



# Proposed Residential Development Alloa Park Phase 9

## Flood Risk Assessment

March 2021

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## 1 Introduction

- 1.1 Dougall Baillie Associates (DBA) have been appointed by Allanwater Developments to prepare a Flood Risk Assessment in support of a planning application to Clackmannanshire Council for Phase 9 of residential development and the relocation of the existing Alloa Rugby Club playing pitches at the wider Alloa Park development to the south east of the town of Alloa.
- 1.2 The Flood Risk Assessment will discuss flood risk at the site and outline any mitigation measures required to ensure that the proposed development is not at an unacceptable risk of flooding and will not increase the risk of flooding elsewhere in accordance with current planning policy.

### Relevant Guidance and Publications

- 1.3 To develop a meaningful Drainage Impact Assessment, the following legislative frameworks, guidance and documentation have been considered -
- Flood Risk Management (Scotland) Act 2009
  - Scottish Planning Policy (Scottish Government 2014)
  - Flood Prevention and Land Drainage (Scotland) Act 1997
  - Planning Advice Note 69 (PAN69) - Planning and Building Standards Advice on Flooding (Scottish Executive 2004)
  - Planning Advice Note 79 (PAN79) - Water and Drainage (Scottish Executive 2006)
  - CIRIA C624 “Development and Flood Risk” (Construction Industry Research and Information Association 2004)
  - SEPA Guidance “Technical Flood Risk Guidance for Stakeholders (Version 12)” (Scottish Environmental Protection Agency 2019)
  - The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (As Amended)
  - SEPA Guidance “Climate Change Allowances for Flood Risk Assessment in Land Use Planning” (Scottish Environment Protection Agency 2019)
  - CIRIA C753 “The SUDS Manual” (Construction Industry Research and Information Association 2015)
  - Sewers for Scotland 4th Edition (Scottish Water October 2018)

## 2 Baseline Conditions

### Site Description

- 2.1 The site forms an irregular plot of greenfield land associated with Alloa Rugby Club located to the south-east of the town of Alloa. The site is characterised by existing sports pitches, a club house, hardstanding area for car parking and open green space.
- 2.2 The site is bound to the north and west by Forth Crescent, to the east by phase 7 of development and the disused St Mungo's Primary School and to the south by Phase 8 of development and existing residential properties associated with Earl's Court. The proposed development site covers an area of approximately 9.3 hectares and is centred on National Grid Reference NS 89188 92190.

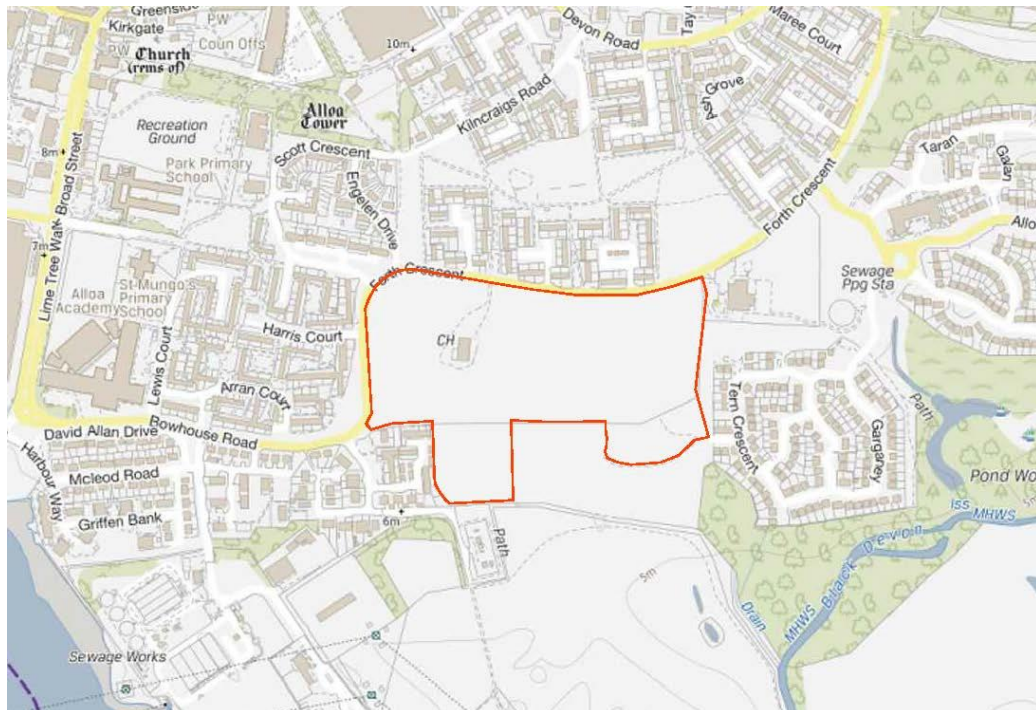


Figure 2-1 - Location Plan

### Development Proposals

- 2.3 It is proposed to relocate the existing rugby pitches and provide 2 new grass pitches and a covered synthetic pitch in the western extent of the site. The relocation of the rugby pitches will then provide the land for 85 new units with associated roads and access, landscaping, open space, parking and supporting infrastructure. A copy of the proposed development masterplan is attached in Appendix A.

### Topography

- 2.4 Review of the topographic survey of the site notes that the site is predominately flat in nature, with a slight fall to the south-west from the north across the site. The site high point is noted along the northern site boundary at a level of

7.6mAOD, with the low point noted to the south-west at a level of 6.0mAOD. A copy of the topographic survey for the site is attached in Appendix B.

#### Ground Conditions

- 2.5 A review of the British Geological Survey geology maps for the area was undertaken to determine the underlying geology of the site.
- 2.6 The maps suggest that the superficial deposits overlying the site consist of Raised Tidal Flat Deposits Of Holocene Age - Silt and clay. This sedimentary superficial deposit formed between 12 thousand years ago and the present during the Quaternary period.
- 2.7 The bedrock geology of the site was noted to consist of Passage Formation - Sedimentary rock cycles, clackmannan group type. This sedimentary bedrock formed between 318 and 328 million years ago during the Carboniferous period
- 2.8 It is recommended that ground conditions should be confirmed through a detailed site investigation report.

#### Existing Hydrological Regime

- 2.9 The development site falls within the natural drainage catchment of the Black Devon watercourse which passes the site approximately 400m to the south-east. The Black Devon originates approximately 17.4km to the east from runoff from the Cleish Hills.
- 2.10 The Black Devon is a tributary of the River Forth which it joins approximately 1.7km to the south ,however the River Forth is located approximately 500m to the south-west of the site at its closest point.
- 2.11 In addition to the open watercourses the Brothie Burn is culverted through the western extent of the development site, where the rugby pitches are to be relocated. The inlet to the culverted watercourse is located some 800m north of the site at Shillinghill roundabout. The culverted watercourse then works its way through the urban environment before discharging to the River Forth some 500m south west of the site adjacent to the Alloa Waste Water Treatment Works.

### 3 Flood Risk Assessment

#### Sources of Flood Risk

3.1 Current best practice recommends, and planning advice requires that all new developments should be free from significant flood risk from any source and should not materially increase the probability of flooding elsewhere. For the purposes of this report existing flood risk has been considered from the following sources -

- Coastal Flooding
- Fluvial Flooding
- Culvert Flooding
- Pluvial Flooding and Overland Flows
- Groundwater Flooding

#### Coastal Flooding

3.2 The development site is located some 500m from the River Forth, at its closest point. The River Forth along this reach is influenced by tidal interactions.

3.3 Information available from the SEPA Coastal Flood Boundary dataset predicts a 0.5% AEP tidal surge level in the River Forth in the Alloa Area of 4.8mAOD. The dataset notes that a freeboard of +300mm be used to allow for any inaccuracies in the predictions given a conservative 0.5%A.E.P surge level of 5.1mAOD.

3.4 SEPA guidance “Climate Change Allowances for Flood Risk in Land Use Planning” notes that a sea level rise allowance of 860mm should be applied for the Forth Estuary to take account of the impacts of climate change up to the year 2100. Taking account of this guidance the 0.5%A.E.P surge level is 5.96mAOD, this includes the 300mm freeboard allowance.

3.5 The lowest proposed floor level within phase 9 of the development is 7.4mAOD, some 1.4m above the conservative surge level. It is therefore considered that due to a combination of plan distance and vertical separation from the flood source that the site is not at risk of coastal flooding.

#### Fluvial Flooding

3.6 Fluvial flooding arises when the capacity of river channels are exceeded due to high flows, resulting in inundation of adjacent floodplains. The potential sources of pluvial flooding to the site are from the River Forth, Black Devon and culverted Brothie Burn.

3.7 Flooding from the River Forth has been considered above in the coastal flooding section, in which it is concluded that the site is not at risk of flooding from the River Forth. No further assessment of flood risk from the River Forth is therefore required.

3.8 Flooding from the culverted Brothie Burn is considered in the following section

of the report under culvert flooding.

- 3.9 In support of the planning application for Phase 8 Allanwater Developments appointed Farihurst to prepare a Flood Risk Assessment. This assessment was prepared in May 2019.
- 3.10 Within the Fairhurst FRA 2D modelling of the Black Devon was undertaken to quantify the risk of flooding from this source to phase 8. The modelling concluded that phase 8 was not at risk of fluvial flooding from the Black Devon under a 0.5%A.E.P (61.3m<sup>3</sup>/s) and 0.5%A.E.P +CC event (73.6m<sup>3</sup>/s) with a flood level of circa 4.5mAOD as per figure 3-1 below.



Figure 3-1 - Black Devon 200 Year + Climate Change Flood Extents. Figure C 10 Fairhurst FRA dated May 2019 Document number 127102/G/W/01

- 3.11 Phase 8 is located between the current proposed Phase 9 of development and the Black Devon. Furthermore the lowest proposed Finished Floor Level in Phase 9 is 7.4mAOD, some 2.9m above the flood level in the Black Devon.
- 3.12 It is therefore considered that the development is not at risk of fluvial flooding from the Black Devon.

Culvert Flooding

- 3.13 Within the 2019 Fairhurst FRA prepared for Phase 8 modelling of the Brothie Burn culvert was undertaken to quantify the risk of flooding to the development.
- 3.14 The major influence in watercourse and culvert hydraulics of the Brothie Burn as it flows through Alloa and the western extent of the development site is the culvert inlet adjacent to Shillinghill Roundabout.



3.15 The modelling found that under normal operating conditions for the 200 year event + CC event there was some flooding of the culvert inlet at Shillinghill Roundabout, however no risk of flooding to Phase 8 and 9 of development.

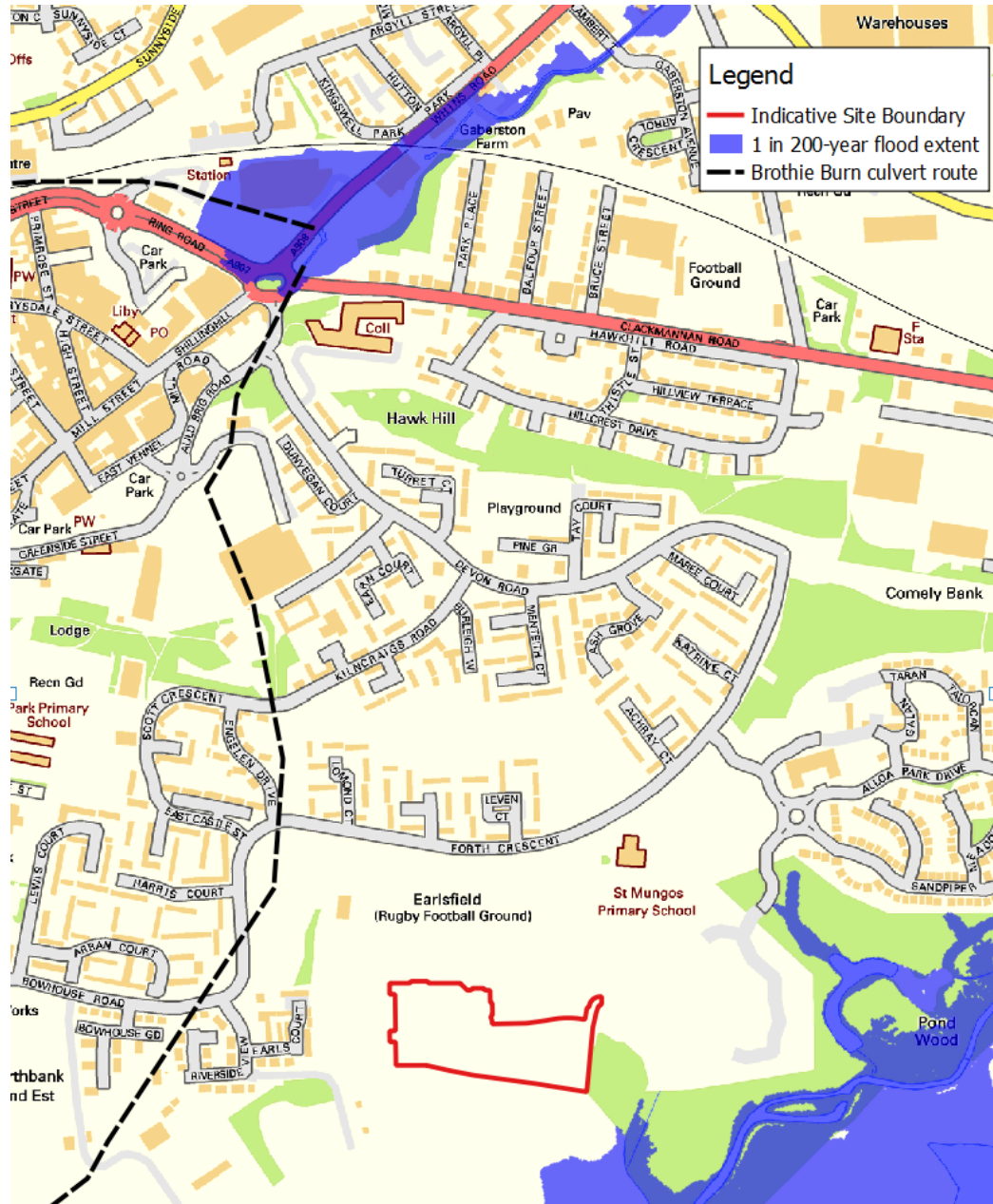


Figure 3-2 - Brothie Burn 200 Year + Climate Change Flood Extents. Figure 2 Fairhurst FRA dated May 2019 Document number 127102/G/W/01

3.16 Further analysis was carried out to establish what the impacts of culvert blockage or failure would have on Phase 8 of development. This analysis found that for a culvert inlet blockage of greater than 70% then overtopping of the Shillinghill Roundabout occurs. Once this happens flows then follow the topographic profile of the area and flow south towards and through Phase 8 and Phase 9 of the development site.

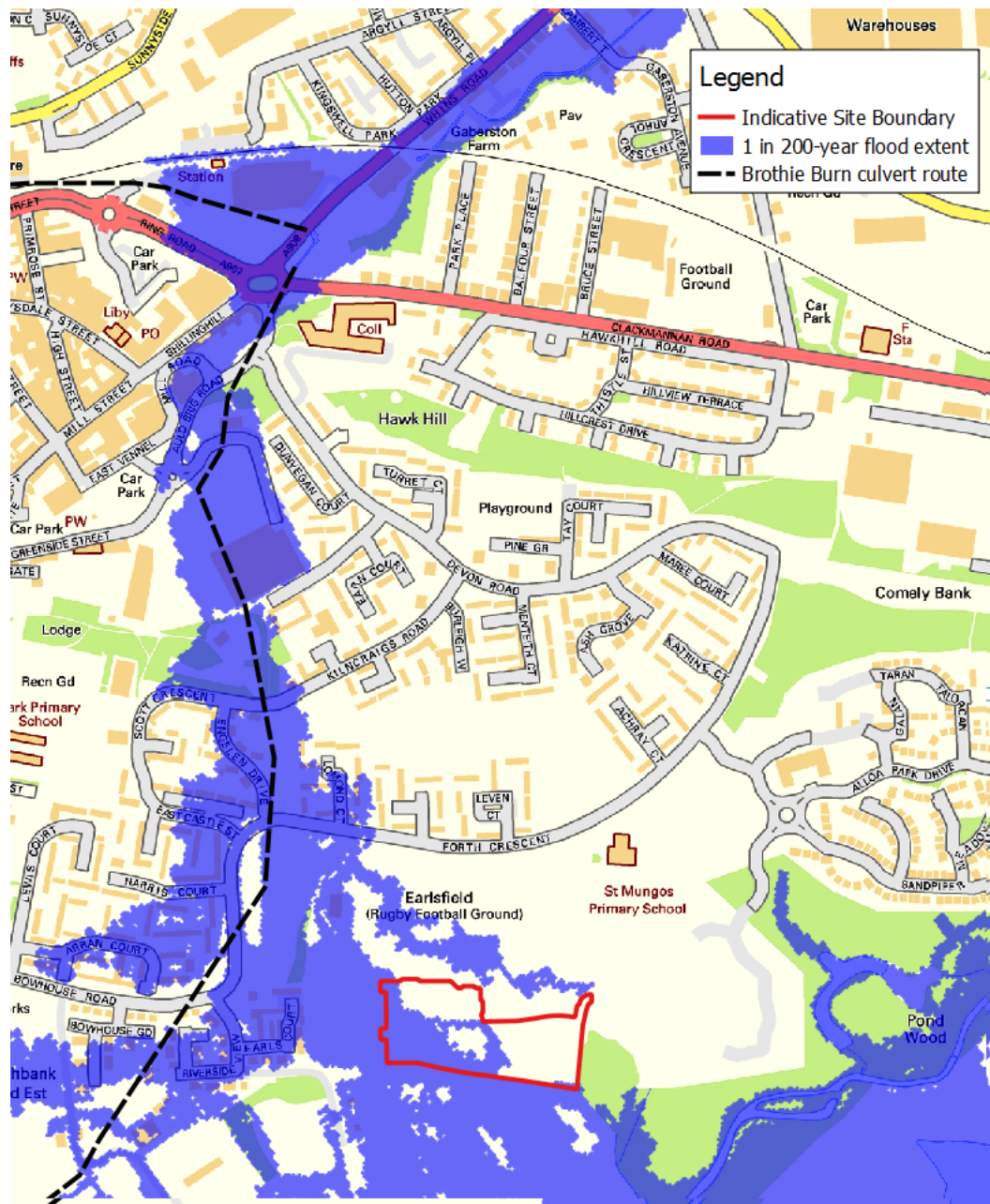


Figure 3-3 - Brothie Burn 200 Year + Climate Change Flood Extents. Figure 4 Fairhurst FRA dated May 2019 Document number 127102/G/W/01

- 3.17 The inlet to the culvert at Shillinghill Roundabout is maintained by Clackmannanshire Council and is inspected on a regular basis. The likelihood of a blockage greater than 70% occurring at the same time as the 0.5% A.E.P event is therefore considered extremely low.
- 3.18 Under the 100% culvert blockage event shown above in figure 3-3 the flooding has the greatest impact on the western extent of phase 9, where the relocated rugby pitches are proposed.
- 3.19 The relocation of the rugby pitches requires the reprofiling of the surface levels to provide a suitable playing surface. The reprofiling provides an opportunity

to channel and convey the flood flows under the extremely unlikely 0.5% A.E.P event plus 100% culvert blockage. This provides the opportunity to avoid overland flows from impacting on phase 8 and 9 of development but would also reduce the risk to existing neighbouring properties.

- 3.20 Fairhurst outlined preliminary principles of the regrading works for the rugby pitches in addition to raising an existing road junction, providing a continuous flood bund along the boundary with the existing properties in Earl's Court and a flow conveyance channel to the Black Devon.
- 3.21 Preliminary modelling of these upgrades was also undertaken, see figure 4-3 below. A larger copy of figure 4-3 is also attached in Appendix C. The modelling notes a reduction in offsite flooding and also no impact on Phase 8 or 9 of development. The modelling notes a flood depth of 250mm adjacent to Phase 9 of development.

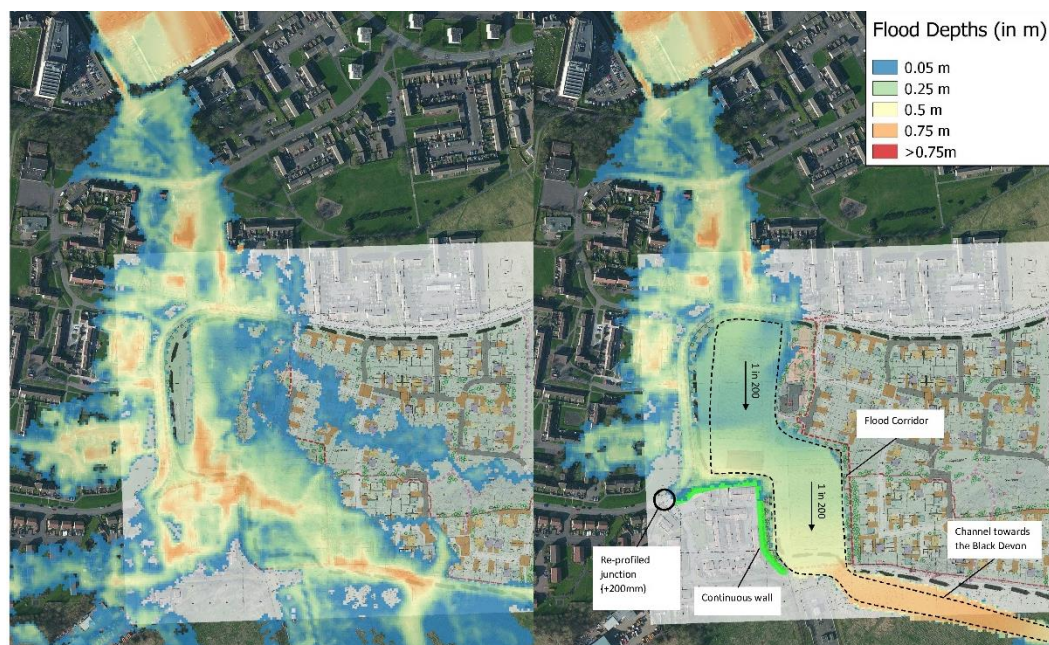


Figure 3-4 - Pre and Post Mitigation flood depths (Fairhurst)

- 3.22 As part of the phase 9 planning application DBA have taken the modelling principles outlined by Fairhurst and developed these into design drawings to form part of the planning application. The plans are attached in Appendix D.
- 3.23 The pitch adjacent to Phase 9 of development slopes in level from 6.6mAOD to 6.05mAOD from north to south, this would give a maximum overland flood flow level of 6.85mAOD. The lowest proposed plot level in phase 9 is 7.4mAOD, some 650mm above the flood level and considered to be a suitable freeboard.
- 3.24 It is therefore considered that by implementing the mitigation works that Phase 9 will not be at risk of flooding in the event of culvert blockage or failure, whilst also reducing the risk of flooding to neighbouring properties.

#### Pluvial Flooding and Overland Flows

- 3.25 Pluvial flooding arises from rainfall generated overland flow prior to the overland flow being intercepted by a watercourse, sewer or other drainage network.
- 3.26 The general topography of the site and wider area is a fall south towards the River Forth. The land to the north of the development site is a residential area and is formally drained via a Scottish Water sewer network. Therefore there is limited potential for flows from the higher ground to the north to shed towards the development site.
- 3.27 Further more in order to facilitate gravity drainage of the site the ground levels of the site are being raised above existing levels. Therefore overland flows from external sources will not be able to flow into the site.
- 3.28 It is considered that the development site is not at risk of pluvial flooding or overland flows from external sources.
- 3.29 It is recommended that post development overland flow paths be clearly identified and given careful consideration during detailed design to ensure that development of the site does not generate any internal issues of pluvial flooding due to overland flows ponding in any low points within the new development.

#### Groundwater Flooding

- 3.30 Groundwater flooding occurs when the water table rises above the ground level. Groundwater is generally a contributing factor to flooding rather than the primary source.
- 3.31 Groundwater levels are generally in hydraulic continuity with nearby watercourses and considering the proximity of the site to the River Forth and Black Devon it is considered groundwater will in continuity with these features. A rise in river levels would result in a subsequent rise in ground water levels at the site. It has already be concluded that the site is not at risk of flooding from the River Forth or Black Devon and it is also considered that any subsequent rise in groundwater level will not impact the development site.
- 3.32 Groundwater levels will be confirmed as part of intrusive ground investigation works and any further recommendations made when this information becomes available.

## 4 Summary and Conclusions

- 4.1 In developing this Flood Risk Assessment for the proposed residential development located on land associated with Alloa Ruby Club to the south-east of Alloa, recommendations have focused on outlining a strategy to ensure that the development is not at an unacceptable risk of flooding and will not increase the risk of flooding elsewhere in accordance with current planning policy.
- 4.2 It has been concluded that the site is not risk at of coastal flooding due to a combination of plan and vertical distance from the flood risk.
- 4.3 It has been concluded that the site will not be at risk of fluvial flooding from the River Forth or the Black Devon due to a combination of plan distance and vertical separation from the watercourses.
- 4.4 Through hydraulic modelling undertaken previously by Fairhurst on behalf of AllanWater Developments it has been identified that under a 0.5%A.E.P event and a culvert inlet blockage of more than 70% that the western extent of the development site would be at risk of flooding from the resultant overland flow from the culverted Brothie Burn.
- 4.5 The relocation of the rugby pitches and associated reprofiling of the ground to provide a suitable playing pitch provides the opportunity to manage flood flows through the site under a culvert inlet blockage of greater than 70% scenario. Modelling of this principle notes that not only is the development site protected but a betterment is provided to the existing residential properties adjacent to the development site.
- 4.6 It is considered due to the presence of formal drainage network serving the built environment surrounding the site in combination with the topography of the area and site that the site is not at risk of fluvial flooding. It is recommended that post development overland flows are considered as part of detailed site design and that adequate drainage measures are implemented to ensure any risk of ponding within the developed site is prevented.
- 4.7 It is considered that the site is unlikely to be at risk of groundwater flooding due to the topography of the site relative to the main water features in the area which groundwater level is considered to be in hydraulic continuity with. It is however recommended that groundwater levels be confirmed as part of a detailed site investigation reporting for the proposed site.

### Closing Conclusions

- 4.8 It is the conclusion of this report that, by implementing the recommendations outlined within; the proposed development at the site will not be at an unacceptable risk of flooding and will not increase the risk of flooding elsewhere.

**Appendix A**  
**Proposed Development Masterplan**

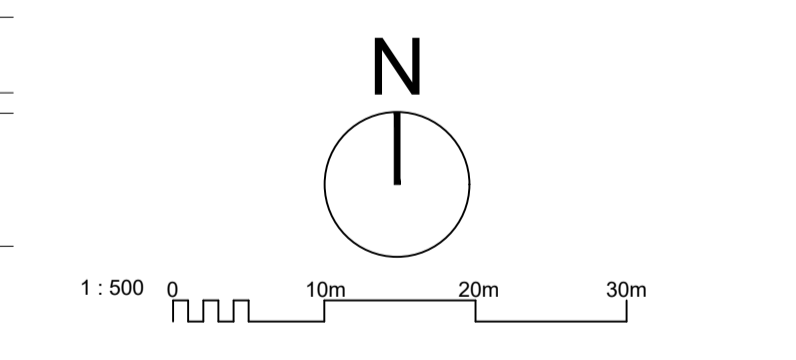


**LEGEND:**

**HOUSETYPES**

	ARROCHAR 3 bed semi 3SV83 [2 parking spaces in curtilage]	8
	NEVIS 3 bed detached 3SV83 [2 parking spaces in curtilage]	14
	CHEVIOT 3 bed detached (int garage) 3DV98 [2 parking spaces in curtilage]	7
	SIDLAW 3 bed detached (dual frontage) 3DV101 [2 parking spaces in curtilage]	24
	OCHIL 4 bed detached (int garage) 4DV104 [3 parking spaces in curtilage]	8
	Fintry 4 bed detached 4DV111 [3 parking spaces in curtilage]	16
	CULLIN 4 bed detached (int garage) 4DV122 [3 parking spaces in curtilage]	7
	ARISAIG 4 bed detached (int garage) 4DV129 [3 parking spaces in curtilage 7x3 garage]	2
<b>TOTAL</b>		<b>86</b>

- EXTERNALS**
- Bins
  - Clothes drying
  - 900mm path path
  - Patio
  - Entrance Platt
- ROADS**
- 1800 high wall and fence panels
  - 1800 high timber screen fence
  - 900 high post and rail fence
  - Boundary hedging
  - Principal road 5.5m with footpath both sides with build outs reducing to 3.7m
  - Raised table junctions in block paviers
  - Shared surface road 5.5m core reducing to 3.7m contrasting block paviers
  - 3m path Pedestrian / cycle paths
  - 3.7m pedestrian / cycle path capable of accommodating an emergency access.
  - Demarcated visitor parking provision



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38 WALKER TERRACE, TILlicOUNTRY, FK13 6EF 01259 750301  
 5 NESS BANK, INVERNESS, IV2 4SF 01463 233760  
 15 LOCHSIDE STREET, OBAN, PA34 4HP 01631 359054

**ALLOA PARK WEST RUGBY FIELDS ALLANWATER**

**PROPOSED HOUSING LAYOUT**

STATUS: **FOR APPROVAL**

SCALE: 1 : 500 DRAWN: --  
 PAPER SIZE: A1 DATE: Mar 2021  
 DWG No. 4603-02-003 REV: G

Pitch No. 2  
94x68m  
3m Flat area beyond pitch

**Phase 8 Development**



Graded embankment  
3m Flat area beyond pitch

New Rugby Grounds

Pitch No. 1  
100x68m

Club House

Existing parking upgraded

Covered 25m x 50m synthetic training pitch.  
Structure 30m x 55m

Pitch No. 2  
90x68m

Green space

EARL'S COURT  
EARL'S CT

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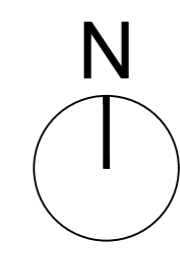
ALLOA PARK WEST  
RUGBY FIELDS  
ALLANWATER

PROPOSED NEW RUGBY FACILITIES

STATUS: **FOR APPROVAL**

SCALE: 1:500 DRAWN: --  
PAPER SIZE: A1 DATE: Dec 2020

DWG No. 4603-02-002 REV. D

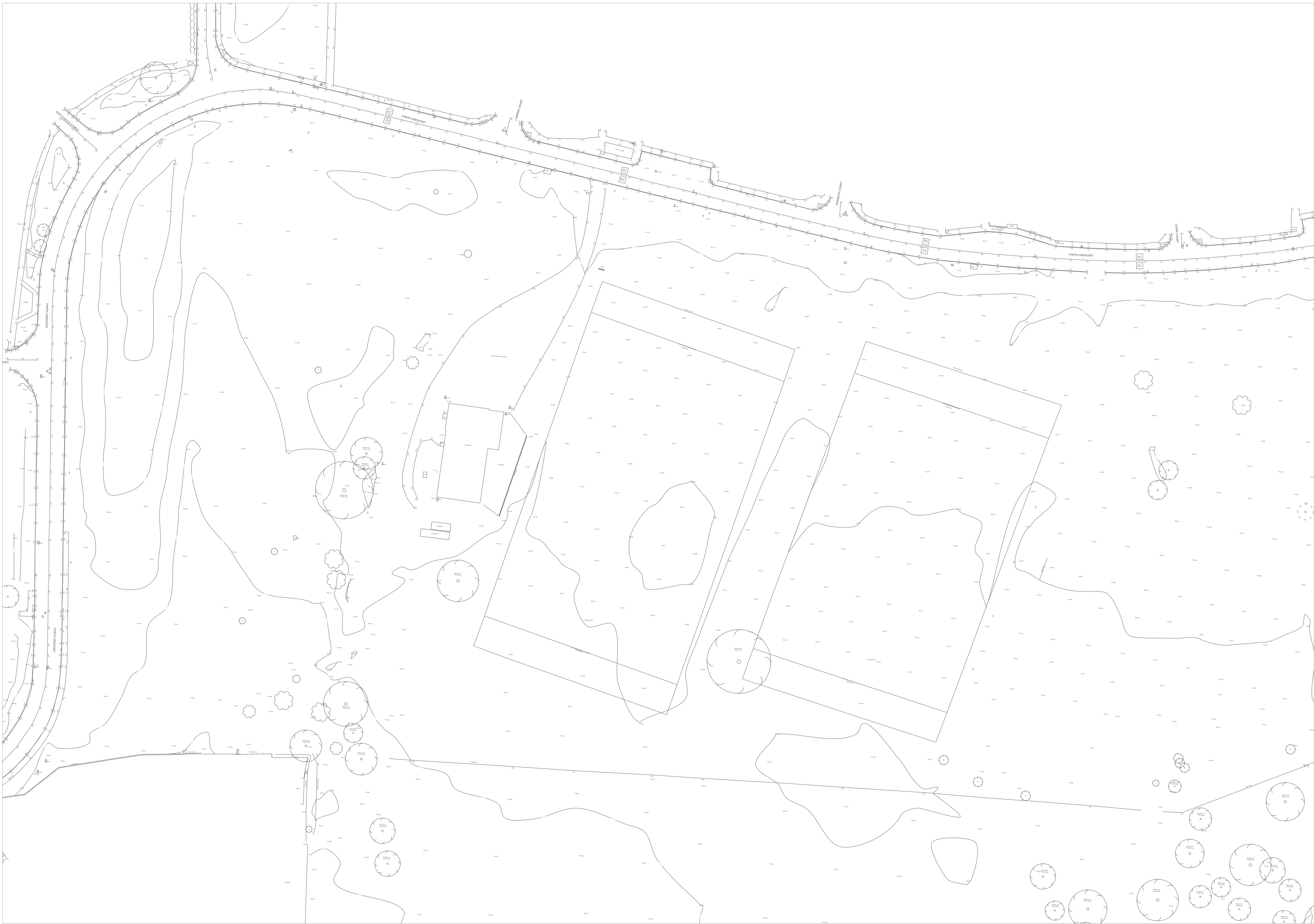


GVC



# **Appendix B**

## **Topographic Survey**



## **Appendix C**

# **Culvert Blockage Mitigation Principles by Fairhurst**