Harborough District Council

Level 2 Strategic Flood Risk Assessment

Detailed Site Summary Table

Site details

Site Code	**8054: Proposed Allocation GB2**
Address	**Land off Dingley Road and Nether Green, Great Bowden**
Area	5.7 hectares
Current land use	Greenfield
Proposed land use	Residential
Flood Risk Vulnerability	More Vulnerable

Sources of flood risk

Location of the site	The site is located between Dingley Road at the south-western boundary and the A6 along the eastern boundary, on the eastern edge of Great Bowden. The site is rural in nature with residential areas to the west of site and is on the right bank of the River Welland. The site is within the River Welland catchment, which flows northeast of the site out to The Wash. It rises approximately 13.8km south-west of the site, drains approximately 82.7km2 at the site, and falls under the Welland Management Catchment.
Topography	The Environment Agency (EA)'s 1m resolution 2022 Composite LiDAR shows that the topography of the site is an east-facing slope, with the lower elevations at the riverbank. The maximum elevation is 77.9m AOD in the northern area of the site, and the lowest elevation is 70.7m AOD at the eastern corner.
Existing drainage features	There are no existing drainage features within the site, however it is likely that site will drain into the River Welland to the east of the site.

Fluvial	**Available data and mapping:** EA Flood Map for Planning for Rivers and Sea. **Fluvial Modelling:** There is modelling of the River Welland (2016), however as the model is in 1d only, depth, velocity, and hazard outputs are unavailable. Flooding is present within the site in all AEP events. In the defended 3.3% AEP event, flood extent is minimal and affects the south-eastern corner of the site, in the 1% AEP event, flooding extends to more of the south-eastern corner of the site, with ponding in areas of lower topography. In the 0.1% AEP event, flooding encroaches further onto the eastern site of the site, impacting more of the southern site boundary and ponding in areas of lower topography. **Flood Map for Planning** **Flood characteristics:** • Flood Zone 1 represents areas which have less than 1 in 1000 (0.1%) chance of river flooding in a given year. Flood Zone 1 covers of 84% of the site. • Flood Zone 2 represents areas which have less than 1 in 100 (1%) but greater than 1 in 1000 (0.1%) chance of river flooding in a given year. Flood Zone 2 covers 16% of the site. • Flood Zone 3 representing an area greater than 1 in 100 (1%) chance of river flooding in a given year. Flood Zone 3 covers 5% of the site. Flood Zone 2 covers the eastern and south-eastern areas of the site in the topographic low areas. Flood Zone 3 partially covers the eastern area of the site. The remainder of the site is situated within Flood Zone 1. It is recommended that developers seek or conduct detailed fluvial modelling of the River Welland at the site as part of a site specific flood risk assessment.
Fluvial plus climate change	The River Welland (2016) hydraulic model was run in the 1% AEP event with a 20% climate change uplift. Results show that in the climate change event, flooding encroaches further into the south-eastern corner of the site.

Surface water	**Available data and mapping:** The EA's Risk of Flooding from Surface Water dataset for the 3.3%, 1% and 0.1% AEP events. **Data analysis:** **3.3% AEP (1 in 30 year) event:** Proportion is 5% Max Depth is 1.64m Max Velocity is 2.24m/s Max Hazard is 2.73, Danger for All Mean Depth is 0.22m Mean Velocity is 0.15m/s Mean Hazard is 0.75, Danger for Some **1% AEP (1 in 100 year event):** Proportion is 12% Max Depth is 2.06m Max Velocity is 2.13m/s Max Hazard is 3.46, Danger for All Mean Depth is 0.27m Mean Velocity is 0.23m/s Mean Hazard is 0.93, Danger for Some **0.1% AEP (1 in 1000 year) event:** Proportion is 46% Max Depth is 3.08m Max Velocity is 3.25m/s Max Hazard is 6.23, Danger for All Mean Depth is 0.56m Mean Velocity is 0.36m/s Mean Hazard is 1.24, Danger for Some

	Flood characteristics: The site is predominantly affected by the 0.1% AEP event, and in each event is likely representing fluvial flooding from the River Welland either in or out of bank, which can affect maximum values and skew the average values. In the 3.3% AEP event, a small flow path bisects the northern area of the site (from west to east), and there is ponding which leads into the River Welland. Depths within the site are predominantly less than 0.3m, with an average depth of 0.22m, within the flow path and ponding. The maximum depth is likely attributed to the River Welland. Velocities within the site are predominantly less than 0.25m/s with an average velocity of 0.15m/s in the flow path and ponding, with the maximum velocity attributed to the River Welland. Within the ponding and flow path, there is a maximum hazard rating of 'Danger to Some'. In the 1% AEP event, there is a flow path that bisects the northern area of the site, and a large area of ponding within the topographic low area of the site which connects to the River Welland. There is some encroachment along the upper eastern and western boundaries. Maximum depths within the extent are between 0.3 to 0.6m, with an average of 0.56m. Velocities are predominantly less than 0.25m, with an average of 0.23m/s and maximum velocities are within the northern flow path with velocities between 0.5 to 1.0m/s. The hazard rating is predominantly 'Danger to Some' with a maximum rating of 'Danger to most' within the flow path and ponding. In the 0.1% AEP event, there is a flow path that bisects the site along the upper western boundary across the northern area, which then connects to a larger flow path that covers the central, eastern, and southernmost areas of the site. In the western area there are four small flow paths that connect to the larger flow path in the northern area, there is some ponding at the

	upper eastern boundary. The larger flow path connects to the River Welland. Maximum depths are between 0.9 to 1.2m in the eastern area of the site with an average depth of 0.56m across the site. Maximum velocities are between 0.5 to 1.0m/s across the site, particularly in the northern and larger flow paths, with an average of 0.36m/s across the site. The maximum hazard rating is 'Danger to Most' along the south-western boundary, with the hazard rating increasing as extents enter into topographic low areas.
Surface water plus climate change	**Available data and mapping:** EA's Risk of Flooding from Surface Water dataset for the 3.3% and 1% AEP events with both upper and central climate change scenarios. **Management Catchment:** The site is located within the Welland Management Catchment. The EA's guidance recommends that the Upper End allowance is considered for both the 3.3% and 1% AEPs for the 2070's epoch, unless the allowance for the 2050's epoch is higher, in which case this should be used. This is appropriate for development with a lifetime beyond 2100. The recommended uplift on peak rainfall intensity for the 3.3% AEP central and upper estimates are 25% and 35%, and 25% and 40% for the 1% AEP event. **Data analysis:** **3.3% AEP (1 in 30 year) central climate change event:** Proportion is 18% Max Depth is 2.49m Max Velocity is 3.22m/s Max Hazard is 5.45, Danger for All Mean Depth is 0.48m Mean Velocity is 0.35m/s Mean Hazard is 1.28, Danger for Most **3.3% AEP (1 in 30 year) upper climate change event:**

	Proportion is 22% Max Depth is 2.83m Max Velocity is 3.22m/s Max Hazard is 5.92, Danger for All Mean Depth is 0.54m Mean Velocity is 0.36m/s Mean Hazard is 1.33, Danger for Most **1% AEP (1 in 100 year) central climate change event:** Proportion is 36% Max Depth is 3.35m Max Velocity is 3.23m/s Max Hazard is 7.4, Danger for All Mean Depth is 0.74m Mean Velocity is 0.39m/s Mean Hazard is 1.5, Danger for Most **1% AEP (1 in 100 year) upper climate change event:** Proportion is 45% Max Depth is 3.64m Max Velocity is 3.23m/s Max Hazard is 8.04, Danger for All Mean Depth is 0.84m Mean Velocity is 0.39m/s Mean Hazard is 1.58, Danger for Most **Flood characteristics:** The site is shown to be at risk of flooding from all four scenarios. The modelled flood characteristics during both the 3.3% AEP plus climate change allowance events are similar in extent to the present day 1% AEP event, and the modelled flood characteristics in both the 1% AEP plus

	climate change allowance events are similar in extent to the present day 0.1% AEP event. It should be noted that the uplifts are likely incorporating fluvial flooding of the River Welland either in or out of bank which can affect the maximum values and skew the averages. The design event for the site is the 1% AEP upper climate change event (1% plus 40% climate change allowance). The maximum depth of 3.64m and maximum velocity is 3.23 m/s is within the eastern area of the site. Both the maximum and average hazard ratings are 'Danger for All' and is present in the eastern and south-eastern areas of the site.
Reservoir	The site is not located in a Wet or Dry day reservoir flooding extent, according to the EA's reservoir flood mapping.
Groundwater	**Available data and mapping:** The JBA Groundwater Flood Data Map (GW5) is provided as a 5m resolution grid. **Flood characteristics:** The JBA Groundwater Flood Data Map shows that the site is at no risk from groundwater emergence.
Sewers	Sewer flood records from Anglian Water were unavailable and therefore cannot be assessed as part of this assessment. The Water Recycling Centre (WRC) for the site is identified to have compliance risk, with risk from internal and external sewer flooding risk until 2050 within Anglian Water's Drainage and Wastewater Management Plan (DWMP). The risk of sewer flooding should be considered within a site-specific flood risk assessment prior to development.
Flood history	The EA's Recorded Flood Outlines dataset shows no recorded historic flood extents within, or in the vicinity of, the site.

Flood risk management infrastructure

Existing defences	The EA's AIMS spatial flood defences dataset shows that there are no formal flood defences at the site or in its vicinity.

Potential defences	The EA's AIMS spatial flood defences dataset shows that there is engineered high ground along both banks of the River Welland in the vicinity of the site.
Residual risk	There is residual risk to the site from breaches or overtopping of engineered high ground. The residual risk a potential breach of engineered high ground poses to the site should be considered within a site-specific flood risk assessment prior to development.

Emergency planning

Flood warning	The site is located within the Welland Valley (055WAF134TWV) Flood Alert Area but is not located within a Flood Warning Area.
Access and egress	At present, the site is only accessible through farming access gates, Dingley Road, and the private access road to the site may be considered by developers. For the surface water events, in the 3.3% AEP and 1% AEP events, access and egress to the site should be achievable in all directions. For the 0.1% AEP event, there is limited access and egress to the site. Access and egress via Dingley Road should be achievable. Flooding along Dingley Road has a maximum depth between 0.6 to 0.9m, a maximum velocity between 0.5 to 1.0m/s, and a predominant hazard rating of 'Danger to Most', increasing to 'Danger to All' as the road approaches the River Welland. For the design surface water climate change event (the 1% AEP plus 40% climate change allowance), flood extents are similar that of the 0.1% AEP event. Access and egress via Dingley Road and the A6 from the upper eastern and south-western site boundaries should be achievable. During this event maximum flood depths along the Dingley Road are 1.17m, maximum velocity is 3.47m/s and maximum flood hazard rating is 'Danger to All'.

	Safe access and egress will need to be demonstrated in the design (1% AEP +CC) fluvial and surface water events. Given the significant fluvial and surface water risk to the site, a site-specific flood risk assessment will be required, considering the duration and likely onset of flooding. A flood warning and evacuation plan should be prepared should any development be proposed in an area at risk of flooding.

Requirements for drainage control and impact mitigation

Broad-scale assessment of possible SuDS	**Geology and Soils** The geology consists of: • Bedrock geology of mudstone forming the Charmouth mudstone formation. • Superficial deposits of clay, silt, sand and gravel alluvium. The soils on site consist of slowly permeable, seasonally wet, slightly acidic but base-rich loamy and clayey soils, which are likely to have impeded drainage. This suggests that infiltration is unlikely to be a viable means of surface water disposal. **SuDS** • JBA Groundwater mapping suggests the site is at 'low risk' of groundwater flooding during a 1% AEP flood event, the site is not considered to be susceptible to groundwater flooding, due to the nature of the local geological conditions. However, infiltration SuDS may not always be appropriate and the infiltration potential of the site should be confirmed through infiltration testing, in line with BRE 365. • The site is not located within a Source Protection Zone and does not contain known historic landfill. As such there are no restrictions over the use of infiltration techniques with regard to groundwater quality. • The site is located within the River Welland Nitrate Vulnerable Zone. Therefore, early engagement with the LLFA and the EA is recommended to determine requirements for the site to manage the impact to surrounding watercourses. Consideration of water quality is likely to be of high importance and demonstrated through the use of the Simple Index Approach.

	• SuDS measures should follow the discharge hierarchy, and if it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner. • Due to the topography, any surface water not intercepted via infiltration will drain via gravity to the east of the site. It is therefore recommended that the LLFA and the EA are consulted about viable discharge locations for surface water from the site and their attenuation potential.
Opportunities for wider sustainability benefits and integrated flood risk management	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity, helping meet requirements for the Nitrate Vulnerable Zone. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints. • The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site. • SuDS are to be designed so that they are easy to maintain, and it should be set out who will maintain the system, how the maintenance will be funded and should be supported by an appropriately detailed maintenance and operation manual. • SuDS should be designed with a holistic approach, combining ecology, landscape and drainage requirements specific to the site, and incorporating Biodiversity Net Gain requirements. • Opportunities to incorporate filtration techniques such as filter strips, filter drains and bioretention areas must be considered. Consideration should be made to the existing condition of receiving

	waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • The potential to utilise conveyance features such as swales to intercept and convey surface water runoff should be considered. Conveyance features should be located on common land or public open space to facilitate ease of access. • SuDS should be designed in line with Leicestershire County Council's SuDS Guidance.

NPPF and planning implications

Exception Test requirements **(Local Authority Considerations)**	The Local Authority will need to confirm that the Sequential Test has been carried out in line with national guidelines. The Sequential Test will need to be passed before the Exception Test is applied. The NPPF classifies the residential development as 'More Vulnerable'. The site is located within Flood Zones 3 and 2 of the EA's Flood Map for Planning. The site is also within the River Welland modelled flood outline during the defended 3.3% AEP event. As the site is within Flood Zone 3, and is at significant risk from surface water flooding, the Exception Test should be applied.
Requirements and guidance for site-specific Flood Risk Assessment **(Developer considerations)**	**Flood Risk Assessment:** The Level 1 SFRA has more guidance on this section and any relevant policies and information applicable to development within Harborough District Council. • The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime, and that developments meets objectives of the NPPF's policy on flood risk. Developers will need to demonstrate that site users will be safe in the 1% AEP fluvial and surface water events, including an allowance for climate change. This will need to use detailed fluvial/surface water modelling and any interaction with the River Welland. Developers will need to show that the site is not

	at an increased risk of flooding in the future and that development of the site does not increase the risk off site. Developers should seek or conduct updated fluvial modelling of the River Welland at the site as part of the flood risk assessment. • Breach modelling of the engineered high ground should be included within the fluvial modelling at the site as part of a site-specific flood risk assessment. • There is significant risk from surface water at the site, as such flow routes should be quantified as part of a site-specific flood risk assessment, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates do not exceed greenfield rates. • Consultation with Harborough District Council, Leicestershire County Council, and the EA should be undertaken at an early stage. • Developers should consult with Anglian Water to ensure that the development aims to help achieve the targets of the Drainage and Wastewater Management Plan. • Development plans should use the Level 1 SFRA for Harborough District Council, as well as the Local Flood Risk Management Strategies to identify cumulative flood risk issues. It should also promote an integrated approach to water management. **Guidance for site design and making development safe:** • The developer will need to show, through a site-specific flood risk assessment, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG).

	• The developer will need to demonstrate maintenance of engineered high ground at the site as well as modelling of breaches and over topping as part of a site-specific flood risk assessment • Arrangements for safe access and egress are likely to be possible, however these will need to be considered further within a site-specific flood risk assessment for the surface water events with an appropriate allowance for climate change, using the depth, velocity, and hazard outputs. • Developers should also seek a Flood Warning and Evacuation Plan as the site within Flood Zones 2 and 3 with significant surface water flood risk. • Finished floor levels should be raised 600mm above the 1 in 100-year plus climate change flood level. • If flood mitigation measures are implemented then they should be tested to ensure that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another). • An EA environmental permit may be required for activity on or near the River Welland as well as on or near the engineered high ground at the south-eastern corner of the site.

Key messages

The site is affected by fluvial flooding in the 3.3% AEP, 1% AEP and 0.1% AEP events, and the fluvial climate change event extents. There is also significant risk from surface water flooding in the 0.1% AEP and surface water design event (1% plus 40% climate change allowance). There is residual risk from breaches or overtopping of engineered high ground at the site. As such the Exception Test should be applied. Development may be able to proceed if:

- The Exception Test shall be undertaken and passed. The site is shown to be at risk during the design surface water event with access and egress issues, therefore part “b” of the Exception Test must be satisfied. If the Exceptions Test is failed, development is unlikely to be able to be proceed.

- A site-specific flood risk assessment demonstrates that site users will be safe in the 1% AEP fluvial and surface water events, including an allowance for climate change. This will need to use detailed fluvial/surface water modelling and any interaction with the River Welland, as well as breaching and overtopping of the engineered high ground. Developers will need to show that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk off site. Developers should seek or conduct fluvial modelling of the River Welland at the site as part of the flood risk assessment.
- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, including a site-specific Surface Water Drainage Strategy, and SuDS maintenance and management plan and supported by detailed modelling (as above), with development to be steered away from the areas identified to be at highest risk of surface water flooding within the site. This is to be in line with the sequential approach to site layout.
- There is early engagement with the LLFA and the EA on the proposed SuDS measures and infiltration rate to discuss requirements on the site meeting relevant conditions due to the sites location within a Nitrate Vulnerable Zone.

Mapping information

The key datasets used to make planning recommendations for this site were the EA's Flood Map for Planning and the EA's Risk of Flooding from Surface Water map. More details regarding data used for this assessment can be found below.

Flood Zones	Flood Zones 2 and 3 have been taken from the EA's Flood Map for Planning mapping.
Climate change	The latest climate change allowances (updated May 2022) have been applied to the EA's RoFSW dataset.
Fluvial depth, velocity and hazard mapping	Fluvial extents were from the River Welland hydraulic model (2016).
Surface water	The EA's Risk of Flooding from Surface Water (RoFSW) map has been used to define areas at risk from surface water flooding.
Surface water depth, velocity and hazard mapping	The EA's Risk of Flooding from Surface Water (RoFSW) has been used to define areas at risk from surface water flooding.

Level 2 Flood Zone Mapping

Harborough District Council
Level 1 Strategic Flood
Risk Assessment

Legend

8054

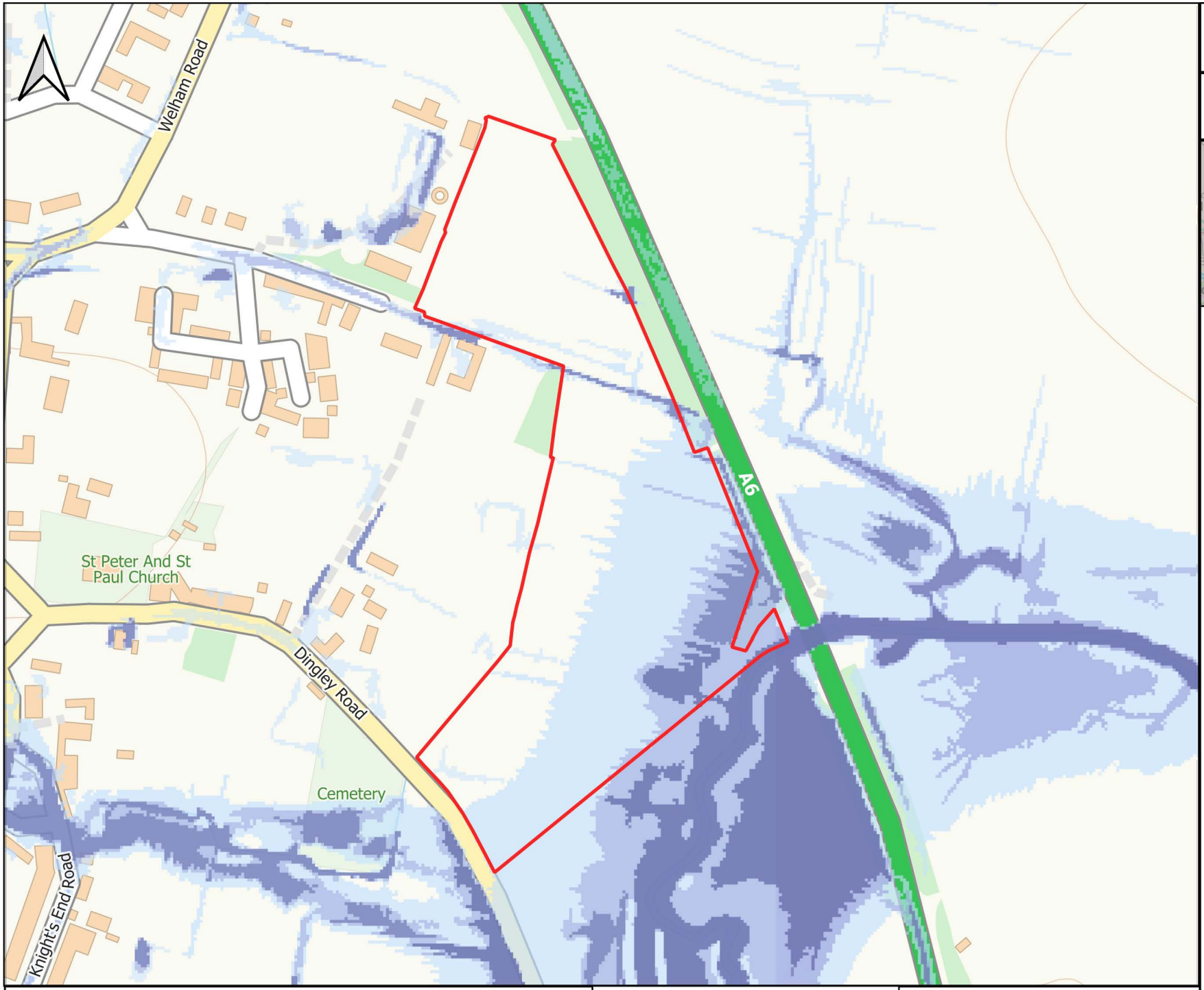
Flood Zones

Flood Zone 2

Flood Zone 3a

Flood Zone 3b

0 50 100 m



Level 2 Surface Water Flood Risk

Harborough District Council Level 1 Strategic Flood Risk Assessment

Legend

8054

Risk of Flooding from Surface Water

- 3.3% AEP
- 1% AEP
- 0.1% AEP

0 50 100 m