

Flood Risk Assessment

Proposed Residential Development off
Siskin Drive, Baginton, Coventry

Prepared for:
SA Consulting

On behalf of:
Coventry City Council

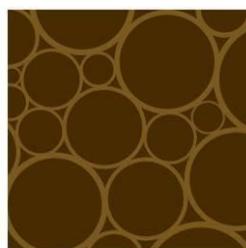


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DRAINAGE



FLOOD RISK



ECOLOGY

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1. INTRODUCTION

1.1 Terms of Reference

Clear Environmental Consultants Ltd was commissioned by SA Consulting to undertake a flood risk assessment to support a planning application for a proposed residential development off Siskin Drive, Baginton in Coventry. The sites location is depicted in Table 1.0. Current proposals for the site show the redevelopment of the site to include facilities for utilities and allocated plots for static homes or caravans. The proposed utility buildings will be constructed to include soft landscaping areas.

According to the Environment Agency's flood maps, the site predominantly lies within Flood Zone 2 (between the 1 in 100 year and 1 in 1000 year flood envelopes) and is therefore considered to be at moderate risk of fluvial flooding. The western aspect of the site lies within Flood Zone 1 and is therefore considered to be at low risk of fluvial flooding. Flood Zone 3 is currently contained and prevented from entering the site boundary due to a landscaping bund around the north and eastern aspects of the site. Development proposals provided by SA Consulting show the retention of the existing landscaping bund, to maintain protection of the site during the 1 in 100 year of greater flood events.

In terms of the Flood Risk Vulnerability Classification given in Table 2 of the Technical Guidance to the National Planning Policy Framework, the proposed use at the site is categorised as "buildings used for dwelling houses" and this implies a vulnerability classification of "more vulnerable". Table 2 of the Technical Guidance to the NPPF suggests the 'more vulnerable' development is permitted within Flood Zones 1 and 2.

The current proposals for the site suggest the demolition of all existing buildings to allow the construction of 16 utility buildings, each containing a kitchen, living area and washing facilities. The proposed residential plots will consist only of hard standing to allow occupants to locate static homes, caravans and other vehicles. The inclusion of vegetated areas adjacent to the utility buildings will increase the impermeable area within the site influencing runoff characteristics post-development.

It is usual for the Environment Agency to raise an objection to development applications that are within Flood Zones 2 and 3 or those sites which are in excess of 1 hectare, until the question of flood risk has been properly evaluated.

1.2 Approach to the Assessment

The proposed site is fundamentally influenced by flood risk from fluvial sources. It is necessary to determine flood water levels at the site for the desired return periods emanating from this source.

The existing site's topographic layout has been provided by SA Consulting and is available in Appendix A. This shows the overall area of the site within its existing parameters. The proposed site layout showing the extent of the proposed development has also been provided by SA Consulting and is available in Appendix B. This includes a comprehensive description and representation of the potential development of the site.

The requirements for flood risk assessments are generally as set out in the National Planning Policy Framework (NPPF) and the Technical Guidance to the National Planning Policy Framework. The detail and complexity of the study required should be appropriate to the scale and potential impact of the development.



For the purposes of this study, the following have been considered:

- Available information on historical flooding in the area.
- Site level information.
- Details of structures, which may influence hydraulics of the watercourse and consideration of the effect of blockage of structures.
- Allowances for increased flows resulting from the effects of climate change.
- Assess the existing runoff characteristics and the potential impact any proposed development will have on the runoff.

Further guidance is also provided in the CIRIA Research Project 624 “Development and Flood Risk: Guidance for the Construction Industry”.



2. DETAILS OF THE SITE

2.1 Site Details

| Table 1.0: Development Location | |
|--|------------------------------------|
| Site Name: | Siskin Drive, Coventry (CV3 4LP) |
| Existing Land Use: | Residential |
| Proposed Land Use: | Residential |
| Site Area: | 0.65 Hectares |
| OS NGR: | SP 36645 75406 [at centre of site] |
| Country: | England |
| County: | West Midlands |
| Local Planning Authority: | Coventry City Council |
| Sewerage undertaker: | Severn Trent Water |
| Other Authority | N/A |
| Location Plan: | |
|  <p>© Crown Copyright and Database Rights 2010 Ordnance Survey</p> <p>— = Approximate Site Location</p> | |



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2.2 Site Description

The proposed development site comprises of several temporary dwellings and hard standing off Siskin Drive, Coventry. The site has an overall area of 0.65Ha and is located to the south of Willenhall and east of Baginton village. The site is bound by arable land to the south and east with industrial development to the north and west. Access is currently available from Siskin drive which comprises the sites western boundary. The A45 London Road comprises the sites eastern boundary.

The River Avon flows through agricultural land approximately 140m to the south of the site with a series of drainage channels located to the east of the A45. It is considered that the nearby drainage network discharges to the River Avon at various locations within close proximity to the site.

The existing site is predominantly impermeable due to the presence of hard standing accounting for approximately 60% of the site. A landscaping bund comprising the south and eastern aspects of the site accounts for the remaining 40%. The development proposals are likely to maintain the existing area of permeable land due to the retention of the vegetated landscaping bund. A survey of the site showed the vegetated bund to be partially dilapidated and to have been levelled within the north-eastern apex of the site.

The topography of the site is relatively flat with existing ground levels within the site boundary varying between 65.97m AOD at the site entrance and 66.49m AOD to the north. The topography rises by approximately 1m around the south and eastern boundary to a height of approximately 67.5m AOD, due to the presence of the landscaping bund. The entrance to the site at Siskin Drive to the west lies at approximately 66m AOD.

An aerial photograph of the existing site is shown below in Figure 2.1, with site photographs taken during a site walkover in Figures 2.2 to 2.7.

Figure 2.1: Site specific aerial photograph



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Figure 2.2: Photograph 1 – Existing access point from Siskin Drive.



Figure 2.3: Photograph 2 – Blocked highway drains running through the site.



Figure 2.4: Photograph 3 – Example of existing permanent buildings recorded within the site.



Figure 2.5: Photograph 4 – Levelled bund within the north-east of the site



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Figure 2.6: Photograph 5- View of vegetated bund along the southern boundary of the site.



Figure 2.7: Photograph 6 – Severn Trent SPS immediately adjacent to the site.



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3. FLOOD RISK ASSESSMENT

3.1 Possible Flooding Mechanisms

| Table 2: Possible Flooding Mechanisms | | |
|---------------------------------------|--------------|---|
| Source/Pathway | Significant? | Comment/Reason |
| Fluvial | Yes | The site lies almost entirely within Flood Zone 2 of the EA's detailed flood maps. |
| Tidal/Coastal | No | The site does not lie within close proximity of the sea. |
| Pluvial (urban drainage) | Possible | The proposals on site have potential to increase the impermeable area of the site. Consideration of surface water management and runoff will be made to better existing conditions. |
| Groundwater | No | No evidence of ground water issues at the site |
| Overland flow | No | The degree of gradient at the site is not significant to cause runoff to flow overland towards the watercourse or highways. |
| Blockage | No | No significant watercourse infrastructure likely to have a significant impact on the site. |
| Infrastructure failure | Possible | Existing highway drainage network within the site was blocked during the site survey. |
| Rainfall Ponding | No | No rainfall ponding was recorded within the site during the site survey. |

Fluvial flooding is considered to be the only significant source of flooding associated with the development. Blockage of the existing highway drains has potential to promote surface water flooding within the site. It is necessary to determine flood water levels at the site for the desired return periods emanating from this source.

3.2 Fluvial Flooding

Consultation with the Environment Agency shows the site to lie within the floodplain of the River Avon. The site lies predominantly within Flood Zone 2, between a 1 in 100 year and 1 in 1000 year annual probability (moderate risk) of flooding. The southern aspect of the site falls immediately adjacent to Flood Zone 3 with a 1 in 100 year or greater probability of flooding. The existing landscaping bund is considered to prevent the extent of Flood Zone 3 from entering the developable area of the site. However this may be limited due to the current condition of the bund. The western aspect of the site lies within Flood Zone 1 with less than a 1 in 1,000 year (low) annual probability of flooding.

Consideration of the Coventry City Council Strategic Flood Risk Assessment (SFRA) confirms the extent of potential flooding from the River Avon and shows the site to intercept Flood Zones 1, 2 and 3.

3.3 Infrastructure Failure

A walkover survey showed the site to be served by a highway drainage system, collecting runoff from the surrounding impermeable area. The drains recorded on site appeared blocked and therefore unlikely to successfully discharge surface water successfully in their current condition.



3.4 Past Flood History

A search of the British Hydrological Society Chronology of British Hydrological Events website found no specific flooding incidents recorded within the vicinity of the proposed site. Records provided by the Environment Agency showing historical flood events in the area show details of floods in 1998 and 1985. The extent of this flood is shown in Appendix C. Flooding from the River Avon extended across approximately half the site in 1985 but did not reach the site in 1998. The extents of these flood events are confirmed within the Coventry City Council SFRA. It is considered likely that during the 1985 flood the landscaping bund around the site was not present but had been introduced prior to the 1998 flood.

3.5 Access and Egress

Access to the site is currently proposed from Siskin Drive to the west. This route lies entirely within Flood Zone 1 and therefore safe dry access above the 1 in 100 year flood level is available at all times.

3.6 Application of the Sequential and Exception Test

The site has been shown to lie almost entirely within Flood Zone 2 whereas the western aspect of the site is shown to lie within Flood Zone 1. Table 3 of the Technical Guidance to the NPPF suggests that residential developments (as characterised within Table 2 of the Technical Guidance to the NPPF) are appropriate in Flood Zones 1, 2 and 3. The proposed development is assumed, therefore, not subject to the passing of the Sequential and Exception Tests.

3.7 Surface Water Runoff

The existing site is considered to be brownfield due to the presence of hard standing and roofed structures. Re-development of the site for permanent residential use is likely to affect the overall permeability of the site. There is likely to be a slight decrease in impermeable area due to the introduction of soft landscaping features within areas previously covered by hard standing. This is likely to result in a minimal impact on surface water runoff.

From the site survey and a study of topographical plans and proposed layout drawings, it is considered that the area of permeable land is likely to change insignificantly. There will be a minor decrease in the total area of hard standing at the site through the introduction of vegetation. Vegetated areas and the existing landscape bund are to be retained post development and are likely to impede runoff and increase interception during precipitation events.

The site is not currently served by a surface water sewer network. It is likely the surface water runoff from the site is not contained and infiltrates to the adjacent agricultural land or highway drainage system off Siskin Drive.

It is therefore recommended that surface water discharge from the proposed development site be restricted to the existing 1 in 2 year Brownfield runoff rate less 20% for betterment and discharged to the nearby sewer network. Confirmation of the capacity of the sewer should be sought from Severn Trent Water. Calculated runoff rates are provided within Table 3 below and calculations are shown in Appendix D.

Ground investigation carried out for this project showed a red clay subsoil overlying hard made ground over firm to stiff clay with gravel intrusions. Examination of the solid and drift geology maps would suggest that these conditions are likely to extend over the whole site. An informal permeability test carried out as part of the ground investigation showed that the underlying clay/gravel had limited permeability. It is therefore concluded that ground infiltration drainage methods are not feasible for draining the site.



3.6.1 Existing Surface Water Runoff Assessment

A walkover survey showed the site to be brownfield with roofed structures and concrete surfaces extending over 60% of the site and permeable vegetated areas accounting for the remaining 40%. Existing pre-development runoff rates from the site have therefore been calculated using the Wallingford Procedure Modified Rational Method. Calculated rates are provided in Table 3 below and calculations are included within Appendix D.

| Return Period | Flow in Litres per Second per Hectare (l/s/ha) | Flow in Litres per Second (l/s) |
|---------------|--|---------------------------------|
| 1 in 2 year | 28.8 | 18.8 |
| 1 in 30 year | 79.8 | 52.1 |
| 1 in 100 year | 120.4 | 78.6 |

Table 3: Pre-Development Runoff Rates

It is recommended that the discharge from the site be limited to the 1 in 2 year pre-development Brownfield runoff rate less 20% for betterment, therefore flows should be restricted to 15.04l/s. This has been calculated using the Wallingford Procedure Modified Rational Method. The existing runoff rates are provided in Table 3 and calculations are provided in Appendix D.

Through the use of suitable flow control devices, variable discharge rates can be applied to allow the higher runoff rates presented in Table 3 to be applied to the corresponding higher return period events. For the purposes of this report, the discharge rate has been conservatively set at the proposed restricted runoff rate when calculating attenuation volumes.

3.6.2 Attenuation Requirements Based on Restricted Discharge Rate

Due to the specific ground conditions at the site it is suggested that ground infiltration drainage methods are infeasible for draining the site. As a result of this, the use of infiltration drainage systems has been discounted.

Using the Wallingford Procedure, Modified Rational Method, the volume to be attenuated for the site has been calculated for the 1 in 2 year, 30 year, 100 year and 100 year plus climate change events based on restricted discharge rates of 15.04l/s for the site for a decrease in impermeable area to 50%. Appendix E contains the calculation spreadsheets used to calculate the required storage volumes on the site for each return period, the results from which are tabulated below in Table 4. This represents a scenario where surface water runoff is discharged from the site with no allowance made for infiltration drainage options. This is due to the site's ground conditions.

| Return Period | Volume to be Balanced (m ³) |
|--------------------------------|---|
| 1 in 2 year | 0 |
| 1 in 30 year | 29 |
| 1 in 100 year | 57 |
| 1 in 100 year + Climate Change | 88 |

Table 4: Modified Rational Method Balance Volumes

It is normal practice to ensure that the 1 in 30 year event is maintained below the ground in the form of storage and that the difference of 59m³ between the 1 in 30 year and 1 in 100 year plus climate change events be permitted to flood the surface in a controlled manner as long as there is no flooding to buildings and the flood volume is contained within the site boundary.



Given the volumes to be attenuated for this site, if feasible, it is recommended that the full 1 in 100 year plus climate change event be stored below ground. For example, the required volume of 88m³ could be provided below parking areas or within swales and filter trenches within gardens and soft landscaping features.

3.8 Foul Drainage

The site is currently developed, containing a number of permanent buildings and static caravans. Five static homes were recorded on site with existing foul water connections to a nearby sewer system. It is anticipated that this sewer network may be sufficient to accept flows from the site post development. Confirmation of the available sewer capacity should be sought from Severn Trent Water.

The indicative master plan suggests that the development will incorporate 15 residential dwellings and a site office. Based on the Sewers for Adoption guideline foul flow allowance of 4,000l/dwelling/day it is estimated that the foul discharge from the overall development will be up to 64m³/day, which is equivalent to an average foul flow rate of 0.74l/s. Applying a typical 3x diurnal peaking factor suggests that peak foul flows could be in the order of 2.22l/s.

The size and topography of the site suggests that foul drainage could drain by gravity to the existing connection in Siskin Drive. The presence of the existing pumping station immediately adjacent to the site suggests that the adjacent sewer network is pumped from Siskin Drive therefore confirmation of the capacity of the sewer and pumping station to receive any increase in flows should be sought from Severn Trent Water.



4. MITIGATION MEASURES

The purpose of this section of the report is to provide information for utilisation as part of the planning application for the proposed development site. The mitigation measures outlined below may be adopted to reduce the consequences of flooding to people and property within the proposed development site.

4.1 Floor Levels and Site Layout

The Environment Agency generally requires finished floor levels to be set 600mm above the 1 in 100 year + climate change flood level. A study of the topographical survey plan shows levels across the whole of the site to be in excess of required floor levels. Therefore there is no specific requirement to alter floor levels. It is recommended however that finished floor levels of the proposed buildings be set at least 150mm above external levels to reduce the risk of flooding from localised ponding and surface water runoff.

The existing landscaping bund within the perimeter of the site should be entirely reinstated. Information provided by the Environment Agency shows the approximate 1 in 100 year + climate change flood level to reach a depth of 64.5m AOD. At present the bund peaks at approximately 67.5m AOD providing an elevation of approximately 1m around the site. It is considered that the bund should be reinstated to 67.5m AOD around the north and east of the site to provide continued protection from higher return period events.

To prevent the future damage of the landscaping bund, it will be fenced, preventing access by the site occupants but should allow access for maintenance when required.

4.2 Flood Warning

The development site has been shown to lie within Flood Zone 1 and 2 and therefore has no requirement to operate a flood warning service. However, as the site has been shown to lie within close proximity to Flood Zone 3, it is recommended that a warning service and flood evacuation plan is put in place.

It is recommended that site occupants sign up to the 'Floodline Warnings Direct' service operated by the Environment Agency. Local flood information is available from the Environment Agency's website or obtained by their 'Quickdial' recorded information service.

The occupiers of the site should produce a flood evacuation plan. The Environment Agency can provide a warning of high water levels within the River Avon, thereby providing advanced warning of flood waters reaching the site. During this instance it may be necessary to evacuate the site. A system for monitoring flood warnings should be developed. During times of high river levels the owner/occupiers should be made aware of the potential for overtopping of the river banks and the likely affect this could have on the site. A procedure should be developed to move people to a safe area above flood water via Siskin Drive.

4.3 Access and Egress

Access to the site is currently proposed from Siskin Drive to the west. This route lies entirely within Flood Zone 1 and therefore safe dry access above the 1 in 100 year flood level is available at all times.

4.4 Floodplain Compensation

Existing floor levels within the site are shown to be above the 1 in 100 year + climate change flood level and therefore there is no requirement for the alteration of floor levels above a certain level. Floodplain compensation measures are therefore not considered necessary.



4.5 Surface Water Management

Due to the specific ground conditions at the site it is recommended that discharge to the onsite sewer system is limited to the 1 in 2year Brownfield runoff rate less 20% for betterment. It is normal practice to ensure that the 1 in 30 year event is maintained below the ground in the form of storage. This would require a storage volume of 29m³ to be provided. The difference between the 1 in 30 year storage and the 1 in 100 year + climate change storage can be detained as temporary surface ponding provided that this does not enter buildings or encroach onto third party land.

It is strongly recommended that Sustainable Drainage Systems (SuDS) such as pervious pavements (for example, porous asphalt / permeable block paving systems) be used within any car parking facilities such as driveways. The application of these methods within certain areas will provide source control treatment and betterment in terms of runoff attenuation. This is discussed further in Section 4.6.

4.6 Sustainable urban drainage systems (SUDS)

The implementation of SuDS techniques is recommended, as they are able to reproduce the natural systems that determine surface water runoff volumes and rates and help to mimic the pre-development conditions.

For this development, infiltration is anticipated to be minimal due to the impermeable nature of the soils. As a result of this, SuDS should be used to improve the surface water quality prior to its discharge into the sewer system. Unrestricted discharge to the nearby drainage channel post-development should be avoided as this may have negative implications for the floodplain downstream of the site. Surface water runoff from the development must be managed within the site and not increase the risk of flooding in other areas.

Permeable pavements are particularly recommended as a source control system for use within car parking facilities. This is due to their ability to allow precipitation to permeate through them thus reducing runoff rates and providing treatment at source. The pavement build-up removes a significant proportion of pollutants through filtration, adsorption and microbial action. This results in improved water quality for the resulting off-site discharge. Maintenance is required to prevent the long term build-up of debris and dust from traffic and spillages which can reduce the permeability of the pavement over time. Permeable pavement can be used to collect surface water which can then be drained to the onsite sewer system and attenuation ponds.

Hard standing areas within the site can be constructed using permeable block paving. A sub-base depth of 300mm with an open-graded granular aggregate with minimum 30% void ratio would provide a storage volume of 196.44m³. This coupled with temporary surface ponding would be sufficient to store the 1 in 100 year + climate change and therefore further attenuation is not required.



5. CONCLUSIONS

This Flood Risk Assessment has been written in accordance with the requirements set out in the NPPF for the proposed re-development of the existing traveller site off Siskin Drive, Coventry.

In terms of fluvial flooding the proposed development site has been shown to lie almost entirely within Flood Zone 2 and is deemed to be at moderate risk of fluvial flooding. The west of the site, including the proposed access point has been shown to lie entirely within Flood Zone 1 with a low probability of flooding.

The development falls within the NPPF flood risk vulnerability classification "More Vulnerable" (Buildings used for dwellings and houses) and is located in Flood Zone 1; therefore the Sequential and Exception Tests are not considered necessary. There are no specific requirements to set floor levels at a certain height however it is recommended that floor levels be at least 150mm above external levels to reduce the risk presented from surface water runoff.

Access and egress from Siskin Drive has been shown to lie at approximately 66mAOD and within Flood Zone 1. Therefore safe, dry access is available above the 1 in 100 year flood level at all times.

The existing site is considered to be largely impermeable due to the presence of hard standing and roofed structures. The post-development impermeable area is likely to reduce slightly due to the introduction of soft landscaping around the proposed utility buildings. Consequently there is likely to be a slight decrease in surface water runoff from the site during periods of heavy rainfall. Despite this, restrictions should be put in place to limit surface water runoff to the existing 1 in 2 year brownfield runoff rate less 20% for betterment.

On this basis it has been calculated that the overall attenuation volumes at the site would be 88m³ for the 1 in 100 year + Climate Change event. It is normal practice to store at least the 1 in 30 year event runoff to prevent surface flooding. However, to minimise the risk of overland flooding it is suggested that the 1 in 100 year + Climate Change runoff volume be attenuated.

It is considered that the existing sewer connection serving the site will be sufficient to convey the proposed discharge from the development. Therefore following attenuation; runoff should be discharged to the sewer system at the recommended discharge rate. Confirmation of this should be sought from Severn Trent Water.

Floor level alterations, flood warning & evacuation protocols and floodplain compensation are not thought to be necessary due to the site's location within the floodplain. The incorporation of SuDS is recommended to provide source control treatment and betterment in terms of runoff attenuation within the proposed development.

Providing the mitigation measures discussed are implemented it is considered that the risk of flooding to the site and adjacent land will be minimal.

