

5. Flood Probability

Fluvial flooding

- 5.1.1 Culloch Water has a catchment of approximately 3.4km² with a index flood (QMED) estimate of 2.07 m³/sec and a peak flow circa 6.1 m³/sec for the 1 in 200 year (0.5% AEP) event, (see Figures A3-A4, Appendix A).
- 5.1.2 Based on photos supplied by the client, it is clear that the channel is incised (B1-B2, Appendix B) in the vicinity of the site. The topographic survey (Appendix C) includes several cross-sections and indicates that the lowest point of the site was 1.94m (176.01m AOD) above the water level at the time of survey.
- 5.1.3 The cross-sections also illustrate that in the event of the channel capacity being exceeded, the west bank of Culloch Burn is generally lower which would allow the field on the west of Culloch Burn to be inundated. However, cross-section AA (Appendix C) illustrates that the bank height adjacent to the north eastern portion of the site is lower than the western bank. As this is downstream in relation to the rest of the site, the risk of the site inundating at this point would be unlikely.
- 5.1.4 The topographic survey also provides details on the unnamed burn to the east of the site. This shows that the surrounding landscape is elevated in relation to the burn which offers protection from any potential flood risk. This is also illustrated in Photo B3, Appendix B.
- 5.1.5 The Falkirk Council Supplementary Planning Guidance Note (SPG)⁶ and the Falkirk Council Local Plan⁷ do highlight some incidences of fluvial flooding from Culloch Burn in several Local Plan Sites. However these have been concentrated downstream at Slamannan. This has been further corroborated following discussions with Falkirk Council. However, due to the rural nature of the area, it can not be guaranteed that all incidences of fluvial flooding will have been reported and recorded.
- 5.1.6 Based on the small catchment size (approximately 3.4 km²) and considering the information above in conjunction with the SEPA Flood Map which does not show a risk to the site, the site is considered to be at low risk of fluvial flooding.

Surface water flooding / overland flow

Risk to the site and other sites from surface water flows generated off site

- 5.1.7 Flooding from overland flows can occur if a significant volume of intercepted rainfall or surface runoff does not reach any drainage channel or permeable ground and is able to form significant surface accumulations.
- 5.1.8 Although the SEPA Flood Map does not show any indication of surface water flood risk, discussions with Falkirk Council have identified that Slamannan Road can be susceptible to surface water flooding.
- 5.1.9 Analysis of the topographic data (Appendix C) shows that the site is elevated in relation to the road. Additionally following a site visit, the camber of the road diverts flow away from the site towards the areas of rough vegetation east of the site (B4,

⁶ Falkirk Council, 2009. Flooding and Sustainable Urban Drainage Systems: Supplementary Planning Guidance Note.

⁷ Falkirk Council, 2010. <http://www.falkirk.gov.uk/services/planning-building/planning-policy/local-plan/#introductionandstrategy> [Accessed 11th January 2015].

Appendix B).

- 5.1.10 The finished floor levels of the dwelling will be 300mm above the finished ground level (Figure A2, Appendix A) which follows recommendations set out in the SEPA response letter (Appendix D). Based on the elevations of the site in the vicinity of the proposed house locations the finished floor levels will be approximately 177.14 – 177.17m AOD which will provide protection against surface water flooding from off-site sources.
- 5.1.11 Any risk from overland flow generated from the areas to the east of the site will be negligible due to the topography and rough grassland which covers the area. Any flows that were generated would be intercepted by the burn.
- 5.1.12 Based on this, it is deemed that the flood risk to the site from surface water flooding from off site sources is low.

Risk to the site and other sites from surface water flows generated on site

- 5.1.13 Flooding from overland flows can occur if a significant volume of intercepted rainfall or surface runoff does not reach any drainage channel or permeable ground and is able to form significant surface accumulations.
- 5.1.14 It is a requirement to demonstrate that the proposed development will not have a detrimental impact on the risk of flooding and the surface water drainage regime in the area. This can occur if the new development generates significant additional volumes or rates of surface water run-off.
- 5.1.15 In its current condition the site is predominately covered in rough grassland with a small area of concrete that remains following the demolition of buildings associated with the previous timber yard. Therefore any development is likely to increase the impermeable area, increasing surface water run-off rates and volumes generated on-site. Based on this, the technical assessment of surface water flood risk is included in Section 6, below.

6. Technical assessment of flood risk

Introduction

- 6.1.1 This section will assess all sources of flooding considered relevant to the site, discuss any mitigation measures which may be required, and demonstrate that the residual risks of flooding to people and property are acceptable and can be satisfactorily managed.
- 6.1.2 From the information provided in prior Sections, it has been demonstrated that the site is not at risk from most sources of flooding, including fluvial, reservoir, canal, sewage, groundwater and surface water flooding from off-site sources.
- 6.1.3 The remaining risk, surface water generated on-site, is assessed below.

Surface Water Flooding / Overland Flow generated on-site

- 6.1.4 This section will assess the current site drainage, assess the likely changes to site surfacing due to future development, consider the impact such changes will make, and give options and recommendations for future drainage of the site following development.

Current Site Drainage

- 6.1.5 Information regarding water and wastewater assets was supplied by the client (Appendix E). This shows that there is a trunk main which is located immediately east of the site. There is no surface water, foul or combined sewers in the vicinity of the site.

Future Site Development

- 6.1.6 It is a requirement that the proposed development will not increase the flood risk elsewhere. This can occur if the new development generates significant additional volumes or flow rates of surface water runoff which could contribute to flooding elsewhere.
- 6.1.7 For a Greenfield development site, usual best practice is to ensure that discharge rates for the site post-development should be no higher than for the Greenfield discharge rates, including an allowance for climate change.
- 6.1.8 In order to analyse the likely surface water run-off rates, the current Greenfield surface water run-off rates were calculated for the site using the methods contained within Institute of Hydrology Report No. 128 (IH 124)⁹. Using this method, peak Greenfield discharge rates for a number of rainfall event return periods were calculated. These calculations are included in Appendix F of this report and summarised in Table 3. Due to the practicalities of limiting flows to less than 5 l/sec a peak discharge of 5 l/sec would apply to this site.

⁹ Institute of Hydrology (June 1994). *Report No. 124- Flood Estimation for Small Catchments*.

Table 3: Simulated Greenfield peak discharge rates. The proposed maximum discharge rate is highlighted in bold.

Return Period	Peak Discharge Rate (l/s)	Peak Discharge Rate (l/s/ha)
Qbar	0.7	4.12
30 years	1.5	9.46
100 years	2	12.8
200 years	2.3	14.5

6.1.9 Due to the increase in impermeable area by approximately 45% (0.07ha) following development, it is likely that surface water run-off rates for the site will be higher than the current run-off rates. In addition, anticipated climate change will lead to an increase in rainfall depths over the lifetime of the development. Therefore, in order to mitigate this increase in surface water run-off, it will be necessary to provide a drainage system for the site which will attenuate the increased run-off volumes.

6.1.10 Due to the relatively small size of the site, it is unlikely that development will significantly increase the volumes and rates of surface water runoff / overland flow which could put other areas at risk. Additionally, the use of permeable paving (mono-block surfacing) for the driveway and turning areas and landscaped areas will minimise surface water by allowing infiltration.

6.1.11 Therefore, it is deemed that the risk from this source of flooding is low.

Surface Water Drainage Options

6.1.12 Surface water flooding can occur if significant volume of intercepted rainfall or surface runoff does not reach any drainage channel or permeable ground and is able to form significant surface accumulations.

6.1.13 Under the Water Environment (Controlled Activities) (Scotland) Regulations 2011 it is a requirement for new developments containing two or more dwellings with surface water drainage systems to include SuDS that surface water runoff will pass through before discharging into the water environment.

6.1.14 Any development will need to ensure that surface water runoff rates and volumes are not increased and will need to accommodate for predicted climate change. Any drainage feature incorporated in the development will follow the CIRIA SuDS Manual¹⁰ and will need to include allowances for climate change and meet the requirements of the Water Environment (Controlled Activities) (Scotland) Regulations 2011.

6.1.15 The asset plan provided by the client (Appendix E) shows there is no infrastructure in the vicinity of the site that can be used to potentially discharge runoff generated on site.

6.1.16 Due to the relatively low permeability of the soil in the area, the use of a soakaway option is unlikely to be suitable. Therefore, the most appropriate option for this site is to discharge surface water into the Culloch Burn. As the site will include more than one residential dwelling this option will need to meet the requirements of the Water Environment (Controlled Activities) (Scotland) Regulations 2011 to prevent pollution to the water environment.

¹⁰ CIRIA, 2007. *CIRIA C697. The SUDS Manual*.

Foul Drainage Options

- 6.1.17 As noted above, the client has provided an asset plan for the area. This shows that there are no foul sewers in the vicinity of the site that could potentially be used for connections.
- 6.1.18 Detailed design of foul sewerage system for any future development will require detailed analysis of water usage by the likely number of site residents. This will allow for peak flows to be estimated. As the site is for two residential dwellings the likely daily loadings will be 12PE or 2.16m³ per day.
- 6.1.19 Based on the Falkirk Council Local Development Plan, there could be potential capacity at the Slamannan Waste Water Treatment Works. However the likely cost implications of this option prevent this from being a realistic option.
- 6.1.20 Following discussions with the client, it is proposed that a package treatment plan will be implemented. This will need to meet the requirements of the Water Environment (Controlled Activities) (Scotland) Regulations 2011 and the appropriate consent sought from SEPA.

7. Conclusions and Recommendations

7.1.1 This Flood Risk Assessment has determined that:

- Based on SEPA Flood Maps, topographic data and additional data sources, the flood risk associated with the site is low for all sources.
- Despite the close proximity of Culloch Burn, the risk of fluvial flooding is low due to the small catchment size, surrounding topography and the incised nature of the channel.
- Finished floor levels should be at least 300mm above the finished ground level of the site and landscaping and access roads should be designed to ensure that surface water is managed effectively and does not increase the risk of flooding to neighbouring properties.
- The development is likely to increase surface run-off rates and volume due to the addition of impermeable surfaces although the use of permeable surfacing will help minimise this risk.
- Septic tanks should be considered as a suitable foul treatment option due to the absence of a sewerage network in the vicinity of the site.
- A Controlled Activities Registration (CAR) licence will be required for any discharge to Culloch Burn.

Appendix A: Figures

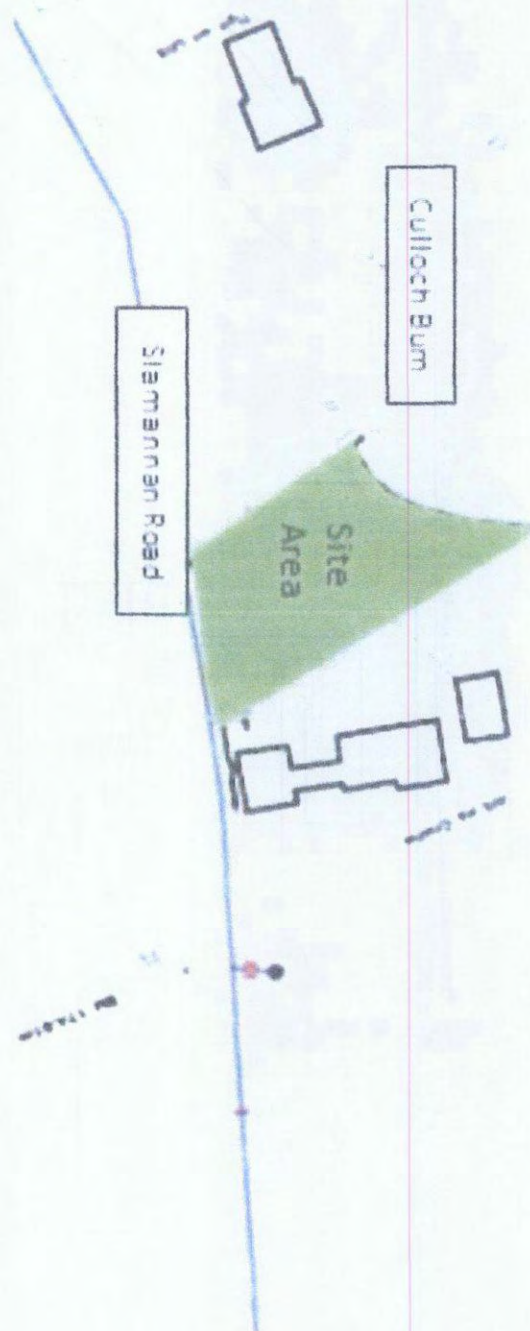


Figure A1- Site location

