FURTHO PIT, MILTON KEYNES
TECHNICAL NOTE: FLOOD RISK AND DRAINAGE
NOVEMBER 2017
REF. 23102/11-17/5524

Introduction
Mewies Engineering Consultants Ltd (M-EC) has been commissioned by A C Land to produce this Technical Note to consider flood risk and drainage matters to support a proposed commercial development at Furtho Pit, Milton Keynes.

The purpose of this report is to examine the flood risk to the site from all sources and identify the mitigation measures required to manage this risk. The report also provides a drainage strategy to manage surface water runoff and foul water from the site. The site boundary is shown in Figure 1 below and a proposed site layout plan can be found attached.

Figure 1: Site location plan

OpenStreetMap contributors

Site Background
The site is a mainly greenfield site that is currently comprises of agricultural land. There is an existing commercial site in the western half of the site. This commercial site, along with an area extending to the south, is located on a historic sand and gravel pit which has been infilled with inert material. An additional commercial premise exists outside the site boundary, just north of the A5.

The Dogsmouth Brook forms the northern boundary of the site to the west before being located in the middle of the site. The A506 forms the western boundary and the A5 the southern, with the A5 – A506 roundabout located to the south-west of the site. The
Dogsmouth Brook and River Great Ouse form the eastern boundary. The site is within the administrative areas of South Northamptonshire District Council and Northamptonshire County Council. The site is in the Great River Ouse Upper catchment with the watercourses falling within an area managed by the Buckingham and River Ouse Internal Drainage Board.

The site generally falls towards the Dogsmouth Brook, with the land south of the brook falling to the north and land north of the brook falling to the south. A high point exists in the western part of the site, related to the gravel works, from which levels fall steeply away. A topographical survey (see attached) records high points of 79.9m AOD in the northern part of the site and 78.8m AOD in the southern part. The bottom of the valley, within which the Dogsmouth Brook is located, runs generally from the west to the east of the site, falling from 67.0m AOD in the west to 61.6m AOD in the east where it joins with the River Great Ouse.

A disused branch of the Grand Union Canal (Old Buckingham Line) runs from north to south through the site within an elevated embankment. This has not been in use since the 1930’s and although groups have been active in attempting to restore this for many years, there are no current plans for restoration. An existing road, Cosgrove Road, runs south through the site from Stratford Road in the north to the existing commercial premises to the south of the site. In addition, an access track feeds off this to serve the commercial premises within the site and then under the A508 to Knotwood Fields Farm to the west.

Proposed Development
The proposed development is located in the western half of the site, with four distinct zones identified. In total, the site is 39.8ha with proposed developable land totalling 16ha. No development is proposed to the east of the disused canal, with this half of the site to be set aside as a Country Park with links to the Stony Stratford Nature Reserve to the south of the A5.

Third party Consultation
As part of this study, consultation has taken place with the key stakeholders involved in flood risk in the area, including the LLFA, Local Planning Authority, EA and Internal Drainage Board (IDB).

Correspondence with the LLFA, Northamptonshire County Council, is attached. In this, they highlight the flood risk to the site, including fluvial, surface water, reservoir and groundwater as well as identifying the recorded historic flooding that has taken place within and surrounding the site. This information is incorporated into the technical note and discussed in the flood risk sections above. The LLFA also noted that the West Northamptonshire Level 1 SFRA on behalf of South Northamptonshire Council (SNC) is due to be completed by the end of October 2017.

Upon contacting SNC as the Local Planning Authority, correspondence attached, it was confirmed that as of 3rd November 2017 the Level 1 SFRA update is still in the final review phase and hence will not be available to review prior to the finalisation of this technical note. SNC did however identify in discussions that a detailed assessment has been undertaken on the Furtho Pit site. This concluded that certain parts of the site are considered to be developable. SNC identified that a certain number of items, including required surface water attenuation, flood zone extents, topography of the site and freeboard of FFLs above flood levels, would be required to be considered in any development proposals. These items have all been considered as part of this technical note. SNC also stated that results of hydraulic modelling would be required to confirm the flood risk to the site.
SNC provided the detailed assessment report carried out by WSP in July 2017, attached, as part of the consultation. Within this report, a comparison of likely peak flows in the 1 in 100 year plus climate change flood event and the capacity of the Dogsmouth Brook was carried out. This was based on LiDAR data, but concluded that the peak water level in the 1 in 100 year plus climate change would be lower than the top of bank and hence flows would be contained within the channel and not flood out of bank. The report suggested that a topographical survey should be carried out to confirm the channel cross-section. Therefore, as part of this study, a comparison of the channel cross-section from the LiDAR and topographical survey has been carried out. This shows that the actual cross-section as surveyed is significantly larger than that measured from the LiDAR, see Figure 2. Therefore, the capacity of the channel is significantly greater than expected and the risk of flooding out of bank is even lower. Although it is not considered appropriate at this stage to undertake full hydraulic modelling, it is recommended that this is carried out at the next stage of the project. This would confirm the fluvial flood risk, particularly with regard to the potential impact of any constrictions within the site such as road and canal crossing.

**Figure 2: Cross-section through Dogsmouth Brook from LiDAR (purple) and topographical survey (dashed green) taken mid-way through the site.**

In order to confirm what modelling data is currently available, the EA had been contacted early on in the process or compiling this report, and product 4 data requested. However, at the time this technical note was finalised a response had not been provided. In order to best present the data that is available, the extents of Flood Zone 2 and Flood Zone 3 as shown in Figure 3 have been used. Discussions were also carried out with the Environment Agency regarding the proposed pedestrian and cyclist crossing of the River Great Ouse, attached.

The Buckingham River Ouzel IDB, managed by the Bedford Group of Drainage Boards, is responsible for the Dogsmouth Brook and therefore a key stakeholder in any development proposals for the site. Consultation, attached, was undertaken to confirm a number of items. Easements of 9m either side of the top of bank line have been confirmed and integrated into the development proposals. Allowable discharge rates have been set and are used in the
design of the surface water network. In addition, requirements for the proposed vehicle crossing of the Dogsmouth Brook were also discussed.

**Flood Risk**

**Fluvial Flood Risk**

The Environment Agency (EA) Flood Map for Planning is shown in Figure 3 below.

The maps show that the majority of the site is located within Flood Zone 1. Flood Zone 2 and Flood Zone 3 areas exist along the corridors of the Dogsmouth and Great Ouse watercourses. Two areas of Flood Zone 2 extend to the south in the centre of the site. It is reported that part of the site is within Flood Zone 3b, although detailed information showing functional flood plain is not available in any Council published literature.

Commercial dwellings classified as being 'less vulnerable' are sequentially acceptable in Flood Zone 1, 2 and 3a in accordance with the National Planning Practice Guidance (NPPF): Flood Zone and Flood Risk Tables (Table 1).

**Figure 3: Environment Agency Flood Map for Planning**

![Environment Agency Flood Map for Planning](image)

**Table 1: Copy of Table 3 from the NPPF Planning Practice Guidance – Flood Risk and Coastal Change - Flood Zone and Flood Risk Tables**

<table>
<thead>
<tr>
<th>Flood Zone</th>
<th>Essential Infrastructure</th>
<th>Water compatible</th>
<th>Highly Vulnerable</th>
<th>More Vulnerable</th>
<th>Less Vulnerable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Zone 2</td>
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<td>✓</td>
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<td></td>
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<tr>
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<tr>
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</table>

exception test
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Flood Risk Vulnerability classification

<table>
<thead>
<tr>
<th>Zone 3b ‘Functional Floodplain’</th>
<th>Essential Infrastructure</th>
<th>Water compatible</th>
<th>Highly Vulnerable</th>
<th>More Vulnerable</th>
<th>Less Vulnerable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exception Test Required</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

The Dogsmouth Brook, classified as an Ordinary Watercourse, causes the greatest flood risk to the site, however much of this is in the eastern half of the site where no development is planned.

Flood zone 3 extends only a very limited distance outside the standoff buffer however development will be excluded from these areas.

There is only 1 area where Flood Zone 2 extends into the proposed developable area, upstream of the disused canal crossing. In this area careful design and setting of Finished Floor Levels (FFLs) above the design level will be considered so that flood risk to properties and people can be mitigated.

Flood risk from the River Great Ouse, classified as a Main River, affects a small area in the south-eastern corner of the site where no development is planned.

Surface Water Flood Risk
The EA Flood Risk from Surface Water map is shown in Figure 4. This shows that the majority of the site is in an area of very low risk. A band of higher risk follows the line of the Dogsmouth Brook, with the medium risk (1% annual probability) extending to a similar degree as the Flood Zone 2, other than the two extensions on the southern side of the brook, and the high risk (3.3% annual probability) area similar to the Flood Zone 3 corridor. In addition, there are a few small areas of risk around the site, signifying ponding of surface water in low spots.

Figure 4: Environment Agency Flood Risk from Surface Water
The surface water maps show flooding caused by overtopping of the Dogsmouth Brook. As this watercourse is modelled within the EA’s fluvial flood maps, the Flood Map for Planning is likely to represent the flood risk much more accurately than Figure 4. The above, however, does identify the lower spots in the topography where the flow routes are likely to develop and runoff pond in extreme events.

Surface water flooding can be mitigated by FFLs being set at 300mm above ground level to direct all overland surface water flows away from the dwellings following the natural topography of the land. The proposed development will include a surface water drainage system and Sustainable Drainage System (SuDS) that will intercept runoff generated within the development. This will minimise the risk to the new buildings and also reduce the incidence of overland flows.

**Flood Risk from Reservoirs**

The risk of flooding from reservoirs according to EA mapping is shown in Figure 5. This shows that there is a corridor through the site following the course of the Dogsmouth Brook. This area is at risk of flooding in the case of a failure of the Wakefield Lodge Reservoir to the north-west. Correspondence from Northamptonshire County Council (NCC), attached states that the anticipated time from breach to the site is approximately 2hs 15mins. The extents are similar again to those of the medium surface water risk and Flood Zone 3. Flow velocities out of bank are shown to be less than 0.5m/s with depths generally between 0.3 and 2m.

The Grand Union Canal is approximately 500m to the north-east and does not represent a flood risk to the site.

**Figure 5: Environment Agency Flood Risk from Reservoirs**
The maximum extents shown are considered to be unlikely as reservoirs are maintained to a high standard, as required by the Reservoirs Act (1975). Therefore, the reservoir presents a residual risk to the site but with a very low probability and with adequate emergency arrangements in place, mitigation would be possible.

**Groundwater Flood Risk**

The EA groundwater maps show the site is not in a groundwater source protection zone, although as shown in Figure 5 the northern part of the site is within a Major Aquifer high vulnerability area and the central part of the site is in a Minor Aquifer intermediate vulnerability area.

British Geological Survey maps indicate that the site is underlain by a variety of superficial deposits south of the Dogsmouth Brook including Alluvium – Clay, Silt, Sand and Gravel along the corridor of the watercourse and Oadby Member – Diamicton (Sand, Gravel, Clay and Flint) to the south of the brook, with pockets of Head – Clay, Silt, Sand and Gravel and Glaciofluvial Deposits – Sand and Gravel also to the south of the brook. North of the brook, there are generally no superficial deposits within the site area. The bedrock that underlays the site comprises the Blisworth Limestone to the north of the brook and the Whitby Mudstone to the south of the brook. There are also smaller outcrops of the Lias Group (siltstone and mudstone) encroaching into the south-eastern corner of the site and the Rutland Formation (mudstone) east of the disused canal.

The Blisworth Limestone is believed to be free draining, while to the south of the brook, soils are clayey and loamy with impeded drainage. In the far east of the site on the floodplain of the River Great Ouse, soils are loamy and clayey with high groundwater. Ground investigation carried out previously by Enzygo Ltd. In Oct 2015 covers the south-western part of the site. This found that material was generally cohesive with a low soil infiltration rate. Groundwater levels recorded during drilling and within the subsequent monitoring were recorded at depths of 2.32m bgl to 7.27m bgl.

Historic BGS GeoIndex trial pit logs available online indicate ground water levels along the southern site boundary of between 1.90m and 2.90m bgl and adjacent to the brook in the north between 2.40m and 3.00m bgl.

Groundwater flood risk was assessed on a broad level for Northamptonshire by the Groundwater Flood Risk Study by ESI Ltd. in April 2016. This identifies that the flood risk varies across the site. Along the course of the Dogsmouth Brook there is a corridor of moderate risk with bands of low and very low risk to the north and south. Approximately along the route of the disused canal, a corridor of very low risk extends to the north. To the north-west of the site, immediately outside the boundary, an area of high and very high risk is located. Correspondence from NCC identifies that at least half of the site is susceptible to groundwater flooding.

While the groundwater flood risk is considered to be moderate, below ground structures would be avoided and designs would include mitigation measures to reduce the impact. Further site investigation would be undertaken at a later stage to confirm the risk of groundwater flooding in all areas of the site.
Flood Risk from the Failure of Infrastructure

The site has a 450mm public surface water sewer running from the south through the centre of the site along the line of Cosgrove Road. This outfalls into the Dogsmouth Brook immediately upstream of the culvert underneath the road. In the case of failure of this sewer, flows would follow the existing topography and flow directly into the brook. Public sewer records from the Water Authority, Anglian Water, are attached.

There is also a 12 inch diameter public foul water sewer that crosses the site. This runs from west to east, starting north of the brook in the west outside the boundary. It then crosses the brook just downstream of Cosgrove Road and continues eastwards until it loops south and then back west in the eastern half of the site. It is joined by another public sewer in the eastern half of the site and is shown to have an overflow outfall into the Dogsmouth Brook upstream of the disused canal crossing. Should the foul sewer fail and flood, due to its proximity to the watercourse, it will flow overland into the brook and be carried downstream away from the development.

In addition to the public sewers, there is also a 15 inch diameter public water main that crosses the site in a north-east – south-west direction and a 3 inch water main that runs along the Cosgrove Road to serve the commercial premises to the south. In the event of failure, flows would follow the existing topography to Dogsmouth Brook and then be carried downstream. By the design of easements around the water mains and setting of FFLs above surrounding ground level, the flood risk from the failure of infrastructure can be mitigated against. It is also the responsibility of Anglian Water to manage the sewer and potable water networks and provide enough capacity to ensure flooding does not occur.
Historic flooding and previous studies
The West Northamptonshire Level 1 Strategic Flood Risk Assessment issued in Feb 2009 records historic flooding to the fields at Dogsmouth Bridge as well as flooding due to a restriction through the culvert under the disused arm of the Grand Union Canal. Historic flooding extents are also identified by the Environment Agency due to fluvial sources both upstream and downstream of the disused canal crossing to the same extent of the Flood Zone 2 outline. Both these and a recorded event related to the River Great Ouse in the south-east corner of the site were recorded in Easter 1998. No groundwater flood incidents have been recorded, although the Lead Local Flood Authority (LLFA) report that several other recorded incidents relating to highway drainage incapacity have occurred in close proximity of the site.

The West Northamptonshire Level 2 Strategic Flood Risk Assessment issued in June 2009 considered two separate sites within the proposed Furtho Pit site boundary. The western of the two sites (Old Stratford – A5) covers Zones A and B on the proposed site layout, attached. This was considered in the Level 2 SFFRA to be acceptable subject to development being restricted to within Flood Zone 1. The proposed development has a 10m buffer from the watercourse to the north and therefore there is no development proposed within Flood Zone 2 or 3 in this area. Zone C of the proposed Furtho Pit development was also considered in the Level 2 SFRA. This was identified as the Old Stratford – Dogsmouth site and does cover an area of Flood Zone 2. However, as a previous planning permission for commercial premises in this area had been granted for the site, no assessment on flood risk was required to be carried out. Zone D to the north of the brook was not identified in the Level 2 SFRA.

Summary
Table 2 below summarises the flood risks to the site.

Table 2: A summary table of the flood risks to the site

<table>
<thead>
<tr>
<th>Source</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td>Fluvial</td>
<td>✔</td>
</tr>
<tr>
<td>Tidal</td>
<td></td>
</tr>
<tr>
<td>Surface Water</td>
<td>✔</td>
</tr>
<tr>
<td>Artificial water bodies</td>
<td>✔</td>
</tr>
<tr>
<td>Groundwater</td>
<td>✔</td>
</tr>
<tr>
<td>Infrastructure Failure</td>
<td>✔</td>
</tr>
</tbody>
</table>

Surface Water Drainage Strategy
Existing Drainage and Infiltration
At present runoff on the site follows the existing topography to Dogsmouth Brook for most of the site. In the eastern corner of the site, topography takes flows into the River Great Ouse.

To date, no soakage tests have been completed across the site. A review of the BGS geology maps and the site’s existing ground investigation report by Enzygo Ltd (Oct 2015) has been undertaken and this shows the southern side of the development, south of the Dogsmouth Brook is underlain by superficial deposits of clay, silt, sand and gravel which are described as cohesive material with low soil infiltration rates. Infiltration of runoff as a discharge option is therefore unlikely to be feasible. To the north of the brook, where limestone underlays the site, infiltration rates may be higher. However, this part of the development sits both on a historic landfill site as identified by EA maps available online, as shown in Figure 7 and on a
Major Aquifer High Vulnerability Zone, as shown in Figure 5. Therefore, without further investigation to confirm the risk to groundwater, infiltration of runoff through the landfill site is assumed to be unacceptable.

**Figure 7: Environment Agency Historic Landfill Sites Map**

The ground investigation report produced by Enzygo Ltd identifies that there is evidence of contamination from the desk study in the form of the infilled historic sand and gravel pit. Records indicate that the pit has been infilled with inert material. In addition, groundwater analysis carried out by Enzygo indicated elevated levels of Fluoranthene which exceeded the Environmental Quality Standards, although levels and pathways were such that remediation was not recommended. It is however important that no below ground works introduce potential pathways into surface water or groundwater. Infiltration of surface water runoff is therefore not recommended in this area and detention basins and other attenuation features will not be located within the extent of the historic pit.

**Proposed Strategy**

It is proposed that the site is split into five catchments. These are based around the four zones identified in the masterplan and an additional catchment for the site wide main access road into the site. This will allow phasing of the development, without the requirement for construction of large amounts of unused infrastructure and complex discharge arrangements.

Detention basins are proposed within three of the four zones to provide attenuation and water quality improvements. Geo-cellular storage is also proposed in these zones to act in combination and provide further attenuation. In Zone C it is proposed for just geo-cellular storage tank to provide the necessary attenuation.

Attenuated flows from Zone B discharges into the site wide network that runs along the main access road. Runoff from the site wide network is proposed to be attenuated within an underground storage tank within the highway. A final flow control structure limits the
discharge which will then combine with flows from Zones A and C and then outfall into the Dogsmouth Brook upstream of the disused canal crossing. To the north of the brook, discharge limited by a flow control structure from the Zone D detention basin, outfalls directly into the Dogsmouth Brook, also upstream of the disused canal crossing.

Pumping of surface water is not believed to be required at this stage, however this is subject to the design of external works, highways and bridges. It is assumed that levels will be raised in the north-east corner of Zone C in order to raise FFLs of any development in this area, provide a crossing over the brook and give additional cover to drainage pipes in this area. Protection of pipes may be required in low spots where limited cover exists within the development.

In accordance with The SuDS Manual (CIRIA C753), appropriate SuDS shall be required in all catchments in order to ensure that all risks of pollution are mitigated against.

The overall strategy is illustrated on drawing 23102_01_230_01 attached.

Table 3 summarises the design for each attenuation system and the contributing impermeable area. These have been sized to contain the 1 in 100 year plus climate change storm event. The development, being commercial in nature, has a typical lifetime of 50 years. Therefore, based on the “upper end” change identified in the latest EA guidance on climate change, an allowance of 20% has been taken as the increase in peak rainfall intensity.

A maximum allowable discharge rate, up to and including the 1 in 100 year plus climate change event, of 3l/s per impermeable hectare is proposed. This is based on correspondence with the Buckingham River Ouzel IDB (attached). This rate of 3l/s is lower than the greenfield runoff rate for both the 1 in 1 year event (3.6l/s per hectare) and the 1 in 100 year event (14.8l/s) and will therefore represent significant betterment up to the 1 in 100 year storm event.

**Table 3: Attenuation Design**

<table>
<thead>
<tr>
<th>Network</th>
<th>Contributing impermeable area (ha)</th>
<th>Discharge Rate (l/s)</th>
<th>Attenuation Volume (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone A</td>
<td>5.100</td>
<td>15.3</td>
<td>3,800</td>
</tr>
<tr>
<td>Zone B</td>
<td>2.975</td>
<td>8.9</td>
<td>2,300</td>
</tr>
<tr>
<td>Zone C</td>
<td>1.190</td>
<td>3.6</td>
<td>860</td>
</tr>
<tr>
<td>Site Wide Network</td>
<td>0.510</td>
<td>1.5</td>
<td>500</td>
</tr>
<tr>
<td>Zone D</td>
<td>3.825</td>
<td>11.5</td>
<td>2,900</td>
</tr>
<tr>
<td>Totals</td>
<td><strong>13.600</strong></td>
<td><strong>40.8</strong></td>
<td><strong>10,360</strong></td>
</tr>
</tbody>
</table>

Further discussions are required with the LLFA and Buckingham River Ouzel Internal Drainage Board to confirm discharge rates and arrangements and outfall approvals. These calculations will be refined as designs progress in due course.

**Foul Water Drainage**

An existing foul water sewer runs through the site, crossing the brook downstream of Cosgrove Road. This is generally at a shallow depth, with manhole covers often protruding above ground level. There is no evidence of the existing commercial premises on the site being connected to the public foul network.
It is proposed to form new connections to the public foul water sewer in two locations. The first catchment shall take foul water discharge from Zone A and Zone C and discharge into Anglian Water manhole MH 1701. The second catchment shall drain Zone B to the south and the third catchment, Zone D to the north. Both catchments shall discharge into Anglian Water manhole MH 2602 downstream. In order to do this, the main pipe run from Zone D to the north shall be required to cross the watercourse. The design of this is subject to the final design of the highway and bridge. If it is not possible for this to cross the brook by gravity within the bridge deck, pumping may be required.

The specific discharge locations and rates are subject to agreement with Anglian Water.

**Summary**
To summarise the key points outlined above:

- All development will be contained in Flood Zone 1 and Flood Zone 2 and is therefore sequentially acceptable.
- The main flood risk to the development comes from the Ordinary Watercourse, Dogsmouth Brook. The valley formed by this watercourse also acts as a flow path for overland flows should Wakefield Lodge Reservoir to the north-west fail. Flood risk from groundwater also represents a risk to part of the site.
- Hydraulic modelling of the brook will be completed in due course to refine flood extents and likely mitigation measures.
- Through the careful location and design of development and other mitigation measures however the risk of flooding should not restrict development.
- The development will not increase runoff or flood risk downstream by utilising a sustainable drainage system. Flows will be restricted to a maximum allowable discharge rate of 3l/s per impermeable hectare providing a betterment up to the 1 in 100 +20% climate change storm event.
- The drainage system can accommodate runoff from the development through the design of five attenuation systems located throughout the site. These networks will discharge to Dogsmouth Brook at the maximum allowable discharge rate. The total storage volume for surface water is estimated at 10,360m³.
- Foul water flows from the development shall be collected and discharged via gravity, subject to highway and bridge design, to the existing Anglian Water public foul sewer that runs through the site.
Furtho Pit, Milton Keynes
Technical Note: Flood Risk and Drainage
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Report Prepared By:

James Gunn Meng CEng MICE
Senior Flood Risk Engineer

Report Checked By:

Mani Ghomi IEng MICE MCIHT
Associate Director
Dear James,

NCC is in the process of updating the West Northamptonshire Level 1 SFRA on behalf of South Northants Council and this is due to be completed by the end of October 2017. As part of this exercise, SNC requested that we look at this particular site in more detail. As such, a detailed assessment has been undertaken and we would suggest that you contact Jennie.Johnson@southnorthants.gov.uk for more information.

**Historical flooding records:** Environment Agency records show three historic flood outlines within the site boundary. All of the flood outlines are associated with flooding which occurred during Easter 1998. Two of the outlines are associated with the Dogsmouth Brook, with the other from the River Great Ouse. The West Northamptonshire Level 2 SFRA (2009) also holds records of flooding within the site boundary, where the brook flows under the Cosgrove Road crossing at Dogsmouth Bridge. Several other recorded flood incidents that we have on record are located within or in close proximity to the site, relating to highway drainage incapacity and therefore the highway drainage system would need to be investigated as part of any proposals coming forward.

**Fluvial flood risk:** a section of the site is located within Flood Zone 3b. The modelled ordinary watercourse (Dogsmouth Brook) runs through the site. Therefore a site-specific FRA must consider this matter fully. Any works within 9m of the Ordinary Watercourse would require Land Drainage Consent. The Bedford Group of Drainage Boards is responsible for issuing all consents on behalf of Northamptonshire County Council for the entire county; their contact details can be found on our Who is responsible? Webpage and more information can be found here in relation to the process and standards: https://www.floodtoolkit.com/planning/consenting/

**Surface water flood risk:** a surface water flow path runs through the site, and this would need to be assessed along with the surface water drainage scheme and discharge rates etc. by our Surface Water Drainage Team: swdrainage@northamptonshire.gov.uk. Any proposals would need to be compliant with our Local Surface Water Standards found here: https://www.floodtoolkit.com/planning/surface-water-drainage/

**Reservoir flooding:** a large proportion of the site is prone to flooding if a reservoir breach were to occur at the Wakefield Lodge Reservoir. The anticipated time from breach to the site flooding is 2 hours 15 minutes with the peak of the flooding after approximately 2.5 hours. Emergency arrangements will need to be considered within the site-specific FRA.

**Groundwater:** at least half of the site is susceptible to groundwater flooding. Any below-ground development would need to be avoided, including basements, and adequate mitigation measures incorporated into any design.

Kind regards,

Flood and Water Management Team
Northamptonshire County Council
One Angel Square, 4 Angel Street, Northampton. NN1 1ED

From: James Gunn [mailto:james.gunn@me.com]
Sent: 17 October 2017 12:05
To: Floodandwater <Floodandwater@northamptonshire.gov.uk>
Subject: Furtho Pit - Preliminary information
Northamptonshire County Council,

I am currently looking at flood risk for a site in South Northamptonshire, see attached site plan. The nearest postcode is MK19 7BB.

Please could you advise me on any historic flooding that has occurred on or near the site.

Please could you also confirm the Ordinary Watercourse running through the site, identified as the “Dogsmonth Brook” is within the Buckingham and River Ouzel IDB” area of responsibility and as such any surface water discharge rates for the development into the Ordinary Watercourse would need to be agreed with them. I understand that the Bedford Group of Internal Drainage Boards handle any land drainage consents for Northamptonshire anyway.

Many thanks for your help.

Regards

James

James Gunn MEng ACGI CEng MICE
Senior Flood Risk Engineer

M-EC Consulting Development Engineers
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For our other office locations visit www.m-ec.co.uk

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James Gunn

From: Jennie Johnson <Jennie.Johnson@cherwellandsouthnorthants.gov.uk>
Sent: 03 November 2017 11:51
To: James Gunn
Cc: Andy Darcy
Subject: FW: Furtho Pit - Flood risk and Drainage discussion
Attachments: Cosgrove Technical Note- 28 July 2017.pdf

James,

Further to our telephone conversation please see attached more detailed Level 1 work, which we were advised to carry out as part of the allocation. This confirms the statements made in our telephone conversation.

I will send across the full SFRA when we get the final version.

Kind Regards,

Jennie.

Jennie Johnson
Senior Planning Policy Officer
South Northamptonshire and Cherwell Council
01327 322382
Jennie.johnson@southnorthants.gov.uk

The Forum, Moat Lane, Towcester, Northamptonshire, NN12 6AD | www.southnorthants.gov.uk

From: James Gunn [mailto:james.gunn@m-ec.co.uk]
Sent: 03 November 2017 11:32
To: Jennie Johnson
Cc: Mani Ghomi; Alex Bennett
Subject: Furtho Pit - Flood risk and Drainage discussion

Jennie,

Many thanks for the discussion by phone this morning. As way of a record of our conversation I wished to summarise the points we talked about:

1. The Level 1 SFRA update is not yet finalised but is in the final review stage and will be issued shortly, after which it will be issued into the public domain.
2. As part of this, a detailed assessment of the Furtho Pit site was undertaken.
3. This confirmed that certain part of the site were developable.
4. There are areas of both Flood Zone 2 and Flood Zone 3 present on the site. These will need to be considered as part of any development.
5. Surface water runoff will be required to be attenuated prior to discharge off site. This will need to be considered as part of any development.
6. Freeboard of finished floor levels above flood levels is required to be considered.
7. A topographical survey of the site is required to be undertaken to better understand the flood risk.
8. Hydraulic modelling of the Dogsmouth Brook is required to better understand the flood risk to the site.
9. One of the key outcomes of any study should be to determine if the site is still viable as a development after flood risk and land take required for attenuation is considered.

Please let me know if you disagree with any of the points above.
Kind regards

James

James Gunn MEng ACGI CEng MICE
Senior Flood Risk Engineer

M-EC Consulting Development Engineers
Midsummer Court | 314 Midsummer Boulevard | Milton Keynes | MK9 2UB

T: 01908 440 046
E: james.gunn@m-ec.co.uk

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TECHNICAL NOTE: FLOOD RISK TO LAND AT FORMER FURTHO PIT, COSGROVE

DATE: July 28, 2017

APPOINTMENT AND BRIEF

WSP UK Ltd. (WSP) was instructed by Northamptonshire County Council to provide flood risk support for the update to the Level 1 West Northamptonshire Strategic Flood Risk Assessment (SFRA).

As part of the update to the SFRA, additional information is required for the Towcester and Cosgrove sites to ensure that the sites can be developed in line with a sequential approach. Both of these sites have an un-modelled ordinary watercourse flowing within/adjacent to them and therefore additional information is required with respect to fluvial risk. This technical note will outline the fluvial flood risk to the Land at former Furtho Pit site, in Cosgrove.

LIMITATIONS

This report is based on flood risk information available and current at the time of drafting. The Level 1 Strategic Flood Risk Assessments and the Level 2 Strategic Flood Risk Assessments were also reviewed.

This report assesses flood risk to the site in its current state and should not be used for any planning applications. Assessment of any increase in flood risk caused by any alterations or future works to the property are not included in this appraisal.

This report is based on the interpretation and assessment of data provided by third parties. WSP cannot be held responsible for the accuracy of the third party data and the conclusions and findings of this report may change if the data is amended or updated after the date of consultation.

The conclusions of the report are based on the data gathered for the purposes of the report and are therefore limited in their accuracy in proportion to the validity of the dataset. The data gathered has been based on an agreed scope of works. WSP cannot guarantee that the data used is the best available at the time of the report, but it is the best available data that could be gathered based on the agreed scope of works.

SITE DESCRIPTION

The site is located south of the village of Cosgrove with the A5 running along the southern boundary of the site and the A508 along the western boundary of the site. A location plan of the site is located in Figure 1.
EXISTING WATERCOURSES AND WATERBODIES

A number of watercourses are present within and close to the site boundary:

— The River Great Ouse flows past the southern and eastern boundaries of the site and as a designated Main River is under the control of the Environment Agency.
— An Ordinary Watercourse, known as the Dogsmouth Brook flows through the site before it joins the River Great Ouse just southeast of the site boundary.
— The Buckingham Branch of the Grand Union Canal runs through the centre of the site.

GEOLOGY AND HYDROGEOLOGY

Online BGS (British Geological Society) published geological data indicates that the site lies largely on a Bedrock of Whitby Mudstone Formation. To the north of the site there are areas that lie on the Rutland Formation Mudstone and the Blisworth Limestone Formation.

The underlying bedrock of Whitby Mudstone Formation has a classification as unproductive strata; these are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow. The Rutland Formation Bedrock is classified as a secondary B aquifer, and the Blisworth Limestone formation is classified as a principal aquifer.

Oadby Member (Diamicton) makes up the majority of superficial deposits underlying the site. Areas of Glaciofluvial Deposits and Alluvium are also present. These superficial deposits are classified as a secondary undifferentiated aquifer based on the Environment Agency’s aquifer designation. This means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.
FLOOD RISK

HISTORICAL FLOODING

Environment Agency recorded flood outlines show three historic flood outlines within the site boundary. All of the flood outlines are associated with flooding which occurred during Easter 1998. Two of the outlines are associated with the Dogsmouth Brook with the other from the River Great Ouse.

The West Northamptonshire Level 2 SFRA (2009) also holds records of flooding within the site boundary, where the brook flows under the Cotsgrove Road crossing at Dogsmouth Bridge.

FLUVIAL FLOOD RISK

An extract of the Environment Agency Flood Map for Planning is shown in Figure 2. This shows that the majority of the site is located within Flood Zone 1, which equates to land having less than a 0.1% (1 in 1,000 year) annual probability of flooding. However the land directly beside the Dogsmouth Brook is within Flood Zones 2 and 3. Land in Flood Zone 2 has between a 1% and 0.1% (1 in 100 year and 1 in 1,000 year) annual probability of river flooding; land in Flood Zone 3 has a 1% (1 in 100 year) or greater annual probability of river flooding.

SURFACE WATER FLOOD RISK

Figure 3 is an extract from the Flood Risk from Surface Water map. This shows that the surface water flooding is associated primarily with the watercourses across the site, and there is limited other ponding on the site. The primary risk to the site is therefore the fluvial risk. There is some surface water flooding associated with the A5 which could affect access and egress to the site. This would need to be considered as part of the site specific FRA once access routes are confirmed.
COMPARISON OF GROUND LEVELS IN RELATION TO ORDINARY WATERCOURSE

Environment Agency LiDAR has been used to compare the ground levels across the site to the levels of the ordinary watercourse in an attempt to determine what flood risk the watercourse poses to the rest of the site. A LiDAR plot for the site is shown below in Figure 4. This shows that the site varies from an elevation of approximately 75mOD in the west, to 64mOD in the east.
Three cross-sections were extracted from the LiDAR to determine the channel geometry and the slope of the watercourse. They were extracted over a distance of approximately 750m, as shown in figure 3, with the cross-section locations shown in Figure 5 and the cross-section geometries in Figure 6.

**Figure 5 - Location of cross-sections**

**Figure 6 - Cross-sections**
The cross-sections confirm that the watercourse has a relatively gentle gradient, with a bed level of approximately 66mOD in the upstream part of the site, falling to 63mOD downstream, over a distance of approximately 750m. From the LIDAR it appears that the channel is larger in size upstream, with a height of approximately 2.6m and width of almost 20m, although this is likely to include some floodplain. In the downstream reach the cross-section appears to be in the order of 1.4m high and approximately 10m wide.

HYDROLOGY AND FLOW CALCULATIONS

Catchment descriptors were extracted for the Dogsmouth Brook from the FEH online portal. The catchment is approximately 20km$^2$. An initial FEH flow estimation (using purely catchment descriptors) via the Revitalised Flood Hydrograph Method (ReFH) shows that the 1% (1 in 100 year) peak flow would be in the order of 9.5m$^3$/s. If climate change allowances were included (an increase of 70% on peak flows for the upper end estimate for the 2080s) then the flow would be in the order of 16m$^3$/s.

Using manning’s equation, and the cross-sections extracted above, it can be shown that the 1% (1 in 100 year) peak flow including climate change would be contained within the main channel area (i.e. the area shown be the cross-sections in Figure 6). This is in agreement with the surface water flood map for the area (Figure 3). There is still uncertainty over the channel dimensions and therefore the form of the channel would need to be confirmed by topographical survey as part of a site specific FRA.

There are however a number of potential constrictions on and near to the site that could impact on the areas that flood. These include:

— The culvert under the A508 – this may restrict the flow onto the site, depending on the size of the culvert and the potential for water to spill over the road.
— The bridge / culvert under Stratford Road – this may restrict the flow and cause backing up in the upstream areas, potentially affecting the site in the nearby area.
— The canal – the mapping suggests that the watercourse runs underneath the canal. Again this may cause a constriction to flow in the extreme events.
— The culvert of the Great Ouse under the A5 – again this may restrict the flow onto the site or impact on the flow routes if water can spill over the A5 (which appears to be possible based on Figure 3).

The locations listed above will need detailed consideration as part of a site specific Flood Risk Assessment.

CONCLUSIONS & RECOMMENDATIONS

The site is located south of village of Cosgrove with the A5 running along the southern boundary of the site and the A508 along the western boundary of the site. The River Great Ouse flows past the southern and eastern boundaries of the site, whilst the Dogsmouth Brook flows from west to east through the site, until it meets the River Great Ouse downstream of the site. The Buckingham Branch of the Grand Union Canal runs through the centre of the site.

LIDAR shows that the site varies from an elevation of approximately 75mOD in the west, to 64mOD in the east.

Cross-sections of the LIDAR taken through the Dogsmouth Brook shown that the channel varies in dimension, from approximately 10m to 20m wide and 1.4m to 2.6m deep. Flow calculations have shown that it is expected that the 1% (1 in 100 year) flow, including an allowance for climate change would be contained within the channel itself (as shown by the LIDAR cross-sections extracted). However, the cross-sections suggest that the land adjacent to the brook is then relatively flat, if not slightly lower than the banks in places, particularly in the eastern part of the site. If the banks are exceeded then flooding would extend wider into the site.

Based on the LIDAR available and initial flow calculations for the site, it is expected that the floodplain would be contained within the channel area (i.e. up to 20m width around the channel) and therefore fluvial risk to
the site is thought to be low. The site is therefore suitable for development in terms of fluvial flood risk provided the development is located away from the channel area and suitable freeboard between flood levels and building floor levels is provided. These calculations do not however include the potential impact of constrictions within the site which may impact on the flooded area. All potential constrictions on the site would therefore need to be included in a topographic survey of the site and assessed by hydraulic modelling to support a site specific Flood Risk Assessment. Safe access and egress to the site via highway areas affected by surface water flood risk should also be assessed.

Any development on the site would need to re-assess the flood risk from the drainage channel utilising site topographic information to verify the findings based on the LIDAR analysis. This would be included within the FRA for the site. The FRA will also need to consider the impact the development will have on flood risk upstream and downstream. Based on the information available as part of this review it is likely that the site would have to be drained by attenuation as it appears that soakaways are unlikely to be appropriate, based on review of available information on ground conditions. The development would therefore need to include sufficient space for attenuation and long term storage volumes.

Rachel Bird
Associate Director, Water
Dear Mr Gun,

Thank you for your call earlier with regards to the proposed pedestrian bridge. As discussed please find below details regarding environmental permits and calculating the soffit level.

To calculate the soffit level you will need to carry out work to determine the 1 in 100 flood event level plus climate change allowance. The climate change allowances are either 25%, 35% or 65%. When further details are available we will be able to offer you further advice with regards to which allowance would be suitable and if a freeboard is also required. The level of freeboard that is recommended is determined on a site by site basis. To be able to work out the flood level for the sites that you are currently looking at as potential locations for the bridge you will need to request a product 4 from the Environment Agency. The product 4 will contain the 1 in 100 year flood levels which you will be able to use to determine the flood levels for the site, taking into account climate change allowances.

A product 4 contains the following information if available:
Detailed Flood Risk Assessment Map, including flood zones, defences and storage areas, areas benefiting from defences, statutory main river designations, historic flood event outlines and more detailed information from our computer river models (including model extent, information on one or more specific points, flood levels, flood flows)

Our Customers and Engagement Team can provide any relevant flooding information that we have available. Please email: Enquiries_EastAnglia@environment-agency.gov.uk or write to us at the address below:

Customers and Engagement,
Central Area Office,
Bromholme Lane,
Brampton, Huntingdon,
Cambridgeshire
PE28 4NE

As part of the environmental permitting process we are able to offer free pre-application advice. As part of this pre-application advice I would consult with other internal teams who will be able to offer advice with regards to the proposals. We can help you identify what risks you need to address and what information you need to provide in your formal application. If you wish to use this service then please do email me, either with the documents that you would like us to check or alternatively we would be happy to discuss these proposals with you in the design phase.

For this proposal you will need to apply for a bespoke permit, to do this you will need to fill in the following forms:

- bespoke permit application form

- about you

- charging and declarations
When you send your application you’ll need to include:

- the above forms
- your method of work
- your risk assessment
- any other supporting documents mentioned in the accompanying form guidance
- your fee – there is an application charge of £170 for one activity, an additional charge of £40 for each subsequent activity on the same application, as well as a possible £70 charge for a compliance check. Both permanent and enabling works should be considered.

You must do a risk assessment if you want to apply for a bespoke permit. You must demonstrate that your proposal will not:

- increase flood risk
- impact on drainage
- harm the environment

Your risk assessment must show that you have considered all the risks from both permanent and temporary activities and have either:

- changed the way you carry out your activity so that it doesn’t cause any adverse effects
- put plans in place to reduce the risks

Further details about the risk assessment process and the method of work can be found by following the links below:


Once you have paid the fee and provided the necessary information, we will tell you if your application is ‘duly made’, meaning it has the information it needs to start the assessment process. You’ll normally get a decision within 2 months if your application relates only to flood risk activities. The Environment Agency will ask you if it needs more information. Its decision will take longer. If you choose a method of work which will require a permit then please send your application details to PSO-Brampton@environment-agency.gov.uk when you are ready to apply.

I hope that this information is of help. If you have any further queries then please do not hesitate to contact us.

Kind Regards

Katharine

Katharine Rist

FCRM Officer, Partnerships and Strategic Overview
East Anglia Area (Great Ouse catchment)
Environment Agency, Bromholme Lane, Brampton, Cambridgeshire, PE28 4NE.
Please note that my working days are Monday, Tuesday and Friday

Tel. No. (Ext.). 020847 49612 (Int.) 49612
Team Email: PSO-Brampton@environment-agency.gov.uk
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James

Please find attached a plan indicating the extent of the Board’s district relative to your site showing the watercourse under its statutory control.

No historic records of flooding exist for this location. However anecdotal evidence suggests that flooding to the adjacent fields occurs from out of bank flows.

Any surface water discharge to the watercourse should be restricted to the equivalent of 2 – 3 l/s per impermeable hectare.

The Board’s byelaw distance of 9m measured from bank top is applied to both sides of the watercourse which is for maintenance. Proposed development should be kept out of this area.

The Board has no modelling data for this watercourse.

Any proposed development within the byelaw, proposed crossing of the watercourse or discharge to it will be subject to the Board’s agreement and consent.

If you wish to meet to discuss possible crossings, please call to arrange a suitable time.

Regards

Trevor Skelding  MSc IEng MICE
Principal Engineer

Bedford Group of Drainage Boards|Vale House|Broadmead Road|Stewartby|Bedfordshire|MK43 9ND

Tel: 01234 767995 | Fax: 01234 768582 | www.idbs.org.uk

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Sir / Madam,

I am currently investigating the flood risk for a site in South Northamptonshire, see attached site plan. The nearest postcode is MK19 7BB.

Please could you confirm that the watercourse through the site, identified as M3 on the Board Area Map (http://www.idbs.org.uk/board-area-map/), is within the Bedford Group of Internal Drainage Boards area of responsibility.

Please could you also confirm the following:

- Any records of historic flooding that has occurred within or around the site.
- Restrictions on the allowable discharge of surface water.
- Whether an easement is required either side of the watercourse and what this is.
- Any other constraints that may affect development.
- Whether you have any modelling data for the watercourses in this area.

As part of the development, as well as any surface water discharge outfall, several bridges are proposed. These currently are likely to include a vehicle bridge over the Dogsmost Brook (Ordinary Watercourse) as well as a pedestrian bridge over the River Great Ouse (Main River). We would like to undertake preliminary discussions with yourselves regarding any structures over the Ordinary Watercourse. Please could you advise whether it would be possible to meet to discuss this.

Many thanks

James

*James Gunn* MEng ACGI CEng MICE
Senior Flood Risk Engineer

**M-EC** Consulting Development Engineers
Midsummer Court | 314 Midsummer Boulevard | Milton Keynes | MK9 2UB

T: 01908 440 046  
E: james.gunn@m-ec.co.uk

For our other office locations visit [www.m-ec.co.uk](http://www.m-ec.co.uk)
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