
JNP GROUP
CONSULTING ENGINEERS

DOCUMENT CONTROL SHEET

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Contents

1 INTRODUCTION

1.1 Terms of Reference

1.1.1 JNP Group has been commissioned by Eliston Homes Ltd to prepare a flood risk assessment for the proposed residential development in Holmfirth, West Yorkshire.

1.1.2 This report assesses flood risk at the development site from all potential sources and describes the measures adopted in the master planning process to manage such risks. It has been prepared in compliance with current policies and best practices and addresses the specific concerns raised by Environment Agency (Appendix A). The Environment Agency (EA) have also been approached to discuss the project but have not been available for a discussion to date.

1.2 Policy Framework and Key Stakeholders

1.2.1 The *National Planning Policy Framework* (NPPF) (February 2019) sets strict tests to protect people and property from flooding which all local planning authorities are expected to follow. Where these tests are not met, national policy is clear that new development should not be allowed.

1.2.2 In areas at risk of flooding or for sites of one hectare (ha) or more, developers must undertake a site-specific flood risk assessment to accompany applications for planning permission (or prior approval for certain types of permitted development).

1.2.3 In decision-taking, local planning authorities must ensure a sequential approach to site selection and master planning is followed so that development is, as far as reasonably possible, located where the risk of flooding (from all sources) is lowest, taking account of climate change and the vulnerability of future uses to flood risk.

1.2.4 Where development needs to be in locations where there is a risk of flooding, local planning authorities and developers must ensure development is appropriately flood resilient and resistant, safe for its users for the development's lifetime, and will not increase flood risk elsewhere.

1.2.5 The Environment Agency (EA) is a statutory consultee on applications where there is a risk of flooding from the sea or main rivers.

1.2.6 Lead local flood authorities (unitary authorities or county councils) are responsible for managing local flood risk from ordinary watercourses, surface water or groundwater, and for preparing local flood risk management strategies. Local planning authorities work with lead local flood authorities to ensure local planning policies are compatible with the local flood risk management strategy.

1.2.7 Kirklees Council (KC) is the lead local flood authority (LLFA) and its strategy for managing local flood risk is set out in Kirklees Local Flood Risk Management Strategy (2012).

1.2.8 KC is also the local planning authority (LPA) and its policies on flood risk management are set out in Local Plan (2019).

1.2.9 Where relevant, local planning authorities and developers must also take advice from:

- Internal drainage boards; to identify the scope of their interests.

- Sewerage undertakers; to ensure they can assess the impact of new development on their assets and plan any required improvements. Yorkshire Water (YW) is the local sewerage undertaker.
- Reservoir undertakers; to avoid an intensification of development within areas at risk from reservoir failure and ensure they can assess the cost implications of any reservoir safety improvements required due to change in land use downstream of their assets.
- Navigation authorities; in relation to developments adjacent to, or which discharge into, canals (especially where these are impounded above natural ground level).

1.2.10 Both The LLFA and EA have been contacted to discuss the proposals. As the site is adjacent to a main river, the LLFA deferred most of the comments on flood risk to the EA.

1.2.11 A summary of the discussion held with the EA is included in Appendix A.

1.3 Sources of Information

1.3.1 This flood risk assessment has been based on the following sources of information:

- Bespoke topographic survey undertaken by AIRD Group (Ref. M811- Revision C, May 2011);
- Bespoke topographic survey undertaken by Met geo Environmental (Ref. P20-01038 Rev. 01, October 2020);
- British Geological Survey's *Geoindex Tool*;

  (*http://mapapps2.bgs.ac.uk/geoindex/home.html)*
- DEFRA / EA's aquifer and source protection data

  (*https://magic.defra.gov.uk/MagicMap.aspx*)
- FEH's catchment data

  (*https://fehweb.ceh.ac.uk/*)
- EA's Flood Map for Planning;

  (*https://flood-map-for-planning.service.gov.uk/*)
- EA's Long Term Flood Risk Information;

  (*https://flood-warning-information.service.gov.uk/long-term-flood-risk/map*)
- Calder Catchment Strategic Flood Risk Assessment (2016);
- KC's Preliminary Flood Risk Assessment (2009);
- KC's Surface Water management Plan (2011);
- EA's detailed flood risk information (Product 4, dated 2018, current data requested but not received to date);
- YW's Asset Location Plan;
- Supplementary Ground Contamination Report & Remediation Strategy. ARC Environmental Ref. 11-516, December 2011.

2 DEVELOPMENT SITE

2.1 Location

2.1.1 The site is located approximately 0.45 km west of Holmfirth town centre (Figure 2.1, Table 2.1). The site covers an area of approximately 1.11 hectares.

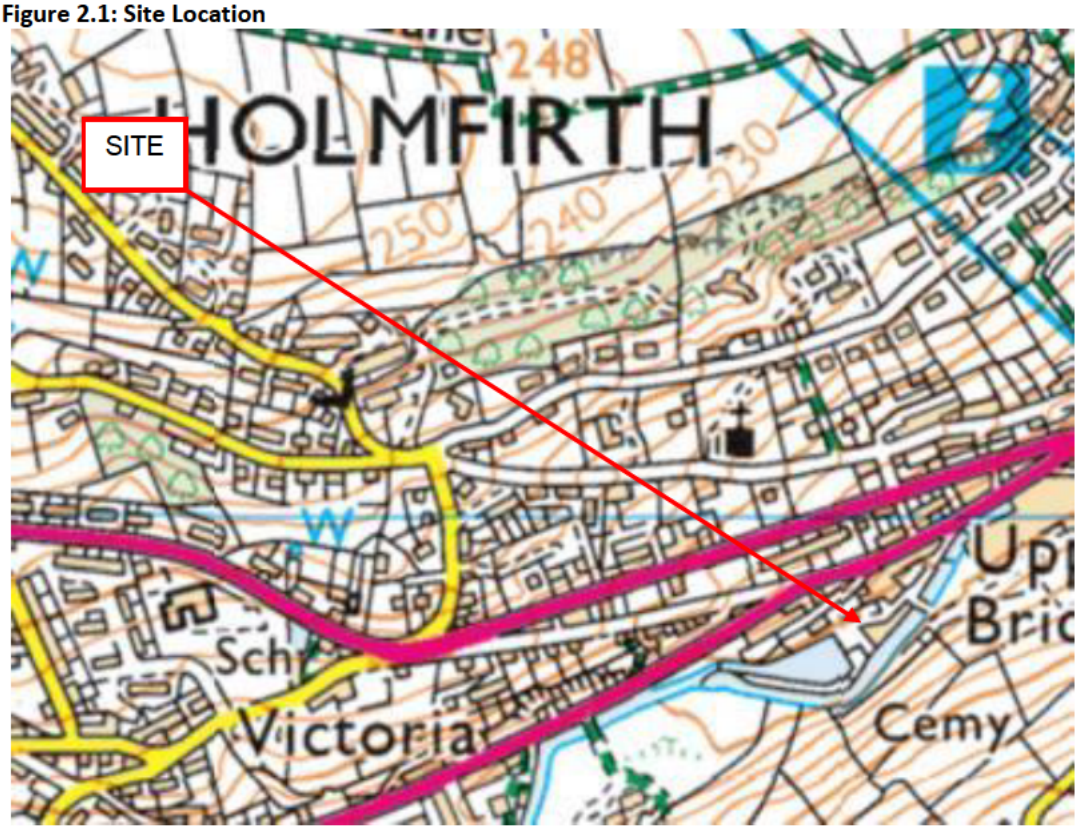
Table 2.1: Site Location

OS X	OS Y	Nearest Postcode
413787	407894	HD9 2NW

2.1.2 The site is a former mill site; the mill buildings have been demolished leaving a vacant site. In the rest of the site is a small mill pond, with a pond wall in the centre of the site.

2.1.3 Land to the south of the river is also included in the application. This is vacant land between the river and a steep wooded bank to the south.

Figure 2.1: Site Location



2.1.4 The surrounding land uses are summarised in the following table.

Table 2.2: Surrounding Land Use

Direction	Land Use
North	Residential with Woodhead Road beyond
East	Small industrial unit, River Holm
South	River Holm
West	Residential

2.2 Topography

2.2.1 The site is located in the bottom of the valley with steep slopes to the north and south. The site itself is relatively flat. Two topographical surveys have been undertaken at the site in 2011 and 2020. The 2011 survey has a larger extent and includes some of the river features. Demolition has occurred on the site since 2011 so the levels recorded on the 2020 survey for the site are considered to accurately represent current conditions (Appendix B).

2.2.2 The western area is dominated by the mill pond which has an inlet from the River Holm in the far west with a mill race connecting this to the pond. The wall to the north of the mill race is 151.69m aOD or higher in this location and the bank to the south, between the mill race and the River Holm, is at 150.0m to 150.5m aOD. At the eastern end of the pond, the top pf the bank to the north is c. 150.5m aOD or higher and the pond wall in the east is at 149.9m aOD. The southern bank of the pond is at an elevation between c. 149.7m and 150.0m AOD.

2.2.3 The area to the east of the pond wall is lower, at an elevation down to 148.25m aOD. The ground then rises to the north and east.

2.2.4 The plot to the south of the river is at an elevation of c. 148.5m to 149.1m aOD, then rises very steeply to the south.

2.3 Hydrology

2.3.1 The River Holm flows west to east along the southern site boundary of the development site. It is classified by the EA as a 'main river' and defines a total catchment area of 26 km^2 at the point where it leaves the vicinity of the site.

2.3.2 There is a weir in the river immediately downstream of the inlet to the mill race with a fall of over 1m over the weir. There is a second weir to the south of the mill pond with a fall of c. 0.6m across the weir.

2.3.3 The water level in the mill pond is at a higher level than the site and is controlled by a sluice gate at the upstream entrance to the pond.

2.3.4 At the mill end of the pond is a further sluice gate, which in the past would have been used to drain the pond through a mill race to operate the mill.

2.3.5 At this end of the mill pond, there is also an overflow pipe discharging into the lower level river where it flows past the site.

2.4 Geology

2.4.1 The geology of the site has been determined by reference to the 1:50,000 scale British Geological Survey (BGS) online Geoindex Tool http://mapapps2.bgs.ac.uk/geoindex/home.html

2.4.2 No artificial or Made Ground is indicated to be present underlying the site, however, from a ground investigation undertaken on site in 2011, Made ground up to 3.2m thick was found. Demolition since then may have contributed to or removed some of this material.

2.4.3 The superficial geology of the site to be is indicated to be Alluvium, which is described by the BGS as *"Normally soft to firm, consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel*."

2.4.4 The underlying geology is indicated to be the Readycon Dean Flags, for which the BGS do not provide a lithological description. These are part of the Millstone Grit Group which the BGS describe as *"Fine- to very coarse-grained feldspathic sandstones, interbedded with grey siltstones and mudstones, with subordinate marine shaly mudstone, claystone, coals and seatearths."*

2.4.5 There is a fault to the north of the site running close to the southern side of Woodhead Road.

2.4.6 JNP Group have consulted online borehole records held by the BGS. There are no accessible borehole records close to the site.

2.4.7 The Environment Agency's website indicates that the site is underlain by a Secondary A Aquifer. The aquifer status refers to both the Alluvium and Millstone grit Group.

2.4.8 The Environment Agency define a Secondary-A Aquifer as:

"Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers."

2.4.9 The site's proximity to groundwater Source Protection Zones (SPZs) was determined by reference to the Environment Agency's website. These zones show the risk of contamination from any activities that might cause pollution in the area, with the closer the activity, the greater the associated risk. The site is not located within or close to a SPZ.

3 PROPOSED DEVELOPMENT

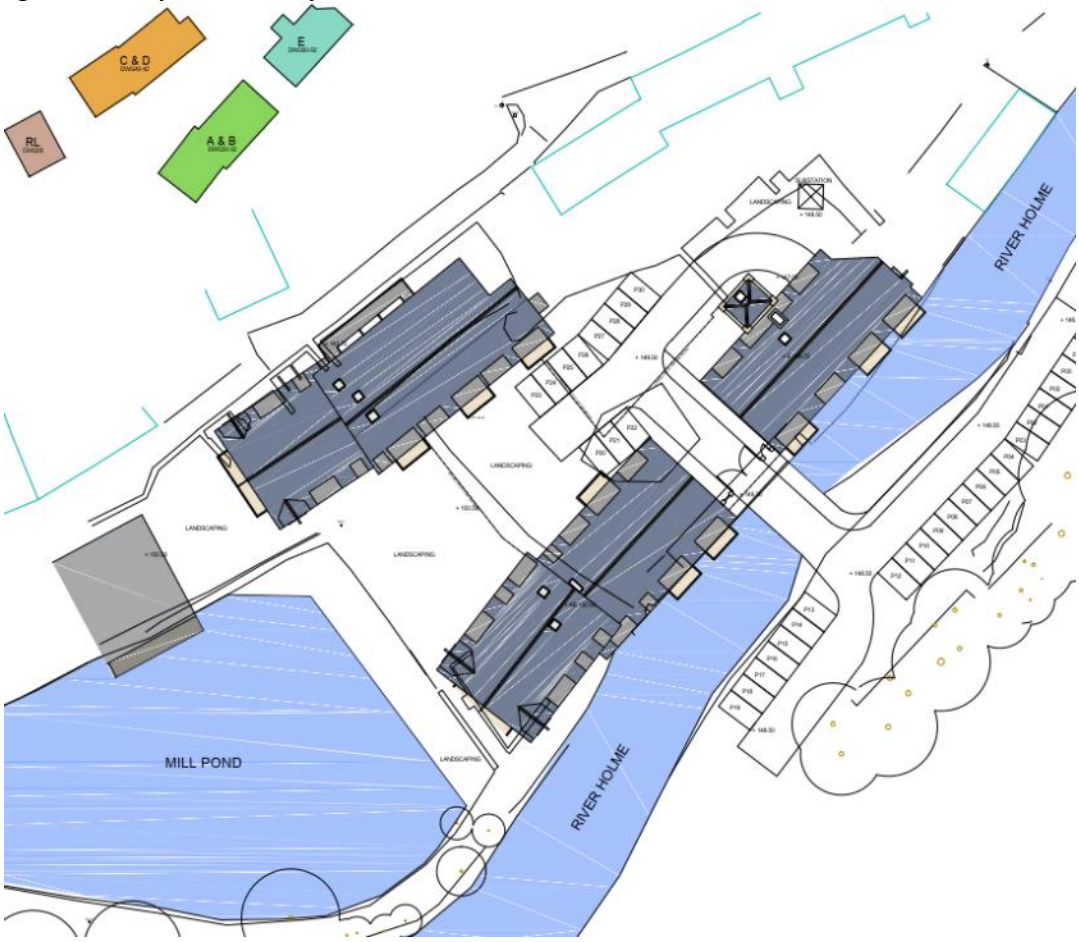
3.1.1 The proposed development (Figure 3.1 and Appendix C) comprises 61 age restricted apartments(two or three bedroom with studies), external residents lounge, Managers office, residents and visitor parking, new bridge access and a riverside walkway. This application comprises a revised scheme to the planning application that was approved in December 2013 (Ref: 2012/90738) and was commenced by the demolition of the existing buildings adjacent to the river (referred to later in the document). A later variation was approved in January 2018 (Ref: 2018/90031).

3.1.2 This application is a reconfiguration with a similar footprint, but with changes to the ridge height and car parking.

3.1.3 The proposed apartments are contained within five multi-storey blocks (A to E) with parking beneath some of the blocks and the central garden area, located to the east of the pond wall. The residents lounge is located to the west of these adjacent to the mill pond. Cross sections of the proposed development are also included in Appendix C.

3.1.4 Under Table 2 of the *Flood Risk and Coastal Change Guidance* (March 2014), the proposed residential development is classified as “more vulnerable”.

Figure 3.1: Proposed Development



4 FLOOD RISK ASSESSMENT

4.1 Overview

4.1.1 All potential sources of flood risk at the development site have been assessed based on the information listed in Section 1.3 and are summarised in Table 4.1. The key sources of flood risk to the proposed development are further described in the ensuing sections.

Table 4.1: Potential Sources of Flood Risk

Source	Flood Risk
Coastal	*Low risk.*
Fluvial	Low to high risk of flooding.
Surface Water	Very low to medium risk.
Groundwater	Potential for groundwater emergence near the river.
Sewers	*Incidents note is recorded in SFRA*
Infrastructure Failure	Potential for flooding from failure of the Digley, Riding Wood, Ramsden and Brownhill Reservoirs.

4.2 Climate Change

4.2.1 The NPPF sets out how the planning system should help minimise vulnerability and provide resilience to the impacts of climate change. This includes demonstrating how flood risk will be managed now and over the development's lifetime, taking climate change into account.

4.2.2 In accordance with the EA's guidance Flood Risk Assessment: Climate Change Allowances (February 2016), the proposed development with anticipated life span into the 2080's (2070 to 2115) must take account of the following allowances:

- Peak River Flows (Humber river basin district)
  - Higher Central 50%
  - Upper End 30%
- Peak Rainfall Intensity
  - Upper End 40%

4.3 Fluvial Flood Risk

4.3.1 Fluvial flooding occurs when a catchment area receives greater than usual amounts of water (e.g. rainfall or snow melt). When the converging runoff exceeds the conveyance capacity of the receiving channel, water spills onto the surrounding floodplains and fluvial flooding occurs.

4.3.2 Fluvial flooding usually occurs hours or days after heavy and / or prolonged rainfall and its effects often last several hours or days.

4.3.3 Besides posing a direct flood risk to floodplain areas, high water levels in watercourses can exacerbate other sources of flood risk by surcharging / locking outfalls, thus preventing the normal discharge of flows or even back flowing into tributary drainage systems.

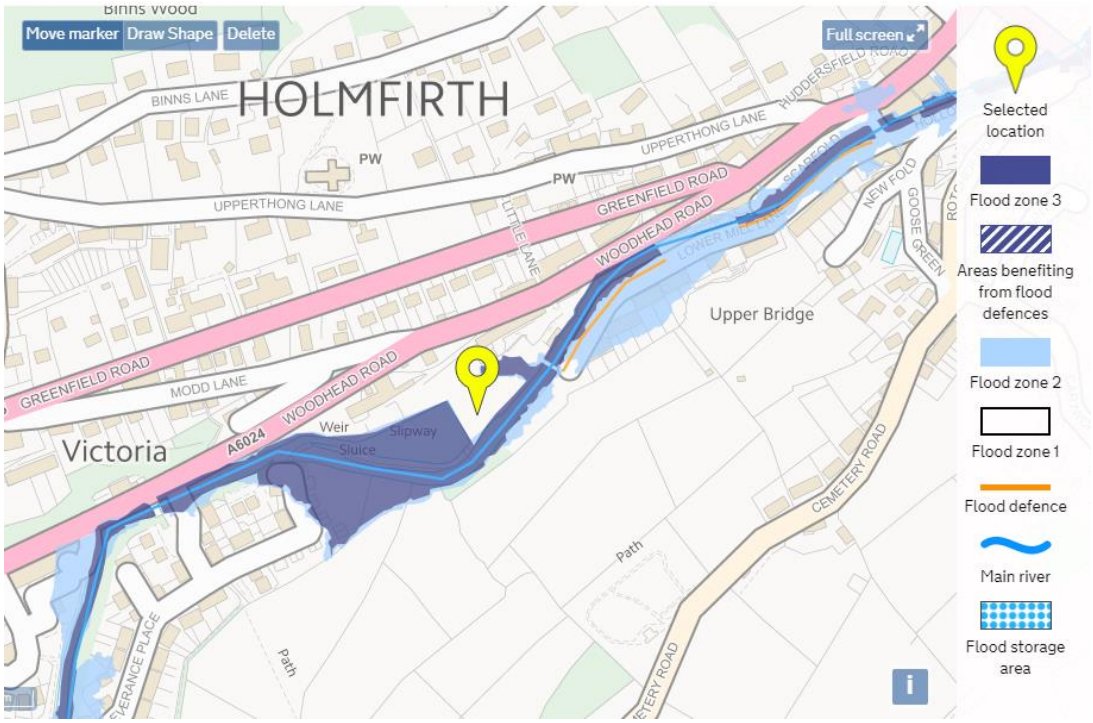
4.3.4 In accordance with the EA's *Flood Map for Planning* (Figure 4.1), most of the site where development is planned is in Flood Zone 1. However, there is an area in the eastern part of the site predicted to be in Flood Zone 2 / 3. The mill pond is also predicted to be in Flood Zone 3 and parts of the land to the south of the river are in Flood Zone 2.

4.3.5 The SFRA indicates that the Flood Zone 3 areas are Flood Zone 3a.

4.3.6 The site does not benefit from formal flood defences.

4.3.7 According the to SFRA, the site has not flooded historically.

Figure 4.1: EA Flood Map for Planning



4.3.8 Predicted flood levels have been provided by the EA (Appendix D). In addition, EA data was also provided in 2018; this data is the same as the current data but also included another model node closer to the intake to the pond. This is also included in Appendix D.

4.3.9 The predicted flood levels provided by the EA include the level for a 1 in 100 year but do not include an allowance for climate change. To assess the impact of climate change, the effect of the 'upper end' (30%) increase in flow on predicted flood levels have been calculated using a regression analysis. A sensitivity test has been completed using the 'higher central' (50%) increase in flow. This methodology is as indicated in a discussion with the EA; should the predicted flood levels be similar, then the site is deemed not to be sensitive to increases in flow and the design flood level can be set at the 1 in 100 year plus upper end (30%) climate change allowance. Should the results not be the same, then the site is deemed to be

sensitive to increases in flow and the design flood level can be set at the 1 in 100 year plus higher central climate change allowance (50%).

4.3.10 The site is set on two levels; higher ground to the west including the mill pond and the location of the proposed residents lounge, and lower ground to the east where the proposed accommodation blocks are situated.

4.3.11 The EA model has several modelling nodes along the river (Figure 4.2 and Appendix D); Node 11910 is located upstream of the inlet to the pond and has been used to assess flood levels in the west of the site, Node 11682 is located adjacent to the eastern part of the site and has been used to assess levels for this area.

4.3.12 The regression analysis is included in Appendix E. The key results are included in Table 4.2 below.

Figure 4.2 EA Node Point Map

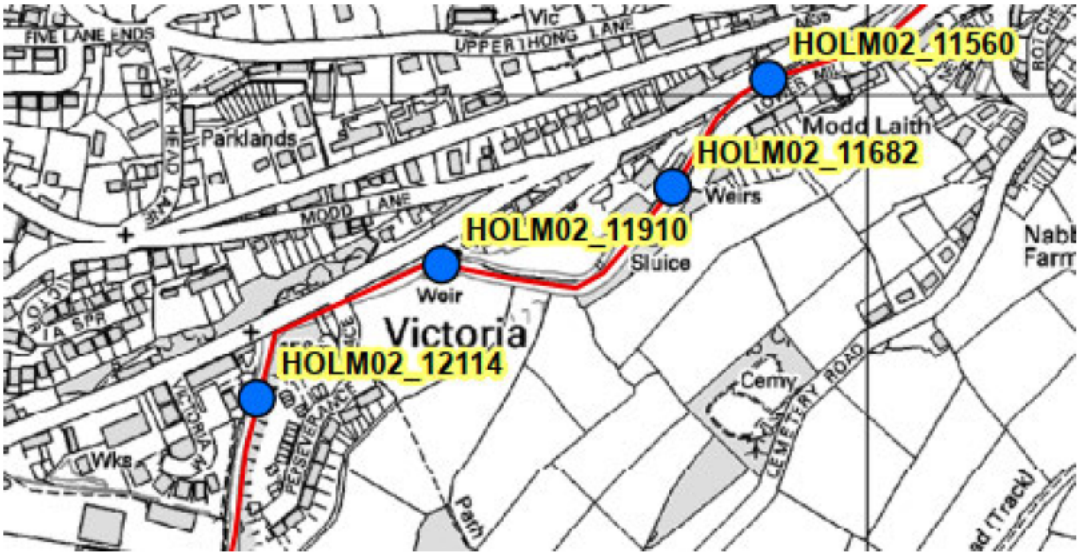


Table 4.2 Regression Analysis

Model Ref:	2010 Colne and Holme Model Results RFI: 79420	
Node Ref:	HOLM02_11910	HOLM02_11682
Climate Change Allowance – Upper End (%)	30%	30%
Climate Change Flow (l/s)	89.56	89.62
Climate Change Flood Level (m aOD)	151.41	149.59
Climate Change Allowance – Higher Central (%)	50%	50%
Climate Change Flow (l/s)	103.34	103.41
Climate Change Flood Level (m aOD)	151.65	150.13

4.3.13 For the accommodation blocks in the east of the site, there is 0.54m difference in the predicted flood levels using the two climate change allowances and so the site is considered sensitive to changes in the river flow and the higher central (50%) climate change allowance should be used. A freeboard allowance is also required above this, but as the higher climate

change allowance has been used, 100mm freeboard is considered sufficient. The predicted 1 in 100 year plus climate change plus freeboard flood level for this part of the site will therefore be 150.23m aOD (150.13m aOD + 0.1m).

4.3.14 For the residents lounge in the west, there is only 0.24m difference in the predicted flood levels using the two climate change allowances and so this part of the site is not considered sensitive to changes in river flow and the upper end (30%) climate change allowance should be used. A freeboard allowance is also required above this, but as the flood levels are relatively insensitive to increased flows, the higher central level has been used i.e. 151.65m aOD.

4.3.15 It should also be noted that the analysis is a linear regression and common sense would suggest that as flood levels increase, the cross sectional area of the valley gets larger, so the rate of increase in flood levels should diminish; the linear regression does not reflect this and so is a worst case scenario.

4.3.16 The location where the residents lounge is proposed is located in Flood Zone 1 and so will be above the 1 in 1000 year flood level. EA modelling data for this scenario is not available but generally, development should be directed towards Flood Zone 1 areas where flood mitigation measures are not required. The predicted flood levels for the residents lounge are therefore considered to be a very precautionary approach.

4.3.17 The management measures proposed to deal with the design flood level of 151.64 m aOD in the west and 150.23m aOD in the east are described in Section 5.2.

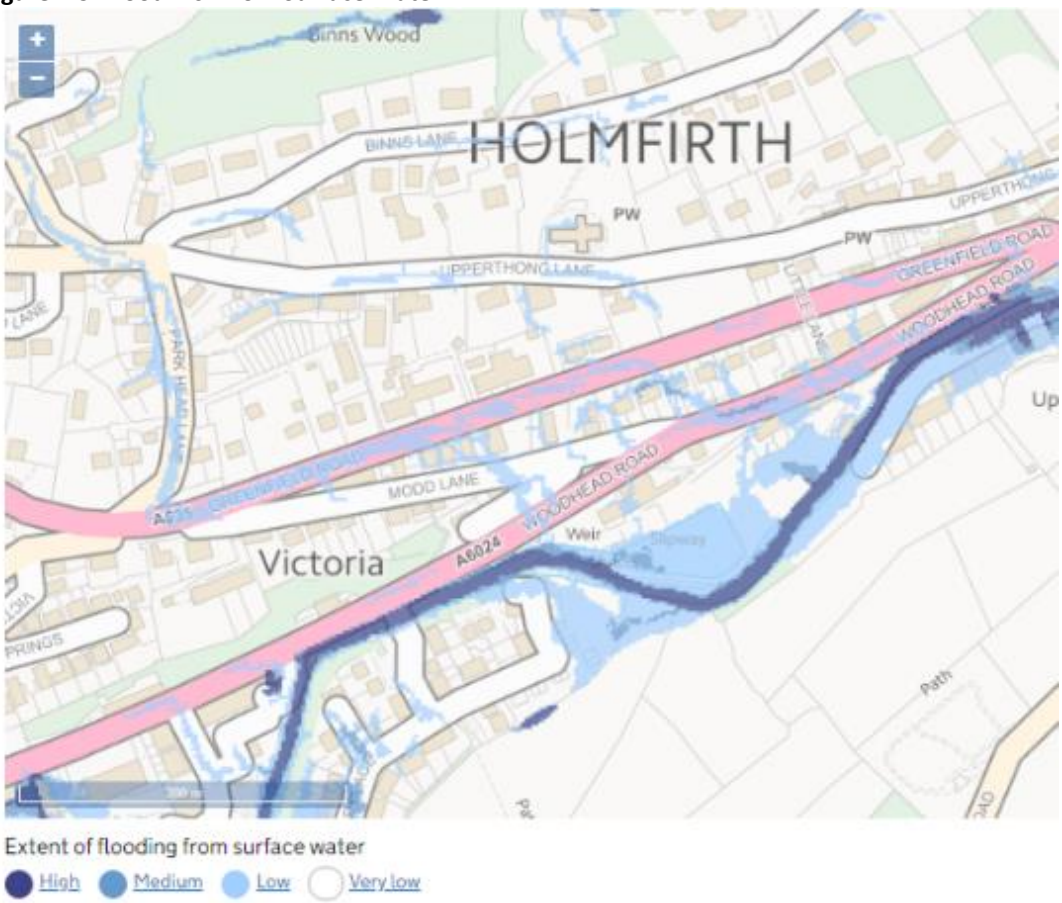
4.4 Surface Water Flood Risk

4.4.1 Surface water flooding is a description for excessive overland flows that have yet to enter a natural or manmade receptor (e.g. aquifer, watercourse or sewer). Surface water flooding also occurs when the amount of runoff exceeds the capacity of the collecting system and spills onto overland flow routes.

4.4.2 Surface water flooding is usually the result of very intense, short lived rainfall events, but can also occur during milder, longer lived rainfall events, when collecting systems are at capacity or the ground is saturated. It often results in the inundation of low points in the terrain.

4.4.3 In accordance with the EA's *Long Term Flood Risk Information* (Figure 4.3), the development site is at very low (< 0.1% AEP), low (0.1% to 1.0% AEP) or medium (1.0% to 3.3% AEP) risk of surface water flooding.

Figure 4.3: Flood Risk from Surface Water



4.4.4 The available information shows that most of the surface water flooding is coincident with the fluvial flooding. It also suggests off-site overland flows are expected to reach the development site from the higher ground to the north, posing some flood risk across the eastern part of the site before discharging into the River Holme.

4.4.5 The management measures proposed to deal with off-site overland flows reaching the site are described in Section 5.2.1.

4.4.6 The risk of surface water flooding from runoff generated within the development site will be managed by the drainage strategy.

4.5 Groundwater Flooding

4.5.1 Groundwater flooding occurs when the level of water filling the pores and / or fractures in the underlying soil and / or rock (i.e. water table) rises and emerges on the surface. The level of the water table varies seasonally and depends upon long term rainfall, thickness and porosity of the underlying strata and groundwater abstraction.

4.5.2 Groundwater flooding is most common in areas where the underlying bedrock and superficial deposits are very porous, but it can also happen at locations where superficial layers of sand or gravel overlay impermeable bedrock.

4.5.3 Groundwater flooding usually occurs after days or weeks of prolonged rainfall and often lasts for days or weeks, as subsiding of the water table can be a very slow process.

4.5.4 Besides posing a direct flood risk to developments (particularly basements), high water table levels can exacerbate other sources of flood risk by preventing infiltration and / or leaking into drainage systems.

4.5.5 In accordance with the SFRA, the development site is in an area with between 25% and 50% risk of groundwater emergence; note that this is not the risk of groundwater flooding. Groundwater frequently emerges close to rivers where it provides baseflow to the river; however, flooding will only occur where such water can pool. In a location such as the Prickleden Mill site, groundwater flooding will be practically indistinguishable from fluvial flooding.

4.5.6 The bespoke ground investigation undertaken by ARC encountered groundwater between 0.5m and 2.2m bgl indicating a relatively shallow water table beneath the site. This is consistent with a location close to a river.

4.5.7 The management measures proposed to deal with groundwater flood risk at the development site are described in Section 5.4.

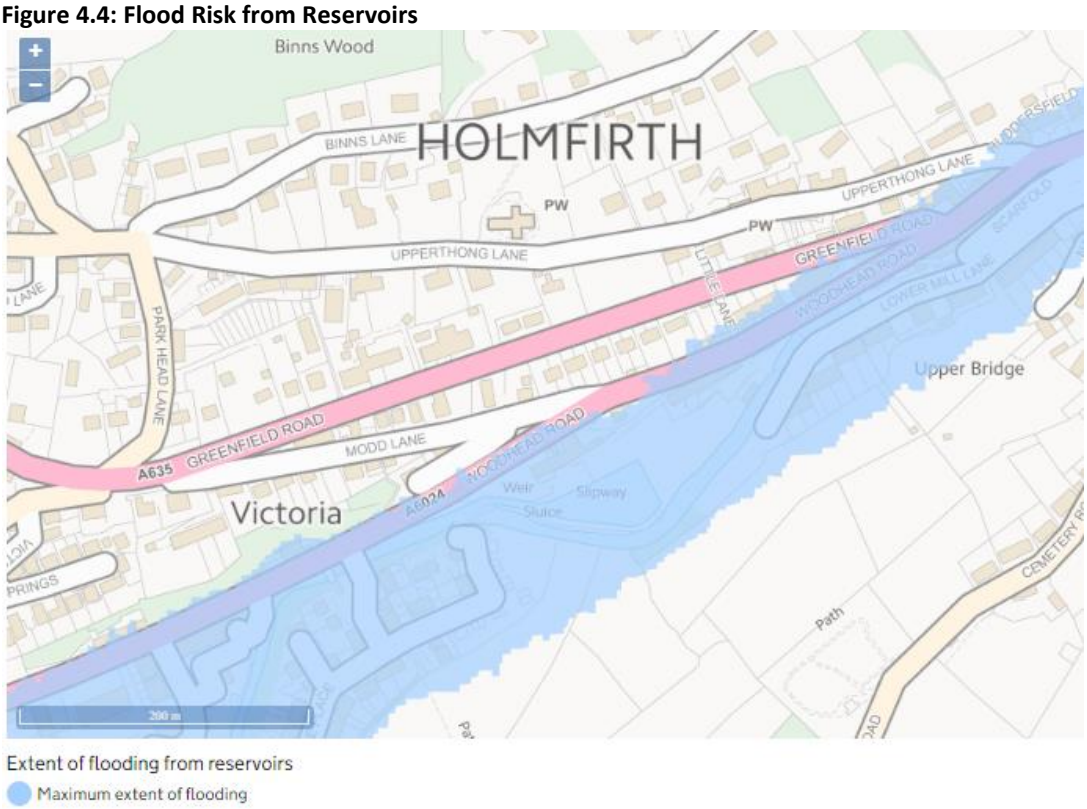
4.6 Infrastructure Failure Flood Risk

4.6.1 Infrastructure failure flooding occurs when a feature holding water above natural ground levels (e.g. reservoir or canal) is overtopped or breached. Infrastructure failure flooding is usually the result of extreme events in excess of the high standards of protection usually considered in the design of such structures (namely reservoirs).

4.6.2 In accordance with the EA's *Long Term Flood Risk Information*, the development site is at risk of flooding from failure of the Digley, Riding Wood, Ramsden and Brownhill Reservoirs, owned and maintained by Yorkshire Water.

4.6.3 Reservoir failures are extremely rare in the UK, as the *Reservoir Act* ensures strict inspection and maintenance of all structures above a certain threshold. Structures under the *Reservoir Act* are also covered by comprehensive emergency plans and warning systems developed in liaison with the relevant civil protection authorities to ensure populations potentially at risk can be safely evacuated in critical situations.

Figure 4.4: Flood Risk from Reservoirs



4.6.4 Flood risk from infrastructure failure is mostly managed off-site by the competent authorities. The residual risk to the site is deemed low / negligible and adequately managed by measures proposed to deal with other sources of flooding.

5 FLOOD RISK MANAGEMENT

5.1 Sequential and Exception Tests

5.1.1 The sequential, risk-based approach to the location of development is designed to ensure that areas at little or no risk of flooding from any source are developed in preference to areas at higher risk. The aim is to keep development out of medium and high flood risk areas (Flood Zones 2 and 3) and other areas affected by other sources of flooding where possible.

5.1.2 Application of the sequential approach in the master planning process, in particular application of the *Sequential Test*, helps ensure that development can be safely and sustainably delivered, and developers do not waste resources promoting proposals which are inappropriate on flood risk grounds.

5.1.3 The *Sequential Test* ensures that a sequential approach is followed to steer new development to areas with the lowest probability of flooding. The aim is to steer new development to Flood Zone 1 (areas with a low probability of sea or river flooding). Where there are no reasonably available sites in Flood Zone 1, local planning authorities in their decision making should take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2 (areas with a medium probability of sea or river flooding), applying the *Exception Test* if required. Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 (areas with a high probability of sea or river flooding) be considered, taking into account the flood risk vulnerability of land uses and applying the *Exception Test* if required.

5.1.4 Table 2 of the *Flood Risk and Coastal Change Guidance* categorises different types of uses and development according to their vulnerability to flood risk. Table 3 of the *Flood Risk and Coastal Change Guidance* (Table 5.1) maps these vulnerability classes against flood zones to indicate where development is appropriate and where it should not be permitted.

Table 5.1: Flood Risk Vulnerability and Flood Zone Compatibility

Flood Zone	Flood Risk Vulnerability				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test	✓	✓	✓
Zone 3a	Exception Test	×	Exception Test	✓	✓
Zone 3b	Exception Test	×	×	×	✓

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

5.1.5 The *Exception Test* is a method to demonstrate and help ensure that flood risk to people and property will be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable sites at lower risk of flooding are not available.

5.1.6 Essentially, the two parts of the *Exception Test* require proposed development to show that it will:

- Provide wider sustainability benefits to the community that outweigh flood risk; and
- Be safe for its lifetime, without increasing flood risk elsewhere and where possible reduce flood risk overall.

5.1.7 The ensuing sections describe how the sequential approach to the location of development and, where necessary, the second part of the *Exception Test* have been implemented in the proposed development's master planning.

5.2 Fluvial Flood Risk

5.2.1 The following fluvial flood risk management measures have been incorporated in the proposed development's masterplan.

Flood Warnings

5.2.2 The Environment Agency (EA) operate a flood forecasting and warning service in areas at risk of flooding from rivers or the sea. This service operates 24 hours a day, 365 days a year. The service is a free service and provides flood warnings direct to you via telephone, mobile, email, sms text message and fax. To sign up to the service visit

https://www.fws.environment-agency.gov.uk/app/olr/register.

5.2.3 The Site Management should register with this service.

5.2.4 This service provides three levels of advice on flood risk to sites located within areas that may be impacted. This site is located in on the edge of such an area. The information issued is as follows (from the EA website):

- Flood Alert Areas are geographical areas where it is possible for flooding to occur from rivers, sea and in some locations groundwater. A Flood Alert is issued to warn people of the possibility of flooding and to encourage them to be alert, stay vigilant and make early / low impact preparations for flooding. Flood Alerts are issued earlier than Flood Warnings to provide advance notice of the possibility of flooding and may be issued when there is less confidence that flooding will occur in a Flood Warning Area.
- Flood Warning Areas are geographical areas where we expect flooding to occur and where we provide a Flood Warning Service. They generally contain properties that are expected to flood from rivers or the sea and in some areas, from groundwater. Specifically, Flood Warning Areas define locations within the Flood Warning Service Limit that represent a discrete community at risk of flooding. A discrete community is a recognised and named geographical community, which can be an urban area, a significant suburb of a large city or a village or a hamlet. The purpose of Flood Warnings is to alert people that flooding is expected and they should take action to

protect themselves and their property. Flood Warnings are issued when flooding is expected to occur.

- Severe Flood Warnings are issued to similar areas when there is a danger to life or widespread disruption is expected.

5.2.5 In the areas where flood warnings are provided, the EA aim to provide a lead flood warning time of up to two hours. This time is invaluable in implementing a flood response / evacuation plan and ensuring that people who live in areas at risk of flooding are suitably prepared.

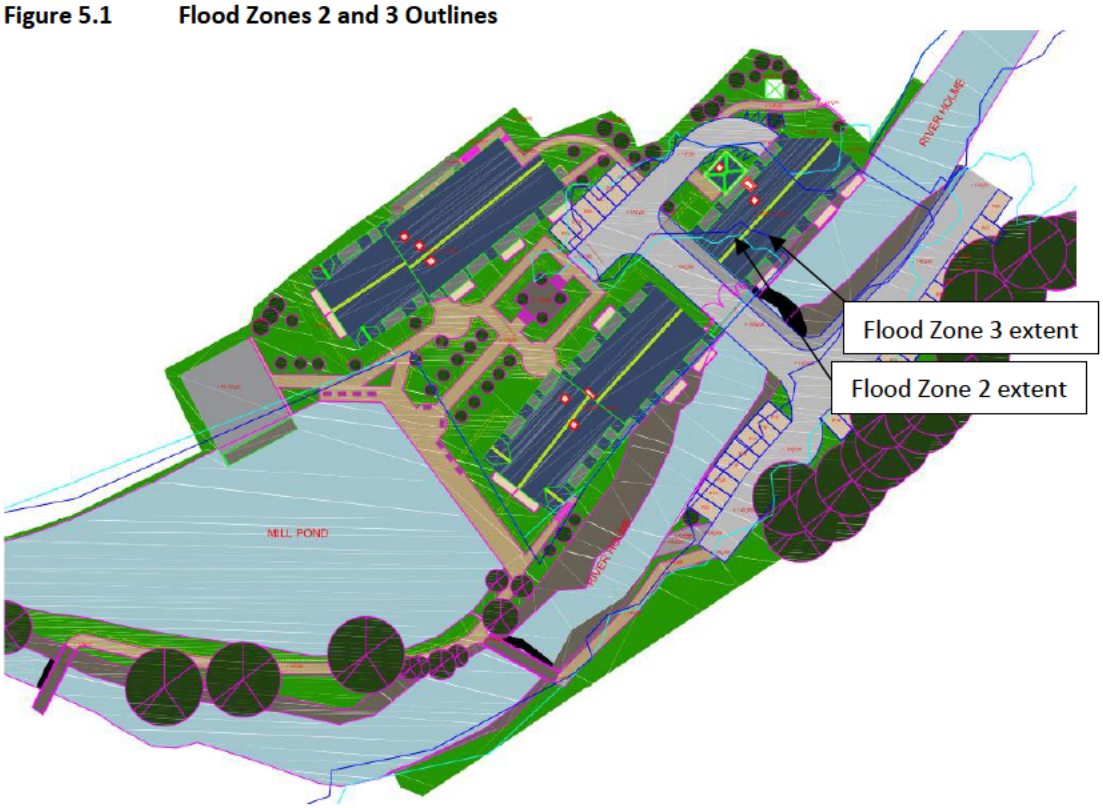
Sequential Test

5.2.6 Most of the development is located in areas indicated as Flood Zone 1. The only parts of the development located in an area designated as Flood Zone 2/3 are:

- Parts of the eastern accommodation block (Block E);
- The access road to this accommodation block; and
- Parts of the car park to the south of the river.

5.2.7 Figure 5.1 shows the outlines of the areas of the proposed development that are in Flood Zones 2 or 3 (cyan or dark blue respectively).

Figure 5.1 Flood Zones 2 and 3 Outlines



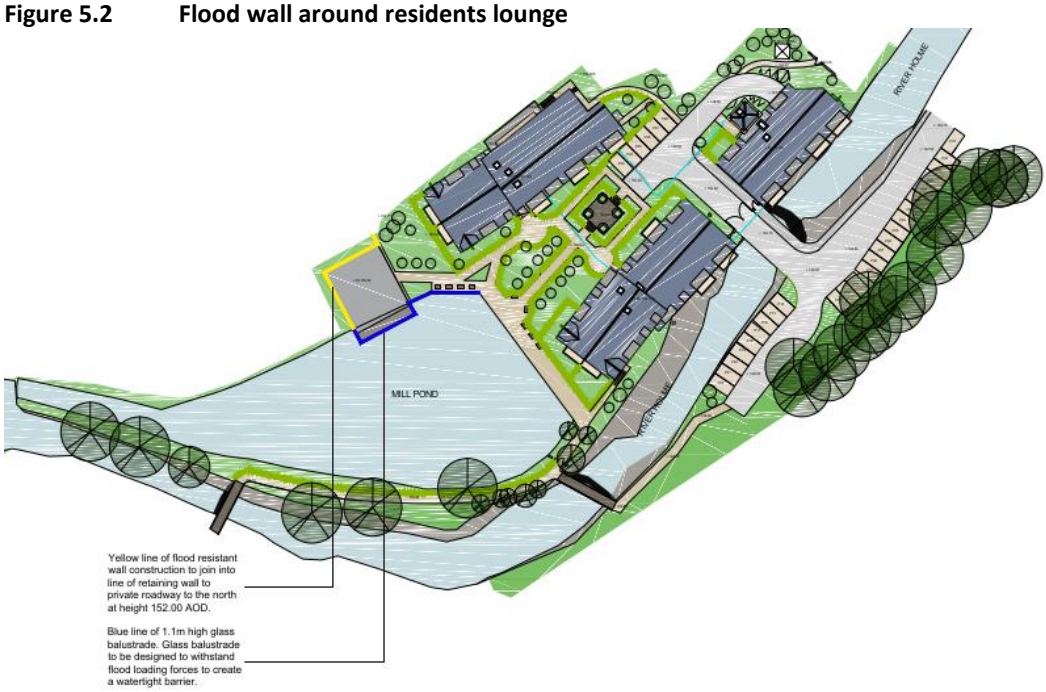
Finished floor levels

5.2.8 The finished floor level of all the accommodation blocks is set at the 1 in 100 year plus climate change allowance plus freeboard, for the east of the site (i.e. 150.23m aOD).

5.2.9 The finished floor level for the residents lounge is set at 150.00m aOD. This is lower than the predicted 1 in 100 year plus climate change allowance plus freeboard, for the west of the site (i.e. 151.65m aOD). However, the residents lounge is located within Flood Zone 1 and this predicted flood level reflects the predicted level at the intake of the pond. Flood levels will diminish across the pond and the flood outlines and topographical survey indicate that water in the pond flows towards a low point in the south eastern corner, before spilling back into the river. Proposed works to the dam wall will raise this slightly, further ensuring that water is directed to the south east.

5.2.10 Although flood mitigation measures are not strictly required for the residents lounge, it is proposed to install a wall around the western and southern side of the building to afford some protection from any flood (Figure 5.2). The top of the wall would be set at 151.0m aOD and the wall would not contain any gates. Any flood water will therefore be directed back towards the pond, affording additional protection to the residents lounge.

Figure 5.2 Flood wall around residents lounge



Dry access routes

5.2.11 There are pedestrian access routes between the accommodation blocks at 150.23m aOD or higher. Between the residents lounge and the accommodation block area is an access route within Flood Zone 1 at 150.0m aOD. Pedestrian access to or from the site during a flood could be achieved via a flight of stairs to the rear of Block C/D, which is to the lane immediately to the north of the site. Figure 5.3 indicates the safe access routes.

Figure 5.3 Safe Access Routes

5.2.12 Safe refuge will also be provided in the upper floors if required.

Flood plain compensation

5.2.13 Any floodplain impingement for events up to the 1 in 100 year (Flood Zone 3) level will be compensated on site, as demonstrated in Appendix F.

5.2.14 Some volume is lost from the Flood Zone 3 area in the vicinity of Block E. The volume lost is compensated almost exactly by the volume gained by the excavation of the undercroft parking beneath Block E. As this is a similar area to where volume is lost, the flooding mechanisms will be similar so all the volume created by the excavation can be accessed by flood water.

5.2.15 Ideally, compensation should be on a level-by-level, volume-by-volume manner. The table below indicates the levels where volume is lost (negative figure) or gained (positive figure) overall on site. The cut / fill balance does result in an overall increase of 70.9m^3 of flood plain storage, but does not balance on a level for level basis. However, the gains in volume are mostly at a lower level than the losses; the gains between 147.0m and 148.0m aOD are 401m^3 with the loses between 148.0m and 150.25m aOD are 378m^3 (there is an additional gain of 48.4m^3 above 150.25 m aOD). As the gains are at a lower level than the losses, these can be used on a more frequent basis, providing overall betterment.

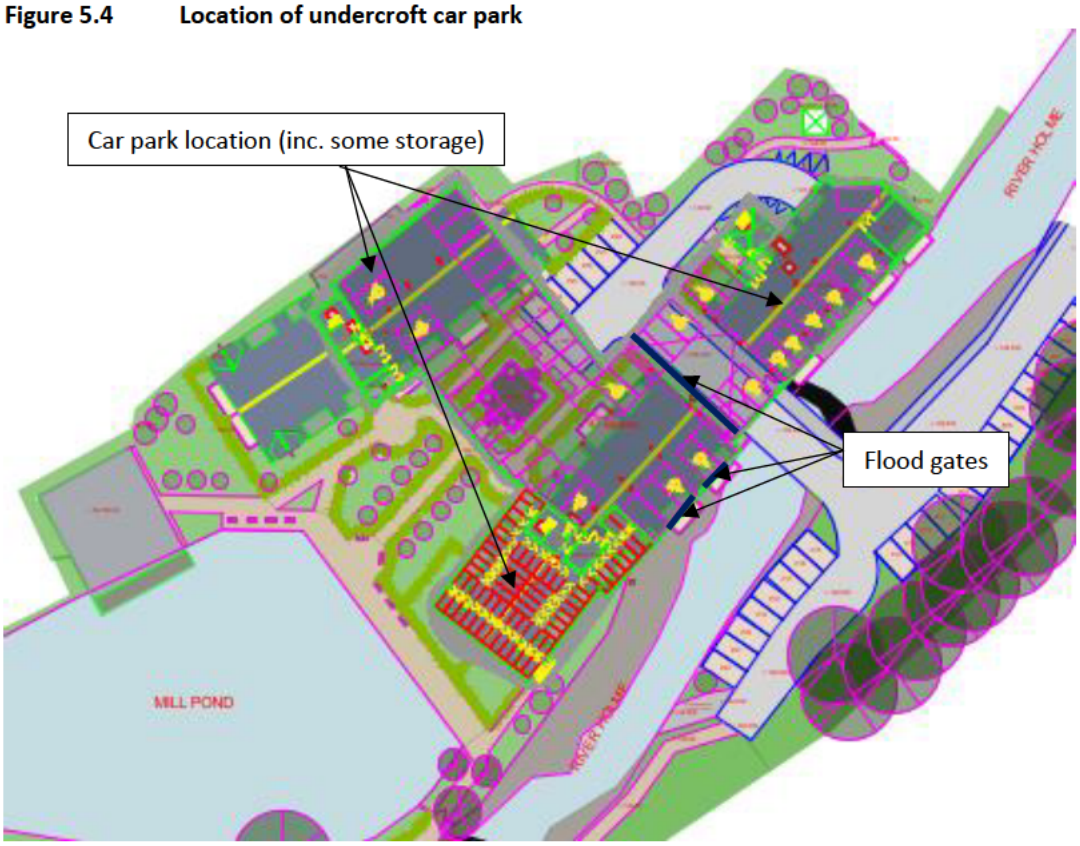
Table 5.2 Flood Compensation Cut / Fill Balance

Elevation (m aOD)	Cut / fill balance (m^3)	
147.000-147.249	142	401
147.250-147.499	136	
147.500-147.749	86.75	
147.750-147.999	35.75	
148.000-148.249	-19.75	-378
148.250-148.499	-47.75	
148.500-148.749	-57	
148.750-148.999	-51.75	
149.000-149.249	-49	
149.250-149.499	-37.5	
149.500-149.749	-20.5	
149.750-149.999	-92.5	
150.000-150.249	-2.25	
150.250-150.499	20.25	48.4
150.500-150.749	5.4	
150.750-150.999	7.75	
151.000-151.249	7.5	
151.250-151.499	7.5	
Overall Net Gain m^3	**70.9**	

Flood defences

5.2.16 An undercroft car park is proposed under Blocks A/B and E and part of Block C/D (Figure 5.4). The floor level of the car park is set at 147.0m aOD. This level is lower than the predicted 1 in 10 year flood level and with open apertures proposed in the sides of the car parks for ventilation etc, clearly these areas could become inundated fairly frequently.

Figure 5.4 Location of undercroft car park



5.2.17 It is therefore proposed to provide full height flood gates (or similar) across the apertures in the car park beneath Blocks A/B and Block C/D with a flood gate between this part of the car park and the part beneath Block E. This would effectively make the part of the car park beneath Blocks A/B and Block C/D water tight during a flood. The volume of this area is therefore not included in the flood plain compensation calculation.

5.2.18 The undercroft parking area beneath Block E is partially in Flood Zone 2 / 3 and partially within Flood Zone 1. This area would be allowed to flood, thereby maintaining the Flood Zone 2/3 area and in fact, providing some additional storage in this area.

5.2.19 To mitigate the risk to vehicles parked in this area, when a Flood Alert was issued, vehicles from this area of the car park would be moved either into the defended area or to higher ground away from the site.

5.2.20 The undercroft area will also be designed using resilient materials and design and ensuring access to all spaces for drying and cleaning.

Bridge

5.2.21 A bridge is proposed as part of the development to enable vehicular and pedestrian access from the south bank of the river to the north. This is a replacement to a bridge that was located at the site, which had a deck height of c. 148.5m aOD (2006 modelling report).

5.2.22 The deck of the new bridge will be approximately 400mm thick and has been set at 150.63m aOD, so the base of the deck is at the 1 in 100 year plus climate change level for this part of the site. This is some 2m higher than the original bridge.

5.2.23 Due to the size of the site, it is not possible to lift the bridge a further 600mm, as requested by the EA, to allow for accumulation of debris beneath the deck during a flood.

5.2.24 The bridge is of clear span construction and is 14m long and 7.3m wide.

5.2.25 There are two footbridge adjacent to the dam (level to be agreed), no other structures (buildings, culverts etc) are proposed across the river.

Exception Test

5.2.26 The proposed mitigation measures outlined above ensure the development is safe for its lifetime, without increasing flood risk elsewhere.

5.2.27 The second part of the Exception Test is therefore deemed to have been passed.

Flood Warning and Evacuation Plan

5.2.28 A Flood Warning and Evacuation Plan will be required for the site to demonstrate how the risks should be assessed and necessary actions before and during a flood event.

5.3 Surface Water Flood Risk

5.3.1 Most of the surface water flooding predicted on the site is coincident with the fluvial flooding and will be mitigated by the measures proposed for fluvial flooding.

5.3.2 Some overland flow is predicted to reach the north east of the site from the north. This will either need to be allowed to traverse the site in a similar manner to the current situation, or it will need to be accounted for and managed in the surface water drainage strategy.

5.3.3 Surface water generated on site will be managed by a new drainage system. The strategy for the surface water drainage has not been completed to date but will need to manage and restrict run-off to levels agreed with the LLFA / EA.

5.4 Groundwater Flood Risk

5.4.1 Whilst the site is located in an area where groundwater emergence may occur, should groundwater pool on the site, it will be managed by the fluvial and / or surface water control measures.

5.5 Infrastructure Flood Risk

5.5.1 Warnings of infrastructure failure would be issued by the EA in a similar manner to fluvial flood alerts or warnings. The Site Management should sign up to the EA system and follow their advice regarding evacuating the site in the unlikely event of this occurrence.

6 EA CONCERNS

6.1.1 A pre-application discussion was held with the EA and a summary of the discussion is provided in Appendix A.

6.1.2 The following contains information about how EA concerns not addressed in the previous section will be addressed.

6.2 Development Close to the River Bank

6.2.1 The EA have indicated that they require a 3m easement along both sides of the bank to enable access to the river for maintenance.

6.2.2 Block A/B is partially set back in excess of 3m from the northern bank, providing this access. Furthermore, a footpath is proposed between this block and the river, extending to between the mill pond and river. This will improve access to this area compared to the current situation.

6.2.3 Block E and the eastern part of Block A/B is located on the edge of the river, and due to access limitations to the north, cannot be moved 3m from the river. However, at ground level, there is an undercroft car park with aperture facing the river to allow access to the river. The river wall in this area would form part of the building's structure and so would be maintained by the site management.

6.2.4 The site was previously a mill with buildings located up to the river (Figure 6.1). Some of the buildings remained to approximately 10 years ago (as part of the approved scheme). Locating Block E and parts of Block A/B adjacent to the river therefore maintains this principle and a practice which is common in the area.

Figure 6.1 1888-1913 OS Six Inch Map

6.2.5 To the south of the river, a car park is proposed. This will provide the easiest access point to the river, including opposite Block E, as there are no buildings proposed in this area and it is closest to the vehicular access point for the site. The river is approximately 10m wide in this location so much of the river could be accessed from the southern bank.

6.2.6 At the southern end of the car park, a slipway is proposed to afford the EA easy access to the river.

6.2.7 Access is therefore available from both sides of the river but is restricted on parts of the northern side of the river. However, the development will improve access from the southern side of the river and provides a slipway so the EA can more easily access the river both upstream and downstream. The proposed development is therefore considered to improve access compared to the current situation.

7 CONCLUSIONS AND RECOMMENDATIONS

7.1.1 JNP Group has been commissioned by Eliston Homes Ltd. to prepare a Flood Risk Assessment for the proposed Prickleden Mill development in Holmfirth.

7.1.2 The site is a brownfield former mill site and is approximately 1.11 ha and is located to the west of the town centre of Holmfirth and spans the River Holm.

7.1.3 The nearest natural watercourse is the River Holm which flows through the site from west to east.

7.1.4 The proposed development comprises 61 age restricted apartments, external residents lounge, Managers office, residents and visitor parking, new bridge access and a riverside walkway.

7.1.5 The Flood Risk Assessment section of this report demonstrates that the risk of flooding from coastal and sewer sources is low.

7.1.6 Most of the site where development is planned is in Flood Zone 1. However, there is an area in the eastern part of the site predicted to be in Flood Zone 2 / 3. The mill pond is also predicted to be in Flood Zone 3 and parts of the land to the south of the river are in Flood Zone 2. The only parts of the development located in an area designated as Flood Zone 2/3 are parts of the eastern accommodation block (Block E), the access road to this accommodation block and parts of the car park to the south of the river.

7.1.7 To mitigate the fluvial flood risk, the following measures are proposed:

- Finished floor levels raised to 1 in 100 year plus climate change plus freeboard level for accommodation blocks;
- Residents lounge located in FZ1 area and further protected by wall on upstream side of development;
- Flood gates fitted to parts of the undercroft parking area to prevent this flooding;
- Dry access routes between the accommodation blocks and land to the north for the 1 in 100 year plus climate change flood;
- Flood plain loss is more than compensated for by flood plain gain, with gained volume in an area accessible to flood water and at a lower level, and therefore more frequently available;
- Bridge deck set c. 2m higher than the bridge formerly on site and at the 1 in 100 year plus climate change level;
- Recommendations to subscribe to the EA Flood Warning System.

7.1.8 As most of the development is located in the Flood Zone 1 area, the Sequential Test is deemed to have been passed.

7.1.9 The proposed mitigation measures ensure the development is safe for its lifetime, without increasing flood risk elsewhere. The second part of the Exception Test is therefore deemed to have been passed.

7.1.10 Most of the surface water flooding predicted on the site is coincident with the fluvial flooding and will be mitigated by the measures proposed for fluvial flooding. Overland flow predicted in the north east of the site will either need to be allowed to traverse the site in a similar manner to the current situation or it will need to be accounted for within the proposed surface water drainage strategy.

7.1.11 Surface water generated on site will be managed by a proposed drainage system. The strategy for the surface water drainage has not been completed to date but will need to restrict run-off to levels agreed with the LLFA / EA.

7.1.12 Whilst the site is located in an area where groundwater emergence may occur, should groundwater pool on the site, it will be managed by the fluvial and / or surface water control measures.

7.1.13 The site is in an area that would be impacted by dam failure upstream. In this unlikely event, warnings of infrastructure failure would be issued by the EA in a similar manner to fluvial flood alerts or warnings.

7.1.14 The EA have indicated that they require a 3m easement along both sides of the bank to enable access to the river for maintenance. This is achievable for most of the site but Block E and parts of Block A/B are located on the edge of the river. However, at ground level, there is an undercroft car part with aperture facing the river to allow access to the river. The river wall in this area would form part of the building's structure and so would be maintained by the site management. To the south of the river, a car park is proposed. This will provide the easiest access point to the river, as there are no buildings proposed in this area and it is closest to the vehicular access point for the site. The river is up to 10m wide in this location so much of the river could be accessed from the southern bank.

7.1.15 At the southern end of the car park, a slipway is proposed to improve EA access to the river, both upstream and downstream of the site.

7.1.16 This report is intended for the use of the developer of the site in support of their planning application for the site only.

8 LIMITATIONS

8.1.1 The information, conclusions and recommendations presented within this report are deemed to be current at the time of issue. No guarantee can be given to the status of this information other than at the time of issuing. Where necessary, the user shall confirm the status of any applicable assessments and consents.

8.1.2 This report has been commissioned by Eliston Homes Ltd. No third party may receive a copy of this report without first obtaining our permission in writing.

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APPENDIX A: EA CORRESPONDENCE

Sarah Longstaff
JNP Group
MBP2 Meadowhall Business Park
Carbrook Hall Road
Sheffield
S9 2EQ

Our ref: RA/2021/142855/01-L01
Your ref: N/A

Date: 08 April 2021

Dear Sarah

FRA ENQUIRY – PRICKLEDEN MILL

Thank you for your email enquiry sent to Frances Edwards on 26 February 2021, which has been passed to me to deal with as I cover the Kirklees Council area. Please accept my apologies for the delay in getting back to you.

I've discussed your enquiry with our Flood Risk Advisor Karen Robson, who I understand has discussed this proposal with you. Our advice and comments are as follows:

- The FRA should demonstrate that the development will not increase flood risk, and where possible, will reduce flood risk overall. Guidance on how to prepare a flood risk assessment can be found at https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications.

- As you identified in your email, most of the site is located within flood zone 1, however, there are some areas within flood zones 2 and 3. A sequential approach should be taken with development located in flood zone 1, and avoiding any 'more vulnerable' uses in flood zone 3.

- The risk of flooding from surface water maps (RoFSW) should be used to assess the surface water risk to the development, and for considering access and egress. You may wish to discuss this with the Flood Risk and Drainage Teams at Kirklees Council.

- The flood zones are based on the current topography of the site, if site levels are altered this may change the flood risk to the site. The FRA should demonstrate that there is no increased flood risk within the site, no alteration of existing overland flow routes, no transfer of flood risk to others and doesn't allow water into nearby watercourses.

- Existing and proposed topographic surveys (in mAOD) should be provided with an indication in cross sections of where site levels will be changed and by how much, in metres.

- We recommend overlaying the flood zones onto the site layout plans so it is clear to see which parts of the development are within flood zone 3.

- Compensatory storage is required for any land raising within flood zone 3 for any flood storage to the 1% plus climate change level.

- We advise finished floor levels for residential developments are raised to the higher of the highest recorded flood level, or the highest 1% annual exceedance probability (1 in 100) modelled level, plus climate change (using the most up to date climate change allowances), plus a further 600mm. As discussed with Karen, for more vulnerable development you should consider the 1% modelled levels with a 30-50% allowance for climate change, depending on the results of the 50% sensitivity check.

- The use of resilience measures, such as raising electrical sockets and other flood sensitive equipment above the flood level should be considered.

- A range of node points in the vicinity of the development, and those which most closely represent the flood risk to the site, should be used in the FRA. We will check on the progress of your data request to our C&E team.

- For areas of the site within flood zone 1 we expect finished floor levels to be above the 1% plus climate change, plus a further 600mm.

- The single storey lounge area is shown to be in flood zone 1 separated from other parts of the development with a wall proposed to protect it. We prefer to see finished floor levels raised to the required levels taking into account climate change, rather than building walls to protect the development because walls can alter existing flow routes and lead to a transfer of flood risk to others. The FRA needs to demonstrate no transfer of flood risk to others as a result of the development. Any wall would need to be built to the 1% plus climate change plus 600mm level and demonstrate a flood defence function. You indicated no gates are required.

- You indicated a wall is required around the lounge due to the flood risk from the mill dam and that the lounge is proposed to be cantilevered over the dam. We hold no information on the flood risk associated with the dam or mill pond. We suggest you discuss this further with the Flood Risk and Drainage Teams at Kirklees Council to see if they hold any further information on the flood risk associated with the Mill Dam.

- Could an internally accessed first floor place of safety be available to the lounge?

- We understand the ground floor of the residential buildings will be used for car parking only and with a proposed area of basement parking within flood zone 3. We suggest a sequential approach to locating any basements within the lower flood risk areas of the site. The definition of a basement from building regulations is “A storey with a floor which at some point is more than 1200mm below the highest level of ground adjacent to the outside walls”. A basement must have unimpeded access and be of waterproof construction to avoid seepage during flooding conditions. Habitable uses of basements within flood affected areas should not be permitted due to the potential dangers to life during a flood. Any room below adjacent ground level would fill up with water first in the

Cont/d..

event of flooding so should be treated with caution and an emergency plan should be produced for the event of a flood. The FRA needs to clarify whether this is a basement and if it would be classed as highly vulnerable.

- A bridge is proposed over the River Holme. We require details on the width and length of the bridge. The soffit level of any bridge over a main river would need to be above the 1% plus climate change level, plus a further 600mm, and be of a clear span construction. We require confirmation in the FRA submitted that there are no buildings or culverts proposed over main river.

- An Environmental Permit is required for any works on the site which are in close proximity to the main river (such as the bridge and buildings). We require a minimum 3 metre development easement from the River Holme to allow for access and maintenance to the river, and for any proposed future works (see further permit information below).

- The FRA needs to show that safe access / egress is provided for both the design flood and 1% probability flood, as well as making sure that future occupants will have the ability for safe evacuation before an extreme flood of 0.1% flood probability. Wherever possible, safe access routes should be provided that are located above design flood levels including climate change and avoiding flow paths (i.e. 'dry'). If 'dry' safe access/egress is not possible, the proposed routes can be 'wet' but must be 'safe'. This is defined by the UK flood hazard rating using the FD2320 methodology, calculated according to flood depth, velocity and likely debris factor.

- The FRA also needs to assess the flood hazard to the site and should assess the likely duration, depths, velocities and flood hazard rating against the design flood.

- We advise an Evacuation Plan is produced for the site in consultation with the Flood Risk and Emergency Planners at Kirklees Council, who will need to be satisfied that the development is appropriate with safe access/egress during a flood. We suggest the LPA consults the emergency planners/ services, about whether a 'safe' access/ egress can be achieved using a Flood warning and Evacuation Plan (FWEP).

Environmental permit - advice to applicant

The Environmental Permitting (England and Wales) Regulations 2016 require a permit to be obtained for any activities which will take place:

- on or within 8 metres of a main river (16 metres if tidal)
- on or within 8 metres of a flood defence structure or culvert (16 metres if tidal)
- on or within 16 metres of a sea defence
- involving quarrying or excavation within 16 metres of any main river, flood defence (including a remote defence) or culvert
- in a floodplain more than 8 metres from the river bank, culvert or flood defence structure (16 metres if it's a tidal main river) and you don't already have planning permission.

For further guidance please visit https://www.gov.uk/guidance/flood-risk-activities-environmental-permits or contact our National Customer Contact Centre on 03708 506 506. The applicant should not assume that a permit will automatically be forthcoming once planning permission has been granted, and we advise them to consult with us at the earliest opportunity.

Cont/d..

Should you wish us to review any technical documents or want further advice to address the environmental issues, we can do this however we would seek to recover our costs as part of our charged for service.

Further engagement at the pre-application stage will speed up our formal response to your planning application and provide you with certainty as to what our response to your planning application will be. It should also result in a better quality and more environmentally sensitive development. As part of our charged for service we will provide a dedicated project manager to act as a single point of contact to help resolve any problems.

We currently charge £100 plus VAT per officer per hour. We will provide you with an estimated cost for any further discussions or review of documents. The standard terms for our charged for service are available here.

Yours sincerely

Mrs Beverley Lambert
Sustainable Places - Planning Advisor

Direct dial 020 302 57982
Direct e-mail bev.lambert@environment-agency.gov.uk

Team phone 020 302 56862
Team e-mail sp-yorkshire@environment-agency.gov.uk

End

APPENDIX B: TOPOGRPAHICAL SURVEY

Notes

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Grid : OS National Grid.
Using the OS GPS Network and applying OSTN15 transformation and then removing the scale factor for true distances with a one-step transformation centred on *****

Datum : OS Level Datum.
Using the OS GPS Network and applying OSGM15 National Geoid Model to obtain local area corrections.

Station Listing

Station	Easting	Northing	Level
B1	413775.031	407909.350	150.357
B2	413837.322	407900.692	148.828
B3	413854.176	407964.303	151.140
B4	413853.800	407928.939	148.782
B5	413878.225	407967.790	149.392
H1	413774.924	407853.763	149.875
H2	413751.508	407846.785	149.909
H3	413728.278	407853.717	149.945
H4	413701.961	407859.826	149.923
H5	413671.820	407868.294	150.958
HR1	413797.295	407952.060	156.660
S1	413877.667	407993.069	153.505
S2	413823.737	407920.343	147.942
S3	413790.972	407869.987	149.932

KEY

AIR VALVE	AV	KERB OUTLET	KO
BENCH MARK	BM	LAMP POST	LP
BIN	BIN	MANHOLE (CIRCULAR)	MH
BOLLARD	BOL	MANHOLE (RECTANGULAR)	MH
BORE HOLE	BH	MANHOLE (TRIANGULAR)	MH
BRITISH TELECOM COVER	BT	MANNOR POST	MNR
BUS STOP	BUS	GULLY	GU
CABLE TV COVER	CATV	RODDING EYE	RE
CABLE TV SUPPLY	CA	SIGN POST	SIGN
COLUMN	COL	TELECOM COVER	TC
DROPPED KERB	DK	TELEGRAPH POLE	TP
EARTHING POINT	EP	THRESHOLD LEVEL	TA
ELECTRICITY COVER	ELEC	TRAFFIC LIGHT	TL
ELECTRICITY POLE	EP	TRIAL PIT	TP
FIRE HYDRANT	FH	WASH OUT	WO
GAS VALVE	GAS	WATER METER	WM
GATE	GATE	WATER STOP COCK	WSC
INSPECTION COVER (CIRCULAR)	IC	WATER STOP VALVE	WSV
INSPECTION COVER (RECTANGULAR)	IC		
COVER LEVEL	CL	CHAMBER BASE LEVEL	CLL
INVERT LEVEL	I.	WATER SURFACE LEVEL	WL
UNABLE TO RAISE	UTR	UNABLE TO MEASURE	UTM
GIRTH OF TREE TRUNK	G	DIAMETER OF TREE TRUNK	D
HEIGHT TO TOP OF TREE CANOPY	H	MULTI BOLT TREE	MB

Rev	Date	Drawn	Description	Check
-	--/--/----	--	--	--

Met GEO ENVIRONMENTAL
Southgate House
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Client
ACUMEN DESIGNERS & ARCHITECTS

Site
PRICKLEDON MILLS, WOODHEAD ROAD
HOLMFIRTH, HD9 2JU

Title
TOPOGRAPHICAL SURVEY

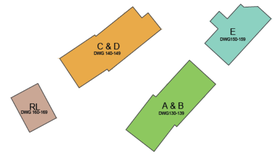
Surveyed	BH, HR	Drawn	BH, HR, MR
Check	DA	Date	09/10/2020
Scale 1:200	Job No P20-01038	Sheet Size A0	Rev 01

DWG Ref

Project Number	Origin	Zone	Level	Desc	Type	Role	Sheet
P20-01038	MET	EXT	XX	TOP	M2	G	001

APPENDIX C: PROPOSED DEVELOPMENT

PROPOSED SITE PLAN



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rev	description	drwn	auth	date

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DESIGNERS & ARCHITECTS
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Headrow House, Old Leeds Road, Huddersfield, HD1 1SG

Client
ELISTON HOMES

Project
PRICKLEDEN MILLS
HOLMFIRTH

Project No	Drawing No	Rev
2659	(100)10	/

Description
PROPOSED SITE PLAN

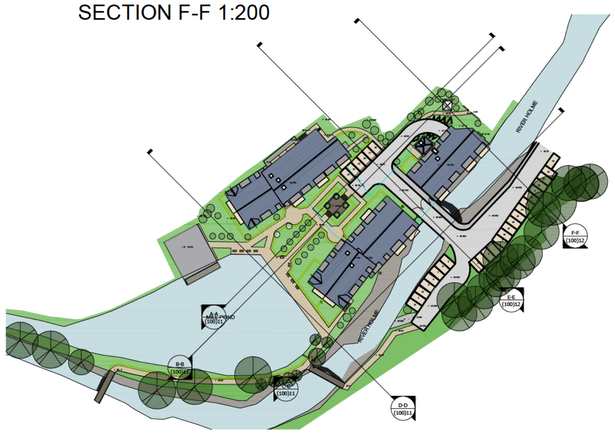
Scale	Date Drawn	Drawn By	Authorised By
1:500@ A1	APR'20	JF	JC

Purpose of Issue
Planning ● Building Regs ○ Tender ○ Construction ○ Comment ○ Info ○

SECTION D-D 1:200

SECTION E-E 1:200

SECTION F-F 1:200



SECTION LINE LOCATIONS

EXISTING GROUND LEVEL

PROPOSED GROUND LEVEL

Only figured dimensions should be used.

Scaled dimensions should be checked with the Architect.

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rev	description	drwn	auth	date

ACUMEN
DESIGNERS & ARCHITECTS
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Headrow House, Old Leeds Road, Huddersfield, HD1 1SG

Client
ELISTON HOMES

Project
PRICKLEDEN MILLS
HOLMFIRTH

Project No	Drawing No	Rev
2659	(100)12	/

Description
PROPOSED SITE SECTIONS
SHEET 2 OF 2

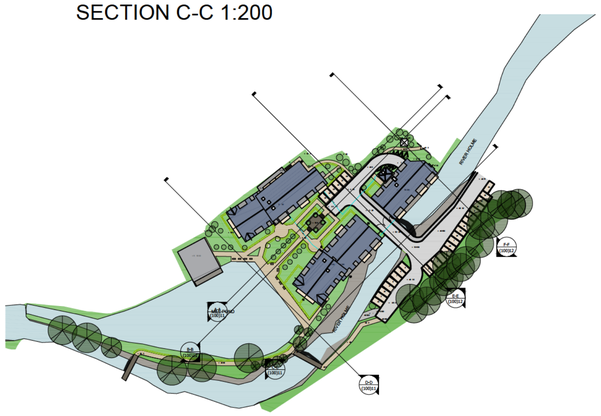
Scale	Date Drawn	Drawn By	Authorised By
1:100 @ A1	APR'21	JF	JC

Purpose of Issue
Planning ● Building Regs ○ Tender ○ Construction ○ Comment ○ Info ○

SECTION A-A 1:200

SECTION B-B 1:200

SECTION C-C 1:200



SECTION LINE LOCATIONS

EXISTING GROUND LEVEL

PROPOSED GROUND LEVEL

Only figured dimensions should be used.

Scaled dimensions should be checked with the Architect.

DO NOT SCALE OFF THIS DRAWING

rev	description	drwn	auth	date

ACUMEN
DESIGNERS & ARCHITECTS
acumenarchitects.co.uk 01484 546 000
Headrow House, Old Leeds Road, Huddersfield, HD1 1SG

Client
ELISTON HOMES

Project
PRICKLEDEN MILLS
HOLMFIRTH

Project No	Drawing No	Rev
2659	(100)11	/

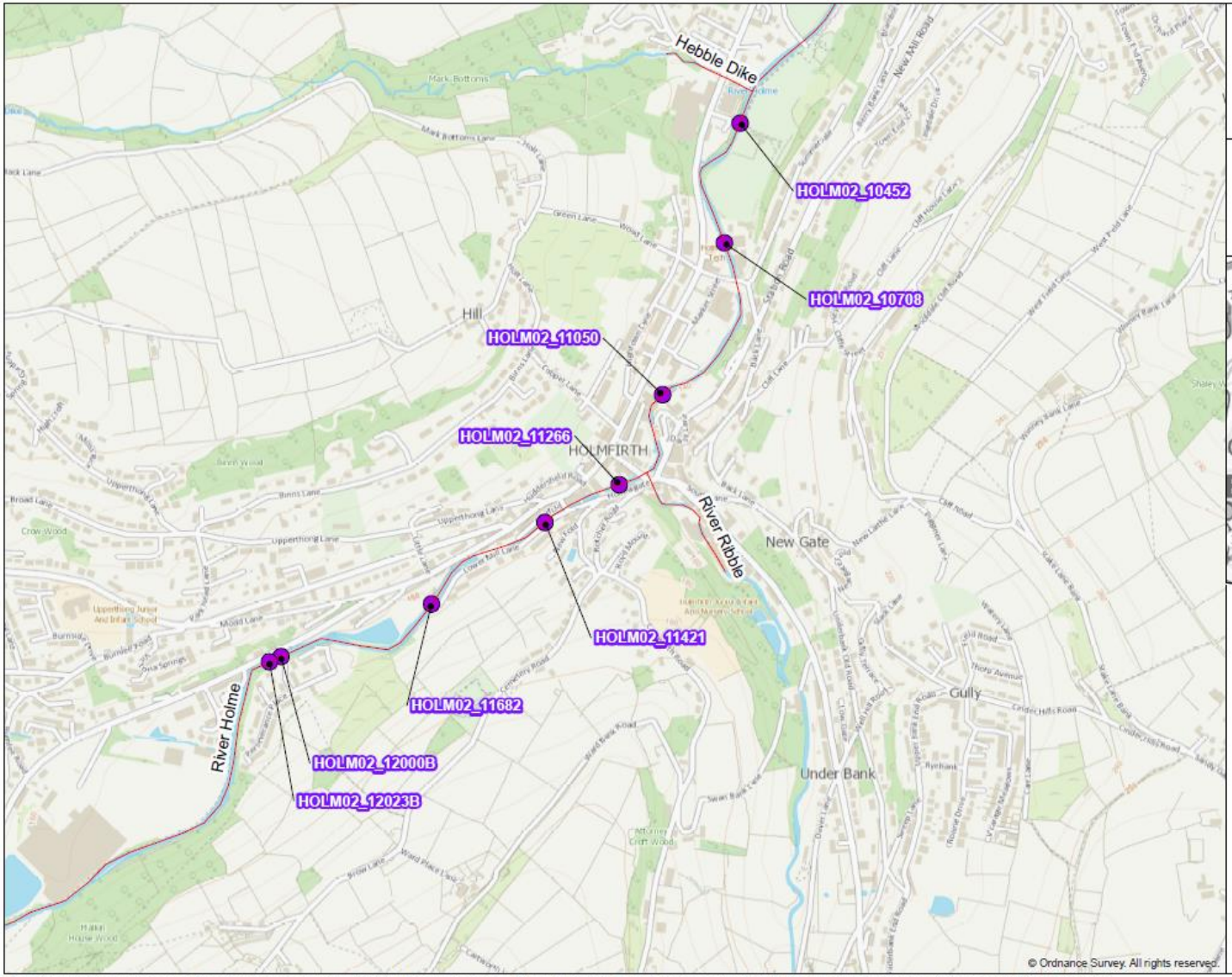
Description
PROPOSED SITE SECTIONS
SHEET 1 OF 2

Scale	Date Drawn	Drawn By	Authorised By
1:200@ A1	FEB'21	JF	JC

Purpose of Issue
Planning ● Building Regs ○ Tender ○ Construction ○ Comment ○ Info ○

APPENDIX D: EA DATA

RFI/202931 Modelled Flood Level Node Point Location Map



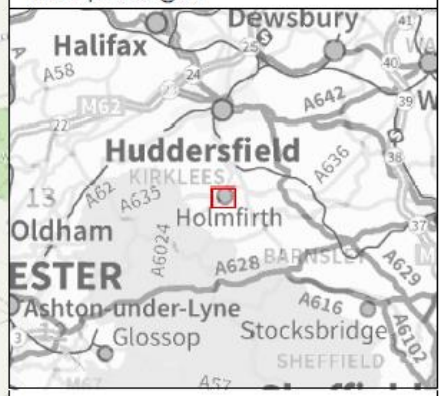
Environment Agency

www.environment-agency.gov.uk

Scale: 1:7,000

when reproduced @ A3

N W E S



LEGEND

Main River

2010 ASM Colne and Holme Node Points

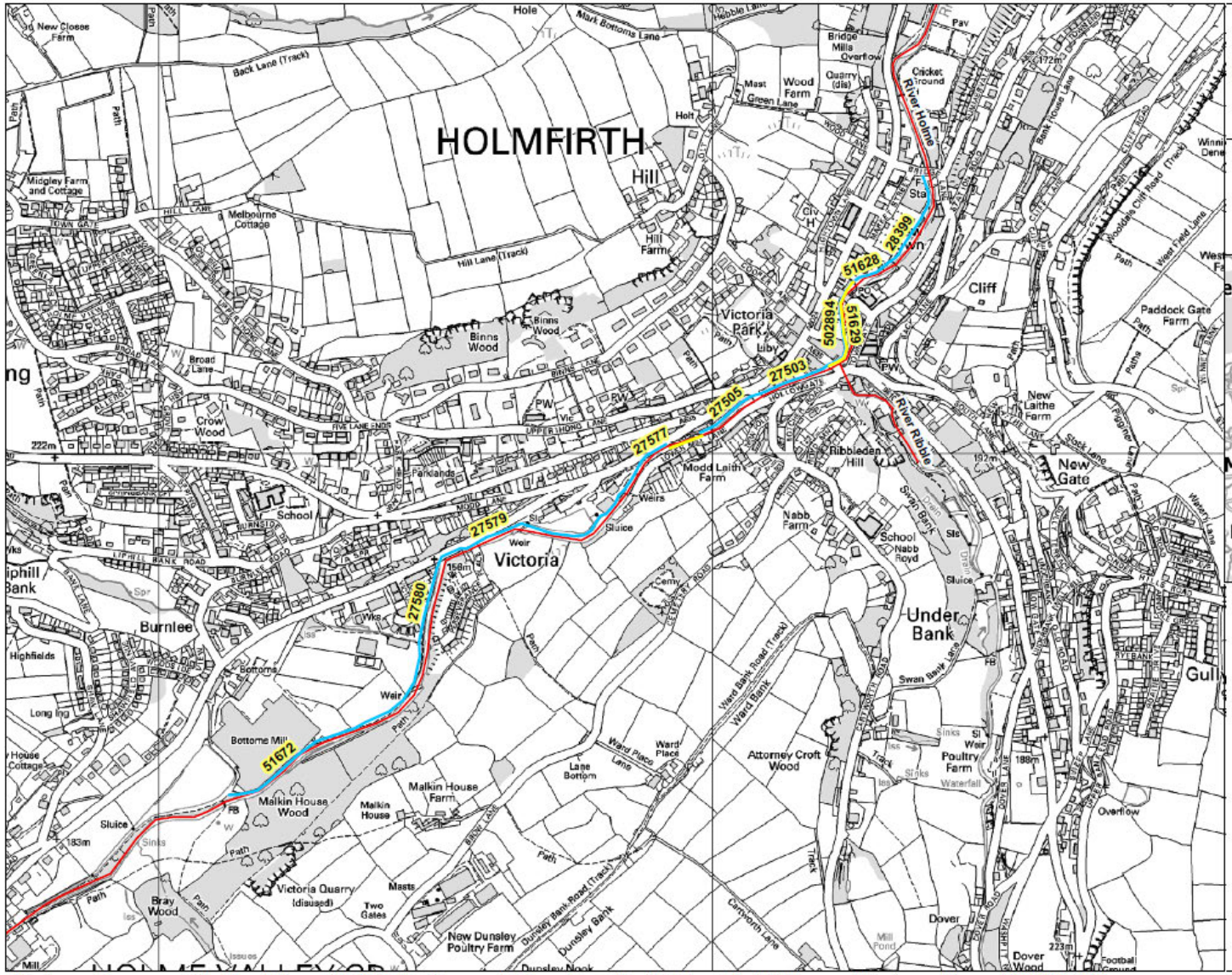
RFI/202931 2010 ASM Colne and Holme Undefended Model Results (Level – mAOD; Flow – m3/s)

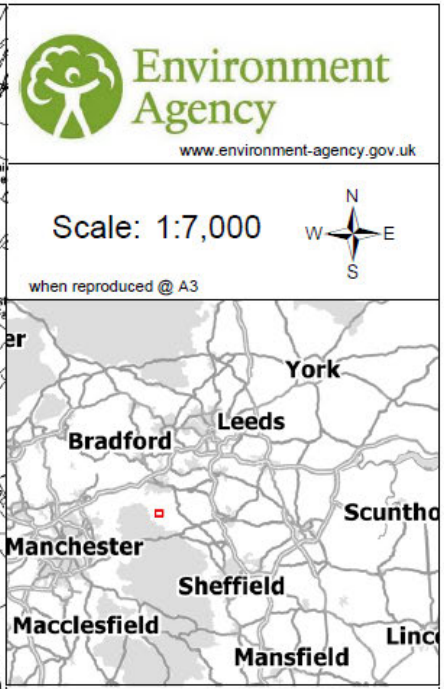
Node Point	Annual Exceedance Probability (AEP)									
	10% AEP (1 in 10)		4% AEP (1 in 25)		2% AEP (1 in 50)		1.33% AEP (1 in 75)		1% AEP (1 in 100)	
	Max Stage	Max Flow	Max Stage	Max Flow	Max Stage	Max Flow	Max Stage	Max Flow	Max Stage	Max Flow
HOLM02_10452	133.09	45.92	133.40	56.99	133.48	66.77	133.58	72.43	133.64	75.66
HOLM02_10708	135.40	45.92	135.65	56.98	135.86	66.77	135.98	72.43	136.04	75.67
HOLM02_11050	139.83	45.92	140.06	56.98	140.25	66.76	140.35	72.43	140.40	75.69
HOLM02_11266	142.39	40.05	142.65	50.84	142.88	60.32	143.01	65.59	143.35	68.88
HOLM02_11421	144.53	40.04	144.88	50.84	145.27	60.33	145.73	65.60	146.19	68.63
HOLM02_11682	147.63	40.05	148.10	50.86	148.44	60.34	148.64	65.64	148.78	68.94
HOLM02d12000	151.04	40.05	151.19	50.87	151.33	60.36	151.39	65.64	151.43	68.99
HOLM02d12023	151.35	40.05	151.63	50.87	151.89	60.36	152.02	65.64	152.11	68.99

RFI/202931 2010 ASM Colne and Holme Defended Model Results (Level – mAOD; Flow – m3/s)

Node Point	2010 model										2005 Model	
	Annual Exceedance Probability (AEP)											
	10% AEP (1 in 10)		4% AEP (1 in 25)		2% AEP (1 in 50)		1.33% AEP (1 in 75)		1% AEP (1 in 100)		0.1% AEP (1 in 1000)	
	Max Stage	Max Flow	Max Stage	Max Flow	Max Stage	Max Flow	Max Stage	Max Flow	Max Stage	Max Flow	Max Stage	Max Flow
HOLM02_10452	133.10	46.06	133.40	57.01	133.48	66.74	133.58	72.38	133.64	75.69	133.84	95.30
HOLM02_10708	135.41	46.06	135.65	57.01	135.86	66.76	135.97	72.38	136.04	75.70	136.40	95.30
HOLM02_11050	139.83	46.06	140.06	57.01	140.25	66.77	140.35	72.39	140.40	75.72	140.69	95.30
HOLM02_11266	142.35	40.24	142.62	50.91	142.84	60.34	142.96	65.55	143.03	68.84	143.49	81.70
HOLM02_11421	144.38	40.24	144.71	50.92	145.03	60.34	145.24	65.55	145.44	68.85	146.81	81.70
HOLM02_11682	147.64	40.25	147.91	50.93	148.13	60.34	148.26	65.56	148.34	68.87	0.00	0.00
HOLM02d12000	151.04	40.25	151.20	50.93	151.33	60.35	151.39	65.56	151.43	68.89	0.00	0.00
HOLM02d12023	151.35	40.25	151.63	50.92	151.89	60.35	152.02	65.56	152.11	68.89	0.00	0.00

RFI/202931 Flood Defence Asset Location Map





Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

RFI/202931 Flood Defence Details

ASSET_ID	DESCRIPTI	ASSET_MAIN	AIMS_SUB_T	LENGTH	ACTUAL_DCL	ACTUAL_UCL	PROTECTION	TARGET_CON	OVERALL_CO	DESIGN_SOP
27579		private	high_ground	326.20	0.00	0.00	fluvial	3	3	0
51671		private	high_ground	10.90	0.00	0.00	fluvial	3	2	0
27577		private	high_ground	118.00	0.00	0.00	fluvial	3	3	0
27505		private	high_ground	112.04	0.00	0.00	fluvial	3	3	0
27504		private	high_ground	21.19	0.00	0.00	fluvial	3	2	0
27503		private	high_ground	130.11	0.00	0.00	fluvial	3	3	0
72214		private	high_ground	18.72	0.00	0.00	fluvial	3	2	0
51629		private	high_ground	158.05	0.00	0.00	fluvial	3	2	0
51628		private	high_ground	68.41	0.00	0.00	fluvial	3	3	0
28400		private	high_ground	16.95	0.00	0.00	fluvial	3	2	0
51672		private	high_ground	404.87	0.00	0.00	fluvial	3	3	0
27580		private	high_ground	271.26	0.00	0.00	fluvial	3	3	0
27578		private	high_ground	11.28	0.00	0.00	fluvial	3	3	0
28399		private	high_ground	167.77	0.000	0.000	fluvial	3	2	0
51630		private	simple_culvert	62.44	N/a	N/a	private	3	3	
502894	Culvert	unknown	simple_culvert	177.25	N/a	N/a	unknown	3	2	

The Flood Map for Planning

The Flood Map for Planning (Rivers and Sea) can be viewed and downloaded as a PDF file on GOV.UK by following this link: https://flood-map-for-planning.service.gov.uk **or downloaded in GIS format under an open data licence from the following address**: https://data.gov.uk/publisher/environment-agency
Please type Flood Map for Planning in the search box.

What is the Flood Map for Planning?

The Flood Map for Planning provides information on flooding from rivers and the sea for England and Wales. The Flood Map also has information on flood defences and the areas benefiting from those flood defences.

The Flood Map for Planning shows the following:

1. Flood Zone 3 (dark blue area on the enclosed map): natural flood plain area that could be affected by flooding from rivers and/or the sea – not taking into account the presence of any flood defences
   - For flooding from rivers the map indicates the extent of a flood with a 1% (1 in 100) chance of happening each year;
   - For flooding from the sea the map shows the extent of a flood with a 0.5% (1 in 200) chance of happening each year.

2. Flood Zone 2 (light blue area): natural flood plain area that could be affected by flooding from rivers and/or the sea – not taking into account the presence of any flood defences. Flood Zone 2:
   - indicates the extent of a flood with a 0.1% (1 in 1000) chance of happening each year.
   - and/or indicates the greatest recorded historic flood, whichever is greater.

3. Flood defences built in the last five years to protect against river floods with a 1% (1 in 100) chance of happening each year, together with some natural or constructed entities which retain, store or channel water and which may protect against smaller floods.

4. Areas benefiting from flood defences - areas that benefit from the flood defences shown, in the event of a river flood with a 1% (1 in 100) chance of happening each year, or a flood from the sea with a 0.5% (1 in 200) chance of happening each year. If the defences were not there, these areas would flood.

Flood History

Flood History – None available

To the best of our knowledge there is no known flood history for this site. Other flooding may have occurred which is not shown. This is the best information currently available. For local drainage information please contact your water utility company and your local council.

Water causing flooding can come from different places, for example from rivers or the sea; surface water (i.e. rainwater flowing over or accumulating on the ground before it is able to enter rivers or the drainage system); overflowing or backing up of sewers or drainage systems which have been overwhelmed or from groundwater rising up from underground aquifers.

Please note that this record doesn't include any flood extents that may have occurred since 31st December 2020. Given the process of recording, verifying and updating our record from major floods is extensive and may take a considerable amount of time.

Assets

Asset Location Map

Please find attached asset map(s) showing location of all (Agency and non Agency maintained) flood defences and channels.

Description of Works

See attached table with description of the defences and structures shown on the above drawing, including condition ratings, upstream and downstream crest levels, where available.

Risk of Flooding – Environment Agency Defences

The risk of flooding in this area is now reduced by the presence of flood defences that we maintain, but there still is a residual risk of flooding if these were to breach or be overtopped by a flood greater than that for which they were designed.

Risk of Flooding – Privately Maintained Defences

You will see that the Environment Agency does not maintain any of those defences. However we undertake regular risk based visual inspections. We do not hold design levels and have no height information on these defences or structures.

Asset Condition Ratings
The performance of a flood defence asset is recorded as the condition of the asset. Our asset inspectors subjectively assess the conditions of assets (during visual inspection site visits) with reference to a national standard template. Each asset is given a rating between one and five with one being very good condition and five being very poor. A condition rating of 3, or 'fair' is the minimal acceptable standard for a critical asset, such as a defence wall that protects properties. We are striving to improve all assets below 'fair' to an acceptable standard.

Asset inspections are done on average every six months, although some critical assets are assessed on a more regular basis. It is possible that adjacent assets are inspected on different dates, which may result in two assets of a similar state of repair having different condition ratings.

Condition ratings of assets may also be affected by the time of year the surveys are conducted, as vegetation may obscure the asset in the summer months, or accessibility may be an issue during winter months. These factors would not usually affect the recorded condition rating of an asset unless the asset is on a borderline between two ratings.

Asset Standard of Protection
Please note that the provided Design Standard of Protection is an estimate and should not be relied on. Please note that where available the defended flood extents provide more reliable information relating to the protection offered by the defence (i.e. at which return period the water levels are likely to overtop the defence). If available and required the defended flood extents can be provided on request.

Modelling

River Colne & Holme - Flood Modelling
The River Colne & Holme Flood Mapping Study, Flood Estimation, Modelling and Floodplain Mapping report was produced by Jeremy Ben Associates in March 2006. It was updated in 2010 to incorporate bank level data surveyed in 2009.

See enclosed:

- Model Nodes Location Map.
- Table showing modelled water levels and flows for the 1% (1 in 100), 1.3% (1 in 75), 2% (1 in 50), 4% (1 in 25) and 10% (1 in 10) Annual Exceedance Probabilities (AEP).
- Model Summary Sheets showing the results for the 0.1% Annual Exceedance Probabilities (AEP), as calculated in 2006. These were not updated in 2010.

Please note there are no depth grids currently available for this model.

Please note no breach scenarios were modelled for this study.

Climate Change

Updated guidance on how climate change could affect flood risk to new development - 'Flood risk assessments: climate change allowances' was published on gov.uk on 19 February 2016. You should confirm the flood risk vulnerability classification and lifetime of your proposed development in line with NPPF and apply the appropriate climate change allowances.

Bespoke Flood Risk Assessment (FRA) advice:

If the pre-application advice is required with regards the preparation of a site-specific Flood Risk Assessment, this can be requested via the Yorkshire Sustainable Places team (email: sp-yorkshire@environment-agency.gov.uk). Charges may apply for any advice that is provided, this currently stands at £100 per hour per person. The .gov.uk pages provide a good starting point on what to include within a site-specific Flood Risk Assessment and can be accessed via https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications. A site-specific Flood Risk Assessment will need to consider flood risks from all sources, including those associated with defence failure (e.g. breach) and accounting for the predicted impacts as a result of climate change. Please contact the Sustainable Places team if you require advice on how to include these within a Flood Risk Assessment.

Other

Surface Water Map

Lead Local Flood Authorities (LLFA) are responsible for managing local flood risk from surface water flooding and groundwater flooding. You should check with the LLFA as they may have more up to date information regarding this type of flooding.

The Risk of Flooding from Surface Water Flood Map can be viewed and downloaded as a PDF file on GOV.UK by following this link: https://flood-warning-information.service.gov.uk/long-term-flood-risk

Surface Water Drainage

The Lead Local Flood Authority is the statutory consultee for planning matters relating to surface water drainage, therefore it is recommended they should be consulted separately regarding this.

Surface water discharge from new development should ideally ‘mimic’ the pre-development situation using a sustainable drainage system so that the flow and volume of water in watercourses is not increased.

A permit may be required, under the Environmental Permitting Regulations 2016 from the Environment Agency for any proposed works or structures in, under, over or within eight metres of a ‘main river’ (e.g. a new outfall). A permit is separate to and in addition to any planning permission granted. Further details and guidance are available on the GOV.UK website: https://www.gov.uk/guidance/flood-risk-activities-environmental-permits

Risk of Flooding from Reservoirs Map

Outlines and simplified depth and velocity maps can be viewed on our website:

https://flood-warning-information.service.gov.uk/long-term-flood-risk/#x=438988&y=406600&scale=2

Please, zoom into the location of interest, and then click on the inundated location for details. As a result a list of reservoirs will be provided with supporting information and a links to other data, such as estimated depths and speed of flooding, at the bottom of the result page.

A map showing the outlines can also be provided on request.

Flood Warning

The site is covered by a Flood Warning. To register to receive this service, you can call Floodline 24 hours a day on 0845 988 1188.

LIDAR Data

Please note that our LiDAR data is now available free of charge (Open Data) from http://environment.data.gov.uk/ds/survey/index.jsp#/survey (once zoomed to the relevant location the available LiDAR products will be listed below the map).

Two LIDAR products are available:

1. Tiled LIDAR data - The full tiled dataset consists of historic LIDAR data which has been gathered since 1998. For some areas we have carried out repeat surveys and data is available in a range of resolutions.

2. Composite LIDAR data - The composite dataset is derived from a combination of our full tiled dataset which has been merged and re-sampled to give the best possible spatial coverage.

Light Detection and Ranging (LIDAR) is an airborne mapping technique, which uses a laser to measure the distance between the aircraft and the ground. This technique results in the production of an accurate, cost-effective terrain model suitable for assessing flood risk and other environmental applications.

The Environment Agency owns two LIDAR systems, which are installed in a survey aircraft along with its other operational remote sensing instruments.

The aircraft is positioned and navigated using Global Positioning System (GPS) corrected to known ground reference points. The aircraft typically flies at a height of about 800 metres above ground level and a scanning mirror allows a swath width of about 600 metres to be surveyed during a flight.

The Rights & Responsibilities of a Riverside Owner

The owner of property adjacent to a watercourse is usually deemed to be the riparian owner and, as such, has both riparian rights and responsibilities with regard to the watercourse within their ownership.

For more information on Rights and Responsibilities of a riverside owner, you can visit our website at:

https://www.gov.uk/guidance/owning-a-watercourse

Ordnance Survey Data

Under the terms of our licence agreement with the Ordnance Survey, we are unable to supply the OS data. Under this agreement we can only supply OS data to consultants/contractors carrying out work on our behalf.

2010 Colne and Holme Model Results RFI: 79420

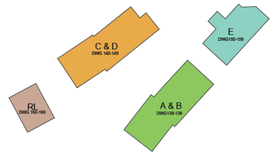
Defended	2010 model										2005 Model	
Label	10 Year		25 Year		50 Year		75 year		100 Year		1000 Year	
	10% annual probability		4% annual probability		2% annual probability		1.33% annual		1% annual probability		0.1% annual probability	
	Max Stage	Max Flow	Max Stage	Max Flow	Max Stage	Max Flow	Max Stage	Max Flow	Max Stage	Max Flow	Max Stage	Max Flow
HOLM02b10633	134.72	46.06	134.99	57.01	135.20	66.75	135.32	72.38	135.39	75.70	135.76	95.30
HOLM02b10970	139.15	46.06	139.38	57.01	139.58	66.76	139.68	72.38	139.74	75.72	140.10	95.30
HOLM02_11376	144.22	40.24	144.58	50.92	144.93	60.34	145.16	65.54	145.39	68.85	0.00	0.00
HOLM02_11560	145.64	40.24	146.03	50.92	146.35	60.34	146.62	65.55	146.82	68.86	147.80	81.70
HOLM02_11682	147.64	40.25	147.91	50.93	148.13	60.34	148.26	65.56	148.34	68.87	0.00	0.00
HOLM02_11910	150.56	40.25	150.75	50.93	150.91	60.35	151.00	65.56	151.05	68.89	0.00	0.00
HOLM02_12114	152.17	40.25	152.49	50.92	152.76	60.35	152.91	65.55	153.00	68.88	153.33	81.70
HOLM02_12384	156.19	39.32	156.30	50.00	156.36	59.42	156.40	64.63	156.42	67.96	156.48	80.40
HOLM02_12833	160.81	39.32	161.11	50.00	161.36	59.43	161.47	64.63	161.55	67.95	161.81	80.40
HOLM02_13212	166.12	39.33	166.73	50.01	167.37	59.42	167.80	64.64	168.10	67.96	0.00	0.00

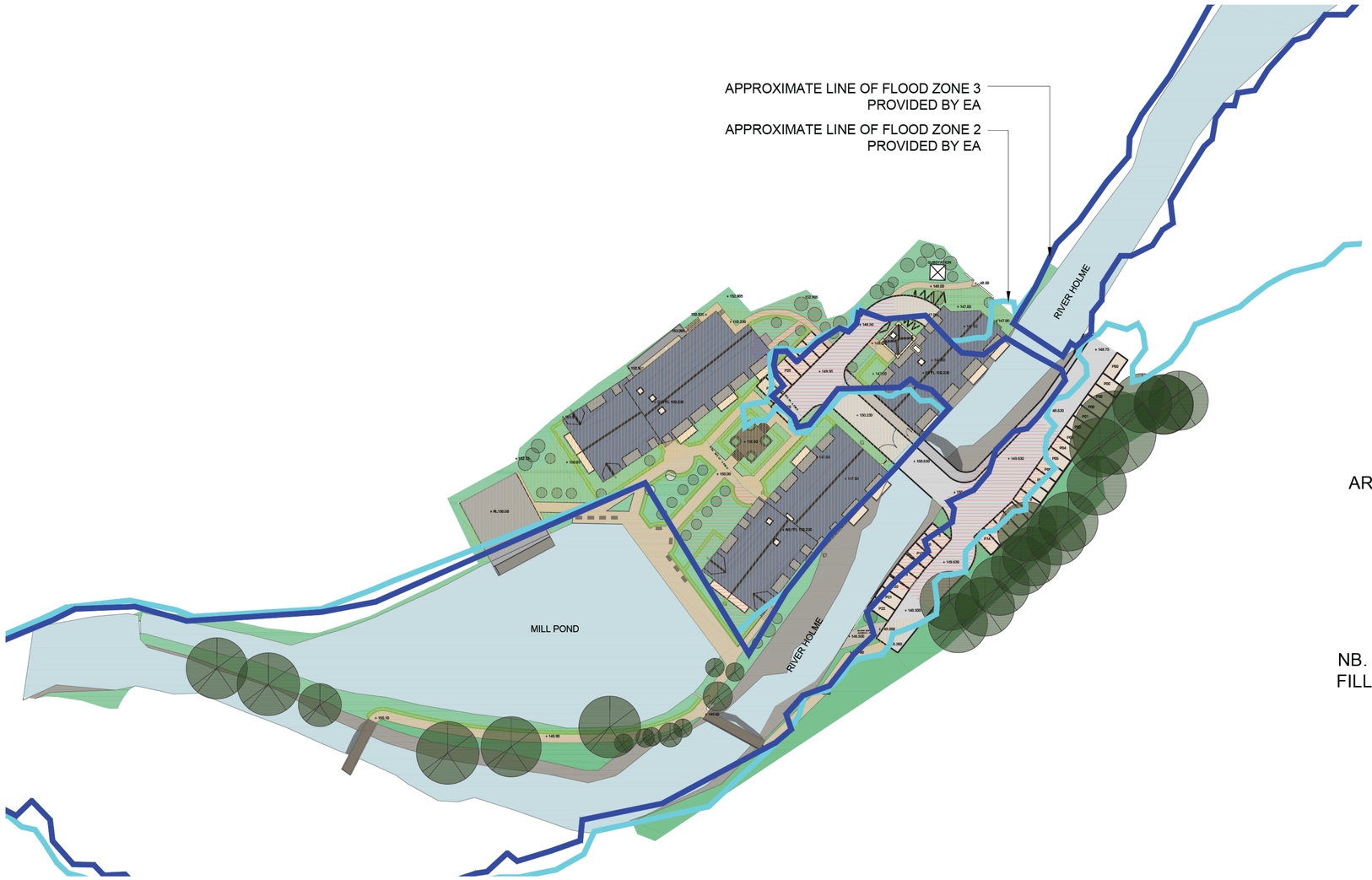
Undefended	2010 model									
Label	10 Year		25 Year		50 Year		75 year		100 Year	
	10% annual probability		4% annual probability		2% annual probability		1.33% annual		1% annual probability	
	Max Stage	Max Flow	Max Stage	Max Flow	Max Stage	Max Flow	Max Stage	Max Flow	Max Stage	Max Flow
HOLM02b10633	134.72	45.92	134.99	56.98	135.20	66.77	135.32	72.43	135.39	75.67
HOLM02b10970	139.15	45.92	139.38	56.98	139.58	66.76	139.69	72.43	139.74	75.69
HOLM02_11376	144.43	40.05	144.79	50.84	145.22	60.32	145.70	65.60	146.15	68.64
HOLM02_11560	146.19	40.05	147.18	50.85	147.79	60.33	148.02	65.61	148.17	68.78
HOLM02_11682	147.63	40.05	148.10	50.86	148.44	60.34	148.64	65.64	148.78	68.94
HOLM02_11910	150.56	40.05	150.75	50.87	150.91	60.35	151.00	65.64	151.05	68.99
HOLM02_12114	152.17	40.05	152.49	50.87	152.76	60.36	152.91	65.65	153.00	69.00
HOLM02_12384	156.19	39.12	156.30	49.94	156.36	59.42	156.40	64.72	156.43	68.06
HOLM02_12833	160.81	39.12	161.11	49.94	161.36	59.43	161.48	64.73	161.55	69.74
HOLM02_13212	166.10	39.12	166.73	49.93	167.37	59.43	167.81	64.73	168.11	68.08

n.b: There are no 100yr results for the undefended scenario available.

APPENDIX E: REGRESSION ANALYSIS

APPENDIX F: FLOOD PLAIN COMPENSATION





AREA OF EXCAVATION

AREA OF FILL

NB. AREAS WITH NO EXCAVATION OR FILL HATCH ARE MAINTAINED LEVELS

PROPOSED EXCAVATION & FILL PLAN

DO NOT SCALE OFF THIS DRAWING

rev	description	drwn	auth	date

ACUMEN
DESIGNERS & ARCHITECTS
acumenarchitects.co.uk 01484 546 000
Headrow House, Old Leeds Road, Huddersfield, HD1 1SG

Client
ELISTON HOMES

Project
PRICKLEDEN MILLS
HOLMFIRTH

Project No	Drawing No	Rev
2659	(100)19	/

Description
PROPOSED EXCAVATION & FILL PLAN

Scale	Date Drawn	Drawn By	Authorised By
1:500@ A1	APR'21	JF	JC

N:\Acc2\Acumen Arch\Clients\Eliston\2659\Mill Dyke Publication\DWG\02-PLOTTER\Planning\Issued\19.dwg

Purpose of Issue
Planning ● Building Regs ○ Tender ○ Construction ○ Comment ○ Info ○

ACUMEN
DESIGNERS & ARCHITECTS

2659 Prickleden Mills Compensatory Flood Zone Calculation

Elevation (M AOD)	Volume Lost From Dam Infill (M3)	Volume lost from FZ 3 (M3)	Volume Gained from Undercroft E (M3)	Volume Gained from Slipway (M3)	Volume Gained fromgeneral on site cut (M3)	Cut / fill balance (M3)
147.000-147.249	0	0	130	3.75	8.25	142
147.250-147.499	0	0	120.5	3.75	11.75	136
147.500-147.749	0	0	69.75	3.75	13.25	86.75
147.750-147.999	0	28.25	41.25	3.75	19	35.75
148.000-148.249	0	38.75	15.25	3.75	0	-19.75
148.250-148.499	0	60.75	5.5	7.5	0	-47.75
148.500-148.749	0	57	0	0	0	-57
148.750-148.999	0	51.75	0	0	0	-51.75
149.000-149.249	0	49	0	0	0	-49
149.250-149.499	0	37.5	0	0	0	-37.5
149.500-149.749	0	20.5	0	0	0	-20.5
149.750-149.999	65	27.5	0	0		-92.5
150.000-150.249	65	5.5	0	0	68.25	-2.25
150.250-150.499	0	4.5	0	0	24.75	20.25
150.500-150.749	0	2.35	0	0	7.75	5.4
150.750-150.999	0	0	0	0	7.75	7.75
151.000-151.249	0	0	0	0	7.5	7.5
151.250-151.499	0	0	0	0	7.5	7.5
Total	**130**	**383.35**	**382.25**	**26.25**	**175.75**	**70.9**

Overall Net Gain M3 70.9


JNP GROUP
CONSULTING ENGINEERS