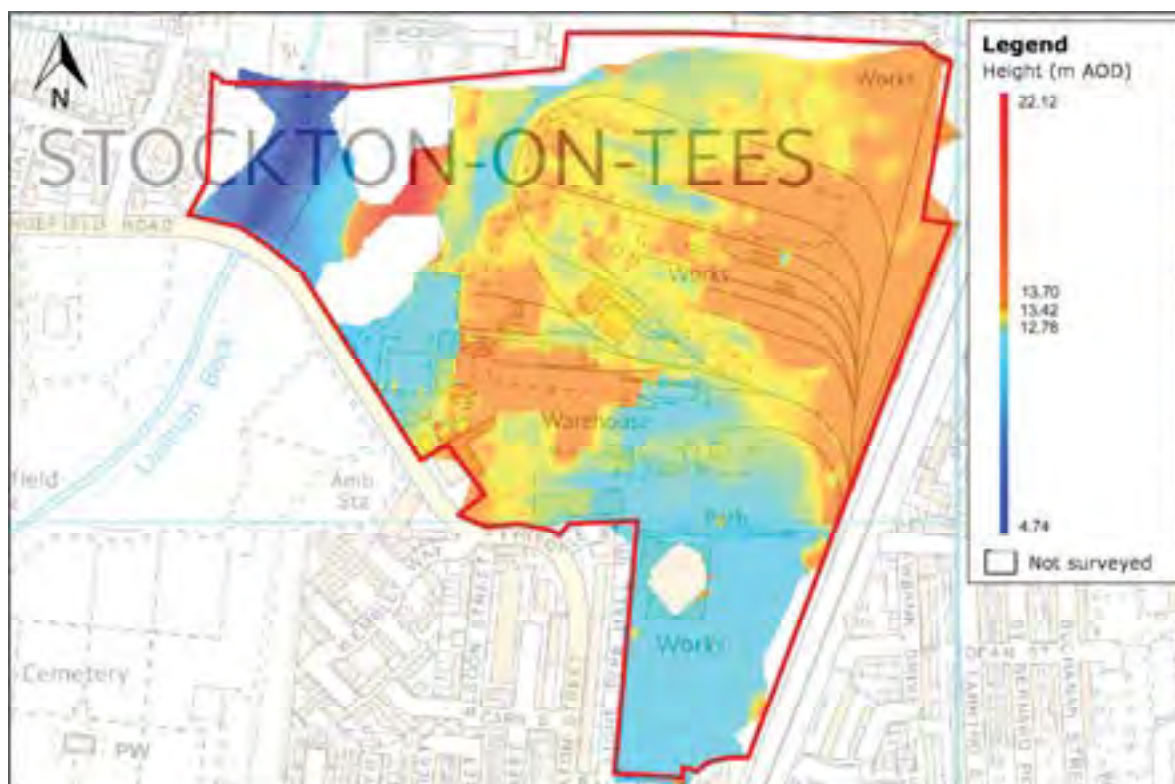


Figure 3: Digital Terrain Model

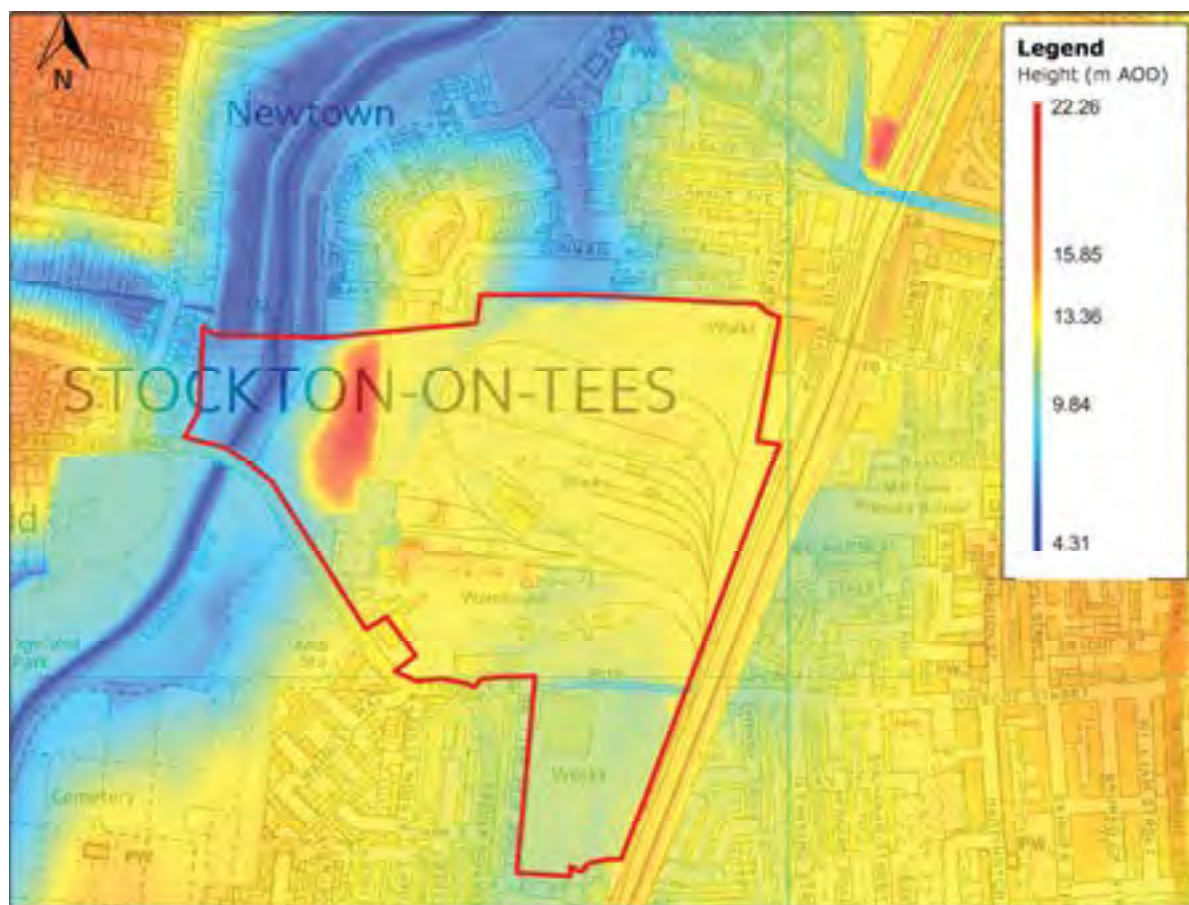


Figure 4: Digital Terrain Model from EA LiDAR

4 REVIEW OF FLOOD RISK

4.1 FLOOD ZONE DESIGNATION

Flood Zones refer to the probability of river and sea flooding. The NPPF PPG defines Flood Zones as follows:

- Flood Zone 1: Low Probability. Land having a less than 1 in 1,000 annual probability of river or sea flooding.
- Flood Zone 2: Medium Probability. Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.
- Flood Zone 3a: High Probability. Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding.
- Flood Zone 3b: The Functional Floodplain. This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the EA.

The flood zones are shown on the EA Flood Map for Planning. The zones do not account for possible future changes in flooding due to the impact of climate change or the presence of flood defences (although areas benefitting from flood defences may be indicated).

According to the EA Flood Map for Planning (Rivers and Sea) (**Figure 5**) the site is predominantly located in Flood Zone 1, with the western edge of the site adjacent to Lustrum Beck located within Flood Zone 3 and Flood Zone 2.

4.2 SEQUENTIAL TEST

The development proposals have been sequentially designed; the development platform for residential development is situated within Flood Zone 1. The site is therefore assessed to satisfy the requirements of the Flood Risk Sequential Test.

4.3 FLUVIAL FLOOD RISK

4.3.1 Lustrum Beck

EA records indicate that land adjacent to Lustrum Beck, including the residential areas of Wrensfeld Road and Bishopton Road, flooded in March 1979, November 2000 and September 2012 (see **Figure 6**) due to insufficient channel capacity and overtopping of flood defences.

The £3 million Lustrum Beck Flood Alleviation Scheme was officially opened in July 2017. The scheme included a number of flood alleviation measures along Lustrum Beck, including a new flood wall along Bishopton Road and a flood storage area known as the Wrensfeld Sustainable Drainage System as well as new embankments, a new road bridge and a lifting screen at Primrose Hill.

Modelled flood levels (in-channel) have been provided by the EA for the 1 in 100, 1 in 100 + 20% CC (climate change) and 1 in 1,000 annual probability events (refer **Figure 7** and **Table 1**).

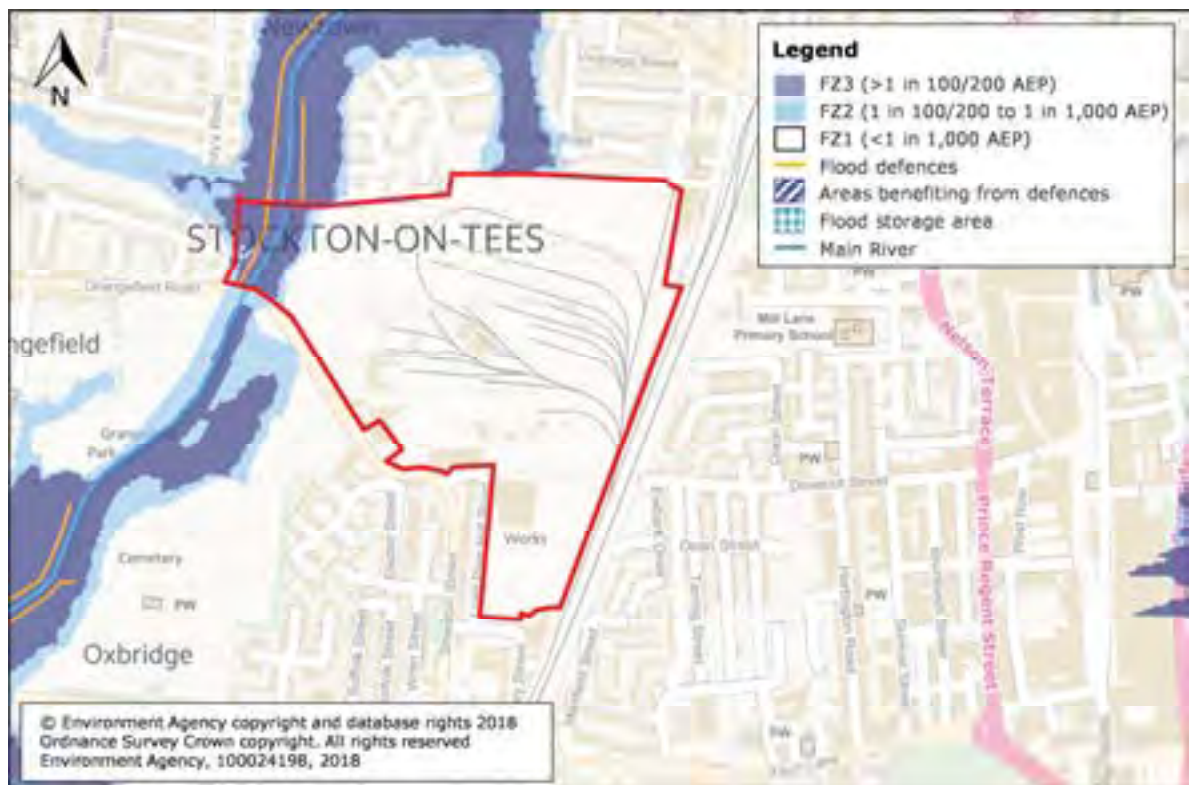


Figure 5: Flood Map for Planning
(Source: gov.uk website)



Figure 6: Historic Flood Outlines
(Source: Environment Agency)



Figure 7: Lustrum Beck Modelled Node Locations
(Source: Environment Agency)

Table 1: Lustrum Beck Modelled Flood Levels (in-channel)

Model Node	Annual Probability Flood Level (m AOD)		
	1 in 100	1 in 100 + CC (20%)	1 in 1,000
EA12_LB087	7.70	8.09	8.94
EA12_LB088	7.47	7.77	8.46
EA12_LB089	7.51	7.82	8.51
EA12_LB090	7.51	7.82	8.51
EA12_LB091	7.51	7.82	8.51
EA12_LB095	7.49	7.81	8.51

In accordance with the latest EA guidance³, climate change allowances of 20%, 25% and 50% have been considered. A simple level-discharge relationship indicates that the peak flood level for the 1 in 100 plus CC (50%) event is in the range of 8.34 to 8.39 m AOD for model nodes 89, 90 and 91 i.e. less than the modelled peak levels for the 1 in 1,000 annual probability event.

A comparison of site levels and the modelled flood levels (in-channel) indicate that peak river levels are approximately 2 to 5 m below the proposed level of the development platform. As such, the development is not assessed to be at risk of flooding from the beck.

³ Flood Risk Assessments: Climate Change Allowances, Environment Agency, 19 February 2016

4.3.2 Unnamed Watercourse

Historical mapping in 1857 indicates the presence of a spring fed watercourse originating towards the south of the site and flowing in a northerly direction. Mapping in 1893 indicates the presence of a steel works (the Moor Steel and Iron Works) on-site with the watercourse originating from the north of the site. Based on this, it is presumed that the watercourse was culverted to facilitate the construction of the new works in the early 1870's.

Drainage surveys undertaken in 1983 and amended in 2001 (see **Appendix C**) and in May 2018 (refer **Appendix D**) indicate that the watercourse is still culverted through the site, commencing from a point in the central southern part of the site as shown on **Figure 1**. The watercourse does not appear to receive any flow from outside of the site boundary and only takes flow from site runoff.

Northumbrian Water Limited (NWL) records (see **Appendix E**) indicate that a culverted watercourse extends along its historical course in a northerly direction before outfalling into Lustrum Beck at Brown's Bridge via a public surface water sewer.

The 2018 drainage survey indicates that the historic culvert has been extended from its original point of origin towards the southern portion of the site in order to facilitate surface water drainage in the southern part of the site.

Stockton-on-Tees Borough Council's Flood Risk Asset Register⁴ does not hold any records of the watercourse. This has been confirmed by direct consultation with Stockton on Tees Flood Risk Management Team⁵.

Based on the above, the site is not assessed to be at risk of flooding from this source.

4.4 FLOOD RISK FROM SURFACE WATER

The EA Risk of Flooding from Surface Water map (**Figure 8**) indicates that the site is predominantly at 'Very Low' risk of flooding from surface water but with the potential for the accumulation of surface water in localised low areas of the site (see **Figure 9**).

Flood risk from this source will be mitigated through the implementation of the measure proposed in **Section 5** of this report and the surface water drainage strategy presented separately (ref: '*Drainage Assessment – Millfield Works, Grange Road, Stockton-on-Tees; Final Report v1.0, June 2018*').

4.5 FLOOD RISK FROM GROUNDWATER

According to the SFRA, there is little documented evidence of groundwater flooding in the Tees catchment and groundwater flooding is not known to be a major problem due to the geology of the catchment.

According to the BGS Groundwater Flooding Hazard map (**Figure 10**) the susceptibility to groundwater flooding is predominantly negligible, with the western portion of the site indicated to be at 'Low' to 'Moderate'. However, the site slopes down towards Lustrum Beck and thus any groundwater emergence in this area would flow towards Lustrum Beck. As such, the site is not assessed to be at risk of flooding from this source.

⁴ <http://public.qismapp.com/stocktoncouncil>

⁵ Telecon between Jane Salisbury (Stockton-on-Tees Flood Risk Management Team) and Weetwood dated 3 May 2018

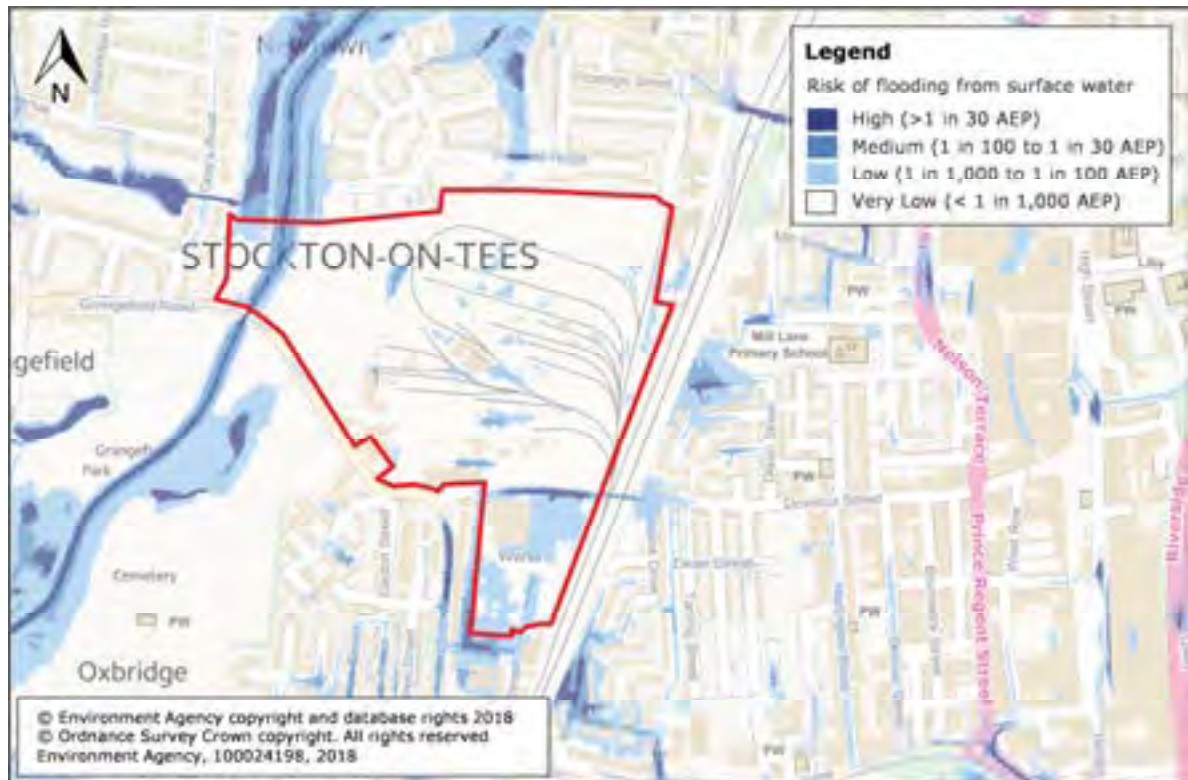


Figure 8: Risk of Flooding from Surface Water
(Source: .GOV website)



Figure 9: Surface Water Depth Maps
(Source: .gov.uk website)

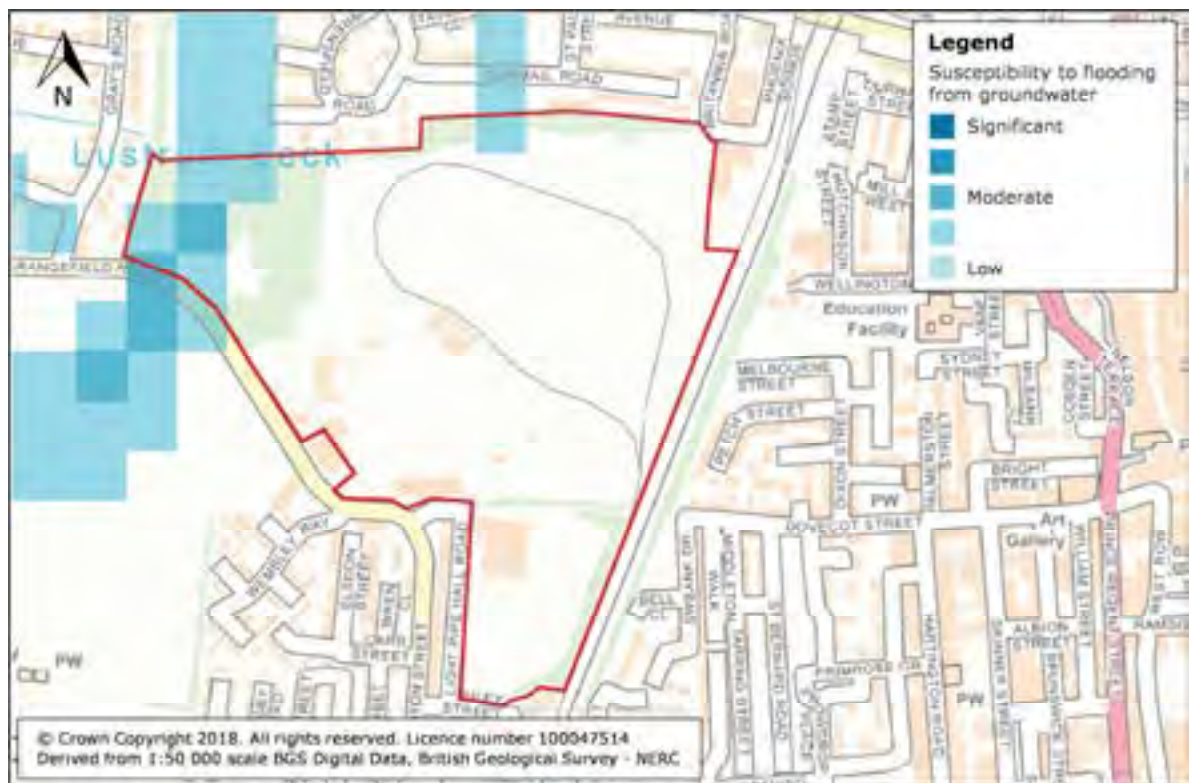


Figure 10: Groundwater Flooding Hazard Map
(Source: Findmaps)

4.6 FLOOD RISK FROM RESERVOIRS, CANALS AND OTHER ARTIFICIAL SOURCES

There are no canals located within the immediate vicinity of the site. The EA Risk of Flooding from Reservoirs map (**Figure 11**) indicates that the western edge of the site is at risk of flooding from this source.

However, as detailed on the gov.uk website, flooding from reservoirs is extremely unlikely and there has been no loss of life in the UK from reservoir flooding since 1925. This is because all large reservoirs are regularly inspected by reservoir panel engineers and any essential maintenance work carried out.



Figure 11: Risk of Flooding from Reservoirs Map
(Source: .GOV website)

5 FLOOD RISK MITIGATION MEASURES

Finished floor levels should be set at a minimum of 0.15 m above adjacent ground levels following any re-profiling of the site in order to mitigate the risk of flooding from surface water.

This will enable any potential overland flows to be conveyed safely across the site without affecting property in accordance with the approach promoted by government policy⁶.

⁶ Making Space for Water, Taking forward a new Government strategy for flood and coastal erosion risk management in England, March 2005, Dept for Environment, Food and Rural Affairs

6 SUMMARY

This flood risk assessment report has been prepared on behalf of TJ Thomson and Son Ltd and relates to the proposed redevelopment of the former Millfield Works site off Grangefield Road, Stockton-on-Tees.

According to the Environment Agency Flood Map for Planning the site is predominantly located outside of the 1 in 1,000 annual probability flood outline and is therefore defined by the NPPF as being situated within Flood Zone 1. The western edge of the site is located within the 1 in 100 annual probability and 1 in 1,000 annual probability flood outline and is therefore defined by the NPPF as being situated within Flood Zone 3 and Flood Zone 2.

The development proposals have been sequentially designed, with the development platform for residential development situated within Flood Zone 1. The site is therefore assessed to satisfy the requirements of the Flood Risk Sequential Test.

The development platform is at least 2 m above the modelled peak level in Lustrum Beck during the 1 in 1,000 annual probability event. As such, the development is assessed not be at risk of flooding from the beck. The site is also assessed to be at negligible risk of flooding from reservoirs or groundwater. There is the potential for surface water to accumulate in localised low areas of the site during heavy rainfall.

This FRA has demonstrated that the proposed development may be completed without conflicting with the requirements of the NPPF.

7 RECOMMENDATIONS

This FRA report has demonstrated that the proposed development may be completed without conflicting with the requirements of the NPPF subject to the following:

- Finished floor levels to be set at a minimum of 0.15 m (150 mm) above adjacent ground levels following any re-profiling of the site.

APPENDIX A:

Development Proposals



0 5 10 20
m

North/south spine road to align with route of existing culvert (approximate routing based on available information shown dotted and to be determined following further intrusive pre-construction investigations and subsequent infrastructure drainage design development).

emergency access

primary access

Extra Care / Concierge Plus over-55s Apartment Building 60no. apartments @ 61+m2 gfa with ground floor services.

- Blue square: 100% buildable area (100% buildable area)
- Green square: 100% buildable area (100% buildable area)
- Purple square: 100% buildable area (100% buildable area)
- Yellow square: 100% buildable area (100% buildable area)
- Light blue square: 100% buildable area (100% buildable area)
- Light green square: 100% buildable area (100% buildable area)
- Light purple square: 100% buildable area (100% buildable area)
- Light yellow square: 100% buildable area (100% buildable area)
- Light cyan square: 100% buildable area (100% buildable area)

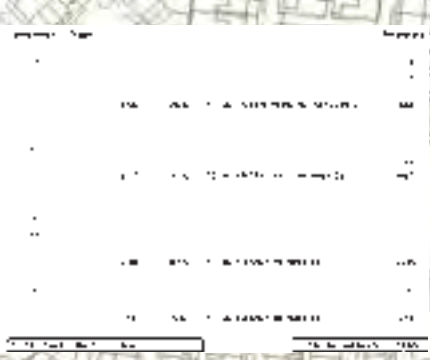
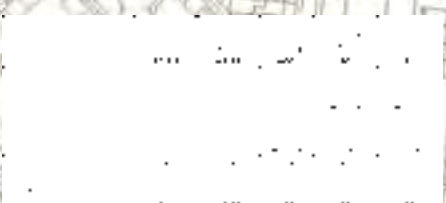
phase 2
phase 1

phase 2
phase 1

phase 1
phase 3

secondary access

phase 1
phase 3



0 5 10 20
m

APPENDIX B:

Topographic Survey



APPENDIX C:

Drainage Survey 1983

APPENDIX D:

Drainage Survey 2018