



Civil | Structural | Rail | Transportation

Bury Council

**FLOOD RISK ASSESSMENT**  
**for MILLTOWN STREET CYCLE BRIDGE REPLACEMENT CROSSING**  
660-024-FRA-0



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## **1.0 Purpose of Report**

- 1.1 The existing Milltown Street Footbridge comprised a two-span structure over the River Irwell, which provided pedestrian access between Rectory Lane and Milltown Street, Radcliffe. The structure spanned from north-west to south-east.

The bridge that was extensively damaged during high river levels on the 26th December 2015. Since this time the bridge has been closed to the public and one of the spans has been removed in the interest of safety.

Bury Council are proposing to construct a replacement pedestrian/cycle bridge, to be located a short distance to the north-east of the existing structure.

- 1.2 In support of a planning application, Wilde Consultants have been commissioned by Bury Council to carry out a Flood Risk Assessment (FRA), in respect of the proposed replacement bridge.
- 1.3 The focus of the Flood Risk Assessment will be to confirm that 600mm freeboard is provided above the 0.1% AEP event to the underside of the new bridge structure and that the proposed abutment locations are not unduly impacting on flood risk. The assessment will also give consideration to flood risk from other sources, which could impact on the proposals or the immediate surrounding area.
- 1.4 This report is for the private use of the client for whom it has been prepared and should not be relied upon by third parties for any use whatsoever without the written authority of a director of Wilde Consultants Ltd.

## **2.0 Site Location**

- 2.1 The existing bridge structure (Structure No. B02/142), which links between Rectory Lane (to the north-west) and Milltown Street (to the south-east), is located in Radcliffe, approximately three miles to the south-west of Bury Centre.

The location of the existing footbridge is detailed on drawing 660-019-LP01 – 'Location Plan', which is included in Appendix A.

The proposed replacement bridge, is to be located approximately 10m upstream of the existing structure (ie to the north-east). As before the bridge will span from north-west to south-east over the River Irwell

The location of the new bridge, relative to the existing bridge structure, is indicated on drawing B142/21/LoW – 'Limit of Works', which is included in Appendix A.

The National Grid reference for the proposed new bridge structure is 379110E, 407240N. The nearest postcode is M26 1WN. Further location plans, and aerial imagery are also included in Appendix A.

Beyond the north-western bank-seat is Rectory Lane, to either side of which is open space, with commercial units and residential properties located of Rectory Lane further to the north-west. Beyond the south-eastern bank seat are commercial premises, including Pioneer Mills to the SE.

### **3.0 Existing Site Area (Topography, Archive, Drainage & Geology)**

3.1 For the purpose of this report the structure will be described as running north to south.

#### **3.2 Topographic**

3.2.1 A topographic survey (160319/TOP/A) of the study area was undertaken by GJ Brookes Ltd and is included in Appendix **B**. The survey indicates the remaining span of the existing river crossing, other pertinent features and the existing levels of the river bank in the vicinity of both the existing and replacement bridge crossings.

#### **3.2.2 *Northern Abutment***

- The survey identifies that existing ground levels at the northern bridge abutment is at circa 62.00mAOD
- The outfall to an existing culvert is identified below this location.
- To the east of Rectory Lane, the ground rises up to an elevation of circa 64.40mAOD, which is the location of the proposed abutment (ie 2.2m higher). The new abutment will be supported above an existing masonry retaining wall.

#### ***Intermediate Pier***

- The top of the remaining intermediate pier, onto which the remaining span is supported, is at an elevation of 62.20mAOD, with the bridge deck at 62.400m

#### ***Southern Abutment***

- The survey identifies that the bridge deck at the southern bridge abutment was set at a level of circa 62.40mAOD.
- Beyond the bridge abutment, the paved approach falls away to the south, with the level of Rectory Lane immediately adjacent Pioneer Mills recorded as circa 61.70m (ie 0.7m lower).
- The level of the adjacent land (to the NE), onto which it is proposed to locate the new abutment is circa 64.400mAOD (ie 2.0m higher).

3.2.3 At the location of the replacement crossing:

- On the northern bank, the top of the existing retaining is at is circa 64.90mAOD, with the level at the river's edge being in the order of 60.1mAOD (at time of survey).
- The top of the river bank on the southern side is at circa 64.30mAOD, with the banking falling to 58.80mAOD at the river's edge (at time of survey). A short distance beyond the top of the southern bank is a small retaining wall of max 1.5m height, with the hardstanding beyond at circa 62.70m.

#### **3.3 Archive Drawings of Existing Bridge**

3.3.1 Archive drawings of the existing bridge structure are included in Appendix **C**. These confirm the existing Milltown Street Footbridge to be a two-span trussed steel structure.

The intermediate support pier is located centrally, with the bridge spans to either side each being circa 23m long, with a 1.8m clear deck width.

The northern and southern abutments, as well as the intermediate support pier are constructed of masonry. The intermediate masonry pier is located within the watercourse and orientated in the direction of flow.

The centreline of the existing footbridge above the northern abutment, is identified as being located above the outfall to an existing culvert. A radius wingwall is evident, immediately to the east of the culvert opening.

### 3.4 Geological

The Geotechnical Report dated April 2019 by GroundSolve Ltd confirms the following:

- 3.4.1 Reference to British Geological Survey Mapping confirms that the superficial deposits below both the existing bridge and proposed replacement bridge locations, are comprised of Alluvium (Clay, Silt, Sand and Gravel), with Glacial Sheet Deposits (Sand and Gravel) either side of the alluvium to the north and south of the river. The Bedrock Geology throughout, comprises Nob End Rock (Sandstone).
- 3.4.2 Reference to historical mapping from 1890 identifies a stream discharging to the Irwell from the north. Later plans identify that the stream was culverted by 1929, with Mills constructed to either side.
- 3.4.3 On the southern side of the river, at the location of the existing footbridge, medium dense sand and gravel was encountered at a depth of 2.0m, with bedrock encountered at 4.95m. Limited access precluded investigations at the location of the proposed abutment, however as levels are several meters higher, there is the potential for increased depths of made ground at this location.

At the proposed northern abutment location, trial holes confirmed the presence of medium dense glacial deposits at a depth of 1.5m.

Further investigations were carried out along the line of the proposed track, which will provide access to the northern abutment. It is noted that the underlying made ground is generally granular in nature derived from local excavations in the underlying glacial deposits, which comprise a mixed assemblage of Clay, Silts, Sand and Gravel.

### 3.5 Existing Drainage

Public Sewer Records obtained from United Utilities are included in Appendix E.

- 3.5.1 A 200mm diameter public sludge main is identified to the west of the existing bridge structure. This runs in a southerly direction alongside Rectory Lane, and continues below the watercourse and alongside Pioneer Mills to Milltown Street.
- 3.5.2 A 450mm culverted watercourse and a parallel 225mm stormwater public sewer are identified running below Rectory Lane to the north. Comments as follows:
  - Although the culvert is identified as 450mm on United Utilities records, reference to the Principal Inspection and Assessment Report for 'Cross Lane Culvert' (Structure No. B02/328), by Sanderson Watts Associates (May 2016), has identified the culvert as a larger channel which typically comprises a reinforced concrete slab soffit supported on rendered stone abutments.
  - The outfall to the river and the first 1.2m upstream comprises a stone masonry arch & headwall, which forms the northern abutment to the existing bridge structure. It is assumed that existing storm-water public sewer discharges to the culvert, just before the outfall.
  - The existing culvert and sewer will remain unaffected by the proposed works, provided consideration is given to culvert capacity when developing the design and associated temporary works access.
- 3.5.3 A further stormwater public sewer and public overflow are identified within the section of Milltown Street, which runs alongside Pioneer Mills. These both flow in a northerly direction and appear to outfall to the watercourse immediately to the west of the existing bridge structure.

## **4.0 Proposed Arrangement of Replacement Crossing**

- 4.1 The general arrangement of the proposed replacement bridge, is reflected on the following Wilde Consulting drawings, each of which is included in Appendix C.

- 660-023-001 P1 – Proposed GA

### **4.2 Demolition**

As part of the works, the existing southern span which remains, will require demolishing and removing from site. The existing southern abutment could either remain buried or form part of the approach to the new abutment level. It is proposed that the existing intermediate pier will be taken down to 'top of cutwater' level and left in-situ, subject to EA Approval.

### **4.3 Environment Agency Consultation**

- 4.3.1 Prior to commencement of the feasibility study for the proposed replacement bridge, advice was requested of the Environment Agency by Mark Nightingale of Bury MBC regarding the required soffit level for the proposed replacement bridge, to reduce the vulnerability of the new bridge to future flooding.

An emailed response from John Ruckledge was received on 13/08/2016. A copy of this email correspondence is included in Appendix G.

Based on modelling (Irwell 2007), the advice received confirmed that a soffit level of 64.870mAOD would provide 600mm freeboard above the 1% AEP flood level (including an allowance for climate change) of 64.270m – this would be circa 2.8m above the deck of the original bridge.

As indicated on the scheme drawing, the suggested soffit level is achieved fully for the 42.1m main span, but will be slightly reduced for the shorter 12.8m span (from intermediate pier to the southern bank-seat), which is detailed to slope down at 1in20 to reduce the required size of the approach ramps.

- 4.3.2 For the avoidance of doubt, and to ensure that the latest flood data was being referred to; a further enquiry was made to the Environment Agency on 26/07/2021, requesting that the relevant River Irwell model data, including Detailed Flood Map and Model Node Flood levels, be provided for inclusion in the FRA. A copy of this correspondence and the data received is included in Appendix G/H.

Unfortunately, the model data provided (Radcliffe & Redvales 2016 study), did not appear to include an allowance for climate change within the figures for the 1% AEP event. Excluding climate change, the floods level are as follows:

#### **Node 5 (undefended)**

- 63.350mAOD for the 1% AEP event
- 64.800mAOD for the 0.1% AEP event.

- 4.3.3 Given the above, further correspondence was entered into with John Ruckledge, copies of which are included in in Appendix G, parts of which are reproduced below:

Wilde email to John Ruckledge, dated 09/08/21:

*Your climate change guidance document suggested that for developments assessed as only requiring a 'basic' approach, it would be acceptable to make a local precautionary allowance of 0.48m for the 1% AEP event, which would increase the flood level to 63.830m and the required soffit level to 64.430mAOD, however I am not sure if the basic approach would be acceptable in this instance (ie a bridge located above Flood Zone 3b).*

*Notwithstanding the above, it is noted that the adopted bridge soffit level of 64.870m AOD, would be marginally above the flood level of 64.800mAOD for the 0.1% AEP event.*

*Given the above, can you please confirm, whether the proposed soffit level of 64.870 mAOD will remain acceptable and that you will be agreeable to the reduced level of the sloping smaller span, which is set circa 0.64m lower at the southern bank seat.*

John Ruckledge response, dated 11/08/21

*The Radcliffe & Redvales 2016 model results you have been provided with are the most recent we are using for data requests and is the baseline model being used to inform the on-going flood risk management scheme just upstream. Although the baseline model does not include climate change allowances it was also used in the flood risk assessment to support the adjoining East Lancs Paper Mill [ELPM] development. The applicant (Homes England and Bury Council) used the model to inform the FRA but also re-ran it to produce +35% and +70% results. These were referred to in the FRA a copy of which is available on Bury LPAs webpages.*

*This suggests the 1% AEP +35% cc flood level adjoining the site would be 64.6m. Presumably the Council will have access to the detailed model results for you to confirm this. You may be aware that the climate change guidance has just been updated in July 2021 to include UKCP18 data. This suggests higher percentage increases are likely for the River Irwell catchment. Plus 35% is now the "central" allowance figure rather than the previous "higher central" allowance but would still be a valid design parameter for an imminent planning application. The "basic" assessment set out in the EA climate change guidance would not really be appropriate for the location based on the risks.*

*As the soffit of the main span is above that suggested for the ELPM development modelling, it still appears a reasonable design given the constraints of the site.*

- 4.3.4 It is noted that the 1% AEP + 35% C.C flood level of 64.600mAOD for the adjoining the site, is identified as being located 'adjacent to the proposed residential properties', which would be a short distance upstream of the replacement bridge.

Whilst it is likely that the flood levels downstream of this location will be slightly lower, it is considered following discussions with our structures team, that even given the constraints of the site, that it should be possible to lift the soffit level of the bridge to 65.200mAOD to provide 600mm freeboard above the 64.600m flood level. This would be 330mm higher than the previous design soffit level of 64.870m.

#### 4.4 Bridge Superstructure/Substructure

The proposed superstructure is to comprise 2 No. simply supported spans, with an intermediate support pier located at the bottom of the southern bank. The longer span is approximately 42.1m long and the shorter span 12.8m.

Each span would comprise a constant height steel truss 1.8m deep supporting steel deck plates. The deck would have an internal clearance of 3.5m to accommodate a combined footway/cycleway and be cambered transversely to assist with drainage.

As indicated on the proposed GA drawing, the soffit level of 65.20mAOD is achieved fully for the 42.1m main span (including allowance for service ducts), but will be slightly reduced for the shorter 12.9m span (from intermediate pier to the southern bank-seat), which is detailed to slope down at 1in20 to reduce the required length of the approach ramp, which is to be constructed in third party land. The proposed footway level of 64.99m would however remain marginally above the flood level of 64.60mAOD.

The bridge will be supported at each end off piled reinforced concrete bank seat abutments, which would ensure that these were not susceptible to flooding water. It is also envisaged that the intermediate pier would comprise a micro-pile supported reinforced concrete pile cap with a stone clad reinforced concrete column.

#### 4.5 Northern Bridge Abutment and Access Arrangements

- The northern abutment is to be relocated to the top of an adjacent embankment located to the east of Rectory Lane.
- The proposed footway level at the northern abutment is 65.635mAOD
- The new access path from the northern abutment will need to tie in with the existing road level of circa 63.37m at the northern end of Rectory Lane. Over its 90m length the level difference amounts to 2.265m which would require that the approach path/ramp be installed at an average gradient of 1in40.
- Based on the existing survey, it appears that levels are generally higher than required over the central section. It is envisaged therefore that the approach ramp will be cut into the existing material with the edges of the path battered back at 1in3. A shorter ramp, installed at a steeper gradient (max 1in20) from the northern end of Rectory Lane, would however allow for the path to be installed at levels closer to existing, which would be the preference.

#### 4.6 Southern Bridge Abutment and Access Arrangements

- As noted in 4.4 above, it is proposed that the shorter second span slopes down from the intermediate pier to the southern bankseat, which will reduce the required length of the access ramp which is to be constructed in third party land.
- The southern bankseat is to be relocated to the top of an adjacent embankment located a short distance to the east of the current bridge abutment.
- The proposed footway level at the southern abutment is 64.99mAOD.
- A new access ramp will be required to facilitate the level change of circa 2.6m between this and the existing ground level of 62.15mAOD in the vicinity of the existing approach. This can be achieved with a series of 1in12 ramps as indicated on drawing 660-023-001.
- As the proposed new access ramp is to be located in an area designated as Flood Zone 3 (see 5.1.1) it is proposed that the ramp be constructed in steel with column supports typically provided at landing locations, with the ramps spanning between landings. It is likely however that some adjustments to ground levels will be necessary in the area of existing retaining (see 3.2.3) to facilitate these works.
- With a flood level of 64.600m, the top of the ramp would be 0.39m higher.

#### 4.7 Intermediate Pier

Whilst the intermediate support pier, which is to be set perpendicular to the bridge span, is largely to be constructed above the southern bank, a small portion to the western side, impinges ever so slightly into the watercourse. Given the flow direction of the river and the orientation of the upstream bend, this is not however considered to be of significant concern.

#### 4.7 Proposed Drainage Design

##### 4.7.1 Generally

In accordance with Planning Practice Guidance the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable:

1. into the ground (infiltration);
2. to a surface water body;
3. to a surface water sewer, highway drain, or another drainage system;
4. to a combined sewer.

This is considered for the Bridge Deck and each approach as follows:

##### 4.7.1 Bridge Deck

The proposed deck to the footway/cycleway is to be cambered to assist with drainage.

In the case of the longer bridge span, this will direct any rainwater run-off back to the watercourse as would have been the case if the bridge was not present (ie direct rainfall to the watercourse).

In the case of the shorter span, which slope at 1in20 longitudinally, the transverse camber will direct the run-off towards the adjacent bank/landscaping located to either side. It is anticipated, that a degree of infiltration will occur; with the remainder findings its way back to the watercourse, as would have been the case if the bridge was not present (ie direct rainfall to the watercourse).

##### 4.7.2 Northern Approach Path

Given the findings of the site investigations carried out to date, infiltration may be a viable option along the line of the proposed access path; however further investigations to be carried out once a contractor is appointed will be required to determine if the made ground or the underlying superficial deposits will be suitable for infiltration.

If infiltration rates are of sufficient magnitude, options to be considered at detailed design stage would include:

- Permeable block paving/porous tarmac with an open graded stone or modular storage medium below.
- A swale/filter drain, running alongside the pathway
- Traditional below ground drainage to a manhole soakaway or modular infiltration storage tank

Should infiltration prove not to be a viable option, the drainage from the northern approach path would be connected at a convenient point of connection into the adjacent culverted section of Crow Trees Farm Brook (*Note: The outline planning application previously submitted for residential development of the adjacent former 'East Lancs Paper Mill' suggests that this culvert may be opened up*).

#### 4.7.3 Southern Approach Ramp

Surface water is to be collected from each section of ramp and carried away via downpipes beneath the steel approach ramp structure. The ramped smaller span of the bridge will similarly be drained at the abutment via channel beneath the joint and carried away via downpipe. In each instance the pipework will be connected into a new below ground drainage.

Given that the approach ramp is to replace existing hardstanding and drained roof area, it is proposed that this small area connect into the existing below ground drainage system at an uncontrolled rate. Drainage investigations will be required to confirm the existing drainage in this area - however it appears from the sewer records that a 300mm diameter stormwater public sewer outfall is located immediately to the west.

## 5.0 STATUTORY CONSULTATIONS

- 5.1 The Environment Agency (EA), Lead Local Flood Authority (LLFA) and United Utilities (UU) were consulted and asked to confirm whether they have any records of flooding incidences at the site, or whether there are any known critical drainage issues in the area. Correspondence has been included in Appendix G.

Details are summarised as follows.

#### 5.1.1 The Environment Agency (EA)

As discussed in section 4.3, the Environment Agency have been consulted to ensure that the necessary 600mm freeboard was provided between the modelled flood level and the underside of the proposed bridge structure.

In addition to providing data in respect of modelled flood levels, the EA additionally confirmed that there are '*no flood defences in the vicinity of the site*'. Records were also provided of historical flooding in the immediate vicinity of the site, copies of which are included in Appendix H, which can be summarised as follows:

- Recorded Flood Outline Map RF01 - Flooding on 23/10/1998 of 'Pioneer Mills' to the south-east of the existing bridge
- Recorded Flood Outline Map RF02 - Flooding on 26/12/2015 of 'Pioneer Mills' and the immediately surrounding area, to the south-east of the existing bridge. The identified flood outline includes a portion of Milltown Street and the southern bridge approach which runs alongside the western elevation of Pioneer Mills.

It is noted that the flood extents identified correlate to a large degree with the flood extents indicated on the flood map for planning, which is discussed in 6.1.1.

The EA will also be a formal statutory consultee as part of the planning application process, which this FRA forms part of.

#### 5.1.1 Lead Local Flood Authority (LLFA)

No response has not been received from Bury Council LLFA thus far, however no significant risk of flooding impact is anticipated, as a result of the proposed replacement bridge crossing.

It is assumed that the LLFA will be a formal statutory consultee as part of the planning application process, which this FRA forms part of.

### 5.1.3 United Utilities

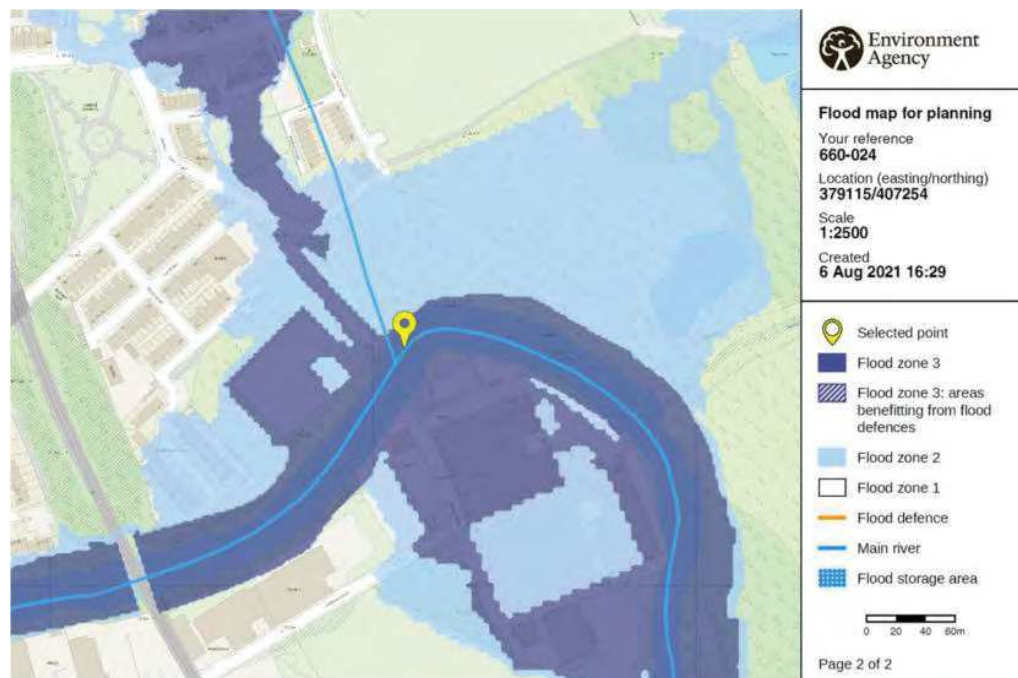
United Utilities have confirmed that they have no current record of sewer flooding within the vicinity of the proposed development.

## 6.0 **Assessment of Flood Risk from All Sources**

6.1 Flooding can be caused in a number of different ways. For each particular site types of flooding should be considered with regard to geography, geology and site-specific topography, and further assessed or discounted accordingly.

### 6.1.1 Fluvial Flooding (including Tidal)

Included within Appendix F is a copy of the 'Flood Map for Planning', an extract of which is included below.



As would be expected for a watercourse, the span of the proposed replacement bridge is located above an area designated as EA Flood Zone 3.

It is noteworthy that the seat abutments to the north and the new access pathway beyond are identified as being located in EA Flood zone 2. Based however on existing ground levels (65.07-63.37mAOD) it is likely that the section of pathway in closest proximity to the river will be located at a level above the flood water.

The southern bridge abutment, access ramp and a portion of Milltown Street, will be located in EA Flood Zone 3, which will limit use of the bridge during an extreme storm event and preclude access from the southern side.

The risk of fluvial flooding in relation to the modelled flood data and the proposed levels for the replacement bridge, is discussed more fully in Section 4.3.

### 6.1.2 Flooding from Surface Water

Radcliffe

Extent of flooding from surface water

- High
- Medium
- Low
- Very low

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*In consideration of the Flood Risk Impact considered to exist from this source is MEDIUM (reducing to LOW if warning signs are provided to inform the public, not to use the bridge during periods of surface water flooding)*

### 6.1.3 Groundwater Flooding

Mapping contained within the Bury Council Preliminary Risk Assessment (May 2011), indicate that for the 1km square grid in which the proposed study area is located, geological and hydrogeological conditions show that >75% of the area will be susceptible to the emergence of groundwater.

In this instance however, any groundwater emergence, would due to the topography of the land, occur along the line of the watercourse, thus eliminating any risk to adjacent land or properties.

*The Flood Risk Impact, considered to exist from this source is VERY LOW*

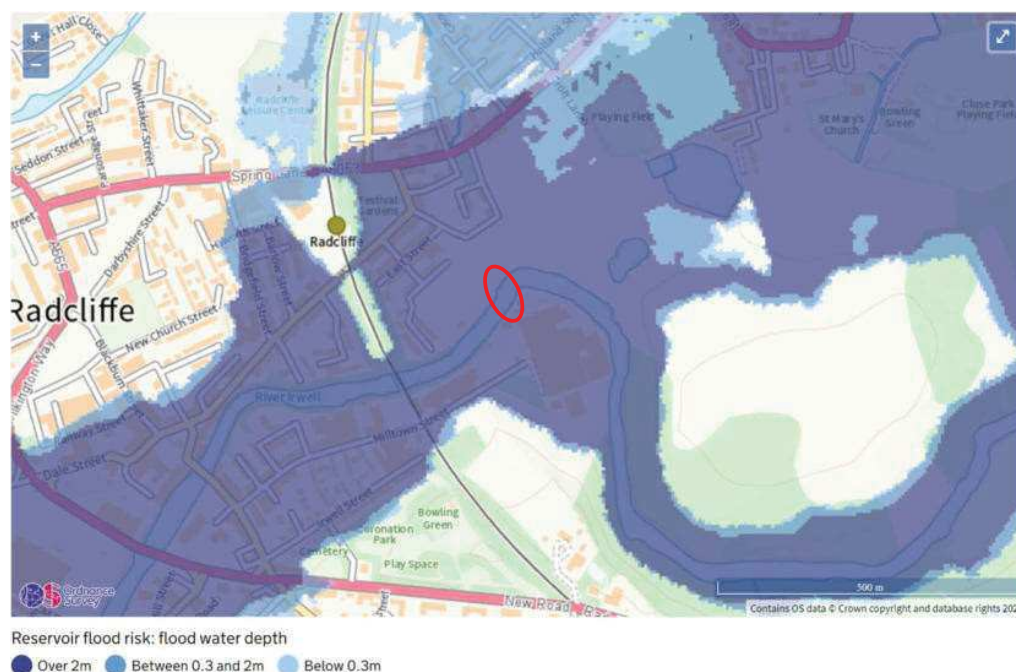
### 6.1.4 Flooding from Sewers

United Utilities have confirmed that they have no current record of sewer flooding within the vicinity of the proposed development. This correlates with the mapping contained within the Bury Council Preliminary Risk Assessment (May 2011), which likewise does not indicate any incidents of sewer flooding in the adjacent postcode area.

*The Flood Risk Impact considered to exist from overloaded public sewers is LOW.*

### 6.1.5 Flooding from Reservoirs & Other Artificial Sources

Included within Appendix F is a copy of the GOV.UK 'Extent of Flooding from Reservoirs' Map, which shows predictions based on local topography and the general position of large reservoirs. An extract of the mapping is included below.



Given that there are a number of reservoirs within the Irwell catchment; theoretical flooding is shown to occur over the extent of the replacement crossing / approaches.

It is noted however, that reservoirs do not generally pose a risk of direct flood, as their construction, maintenance & safety is regulated by the 'Reservoirs Act 1975' and 'Flood & Water Management Act 2010'. Although there is small residual risk associated with lower probability events such as over-topping and embankment failure, the latter is managed by a high degree of safety inspection and continued maintenance.

*Due to the high degree of safety inspection and maintenance associated with such bodies of water, the Flood Risk Impact considered to exist is VERY LOW (ie this is a residual risk associated with lower probability events)*

## 7.0 Sequential Test

- 7.1 The National Planning Policy Framework (NPPF) aims to ensure that inappropriate development is avoided in areas at risk of flooding. The Sequential Test, required under the NPPF, aims to determine land uses compatible with the level of flood risk at the development site.
- 7.2 The Environment Agency produces Flood Zones on which the sequential test is based. Zones 2 and 3 are identified on flood maps, with all land outside Zones 2 & 3 being designated as Flood Zone 1. These are categorised as follows:

| Flood Zones                    | Annual probability of flooding from rivers         |
|--------------------------------|----------------------------------------------------|
| Zone 3b Functional Flood Plain | Land where water flows or stored in times of flood |
| Zone 3a High probability       | > 1 in 100 (> 1%)                                  |
| Zone 2 Medium probability      | 1 in 100 – 1 in 1000 (1% - 0.1%)                   |
| Zone 1 Low probability         | < 1 in 1000 (< 0.1%)                               |

- 7.3 With reference to the EA flood maps (Appendix E) it can be seen that the replacement footbridge lies within Flood Zone 3, although the bank seat and approaches to the east and west, will be in Flood Zone 1 and Flood Zone 2 respectively.

The flood risk vulnerability classification for the replacement bridge (ie Amenity Open Space), in accordance with NPPF - Table 2, is 'Water-compatible Development'.

In accordance with the NPPF - Table 1, for development sites located in Zone 2/3, water-compatible uses of land are appropriate.

- 7.4 From the above, and making reference to NPPF – Table 3, it can be seen that the proposed replacement bridge, would satisfy the sequential test (ie development is appropriate) without the need for the exception test to be applied.

## 8.0 Conclusions

### 8.1 Fluvial Flooding

The longer span of the replacement bridge is to be provided with soffit height of 65.20mAOD (to underslung service ducts) . This provides 0.60m freeboard to the 1% AEP + 35% climate change flood level of 64.60mAOD (quoted in the FRA for the adjoining 'East Lancs Paper Mill' development, located a short distance upstream of the proposed replacement bridge).

Whilst the intermediate support pier, which is to be set perpendicular to the bridge span, is largely to be constructed above the southern bank, a small portion to the western side, impinges ever so slightly into the watercourse. Given the flow direction of the river and the orientation of the upstream bend, it is considered that a degree of protection will be provided.

Whilst the southern end of the shorter span, which slopes down at 1in20, will provide a diminishing freeboard towards the southern bankseat, the proposed footway level of 64.99m would remain circa 0.39m above the flood level.

Given that the shorter span is located above the river bank, it is also considered that this span will be less susceptible to impact from floating river debris during a storm event, which would be more likely to be located in the centre of the river channel, given the protection the flow direction/river profile provides to the southern bank.

The bank seats, to either side of the bridge, will likewise not inhibit flow, as each are located at an elevated level and will largely be buried below ground level.

Together, the above proposals ensure that hydraulic behaviour of the river will not be adversely affected by the proposed works, and will not increase flood risk elsewhere.

Much of the southern bridge approach will be impacted by flooding during 1% AEP + 35% climate change event; which will preclude access to the bridge during these periods. It is noted however that the ground level for a proportion of the northern approach footpath (65.635m at the bankseat), would put this marginally above the flood level, although flooding would likely impact on the footpath towards the northern end of Rectory Lane, as this is ramped down to tie in with the existing highway levels.

### 8.2 Flood Risk from All Sources

Whilst theoretical risk of flooding exists in the vicinity of the proposed replacement bridge, in relation to Groundwater Flooding, Sewer Flooding and Reservoir Flooding, it can be seen from Section 6.0 that in each case the risk has been categorised as either LOW or VERY LOW.

In the case of Fluvial Flooding or Surface Water Flooding, the risk is reduced from MEDIUM to LOW provided that warning signs are provided to inform the public, not to use the bridge during periods of flooding.

### 8.3 Sequential Test

The proposed replacement bridge, satisfies the sequential test (ie development is appropriate) without the need for the exception test to be applied.

### 8.4

This report is confined to the matters mentioned in Section 1 and no opinion is expressed or implied on matters not specifically mentioned.