FLOOD RISK ASSESSMENT
LEVEL 1 SCREENING STUDY

Greenside Mills

SAVILLE ROAD
SKELMANTHORPE
HUDDERSFIELD
HD8 9EE

Project ref: 163-11FR

Date: 9th May 2016

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We have prepared this report in our professional capacity using reasonable skill, care and diligence. The assessments, conclusions and recommendations within this report pertain to the study site (the extents of which are in Figure 1, below) and the immediate area in continuity with the Site. They are based on the historical uses, information available at the time of writing and the proposed use of the Site. Where any information supplied by the client or other sources have been utilised, it has been assumed that the information is correct. No responsibility can be accepted by Adeptus for inaccuracies in data supplied by any other party.

Any plans, diagrams, cross sections or images are for illustrative purposes only and should be checked for accuracy on-site. In the event of changes to the proposed end use of the Site, the report may require updating to reflect such changes.

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SCOPE AND OBJECTIVES

Introduction

Adeptus has been instructed to carry out a level 1 flood risk assessment (screening study) on behalf of Paramount Retail Group Holdings Limited in respect of the proposed redevelopment of the Site for residential use.

The following information and data sources are utilised in compiling this report:

- Calder Valley Strategic Flood Risk Assessment
- Kirklees Surface Water Management Plan
- Groundsure environmental data report (Appendix A)
- Site Inspection
- Historical Ordnance Survey Maps
- Geological maps of the vicinity
- British Geological Survey (BGS) borehole logs
- Environment Agency maps

Report Objectives and Structure

The objective of a Level 1 Screening Flood Risk Assessment is to identify whether the site may be affected by any potential flooding or surface water management issues that require further investigation. This is achieved by a review of data relating to all sources of flood risk relevant to the site, such as local and national policy, historical flood events and aspects of the development proposals.

The report consists of seven main sections; below is an outline of their contents for ease of navigation.

- Section 1: Introduction (here).
- Section 2: Describes the Site, its surroundings, environmental constraints and findings of the walkover.
- Section 3: Assesses flood risks to the development.
- Section 4: Assesses suitability of the development in terms of policy and resultant flood risk.
- Section 5: Summarises the conclusions of the flood risk assessment and recommendations.
- Section 6: Includes general mitigation measures.

1. THE SITE

Location and Description

The Site is a former industrial/mill complex at the north-eastern edge of the village of Skelmanthorpe, occupying an irregular shaped parcel of land with a total area of ca. 3.5ha (Figure 1). The Site is dissected by the Kirklees Light Railway (KLR - highlighted yellow); to the north of the railway are two distinct open-fields, and to the south is the Main Site.

National Grid Reference (NGR): 423421,410972. Approximate height AOD: 140M-150m.

Figure 1: Site Plan (based on the plan in Appendix B)

Access to the Main Site is from Saville Road, close to the junction with Marsden Street, which itself terminates at the site. Current development encompasses a complex of largely single-level traditional mill buildings with north-light style roofs, and two more modern large portal framed steel buildings. A three-storey stone building sits between the two main points of access to the site, at the junction of Saville Road and Marsden Street.

The Site is largely bounded by residential properties, with a relatively recent residential development at Laurel Bank, on high ground to the north-west. Open land forming the northern and easterly parts of the site is bounded by further open land.

Topography and Vegetation

Natural site levels fall steeply east and south from a high point at the north-west corner, near to Saville Road. However, a retaining structure and site buildings create a relatively flat area from close to Saville Road, across to the area of the large tanks/silos central to the site. Surface levels fall steeply from the centre of the Site toward the Marsden Street entrance, via a gated access road immediately north of the chimney and boilerhouse. A relatively level access road runs between buildings toward a crossing point for the KLR. The railway corridor is roughly level with the site, and the fields beyond it fall gently toward Parkgate Dike.

The lowest part of the site is the open land south of the KLR, where a mill/settlement pond sits immediately behind the blue oil/fuel tank at the top of Marsden Street. Vegetation in this area suggests it is relatively well drained. Houses close to the end of Marsden Street may be particularly vulnerable to any overland flow from the site, but sit at the same level as the road, rather than of this adjacent lower land.

Drainage

It is not clear where surface-water drainage discharges to, but it would be expected to be into the above pond, and then into the watercourse that crosses the lower-lying open land to the east of the site. This could not be confirmed as there was no access to this area.

Site Inspection

A walkover survey was carried out on the 21st of April 2016. Numbered site-walkover photos are referenced in Table 1, below, and attached in Appendix C.

Table 1: Site Walkover Observations

Photo No.	Site Area	Observations and potential sources
1, 2.	West gate.	View south along Saville Rd. Site high point: entrance at far west of Site.
3, 4, 5.	North-west corner	Site incline inside west gate: mostly running north-east, parallel to boundary with laurel Bank.
6, 7, 8, 9.	North-west corner	Embankment giving way to large retaining wall as adjacent road level increases.
10, 11.	Central, boilerhouse	Fall to access road from centre of site.
12, 13.	Site road beyond Marsden St.	Roughly level access road toward KLR. Drainage grid and cable/pipe duct.
14, 15, 16.	Railway corridor. North site.	Railway corridor roughly level with site. Vegetation appears healthy. Open fields beyond Railway corridor.
17, 18, 19.	Top of Marsden St.	Hardstanding with fall toward adjacent houses and open land, watercourse.
20.	Marsden St.	Road falling toward the Site. Adjacent garage on lower ground.
22.	Junction of Saville Rd., Marsden St.	Assumed office building. Visible of roads and site from north-west to south-east.
22.	Saville Rd. entrance.	Yard with similar falls to the road.

2. GEO-ENVIRONMENTAL SETTING

Hydrogeology

There is no geological map data for superficial (drift) geology in proximity to the site.

Geological maps indicate the underlying solid bedrock in the vicinity of the site consist of the Pennine Lower Coal Measures formation, typically comprising of mudstone, siltstone and sandstone, and are considered to be a Secondary A aquifer (formerly minor aquifer).

BGS borehole scan data suggest that superficial deposits beneath much of the site consist of clay and/or clayey stones to a depth of between four and six metres, with these underlain by a bed of shale to depths of around 19 metres.

There are no BGS Geological Indicators of Flooding recorded within 250m of the site.

Hydrology

Surface Water Features within 250m of the Site

A surface water course designated a Tertiary river runs beneath Saville Road just south of the site, along the edge of the Site and though the open scrub land toward the railway corridor. The culverted section of this watercourse beneath the railway is designated a Secondary River. This merges with Parkgate Dike (designated a Primary River) at ca. 100m north east of the site boundary at its closest point.

Overland flow routes

Given that Saville Road runs perpendicular to the gradient of land higher than the site, with gullies and no significant camber, run-off from adjoining higher land is unlikely to be an issue.

Infrastructure proximity

- Kirklees Light Railway - runs through the site and railway corridor extends east and west.
- Culverted section of drainage dike runs beneath rail line.
- No areas used for flood storage within 250m of the site.
- No flood defences within 250m of the site.
- No areas benefitting from flood defences within 250m of the site.
- No proposed flood defences within 250m of the site.

3. FLOOD RISK TO THE DEVELOPMENT

Historical flood events

No historical flooding events are recorded within 250m of the Site.

Historical flood data provide information on the occurrence of and possible causes previous flooding, as available. Absence of recorded flood events does not mean that flooding has never occurred or will not occur in the future at the Site.

Fluvial/tidal flood risk

As indicated by the Environment Agency Flood Map for Planning (Figure 2), the Site does not lie in the fluvial or tidal indicative floodplain of any local rivers and as such is in Environment Agency Flood Zone 1.

Zone 1 – little or no risk with an annual probability of flooding from rivers and the sea of less than 0.1%

The site is located ca. 98m south of the fluvial/tidal Flood Zone 2 and 3 of Parkgate Dike. However, given this distance and local topography, flooding from this source is low risk.

Zone 2 – low to medium risk with an annual probability of flooding of 0.1-1.0% from rivers and 0.1-0.5% from the sea

Zone 3 – high risk with an annual probability of flooding of 1.0% or greater from rivers, and 0.5% or greater from the sea.

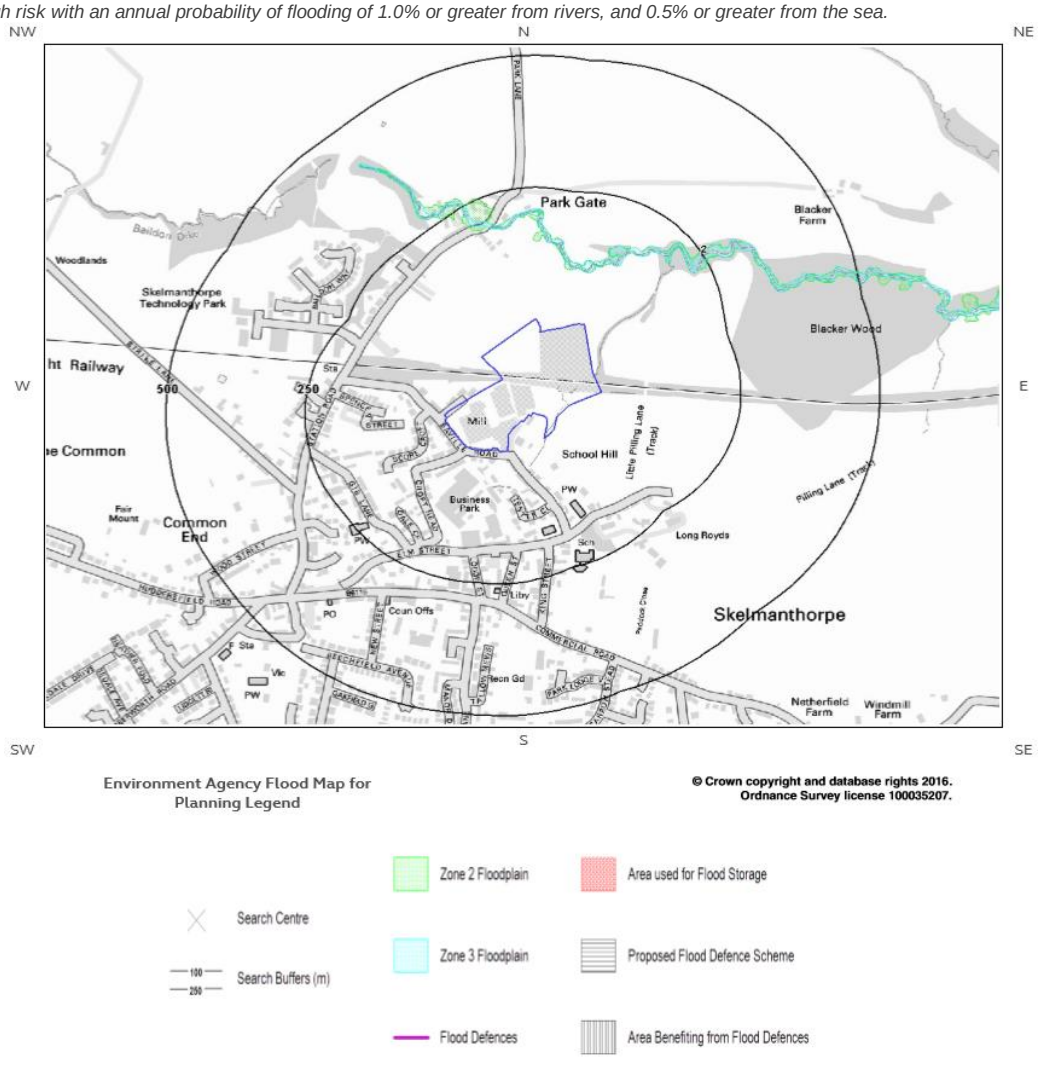

Figure 2: Environment Agency Flood Map for Planning

Risk of Flooding from Rivers and the Sea

As indicated by the Environment Agency's Risk of Flooding from Rivers and the Sea (RoFRaS) Map (Figure 3), the Site is in an area with a Very *LOW* (less than 1 in 1000) chance of this kind of flooding in any given year.

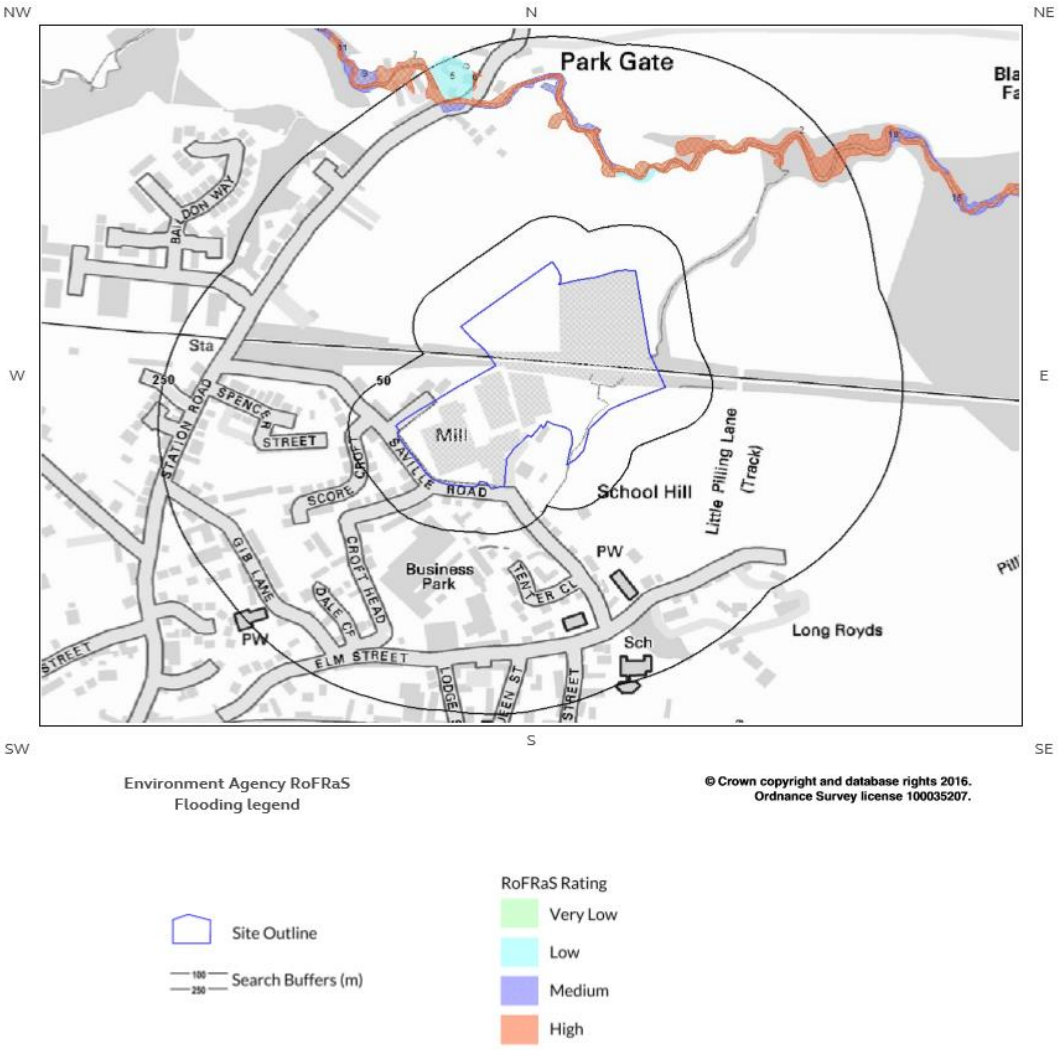

Figure 3: Environment Agency RoFRaS Flooding Map

Pluvial (surface water) flooding

The risk of surface water flooding in some parts of the site is indicated to be *SIGNIFICANT*.

With reference to Figure 4, it is that indicated that in a 1 in 75-year rainfall event, the areas coloured red would be expected to be affected by surface water flooding to a depth of between 0.3m and 1m, and those coloured yellow to a depth of .01m and 0.3m.

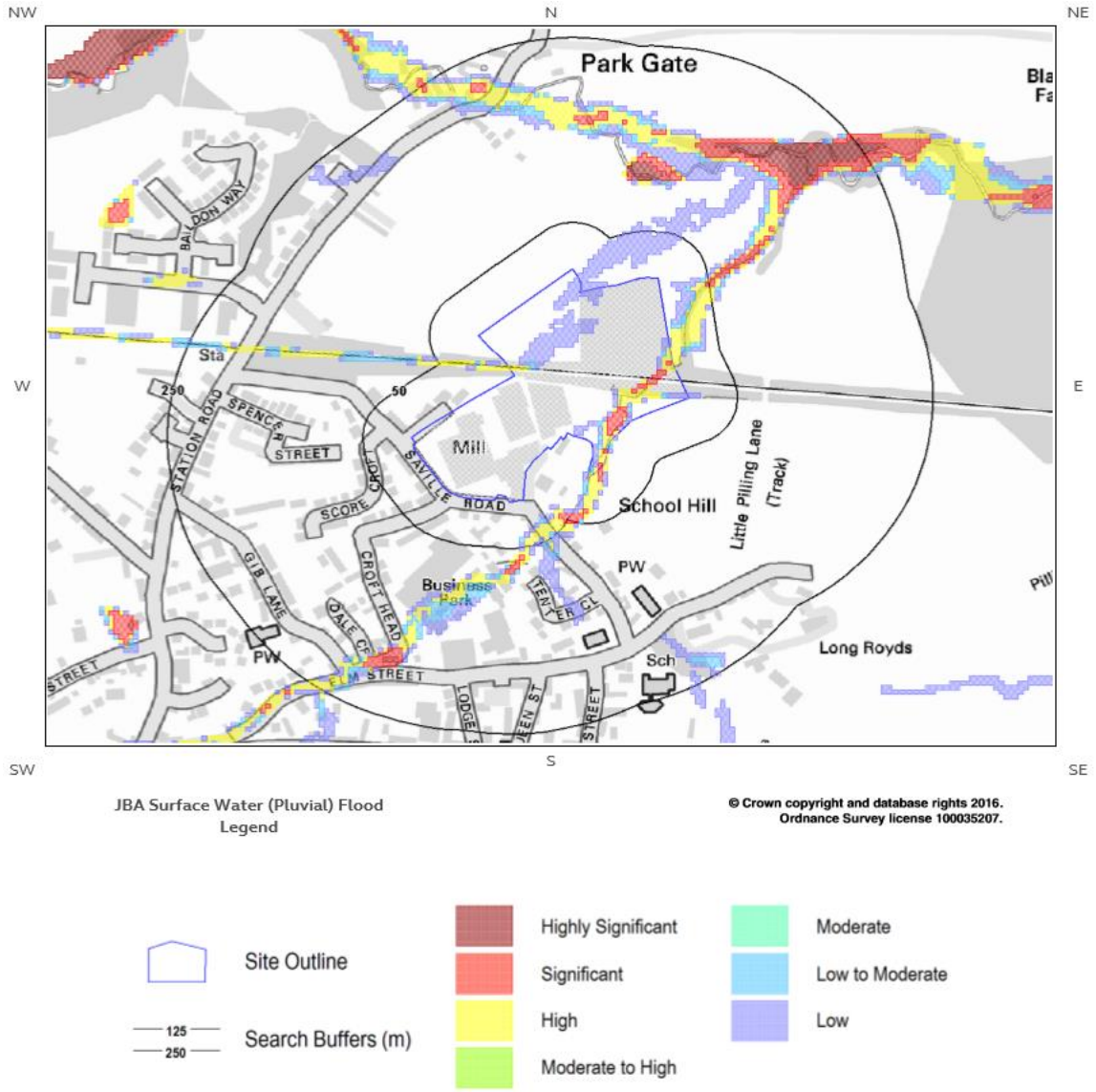

Figure 4: JBA Pluvial Flood Risk Map

Surface water flooding occurs when high rainfall events result in overland flow exceeding the drainage capacity in an area. This may also occur with lower rainfall falling on land with low permeability and/or that is already saturated, frozen or developed. In such events, surface watercourses drainage and sewerage systems may be overwhelmed.

Groundwater Flooding

The site is within 50m of BGS groundwater flooding susceptibility areas, with potential susceptibility to Clearwater Flooding (associated with unconfined aquifers) at the land's surface indicated. Based on the amount and precision of information used in this assessment, relative confidence in the susceptibility result is given as LOW.

These data should not be used in isolation to indicate risk of groundwater flooding, particularly where there is a lack of confidence in the accuracy of the result. They should be used in conjunction with a large number of other factors, such as/evidence/records of previous incidence of groundwater flooding, land drainage and development type to establish relative risk.

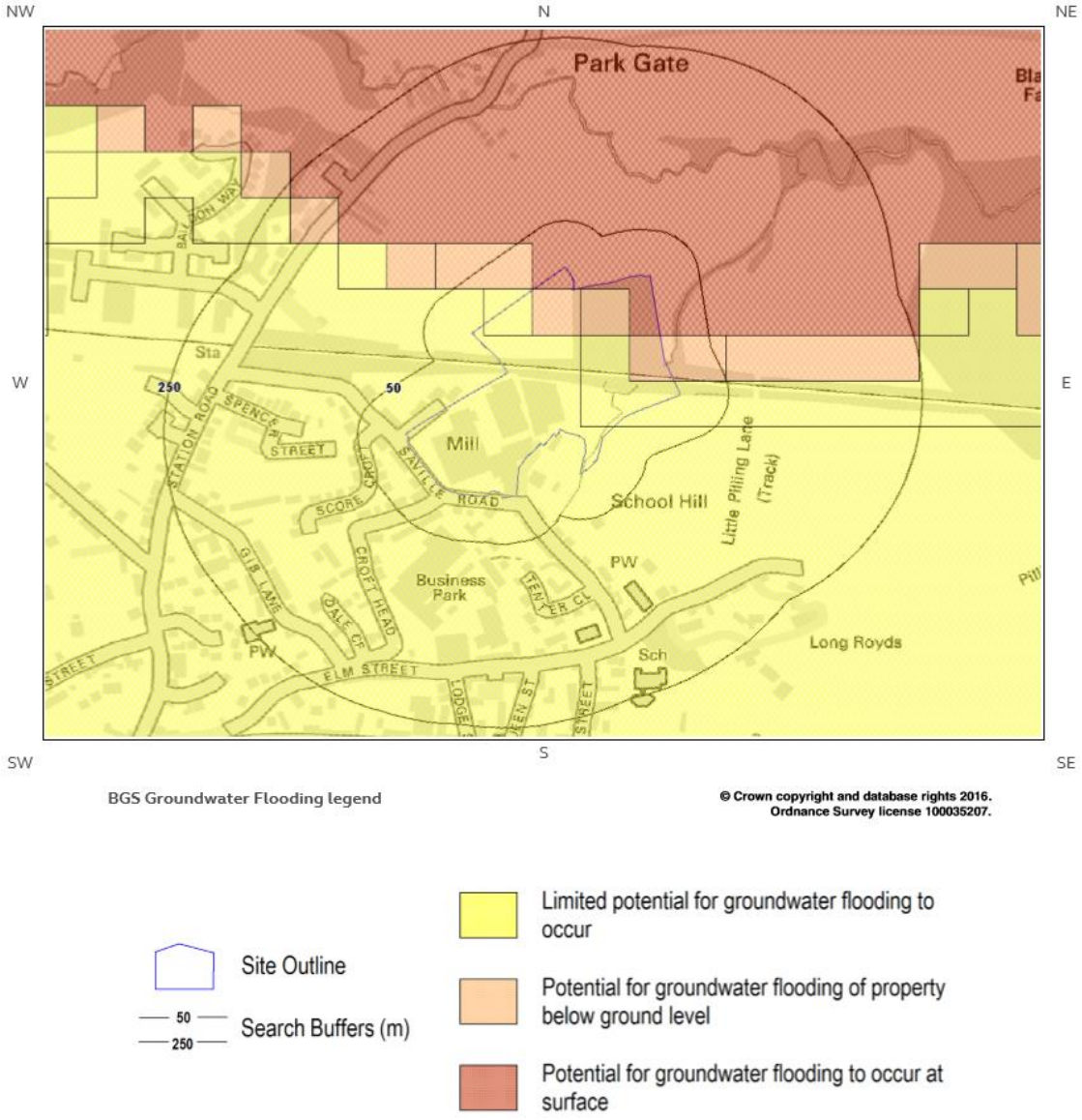

Figure 5: Groundwater Flooding Susceptibility

BGS borehole scan data indicate that superficial deposits beneath much of the site consist of clay and/or clayey stones to a depth of between four and six metres. These impermeable and/or low permeability deposits suggest a low risk of groundwater flooding.

The same data suggest bedrock deposits consist of low-permeability shale to depths of around 19 metres, further underlain by interbedded sandstone and shale.

^These low permeability strata are unlikely to support regional scale groundwater flows; this is reflected in the classification as a Secondary-A Aquifer.

A borehole resting water level was recorded in 1923 of around 20m below ground surface at 146m AOD (roughly central to the site), and in 1977 around 4.7m below ground surface in the north west corner of the site. Height AOD for this latter measurement is not given, and is unknown due to the subsequent construction of a significant retaining structure and change of levels in that area.

Despite apparently significant ground workings and a difference in levels of more than 3m created by the retaining structure, signs of groundwater seepage through/around the retaining structure appear minimal when viewing the site walkover photos in Appendix C.

A review of current and historical maps identified no springs within 500m; the closest being beyond Parkgate Dike ca. 1km north west of and at similar elevation to the Site.

Culverts and Bridges

The Tertiary river thought to receive the majority of surface waters from the Site becomes a culvert where passing beneath the railway corridor. Upstream of the site, a culverted section also passes beneath Saville Road.

Reservoir and Canal Flooding

The site is not in an area identified as being at potential risk in the event of a reservoir failure or canal break.

4. SUITABILITY OF THE DEVELOPMENT

Development Proposals

Redevelopment of the Site for residential use is proposed and it is thought that the site will accommodate around 50 dwellings.

National Policy

As set out in the NPPF, the Sequential Test is designed to steer new development to areas with the lowest probability of flooding (Zone 1). See Table 2, below.

Residential end use is falls into the ‘More Vulnerable’ classification. However, as the development is in Flood Zone 1 (and a change of use from commercial to residential), the sequential test is considered to be passed.

As the site is in Flood Zone 1, the exception test is not applicable.

Table 2: Flood risk vulnerability and flood zone ‘compatibility’.

Flood Risk Vulnerability Classification		Essential Infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Flood Zone	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

Local

No further information relating to potential sources of flooding close to the site, such as Parkgate Dike or Baildon Dike, were found in reviewing the Calder Valley Strategic Flood Risk Assessment (SFRA) or Kirklees SFRA Map (Appendix D).

The Kirklees Surface Water Management Plan[1] includes analysis of the flooding experienced across Yorkshire in 2007, as 70% of this was thought to have been caused by surface water. With relevance to Skelmanthorpe, the area of Parkgate (NGR SE2311SW) is given a priority ranking of Low.

The above report also ranks an area at the south of Skelmanthorpe (NGR SE2310NW) 468th of 900 areas within Kirklees, with an overall risk for fluvial flooding of Low. This area is topographically lower than but unlikely to be affected by the site.

Site Run-off

Where an increase in impermeable surfaces is proposed, estimates of run-off volumes are required to enable the development of strategies to ensure the development does not result in increased flood risk to off-site receptors.

The area of impermeable surfaces at the site in its current configuration is approximately 11,800m2 (Figure 6). Total area of impermeable surfaces for the proposed development has been estimated at 4200m2. The reduction of more than 60 percent in impermeable surfaces would be expected to significantly attenuate run-off reduce loading on immediate downstream drainage infrastructure.

[1] *https://www.kirklees.gov.uk/community/flooding/pdf/SurfaceWaterManagement.pdf*

Figure 6: Approximate Current Area of Impermeable Surfaces

5. CONCLUSIONS AND RECOMMENDATIONS

Fluvial (river) Flooding

A LOW fluvial flood risk has been identified (the Site is located in Flood Zone 1). As the Site is located in Flood Zone 1, fluvial mitigation measures are not required.

Surface Water Flooding

A SIGNIFICANT surface water flooding risk has been identified for the low lying part of the Site. This relatively small area of the Site, in the vicinity of the Tertiary river identified in section 2, is indicated to be at high or significant risk; development of buildings close to the watercourse should be avoided.

Site topography suggests that the vast majority of surface waters from the site are received by the above water course. The reduction in paved surfaces indicated in section 4 can be expected to significantly attenuate run-off from the Site and may reduce the potential for surface water flooding somewhat.

Consideration should be given to suitable further mitigation measures in this area, such as the construction of detention basins, ponds or wetlands as part of the development.

With reference to potentially infilled and/or contaminated ground highlighted in the geo-environmental desk study for the Site, the potential for mobilisation of any contaminants due to increased rainwater infiltration should be fully investigated. Similarly, the likelihood of adverse impacts on downslope bearing properties should be assessed.

Maintenance of the culvert via which the watercourse drains north toward Parkgate Dike will be essential to ensure blockage does not occur and prevent flooding of this area and those immediately upstream.

Groundwater Flooding

A POTENTIAL groundwater flooding risk has been identified, but on the balance of further available data that potential is thought to be low.

6. GENERAL MITIGATION AND RESPONSE

General Flood Mitigation Measures

The following general flood mitigation measures are further suggested.

- Finished floor levels to the properties should be designed to a minimum of 150mm above external levels, and if in lower lying parts of the site, taking into account flood levels 1 in 75-year flood levels predicted in Figure 4.
- The proposed dwellings should be designed without basements and ground the
- Floors shall comprise beam and block or concrete construction.
- External levels shall be designed with falls to non-critical areas, such as landscape, where water can pond in the unlikely event of flooding of the site.

Emergency Evacuation/Safe Egress Routes

As the site is within Flood Zone 1, no special mitigation measures such as emergency egress during times of flood are required.

Registration ca be made with the Environment Agency's flood warning scheme at https://fwd.environment-agency.gov.uk/app/olr/register

End of report.

APPENDIX A – GROUNDSURE ENVIRONMENTAL DATA REPORT

Attached with email.

APPENDIX B – LAND REGISTRY TITLE PLAN

APPENDIX C – SITE INSPECTION PHOTOS

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

Photo 7

Photo 8

Photo 9

Photo 10

Photo 11

Photo 12

Photo 13

Photo 14

Photo 15

Photo 16

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Photo 20

Photo 21

Photo 22

APPENDIX D – KIRKLEES STRATEGIC FLOOD RISK ASSESSMENT MAP