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Level 2 Strategic Flood Risk Assessment - Site CH13

A1-C01

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Prepared for:

Newcastle-under-Lyme Borough Council

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NEWCASTLE UNDER LYME BOROUGH COUNCIL

Contents

1 Background

This is a Level 2 Strategic Flood Risk Assessment (SFRA) site screening report for CH13. The content of this Level 2 SFRA site screening report assumes the reader has already consulted the 'Newcastle-under-Lyme Level 1 SFRA' and read the 'Newcastle-under-Lyme Level 2 SFRA Main Report' and is therefore familiar with the terminology used in this report.

1.1 Site details

- **Location:** Castletown Grange, Douglas Road, Cross Heath. Urban area, northwest of Newcastle-under-Lyme centre.
- **Site area:** 0.59 ha.
- **Existing site use:** Brownfield existing residential buildings.
- **Proposed site use:** Residential.

1.2 Topography

The Environment Agency (EA) 1m resolution LiDAR indicates that the western side of the site is situated at a higher level than the eastern side of the site, with a relatively steep decline in the centre of the site. The site reaches a maximum elevation of 127.93mAOD at its southwestern boundary, while the minimum elevation is 121.24mAOD at the southeast border.

The ground surrounding the site follows the same gradient as the site, sloping downhill from the northwest to the southeast. There is a raised railway embankment situated approximately 130m south of the site.

1.3 Geology and soils

Geology at the site consists of:

- Bedrock made up of mudstone, siltstone, and sandstone that form the Halesowen Formation.
- Superficial deposits comprising till.

Soils at the site consist of:

- Slowly permeable seasonally wet acid loamy and clayey soils.

2 Sources of flood risk

2.1 Location of site within the catchment

The site is in the upstream end of the 'Lyme Brook Catchment (trib of Trent)', which drains an area of 29.59 km^2. Lyme Brook flows south, converging with the River Trent near Hanford. The site is situated approximately 200m west and 580m east of the two branches of Lyme Brook.

The majority of the catchment is urban, encompassing a number of built-up areas and settlements, the largest being Newcastle-under-Lyme. The are more rural areas in the northwest of the catchment, located north of Silverdale. There are also green spaces along the watercourse, particularly to the south of Newcastle-under-Lyme.

2.2 Existing drainage features

There are no existing drainage features within the site.

Ashfield Brook enters a culvert approximately 400m north of the site and runs as a culverted watercourse along the southeastern boundary of the site.

Lyme Brook flows southwards approximately 200m west of the site and 580m east of the site. To the west of the site the watercourse is culverted from Lower Milehouse Lane.

2.3 Fluvial

2.3.1 Available data

The EA’s 2015 Estry-TuFLOW detailed hydraulic model of Lyme Brook was available for use within this assessment.

2.3.2 Description of risk to the site

The site is located within Flood Zones 2 and 3a but not Flood Zone 3b. Only the southeastern side of the site is at fluvial flood risk. The modelled fluvial risk shows the Ashfield Brook overtops at its culvert inlet approximately 400m north of the site. The fluvial flood extents then follow the lower topography through the park north of the site and along the southeastern boundary of the site. Downstream of the site, the flow is restricted by the raised former railway embankment resulting in the area of risk increasing in the vicinity of the site.

In the 0.1% AEP event 0.06ha of the site is at risk, the maximum depth is 2.19m, and the maximum velocity is 0.98m/s. 2% of the site is at risk in the in the 1% AEP event, the maximum depth is 0.55m, and the maximum velocity is 0.30m/s. The maximum hazard classification is 'Danger for All' in the 0.1% AEP event and is 'Danger for Some' in the 1% AEP event.

Table 2-1: Existing fluvial flood risk based the EA 2015 Estry-TuFLOW Lyme Brook model.

Risk	Flood Zone 1 (%)	Flood Zone 2 (%)	Flood Zone 3a (%)	Flood Zone 3b (%)
Percentage of site at risk* (%)	90	10	2	0
Maximum depth (m)	N/A	2.19	0.55	N/A
Maximum velocity (m/s)	N/A	0.98	0.38	N/A
Maximum hazard classification	N/A	Danger For All	Danger For Some	N/A

** The percentage flood zones quoted show the percentage of the site at flood risk from that particular flood zone or event, including the percentage of the site at flood risk at a higher risk zone, e.g. Flood Zone 2 includes the Flood Zone 3 percentage. Flood Zone 1 is the remaining area outside Flood Zone 2 (Flood Zone 2 + Flood Zone 1 = 100%).*

2.4 Surface water

2.4.1 Available data

The EA's Risk of Flooding from Surface Water (RoFSW) map has been used within this assessment.

2.4.2 Description of risk to the site

Table 2-1 shows the extent of the site at risk in the 3.3%, 1%, and 0.1% AEP events, and the maximum depths, velocities, and hazards within the site boundary. In all of the modelled AEP events, most of the site is not shown to be at surface water risk.

In the 3.3% AEP event, there is a surface water flow path that forms along Douglas Road, which is located east outside of the site. This flow path encroaches into the boundary in the southeast but covers less than 1% of the site.

In the 1% AEP event, almost the entirety of Douglas Road is covered by a flow path. Outside of the site boundary, the extent of the surface water flood risk covers the houses directly east of Douglas Road, on both sides of the entrance to Ramsey Road. However, only 1% of the site is at risk, along the southeastern border of the site. The maximum depth, velocity, and hazard classification all increase from the 3.3% AEP event. The maximum depth is between 0.60m and 0.90m. The maximum velocity is between 0.50m/s and 1.00m/s, and the maximum hazard classification is 'Danger for Most'.

In the 0.1% AEP event, the percentage of the site at risk increases to 7%. More of the southeastern area of the site is covered by the flow path, which now covers the entirety of Douglas Road. A new area of isolated surface water ponding also emerges in the west of the site. The maximum depth is greater than 1.20m by the boundary, and the maximum depth in the area of ponding in the west is between 0.30m and 0.60m. The hazard classifications remains at 'Danger for Most', as in the 1% AEP event. However, the maximum velocity increases to between 1.00m/s and 2.00m/s in the east of the site, with the area of isolated ponding having a velocity that reaches up to 0.25m/s.

Table 2-2: Existing surface water flood risk based on the RoFSW map.

Event	3.3% AEP	1% AEP	0.1% AEP
Percentage of site at risk* (%)	Less than 1	1	7
Maximum depth (m)	0.15 to 0.30	0.60 to 0.90	Greater than 1.20
Maximum velocity (m/s)	0.00 to 0.25	0.50 to 1.00	1.00 to 2.00
Maximum hazard classification	Very Low Hazard	Danger For Most	Danger For Most

** The percentage surface water extents quoted show the percentage of the site at surface water risk from that particular event, including the percentage of the site at flood risk at a higher risk zone (e.g. 1% AEP includes the 3.3% AEP percentage).*

2.5 Reservoir

The site is not shown to be at risk of reservoir flooding during the 'dry day' or 'wet day' scenario from the EA reservoir flood maps.

2.6 Groundwater

The EA Areas Susceptible to Groundwater Flooding (AStGWF) dataset (1km resolution) suggests that the site has a greater than 75% susceptibility to groundwater flooding.

The JBA Groundwater Emergence Map (5m resolution) shows that the site itself has negligible risk of groundwater emergence. However, several locations to the east and south of the site have groundwater levels range from 0.025m to 0.5m below the ground surface, reaching or coming very near (within 0.025m) to the ground surface in the south. Therefore, there could be a risk of surface water flows where groundwater emerges off site.

This assessment does not negate the requirement that an appropriate assessment of the groundwater regime should be carried out at the site-specific Flood Risk Assessment (FRA) stage.

2.7 Sewers

The site is located in a postcode area (ST5 9), where there were 20 recorded historic sewer flooding incidents within the Newcastle-under-Lyme borough, according to information provided by Severn Trent Water. Severn Trent Water provided historical flooding data for reports of external and internal sewer flooding between 1 January 2004 and 19 March 2024, including locations with repeat incidents.

There are no incidents of sewer flooding within the site or its immediate vicinity.

2.8 Flood history

The EA’s historic flooding and recorded flood outline datasets do not have a record of any flooding on or surrounding the site.

3 Climate change

Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard, and frequency of both fluvial and surface water flooding. Please see Section 3.5 of the main Level 2 SFRA report for information on fluvial models and climate change allowances.

Development proposals at the site must address the potential changes associated with climate change and be designed to be safe for the intended lifetime. The provisions for safe access and escape routes must also address the potential increase in severity and frequency of flooding.

3.1 Fluvial

3.1.1 Available data

As part of the 2024 Level 1 SFRA for Newcastle-under-Lyme borough, the existing Environment Agency's 2015 Estry-TuFLOW detailed hydraulic model of Lyme Brook was uplifted with the latest central, higher central, and upper end climate change allowances for the 3.3%, 1%, and 0.1% AEP events.

3.1.2 Description of risk to the site

The site is slightly sensitive to increased fluvial flood risk associated with climate change, however, in all modelled climate change events the risk is shown to remain confined to the southeastern side of the site.

In the 3.3% AEP present day event there is no fluvial flood risk posed to the site. However, 1% of the site is at risk in the central climate change event, and 2% in the higher central climate change event. In the central climate change event, the depth is 0.39m, increasing to 0.57m in the higher central climate change event. Velocity increases slightly from 0.34m/s in the central event to 0.39m/s in the higher central event. The hazard classification also escalates from 'Danger For Some', to 'Danger For Most', between the two climate change events.

In the 1% AEP event, the percentage of the site at risk increases from 2% to 5% in both the central and higher central climate change events. The hazard classification also increases from 'Danger for Some', in the 1% AEP event, to 'Danger for Most' in both events. Maximum depth and hazard also increase in the central and higher central events, with a depth of 1.18m and 1.36m respectively. In the 1% AEP event the maximum velocity is 0.38m/s. The velocity increases to 0.81m/s in the central climate change event, and to 0.87m/s in the higher central event.

Table 3-1: Fluvial flood risk to the site in the 3.3% and 1% AEP events considering central and higher central climate change.

Event	3.3% AEP	3.3% AEP plus 29% CC	3.3% AEP plus 39% CC	1% AEP	1% AEP plus 29% CC	1% AEP plus 39% CC
Percentage of site at risk* (%)	0	1	2	2	5	5
Maximum depth (m)	N/A	0.39	0.57	0.55	1.18	1.36
Maximum velocity (m/s)	N/A	0.34	0.39	0.38	0.81	0.87
Maximum hazard classification	N/A	Danger for Some	Danger for Most	Danger for Some	Danger for Most	Danger for Most

3.2 Surface water

3.2.1 Available data

The latest climate change allowances have been applied to the RoFSW map to indicate the impact on pluvial flood risk.

The design event for rainfall intensities is the 1% AEP event with the upper end climate allowance for the 2070s epoch, which is the 1% AEP plus 40% climate change for the Trent Valley Staffordshire Management Catchment which this site falls within.

3.2.2 Description of risk to the site

The extent of the 1% AEP plus 40% climate change event is slightly greater than the present day 1% AEP event, with 12% more of the site at risk, as seen in Table 3-2. The surface water risk mostly remains confined to the southeastern side of the site, however, an area of ponding also develops in the centre of the site (as seen in the 0.1% AEP event. The climate change event also has a higher maximum depth at 2.45m, and a higher hazard classification of 'Danger for All'. The maximum velocity for the design event is 0.74m/s, which falls in the same category, of between 0.50m and 1.00m/s, as in the 1% AEP event.

Table 3-2: Comparison of surface water flood risk to the site between the 1% AEP and 1% AEP 2070s Upper End climate change extents.

Event	1% AEP	1% AEP plus 40% climate change
Percentage of site at risk* (%)	1	13

Event	1% AEP	1% AEP plus 40% climate change
Maximum depth (m)	0.60 to 0.90	2.45
Maximum velocity (m/s)	0.50 to 1.00	0.74
Maximum hazard classification	Danger For Most	Danger For All

4 Flood risk management infrastructure

4.1 Defences

The EA AIMS dataset shows that the site is not protected by any formal flood defences.

4.2 Residual risk

The site is at a residual risk of flooding from the culverted Ashfield Brook watercourse which flows along the southeastern boundary of the site. The existing fluvial flood risk to the site is a result of the Ashfields Brook culvert overtopping upstream of the site and following the lower topography along the southeastern site boundary. The risk then backs up upstream of the railway embankment to the south of the site. Should the culvert become blocked or the capacity become restricted in anyway, then the risk to the site is likely to increase.

5 Emergency planning

5.1 Flood warnings and alerts

The southeastern side of the site is located in the 'Stoke Trent' EA Flood Alert Area and the 'Ashfield Brook at Newcastle-under-Lyme' EA Flood Warning Area.

5.2 Access and escape routes

Safe access and escape routes will need to be demonstrated in the 1% AEP plus climate change fluvial and surface water events. Site drainage proposals should address the requirements for access routes, avoid impeding surface water flows and preserve the storage of surface water to avoid exacerbation of flood risk elsewhere on the site and in the wider catchment.

5.2.1 Existing access

The site is accessible via Ronaldsway Drive, which runs along the southern border of the site. Ronaldsway Drive loops around and joins Douglas Road at two junctions south of the site. Douglas Road heads north, where it intersects with Lower Milehouse Lane (B5368) less than 500m from the site. Douglas Road also meets Albermarle Road south of the site and via Laxley Road. Albermarle Road runs parallel to Douglas Road and has several feeder roads connecting to the Liverpool Road (A34) corridor.

North of the site there is a park, and the site can be accessed on foot via a footpath that leads directly to Twynwald Grange at the northern boundary. This footpath connects to a cycle path that crosses from Douglas road to Morrisons. The footpath is tarmacked and also connects to Archer Grove north of the site, as well as running along the entire eastern and southern boundaries of the site.

5.2.2 Fluvial

In all modelled fluvial events, including the central and higher central climate change uplifts for the 1% AEP event, the entirety of Douglas Lane is at risk of fluvial flooding. Access and escape routes are therefore impacted, as this is the main road providing access to the site. Both junctions to Douglas Lane from Ronaldsway Drive have depths exceeding 0.3m, which is the maximum safe level for passage. This would impede emergency service access to the site. However, the site can still be accessed on foot, from the tarmacked footpath which connects to Archer Grove and the supermarket, where the western roads are free from fluvial flood risk.

Developers will need to demonstrate safe access and egress in the 1% AEP plus climate change fluvial event. If there are significant issues, a Flood Warning and Evacuation Plan should be prepared which considers the likely onset and duration of flooding, including during a breach scenario, and demonstrates how residents can safely be evacuated and/or shelter safely in situ.

5.2.3 Surface water

In the 3.3% AEP event, access and escape routes are greatly impacted by a flow path along much of Douglas Road. The maximum depths are between 0.90m and 1.20m at junctions to Douglas Lane from Ronaldsway Drive. The depths increase to above 1.20m in the 1% AEP event and 0.1% AEP events. In the 1% AEP event plus 40% uplift for climate change, the maximum depth reaches 3.57m along Douglas Road. Access for emergency vehicles and escape routes are therefore impacted in all surface water events. It is still possible to access the site on foot from the north, either via Archer Grove, or the supermarket.

5.3 Dry islands

The site is not located on a dry island.

6 Requirements for drainage control and impact mitigation

6.1 Broadscale assessment of possible SuDS

- The EA AStGWF map suggests the site is considered to be highly susceptible to groundwater flooding. The JBA Groundwater Emergence Map shows that the site itself has negligible risk of groundwater emergence but may be at risk of surface water flows, where groundwater emerges off site. Groundwater flooding could occur at the surface which may flow to and pool within topographic low spots during very wet winters. Detention and attenuation features should be designed to prevent groundwater ingress from impacting hydraulic capacity and structural integrity. Additional site investigation work may be required to support the detailed design of the drainage system. This may include groundwater monitoring to demonstrate that a sufficient unsaturated zone has been provided above the highest occurring groundwater level. Below ground development such as basements are not appropriate at this site.
- BGS data indicates that the underlying geology is comprised of a combination of mudstone, siltstone, and sandstone which is likely to have variable permeability. The local soils are identified to be slowly permeable seasonally wet acid loamy and clayey soils which may limit infiltration potential within the winter months. Infiltration potential at the site should be confirmed through infiltration testing. Off-site discharge in accordance with the SuDS hierarchy may be required to discharge surface water runoff from the site.
- The site is not located within a Groundwater Source Protection Zone and there are no restrictions over the use of infiltration techniques with regard to groundwater quality.
- The site is located within a 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.
- The site is not located within a historic landfill site.
- Surface water discharge rates should not exceed pre-development discharge rates for the site and should be designed to be as close to greenfield runoff rates as reasonably practical in consultation with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques.
- The RoFSW mapping indicates the presence of surface water flow paths along the southeastern side of the site in all modelled surface water events. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space.

- If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving asset should be confirmed through surveys and the discharge rate agreed with the asset owner.

6.2 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 (Local Planning Authority, Lead Local Flood Authority, and Environment Agency) at an early stage to understand possible constraints.
- Development at this site should not increase flood risk either on or off site. 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, particularly in the southeast of the site.
- Opportunities to incorporate filtration techniques such as filter strips, filter drains and bioretention areas must be considered.
- Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site.
- 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. Where slopes are >5%, features should follow contours or utilise check dams to slow flows.

7 NPPF and planning implications

7.1 Exception test requirements

The Local Planning 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 residential development as 'More Vulnerable'.

Should 'More Vulnerable' development be proposed within the extent of Flood Zone 3a, the exception test is required for this site.

7.2 Requirements and guidance for site-specific Flood Risk Assessment

At the planning application stage, a site-specific FRA will be required as the proposed development site:

- Is in Flood Zones 2 and 3.
- Is subject to surface water flooding.
- Is identified as being at increased flood risk in the future, due to climate change.

All sources of flooding should be considered as part of a site-specific FRA.

The site-specific FRA should include a detailed assessment of the Ashfields Brook culvert (capacity and blockage scenarios, culvert route, and condition).

Guidance on the requirements for site-specific FRAs can be found in the accompanying Level 2 SFRA report.

7.3 Guidance for site design and making development safe

Development should be steered outside of the southeast side of the site, which is impacted by a surface water flow path and fluvial flooding. Developers should consider utilising this area as a green corridor or as a location for SuDS.

The risk from surface water flow routes should be quantified as part of a site-specific FRA, 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 are as close as possible to pre-development greenfield rates, with areas of surface water ponding used as open space and SuDS or water compatible/essential infrastructure uses only.

Arrangements for safe access and escape routes will need to be provided for the 1% AEP fluvial and surface events with an appropriate allowance for climate change, considering depth, velocity, and hazard. Design and access arrangements will need to incorporate measures, so development and occupants are safe.

Provisions for safe access and escape routes should not impact on surface water flow routes or contribute to loss of floodplain storage. Consideration should be given to the siting of access points with respect to areas of surface water flood risk.

8 Conclusions

The southeast of the site is at risk from fluvial flooding, and is located within Flood Zones 2 and 3a, but not Flood Zone 3b. The southeast of the site is also at risk of surface water flooding, where a flow path encroaches the boundary from Douglas Road in all events. A new area of isolated surface water ponding also emerges in the west of the site in the 0.1% AEP event and in the 1% AEP plus 40% climate change events. Additionally, there are significant issues with access and escape routes in all modelled fluvial and surface water events.

Should 'More Vulnerable' development be proposed within the extent of Flood Zone 3a, the exception test is required for this site. A site-specific FRA will be required, because the proposed development site is in Flood Zones 2 and 3, subject to surface water flooding, and identified as being at increased flood risk in the future. The site-specific FRA should include a detailed assessment of the Ashfields Brook culvert (capacity and blockage scenarios, culvert route, and condition).

The following points should be considered in development of this site:

- Whether it can be demonstrated that the development passes both parts of the exception test.
- All development should be steered away from the areas of highest risk in the southeast of the site. Developers should consider utilising this area as green corridor or as a location for SuDS.
- The Lead Local Flood Authority should be consulted to determine requirements for a buffer zone with no built development over the culvert and necessary permits.
- Safe access and escape routes should be demonstrated in the 1% AEP plus climate change fluvial and surface water events. Currently, this Level 2 SFRA cannot demonstrate that safe access and escape routes can be demonstrated within these events.
  If there are significant issues, a Flood Warning and Evacuation Plan should be prepared which considers the likely onset and duration of flooding, including during a breach scenario, and demonstrates how residents can safely be evacuated and/or shelter safely in situ during the surface water design event.
- A carefully considered and integrated flood resilient and sustainable drainage design should be put forward, including a site-specific Surface Water Drainage Strategy, and SuDS maintenance and management plan and supported by detailed modelling.
- Flood mitigation measures should be implemented then tested to check that they will not displace water elsewhere (for example, if land is raised to permit development in one area, compensatory flood storage will be required in another).

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