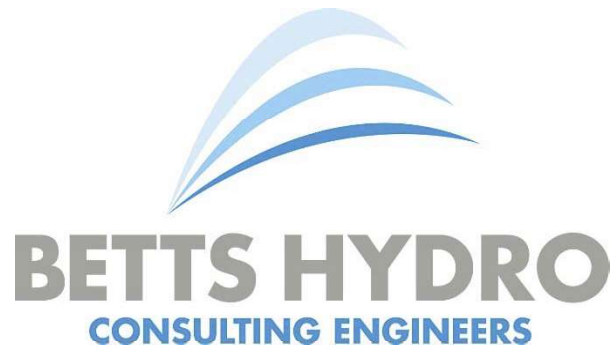




LAND OFF ROSSETT ROAD ROSSETT

RIVER ALYN AT ROSSETT HYDRAULIC ASSESSMENT



For
Castle Green
Unit 20
St Asaph Business Park
St Asaph
Denbighshire
LL17 0LJ

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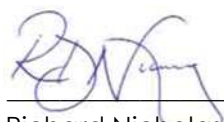
RIVER ALYN AT ROSSETT HYDRAULIC ASSESSMENT

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Specialist Software

-  Flood Modeller 4.6
-  TUFLOW Build 2018-03-AE
-  QGIS 3.16.6

Abbreviations & Acronyms

AEP	Annual Exceedance Probability	mAOD	Metres Above Ordnance Datum
FZ	Flood Zone	NGR	National Grid Reference
CC	Climate Change	NPPF	National Planning Policy Framework
EA	Environment Agency	OS	Ordnance Survey
FEH	Flood Estimation Handbook	TWL	Top Water Level
FRA	Flood Risk Assessment	LLFA	Lead Local Flood Authority

1.0 INTRODUCTION

1.1 Commission

- 1.1.1 This Hydraulic Assessment was commissioned by Castle Green to undertake a Hydraulic Assessment understand the fluvial flood risk posed by the River Alyn in relation to a proposed development on Land at Rossett Road, Rossett.
- 1.1.3 This report is to support the Flood Consequence Assessment and Drainage Management Strategy as part of a planning application.

1.2 Outline of Assessment

- 1.2.1 Betts Hydro obtained Natural Resources Wales's (NRW) hydraulic model of the River Alyn in Rossett.
- 1.2.2 Modifications were made to the NRW model to improve the accuracy of the outputs and make them more relevant to the development site.
- 1.2.3 The model was run for the fluvial events from the 1 in 2 year to the 1 in 1000 year, including climate change and blockage analyses in the existing scenario. The key flood events were then simulated in the proposed scenario.
- 1.2.4 The results of the study provided flood depth, level, modelled events, and a comparison of flood depth difference in the existing and proposed scenarios was undertaken.

2.0 EXISTING SITE

2.1 Location

- 2.1.1 The site is accessed off Rossett Road in Rossett. The Ordnance Survey National Grid Reference (OS NGR) for the site is E: 337284, N: 357242 and the nearest postcode is LL12 0DZ (full location plan is included in **Appendix E**). The total site covers 6.27ha and is divided into two separate parcels by Rossett Road. The Northern Development Parcel covers 2.83ha and the Southern Development Parcel covers 3.44ha. The parcels are edged in red in **Figure 1**. The site is bounded to the north, east and south by undeveloped agricultural land. To the west of site however is the main village of Rossett with both residential and commercial development.

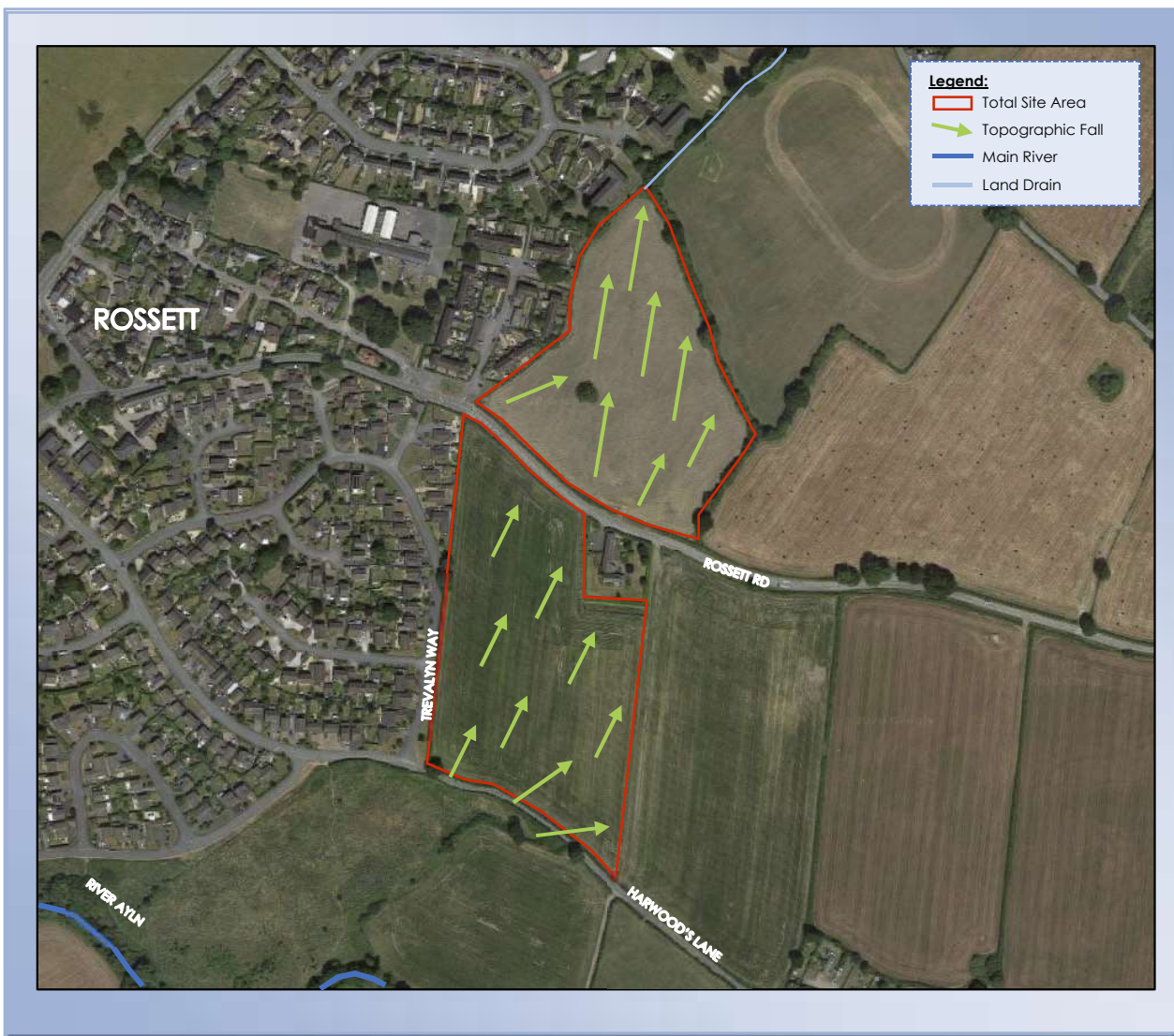
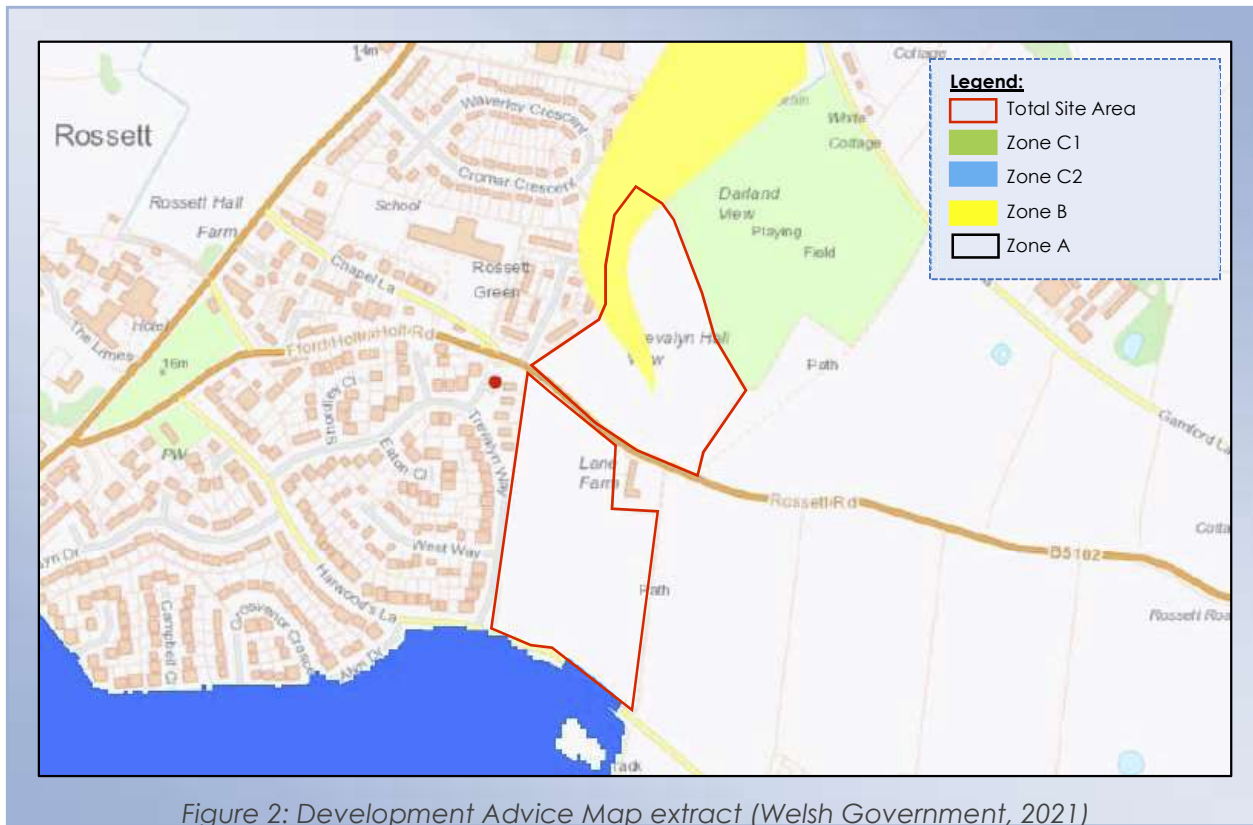


Figure 1: Aerial Photograph of site (Bing Maps, 2021)

2.2 Natural Resources Wales Development Advice Map (DAM)

2.2.1 The Natural Resources Wales' (NRW) Development Advice Map (DAM) indicates that the site is located within Zone A and is within an area of low fluvial flood risk. The nearest Main River is the River Alyn located less than 180m to the south. There are flood defences upstream of the site on the northern bank of the River Alyn. The DAM is shown in **Figure 2**.



2.2.2 The Flood Zones are defined as follows:

-  Flood Zone A: Areas considered to be at little or no risk of fluvial/tidal flooding.
-  Flood Zone B: Areas known to have historically flooded based on sedimentary evidence deposits.
-  Flood Zone C: Areas considered to be located on floodplain based on EA extreme flood outline data (equal to or greater than 0.1% fluvial/tidal flooding). This zone is subdivided into:
 - Zone C1 - Areas considered to be developed and served by significant infrastructure (flood defences).
 - Zone C2 - Areas considered to be located within natural floodplain without significant flood defences.

3.0 HYDRAULIC MODELLING

3.1 River Alyn Model

- 3.1.1 Natural Resources Wales has provided the River Alyn hydraulic model. Betts Hydro has reviewed NRW's River Alyn model, the extent of which is shown in **Figure 3**. The model includes the River Alyn from Croeshowell Hill west of the A483 to Rossett Road bridge. The NRW model includes data for simulating events from the 1 in 2 year to the 1 in 1000 year and includes the 20% and 30% allowance for climate change on the 1 in 100 year event.

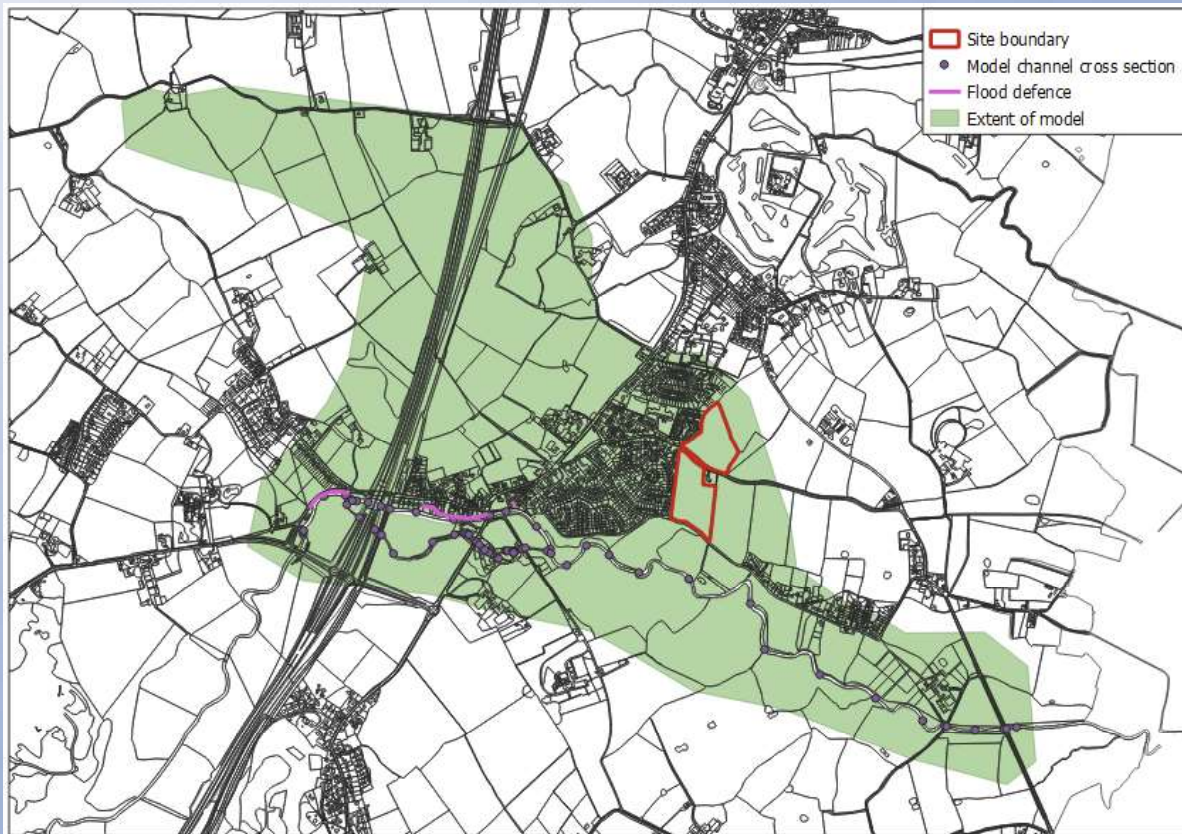


Figure 3: NRW model extent

- 3.1.2 The current guidelines for climate change on the River Dee catchment (in which the River Alyn falls under) is for an allowance of 25% for the Higher Central (70th percentile) estimate and 45% for the Upper (90th percentile) estimate on top of the 1 in 100 year flow event.
- 3.1.3 The resolution of the flood outputs is a 3m grid, which was deemed adequate for the present study.

3.2 Existing Scenario Model Modifications

3.2.1 The NRW model was modified to provide better accuracy and the update the climate change allowance to the current standard. The following modifications were made to create the present study existing scenario model:

-  Model 2D domain extended;
-  New HQ boundaries added at 2D model extent;
-  Site specific topographical survey added;
-  Climate change allowance updated to current standard of 25% and 45%.

3.2.2 The existing site topographical survey is shown on the MB Surveying Ltd drawing no. **MBS825** in **Appendix A**. The full model schematic is provided on drawing no. **HYD554/001/A** in **Appendix B**.

3.3 Proposed Scenario Model Modifications

3.3.1 Proposed site ground and finished floor levels were added to the model to create a proposed scenario. The proposed site levels are shown on Drawing nos. **HYD554/0101/B** and **HYD554/0104/B** in **Appendix C**.

3.3.2 The design allows flood flow to pass through the site in extreme events while maintaining the proposed dwellings free from flooding without detriment to nearby properties.

4.0 MODEL RESULTS

4.1 Introduction

- 4.1.1 For the present study, the Natural Resources Wales River Alyn model was used, with some modifications, to better understand the fluvial flood risks to the site. The following modelling scenarios were undertaken:

-  Existing scenario
-  Proposed scenario

- 4.1.2 The results of these modelling scenarios were presented as flood extent, depth and level maps focusing on the proposed development area.

4.2 Existing Scenario

- 4.2.1 Betts Hydro has updated the NRW with the site topographical survey and the climate change allowances to meet the current standard of 25% and 45% increases over the next 100 years.

- 4.2.2 To give a full picture of flood risk to the site of a wide range of annual exceedance probabilities (AEP) and scenarios have been assessed. In all simulations, the defended scenario has been used to provide the real flood risk. The following simulations have been undertaken:

-  50% AEP (1 in 2 year)
-  10% AEP (1 in 10 year)
-  5% AEP (1 in 20 year)
-  3.3% AEP (1 in 30 year)
-  2% AEP (1 in 50 year)
-  1% AEP (1 in 100 year)
-  0.1% AEP (1 in 1000 year)
-  1% AEP plus 25% climate change
-  1% AEP plus 45% climate change
-  0.1% AEP plus 25% climate change
-  0.1% AEP plus 45% climate change
-  1% AEP with blockage at Chester Road bridge
-  1% AEP plus 25% climate change with blockage at Chester Road bridge
-  1% AEP plus 45% climate change with blockage at Chester Road bridge

- 4.2.3 The results have been presented as the enclosed peak flood depth and flood level plans.

Existing Scenario Results

- 4.2.4 Flow remains mostly within the River Alyn channel banks in the 50% AEP (1 in 2 year) event, as shown on drawing nos. **HYD554/101/A** and **HYD554/102/A** in **Appendix D**. There is no flooding on the north side of the River Alyn and no flood risk to the proposed development site.
- 4.2.5 In the 10% AEP (1 in 10 year) event, flooding on land between the River Alyn and Harwood's Lane occurs, as shown on drawing no. **HYD554/103/A** in **Appendix D**. Peak depth of flooding is between 0.41m and 0.60m. Drawing no. **HYD554/104/A** in **Appendix D** shows the peak level which is between 12.81mAOD and 13.00mAOD near to Harwood's Lane. The lowest ground level on the southern parcel of the proposed is approximately 13.50mAOD, hence no risk of flooding to site is posed in this event.
- 4.2.6 Flood extent and depth increased in the 5% AEP (1 in 20 year) when compared to the 10% AEP event, as can be seen on drawing nos. **HYD554/105/A** and **HYD554/106/A** in **Appendix D**, although the flood still does not extend to Harwood's Lane. The peak flood depth is approximately 0.61m and the peak flood level is between 12.81mAOD and 13.00mAOD closest to Harwood's Lane.
- 4.2.7 Drawing no. **HYD554/107/A** in **Appendix D** shows the peak flood depth in the 3.3% AEP (1 in 30 year) event which is between 0.61m and 0.80m just south of Harwood's Lane. The peak flood level, shown on drawing no. **HYD554/108/A** in **Appendix D**, is between 13.01mAOD and 13.20mAOD on the southern side of Harwood's Lane.
- 4.2.8 The flood extent has increased in the 2% AEP (1 in 50 year) event when compared to the 3.3% AEP event as expected. The flooding is still confined south of Harwood's Lane. The peak flood depth is approximately 0.81m just south of Harwood's Lane, as shown on drawing no. **HYD554/109/A** in **Appendix D**. The peak flood level, shown on drawing no. **HYD554/110/A** in **Appendix D**, is between 13.01mAOD and 13.20mAOD.
- 4.2.9 Drawing nos. **HYD554/111/A** and **HYD554/112/A** in **Appendix D** show the peak flood depth and flood level in the 1.3% AEP (1 in 75 year) event, respectively. The peak flood depth is between 0.81m and 1.00m just south of Harwood's Lane and the peak level is between 13.21mAOD and 13.40mAOD.
- 4.2.10 The peak flood depth in the 1% AEP (1 in 100 year) event is shown on drawing no. **HYD554/113/A** in **Appendix D** and is between 0.81m and 1.00m. The flood still does not extend beyond Harwood's Lane the site is not affected. Drawing no. **HYD554/114/A** in **Appendix D** shows the peak flood level in the 1% AEP event to be between 13.21mAOD and 13.40mAOD which below the lowest site ground level.
- 4.2.11 The 0.1% AEP (1 in 1000 year) event flood depth and level plans are shown on drawing nos. **HYD554/115/A** and **HYD554/116/A** in **Appendix D**, respectively. The peak flood depth is approximately 1.21mAOD and the peak flood level is approximately 13.60mAOD on the southern side of Harwood's Lane close to the south west corner of the site.

Climate Change

- 4.2.12 The 1% AEP (1 in 100 year) and 0.1% AEP (1 in 1000 year) events were simulated with the latest climate change allowances of 25% and 45% increases in flow. The 1% AEP event plus 25% climate change flood depth and level plans are shown on drawing nos. **HYD554/117/A** and **HYD554/118/A** in **Appendix D**, respectively. The flood extent still remains south of Harwood's Lane and the peak depth is between 1.01m and 1.20m. The peak flood level is between 13.41mAOD and 13.60mAOD.
- 4.2.13 Drawing nos. **HYD554/119/A** and **HYD554/120/A** in **Appendix D** show the flood depth and level respectively for the 1% AEP event plus 45% climate change. The proposed development site is not at risk of flooding in this event.
- 4.2.14 In the 0.1% AEP event plus 25% climate change, the proposed development site is at risk of flooding. The peak flood depth in the site south of Rossett Road is approximately 0.19m and 0.30m on the north site of Rossett Road, as shown on drawing no. **HYD554/121/B** in **Appendix D**. The peak flood level plan is shown on drawing no. **HYD554/122/B** in **Appendix D**. Peak flood level on the site south of Rossett Road is approximately 13.35mAOD and on the northern side 12.66mAOD.
- 4.2.15 The flood depth and level plans for the 0.1% AEP plus 45% climate change are shown on drawing nos. **HYD554/123/B** and **HYD554/124/B** in **Appendix D**, respectively. The peak flood depth on the proposed development site south of Rossett Road is predicted to be approximately 0.26m and on the northern side approximately 0.51m. The peak flood level on the site south of Rossett Road is predicted as approximately 13.5mAOD and on the site north of Rossett Road approximately 12.7mAOD.

Blockage Analysis

- 4.2.16 A blockage analysis was performed by simulating an 80% reduction in the area of the opening at the arch bridge at Chester Road. The flow AEP events simulated were the 1% AEP (1 in 100 year) event, 1% AEP event plus 25% climate change, and the 1% AEP event plus 45% climate change.
- 4.2.17 The flood depth and level for the 1% AEP blockage scenario are shown on drawing nos. **HYD554/125/B** and **HYD554/126/B** in **Appendix D**, respectively. In this scenario, flood flow enters the site from the east on the southern side of Rossett Road. Flood depth of the southern part of the site is less than 0.20m and on the northern side the peak depth is approximately 0.43m. Peak flood level is approximately 13.54mAOD on the southern side of Rossett Road and 12.67mAOD on the northern side.
- 4.2.18 The flood depth for the 1% AEP plus 25% blockage scenario is shown on drawing no. **HYD554/127/B**, in **Appendix D**. The peak depth in the southern portion of the site is approximately 0.20m and north of Rossett Road it is 0.44m. Drawing no. **HYD554/128/B** in **Appendix D** shows the flood level. The peak flood level is 13.55mAOD on the site south of Rossett Road and 12.68mAOD on the northern side.
- 4.2.19 The flood depth in the 1% AEP plus 45% blockage scenario is shown on drawing no. **HYD554/129/B** in **Appendix D**. Peak flood depth south of Rossett Road is approximately 0.21m and north of Rossett Road, 0.46m. Peak flood level, which is shown on drawing

no. **HYD554/130/B** in **Appendix D** is approximately 13.56mAOD south of Rossett Road and approximately 12.69mAOD north of Rossett Road.

Conclusions

4.2.20 The site remains flood free in all events up to the 0.1% AEP (1 in 1000 year) event and 1% AEP (1 in 100 year) plus 45% climate change event. Flooding does occur on the site in the 0.1% AEP plus 25% climate change and 0.1% AEP plus 45% climate change events and in the Chester Road bridge blockage scenarios for 1% AEP, 1% AEP plus 25% climate change and 1% AEP plus 45% climate change. A summary of the peak depths and levels on the site in those flood risk events is shown in Table 1.

Events	Peak depth southern parcel (m)	Peak level southern parcel (mAOD)	Peak depth northern parcel (m)	Peak level northern parcel (mAOD)
0.1% AEP plus 25% climate change	0.19	13.35	0.30	12.66
0.1% AEP plus 45% climate change	0.26	13.50	0.51	12.70
1% AEP with blockage	0.20	13.54	0.43	12.67
1% AEP plus 25% climate change with blockage	0.21	13.55	0.44	12.68
1% AEP plus 45% climate change with blockage	0.22	13.56	0.46	12.69

Table 1: Approximate flood depth and level on proposed development site

4.3 Proposed Scenario

4.3.1 The Stage 1 hydraulic modelling assessment has addressed the existing site scenario and identified the events that posed a flood risk to the site. Stage 2 has addressed the post development scenario in those events. The events identified that pose a flood risk to the site were:

-  0.1% AEP plus 25% climate change
-  0.1% AEP plus 45% climate change
-  1% AEP with blockage at Chester Road bridge
-  1% AEP plus 25% climate change with blockage at Chester Road bridge
-  1% AEP plus 45% climate change with blockage at Chester Road bridge

Post Development Scenario

4.3.2 **Figure 4** shows the proposed development layout with the 0.1% AEP (1 in 1000 year) plus 45% climate change flood extent and depth and the basic direction of flood flow through the development site. Flood flow enters the southern parcel from the west and the south, crossing Rossett Road and flowing north through the northern parcel.

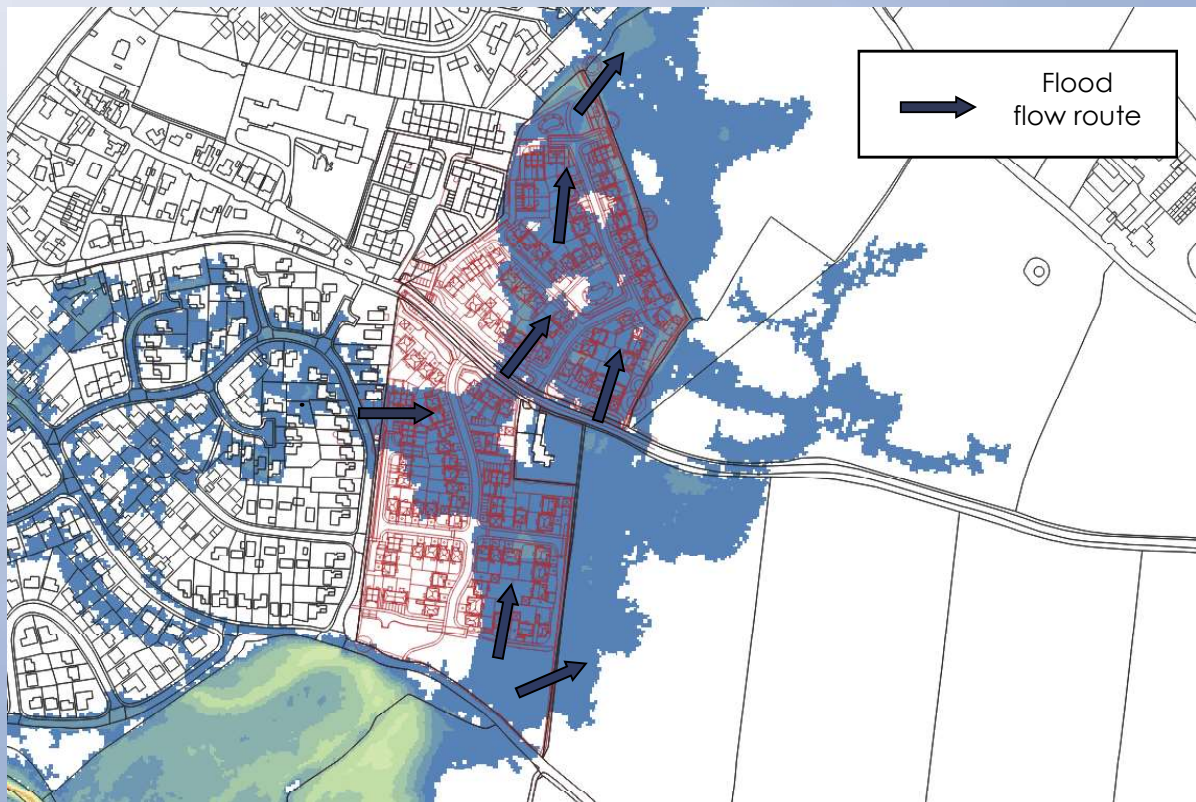


Figure 4: Existing flood flow routes through proposed development site

- 4.3.3 Levels in the proposed development have been designed to facilitate flood flow through the site, whilst keeping the dwellings flood free. The proposed flood routes through the development in the 0.1% AEP event are shown in **Figure 5**. The design has mimicked as closely as possible the existing flood flow routes through the development.
- 4.3.4 In the 0.1% AEP event plus 25% climate change, the proposed development site is at risk of flooding, as shown on drawing no. **HYD554/221/A** in **Appendix E**. Flood water enters the site from the south across Harwood Lane. The proposed ground elevations within the development channel the flood water northward along the main road through the site, exiting the southern parcel on Rossett Road. Flood water is then channel through the northern parcel along the main road and exits at the north east boundary. Flood depth remains less than <0.2m (200mm) in the majority of the development with a small area greater than 0.2m by the northern boundary.
- 4.3.5 The peak flood level plan is shown on drawing no. **HYD554/222/A** in **Appendix E**. Peak flood level on the site south of Rossett Road is approximately 13.457mAOD and on the northern side 12.564mAOD.

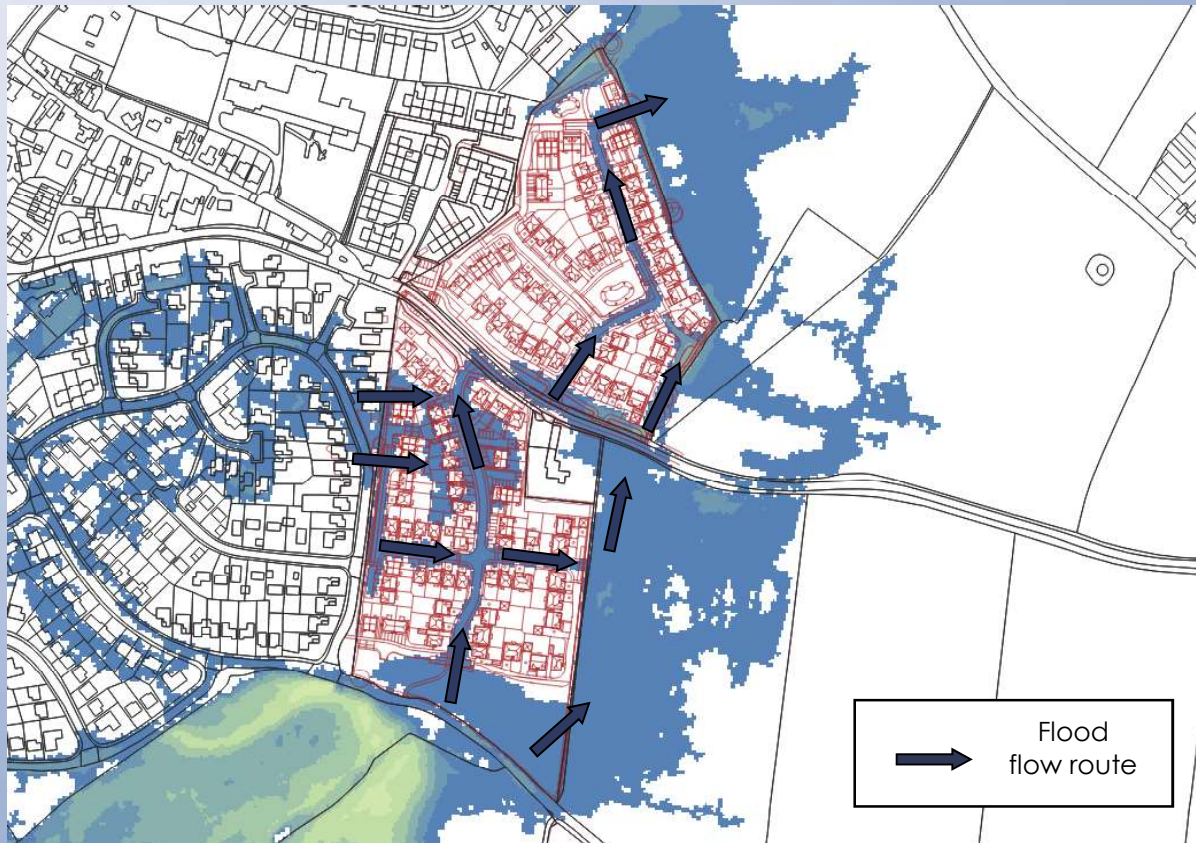


Figure 5: Proposed flood flow routes through development site

- 4.3.6 Flood depth in the 0.1% AEP event plus 45% climate change is shown on drawing no. **HYD544/223/A** in **Appendix E**. Flood flow enters the southern parcel site from the south and the west with flood depth mostly less than 0.2m (200mm). Flood water crosses Rossett Road and is channel through the northern parcel site along the main road before exiting at the north east boundary. No dwellings are at risk of flooding in the 0.1%AEP plus 45% climate change event.
- 4.3.7 Drawing no. **HYD554/224/A** in **Appendix E** shows the peak flood levels in the 0.1%AEP plus 45% climate change event. Peak flood level ranges from 13.521mAOD in the south of site to 11.895mAOD in the north.

Blockage Scenario

- 4.3.8 As in the existing scenario, the proposed scenario was tested with a blockage of 80% at Chester Road bridge. Drawing no. **HYD554/225/A** in **Appendix E** shows the flood depth plan in the 1% AEP blockage scenario. Flood flow enters the southern parcel of the development site via the western boundary. Flood depth on the development site is predicted to be mostly less than 0.2m (200mm) with small areas of between 0.2m and 0.4m (200mm and 400mm).
- 4.3.9 The flood level plan for the 1% AEP blockage scenario is shown on drawing no. **HYD554/226/A** in **Appendix E**. The peak flood level is approximately 13.54mAOD on the western boundary. Flood level falls in the westerly and northerly directions and is approximately 11.82mAOD on the northern boundary of the northern parcel.

- 4.3.10 The flood depth map for the 1% AEP event plus 25% climate change is shown on drawing no. **HYD554/227/A** in **Appendix E**. Flood water enters the site from the west and is mainly less than 0.2m (200mm) with some small areas of flood depth between 0.2m and 0.4m (200mm to 400mm).
- 4.3.11 The flood level plan for the % AEP event plus 25% climate change event in the blockage scenario is shown on drawing no. **HYD554/228/A** in **Appendix E**. Peak flood levels of around 13.56mAOD are predicted at the western boundary of the southern parcel where flood flow enters the site. No properties are at risk of flooding in this scenario.
- 4.3.12 Drawing no. **HYD554/229/A** in **Appendix E** shows the flood depth plan in the 1% AEP plus 45% climate change blockage scenario. Flood flow enters the southern parcel of the development site via the western boundary/ Flood depth on the development site is predicted to be mostly less than 0.2m (200mm) with small areas of between 0.2m and 0.4m (200mm and 400mm).
- 4.3.13 The flood level plan for the 1% AEP plus 45% climate change blockage scenario is shown on drawing no. **HYD554/230/A** in **Appendix E**. The peak flood level is around 13.59mAOD on the western boundary. Flood level falls in the westerly and northerly directions and is approximately 11.59mAOD on the northern boundary of the northern parcel.

Depth Difference

- 4.3.14 A comparison of flood depth between the existing and proposed scenarios has been undertaken in the following events:
-  0.1% AEP plus 25% climate change
 -  0.1% AEP plus 45% climate change
 -  1% AEP with blockage at Chester Road bridge
 -  1% AEP plus 25% climate change with blockage at Chester Road bridge
 -  1% AEP plus 45% climate change with blockage at Chester Road bridge
- 4.3.15 The depth difference in the 0.1% AEP plus 25% climate change is shown on drawing no. **HYD554/401/A** in **Appendix F**. There is a reduction or elimination of flooding on site where there are proposed dwellings and a reduction or negligible increase (<5mm) in flood depth in the wider flood plain area.
- 4.3.16 The depth difference in the 0.1% AEP plus 45% climate change event is shown on drawing no. **HYD554/401/A** in **Appendix F**. There are increases in flood depth within the development site along the roads where the flood flow is proposed to be channelled as part of the flood mitigation design. The flood depth is reduced (i.e., flooding is removed) in the areas where dwellings are proposed. There is also a reduction in flood depth and extent to the existing dwelling located at the north eastern boundary of the southern parcel. In the wider flood plain, there is a reduction or insignificant increase (<5mm) in flood depth in areas of existing housing to the north and the west of the proposed development.

- 4.3.17 Drawing no. **HYD554/403/A** in **Appendix F** shows the depth difference map for the 1% AEP blockage scenario. There is a reduction or elimination of flooding on site where there are proposed dwellings and a reduction or negligible increase (<5mm) in flood depth in the wider flood plain area. There is an increase in flood depth in the field to the north of the development of approximately 21mm.
- 4.3.18 In the 1% AEP plus 25% climate change blockage scenario depth difference map is shown on drawing no. **HYD554/402/A** in **Appendix F**. It shows reduction or negligible increase (<5mm) to the wider flood plain where existing housing is situated. There is an increase in flood depth in the field to the north of the site of approximately 30mm, however this is undeveloped land.
- 4.3.19 Drawing no. **HYD554/403/A** in **Appendix F** shows the depth difference map for the 1% AEP event plus 45% climate change blockage scenario. There is a reduction or elimination of flooding on site where there are proposed dwellings and a reduction or negligible increase (<5mm) in flood depth in the wider flood plain area. There is an increase in flood depth in the field to the north of the development of approximately 40mm.

Sensitivity Analysis

- 4.3.20 A sensitivity analysis was undertaken on the following key parameters in the model:

-  Manning's roughness +/- 20%
-  Structure coefficients +/- 20%
-  Flow + 20%
-  Downstream boundary +0.5m

- 4.3.21 The event used for the sensitivity analysis was the 0.1% AEP plus 45% climate change; the most extreme event simulated in the present study. The results of the sensitivity analysis at channel nodes downstream of Chester Road to Rossett Road bridge are tabulated in **Table 2** in **Appendix G**. Peak flood level plans for sensitivity tests in which flood level has increased have been created and are presented in **Appendix H**. Sensitivity tests in which level has increased are Manning's roughness +20%, flow +20% and downstream boundary level +0.5m.
- 4.3.22 When the channel and flood plain Manning's roughness coefficient was increased by 20%, this resulted in a maximum increase in water level of 0.081m (81mm) immediately downstream of Chester Road bridge. The mean increase was 0.02m (20mm) as shown in **Table 2** in **Appendix G**. The flood level plan of the development site, shown on drawing no. **HYD554/501/A** in **Appendix H**, demonstrates that none of the proposed dwellings is at risk from flooding.
- 4.3.23 A reduction in Manning's roughness coefficient resulted in a maximum reduction of 0.123m (123mm) immediately downstream of Chester Road bridge and a mean change of -0.04m (-40mm) as shown in **Table 2** in **Appendix G**.
- 4.3.24 Increasing structure coefficients (orifice and weir coefficients) by 20% resulted in a peak reduction in water level of 0.019m (19mm) and a mean change in peak water level of -0.014m (-14mm). A reduction of structure coefficients of 20% caused peak water level

to reduce by a maximum of 0.079m (79mm) and a mean change of -0.053m (-53mm) as shown in **Table 2** in **Appendix G**.

- 4.3.25 When flow was increased by 20%, peak water level increased by a maximum of 0.075m (75mm) occurring at node Alr10 (OS grid reference 337079, 356886) and a mean increase of 0.052m (52mm) as shown in **Table 2** in **Appendix G**. The flood level plan for the flow +20% analysis, shown on drawing no. **HYD554/502/A** in **Appendix H**, demonstrates that even with a 20% increase in flow on an extreme event, the proposed dwellings are not at risk of flooding.
- 4.3.26 The level (h) in the downstream stage-discharge curve was increase by 0.5m to test the sensitivity of peak levels to the level at the model downstream boundary. This resulted in a peak increase of 0.066m at node Alr00u (OS grid reference 338434, 356305) at Rossett Road bridge and a mean change of 0.002m (2mm) as shown in **Table 2** in **Appendix G**. The flood level plan for the flow+20% analysis is shown on drawing no. **HYD554/503/A** in **Appendix H** and shows that none of the proposed properties is at risk of flooding.

5.0 CONCLUSIONS AND RECOMMENDATION

5.1 Conclusions

- 5.1.1 The existing site remains flood free in all events up to the 0.1% AEP (1 in 1000 year) event and 1% AEP (1 in 100 year) plus 45% climate change event.
- 5.1.2 Flooding does occur on the site in the 0.1% AEP plus 25% climate change and 0.1% AEP plus 45% climate change events and in the Chester Road bridge blockage scenarios for 1% AEP, 1% AEP plus 25% climate change and 1% AEP plus 45% climate change. These are extreme events and are beyond that which would normally be considered a design event.
- 5.1.3 Proposed road and dwelling levels have been set channel flood flow through the site in the extreme events in which the site is at risk of flooding.
- 5.1.4 The proposed scenario hydraulic model has demonstrated that flood flow can pass through the site in extreme events and the dwellings will remain flood free.
- 5.1.5 The hydraulic modelling of the proposed scenario has also demonstrated that there is none or negligible impact on surrounding properties as a result of the proposals. The proposals in some instances reduce flood risk to neighbouring properties.
- 5.1.6 A sensitivity analysis has shown that variation in the model key parameters does not affect the predicted flood levels to such an extent that the proposed dwellings would be at risk of flooding.

5.2 Recommendation

- 5.2.1 A Flood Risk Assessment should be undertaken using the findings from this hydraulic assessment to support a planning application.

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