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FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY at

Penhurst, Newton Poppleford, EX10 0DW

Ref: 06057E - First Issue

Date: 10th April 2024

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REVISION RECORD									
Rev	Description	Date	Originator	Reviewed					
-	Initial Issue	10 April 2024	JWC	WP					



1 INTRODUCTION

- 1.1 structureHaus was commissioned to provide a Flood Risk Assessment (FRA) for the repair works to an existing river wall and footbridge. This site is located at Penhurst, Newton Poppleford, EX10 0DW.
- 1.2 This FRA is written per the requirements set out in the National Planning Policy Framework Document and Planning Practice Guidance which was last revised in August 2022. The Planning Practice Guidance was first published in 2014 and has since been continually updated.
- 1.3 A site specific Flood Risk Assessment is mandatory for the following:
 - Proposal of 1 hectare or greater situated in Flood Zone 1,
 - New development (including minor development and change of use) located in areas of Flood Zone 1 that have critical drainage problems,
 - New development (including minor development and change of use) located in areas of Flood Zones 2 & 3.
- 1.4 The main objectives of this report (as recommended in the National Planning Policy Framework Document) are to:
 - Identify the probability of flooding at the proposed site under existing and proposed conditions,
 - Identify the proposed site use and the effects of flooding on its users,
 - Consider the sites future flood risk due to climate changes and extreme flooding events,
 - Produce a conceptual surface water drainage strategy using sustainable drainage design where suitable and appropriate,
 - Ensure flooding to third parties is not increased as a result of development,
 - If applicable, mitigate any residual risks to flooding, including flood resilience and resistance, safe access/escape routes, and emergency planning.
- 1.5 This site is located within flood zone 3 therefore, a flood risk assessment is required.



2 SITE DESCRIPTION

- 2.1 The site is located at postcode EX10 0DW at National Grid Reference SY 08461 89737 and is bounded by the following:
 - To the north is land under the ownership of the property holder,
 - To the east is neighbouring garden,
 - To the south is neighbouring garden and land under ownership of property owner,
 - To the west is neighbouring garden.



Figure 1: Aerial view of the site

Existing Site

2.2 The existing site is a timber bridge with cobble faced block retaining wall over a river below.



Existing Drainage

2.3 There is no drainage for the existing bridge.

3 HYDROLOGY AND GEOLOGY

- 3.1 The closest water feature is Back Brook, the bridge crosses this water feature. The Brook is considered as a River by the Environment Agency.
- 3.2 The online British Geological Survey (BGS) map indicates that the site is underlain by Helsby Sandstone Formation, which is described by BGS as "Fineto medium-grained, locally micaceous, cross-bedded and flat-bedded sandstones, weathering to sand near surface."
- 3.3 It is possible that superficial deposits, in the form of Alluvium may also be present in some areas of the site. Alluvium is described by BGS as "clay, silt, sand and gravel".
- 3.4 The underlying strata are classified as a Principal Aquifer and are described by the Environment Agency as "layers of rock or drift deposits that have high intergranular and/or fracture permeability meaning that usually provide a high level of water storage. They may support water and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer"
- 3.5 The underlying superficial deposits strata are classified as Secondary A Aquifer and are described by the Environmental Agency as "permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers."
- 3.6 The site is within a source protection zone classified as Zone III Total Catchment. This is described by the Environment Agency as an "area around a supply source within which all the groundwater ends up at the abstraction point."
- 3.7 The site is located within a medium-high groundwater vulnerability.
- 3.8 Medium groundwater vulnerability is defined by the EA (Report SC040016) as "soils of intermediate leaching potential that have a moderate ability to attenuate



- diffuse source pollutants or in which it is possible that some non-adsorbed diffuse source pollutants and liquid discharges could penetrate the soil layer."
- 3.9 High groundwater vulnerability is defined by the EA (Report SC040016) as "soils of high leaching potential with little ability to attenuate diffuse source pollutants and in which non-adsorbed diffuse source pollutants and liquid discharge have the potential to move rapidly to underlying strata or groundwater".

4 FLOODING ISSUES Fluvial and Tidal Flooding

4.1 The Environment Agency flood map shown in Figure 2 indicates that the site lies within Flood Zone 3. This comprises land assessed as having a 1 in 200 or greater probability of tidal flooding or a 1 in 100 or greater probability of fluvial flooding.

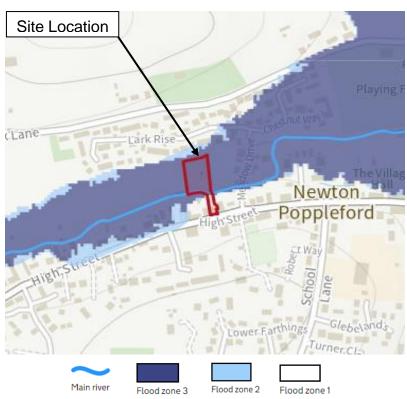


Figure 2 – Fluvial and Tidal Flood Map



Surface Water Flooding

4.2 Based on information provided by the Environment Agency, as shown in Figure 3, the bridge will be in an area at high risk of surface water flooding. This means there is more than a 3.3% chance of flooding each year.

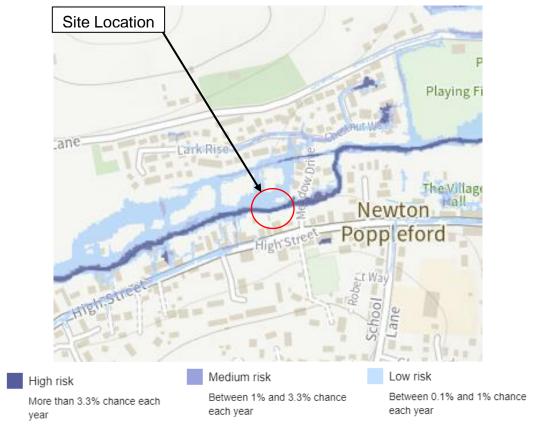


Figure 3 – Risk of Flooding from Surface Water Map

Product 4 Information

- 4.3 Product 4 information has been received from the EA and a full copy of the report can be found in Appendix A.
- 4.4 Flow information has been provided and used to calculate the predicted flood level for specified years.



4.5 Product 4 estimates a 9.98m³/s flow for a 100-year time period. To predict flood level peak river flow should be considered. This site is within flood zone 3a therefore, the central allowance must be used. Based off the longest lifetime (2080s) a peak river flow of 46% should be used to estimate the flow.

$$9.98 \times 1.46 = 14.57 \text{m}^3/\text{s}$$

4.6 Using Mannings Conveyance Equation below and 06057E-500-Watercourse Cross Section shown in Appendix B the flood depth was predicted for a 1 in 100-year time period and 46% peak river flow allowance:

 $Q = A R^{2/3} S^{0.5} n^{-1}$ $Q = Flow rate (m^3/s) = 14.47m^3/s$ n = Manning coefficient (0.035) s = Slope of channel (m/m) = 1/1340 R = Hydraulic radius = A/P = 0.399 $A = Cross sectional area (m^2) = 34.34m^2$ P = Wetted perimeter (m) = 86.05m $Q = 34.34 \times 0.399^{2/3} 1/340^{0.5} 0.035^{-1}$

- 4.7 Using the wetted perimeter and cross-sectional area above a flood level of 30.13m AOD is estimated.
- 4.8 Product 4 information also indicated existing flood defences in the form of embankments () located to the east of site along the boundary of the residential area. The upstream crest level of these embankments range between 25.65mAOD and 20.85mAOD.
- 4.9 There are also flood defences located to the west of the site next to Venn Ottery Road. These are indicated by product 4 as an embankment and bridge abutment. Both defences have a crest level of 36.90mAOD.
- 4.10 Furthermore, Product 4 provides a record of the previous flood events within and around the site. In July 1972 and October 2008 flooding occurred along Back Brook which affected the site. Two further flood events have occurred in July 1968 and December 1972, however both events only affected the area around the River Otter to the west of site.



Flooding from Reservoirs

4.11 As shown in Figure 4 by the EA map, the site is outside of the maximum extent of reservoir flooding.



Figure 4 – EA Map Showing the Maximum Extent of Flooding from Reservoirs

Flooding From Existing Drainage Systems

4.12 The bridge has no existing drainage.

Other Flood Risks

4.13 The bridge will be at risk of blockages, if a blockage was to occur water levels will rise around the bridge before entering the River again the opposite side of the blockage. Flood risk will not increase due to this.

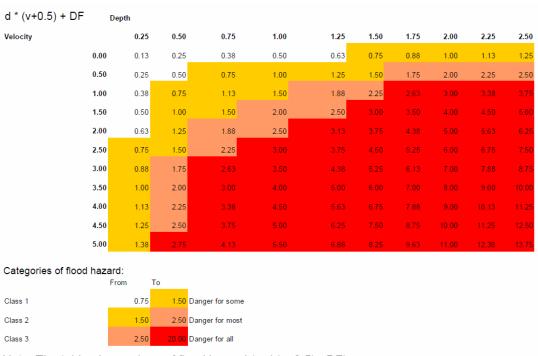


5 PROPOSED DEVELOPMENT

- 5.1 The proposal is to replace the existing timber bridge with a galvanized steel structure with block retaining wall and foundation. Refer to Appendix C for proposed layout.
- 5.2 These proposed works will require a EA permit for the construction the bridge within the river.

6 FLOOD HAZARD

6.1 Figure 5 below provides a flood hazard rating depending on the flood depth and flood velocity. The flood hazard rating varies from Class 1 (danger for some to Class 3 (danger for all) with the rating gradually increasing on the flood depth and velocity of flood water.



Note: The table gives values of flood hazard (= $d_*(v+0.5) +DF$)

Figure 5 – Flood Hazard Rating



6.2 Table 2 provides classification of the flood hazard rating derived from Figure 5 in relation to hazard to people ranging from low to extreme.

Table 1 - Hazard to People Classification

Hazard Rating	Hazard to People Classification
Low	Very low hazard - caution
Medium	Danger for some – includes children, the elderly and the infirm
Significant	Danger for most – includes the public
Extreme	Danger for all – includes the emergency services

6.3 The estimated flood level is 30.13m AOD. The proposed bridge has a path level of 29.79m AOD at the lowest point, this gives a flood depth of 0.34m. The hazard rating will be between low and significant. During a flood event the bridge will not provide essential access and therefore, should not be used.

7 ACCESS AND EGRESS

- 7.1 During extreme flood events the flood level could rise to an extent to which access across the bridge may not be possible.
- 7.2 If residents are on the northern side of the bridge during a flood event egress from the site can be found by heading to the northern boundary of the garden where a footpath can be found.
- 7.3 If residents are on the southern side of the bridge egress can be found by heading towards the property. The property is not within flood zone 2 or 3.

8 FLOOD RESILIENCE MEASURES

8.1 The structure will be underwater during extreme flood events therefore, will need to be suitably flood resilient.



9 SUMMARY

- 9.1 This FRA was written for the repair works to an existing river wall and footbridge. This site is located at Penhurst, Newton Poppleford, EX10 0DW.
- 9.2 Based on the Environment Agency flood map the proposed site lies within Flood Zone 3. This comprises land assessed as having a 1 in 200 or greater probability of tidal flooding or a 1 in 100 or greater probability of fluvial flooding.
- 9.3 The Environment Agency "Risk of Flooding from Surface Water" map indicates that the site is within an area at high risk of surface water flooding.
- 9.4 Product 4 information has been received from the EA giving information on predicted flow rates, flood defences and flood history.
- 9.5 Mannings Conveyance Equation was used to determine the flood level based on product 4 flow rates. For a 1 in 100-year period and 46% additional peak river flow the predicted flood level is 30.13m AOD.
- 9.6 Flood defences are located to the east of site in the form of embankments and west of site in the form of an embankment and bridge abutment.
- 9.7 Product 4 has records of 4 previous flood events within and around the site. Flooding has affected the site in July 1972 and October 2008 then further flooding has occurred around the site in July 1968 and December 1972 which did not affect the site.
- 9.8 The site is classed as a minor development therefore, according to the NPPF a exception and sequential test is not required.
- 9.9 The proposed bridge has a path level of 29.79 at its lowest point. With a predicted flood level of 30.13m AOD a flood dept of 0.34m is estimated.
- 9.10 There are 2 options for egress. If flooding occurs blocking the bridge, occupants on the northern side of the bridge can find egress by heading north towards the boundary of the garden where a footpath can be found. If occupants are on the southern side of the bridge egress can be found by heading towards the property. The property is outside of flood zone 3.



10 RESERVATIONS

10.1 This Flood Risk Assessment is generally based on information and statistics supplied by the Environment Agency with respect to historic and predicted events. As a result, this report does not in any way constitute or can be construed as constituting a representation or warranty, actual or implied, regarding the possibility of future flooding to the site. Ultimately, we cannot accurately forecast future natural events but 'best guess' these events based on historical statistics. As such, we have considered the likelihood of flooding, the possible implications and the mitigation measures that may be employed in order to minimise the impact.



APPENDIX A

Product 4

Flood risk assessment data



Location of site: 308430 / 89791 (shown as easting and northing coordinates)

Document created on: 26 March 2024

This information was previously known as a product 4.

Customer reference number: XHAF485AV4R6

Map showing the location that flood risk assessment data has been requested for.



Flood map for planning (rivers and the sea)

Your selected location is in flood zone 3.

Flood zone 3 shows the area at risk of flooding for an undefended flood event with a:

- 0.5% or greater probability of occurring in any year for flooding from the sea
- 1% or greater probability of occurring in any year for fluvial (river) flooding

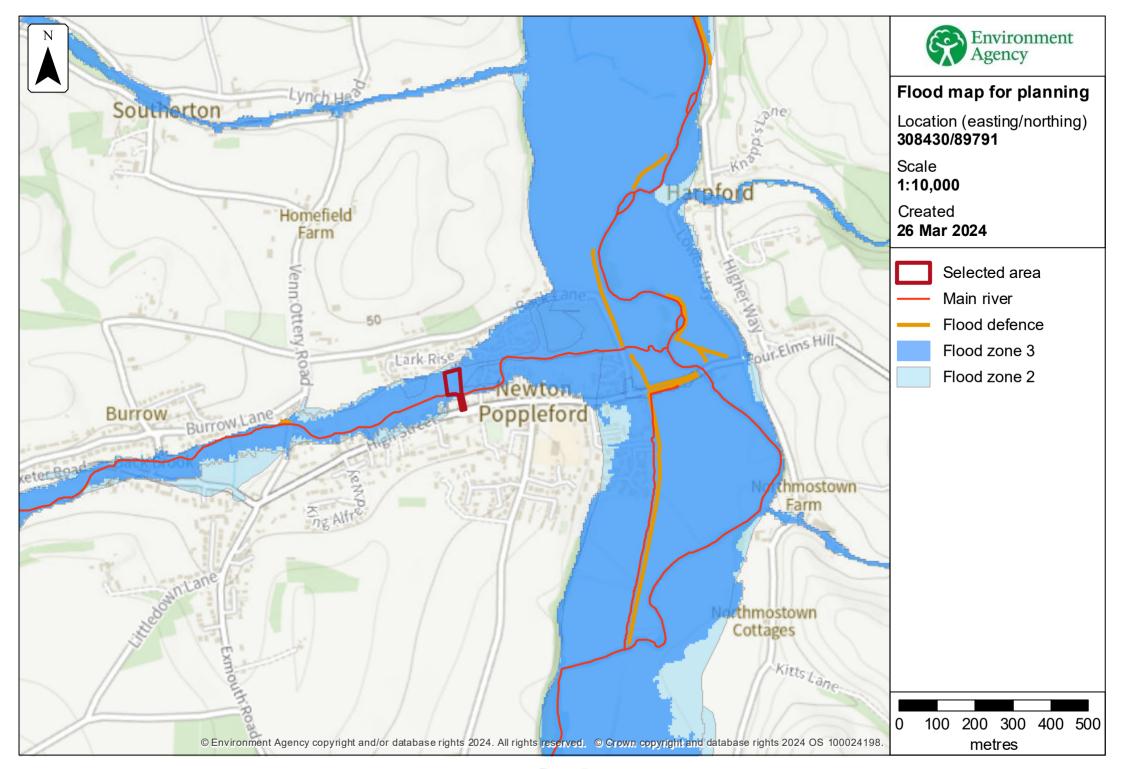
Flood zone 2 shows the area at risk of flooding for an undefended flood event with:

- between a 0.1% and 0.5% probability of occurring in any year for flooding from the sea
- between a 0.1% and 1% probability of occurring in any year for fluvial (river) flooding

It's important to remember that the flood zones on this map:

- refer to the land at risk of flooding and do not refer to individual properties
- refer to the probability of river and sea flooding, ignoring the presence of defences
- · do not take into account potential impacts of climate change

The flood zones are not currently being updated. The last update was in November 2023. Some of the flood zones may have changed, however all source data is included in the models below.



Page 5

Historic Information

The map below is an indicative outline of areas that have previously flooded.

Historic outlines may not be visible where they overlap. You can download the outlines separately via the link below.

Download recorded flood outlines in GIS format

Our historic flood event outlines:

- are an indication of the geographical extent of an observed flood event. We map flooding to land, not individual properties.
- do not give any indication of flood levels for individual properties. They also do not imply that any property within the outline has flooded internally.
- are based on a combination of anecdotal evidence, Environment Agency staff observations and survey.
- do not provide a definitive record of flooding.

It is possible that there will be an absence of data in places where we have not been able to record the extent of flooding. It is also possible for errors to occur in the digitisation of historic records of flooding.

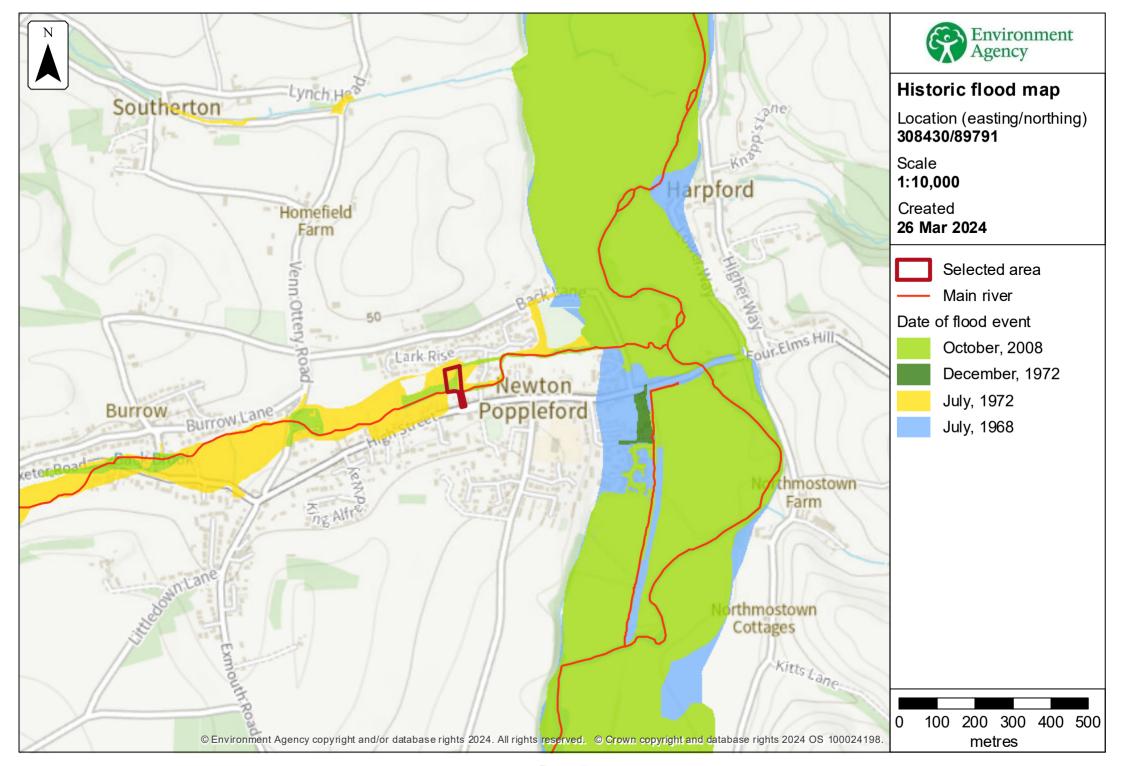
In addition to the Historic Flood Map we also hold historic flood information locally.

We have records of this area flooding in: October 2008 and May 2023

Please see attached maps/photographs if available.

Remember that other flooding may have occurred that we do not have records for.

Please note that our records are not comprehensive. Therefore, we advise that you make further enquiries locally with specific reference to flooding at this location. You should consider contacting the relevant Local Planning Authority and/or water/sewerage provider for the area.



Page 7

Flood defences and attributes

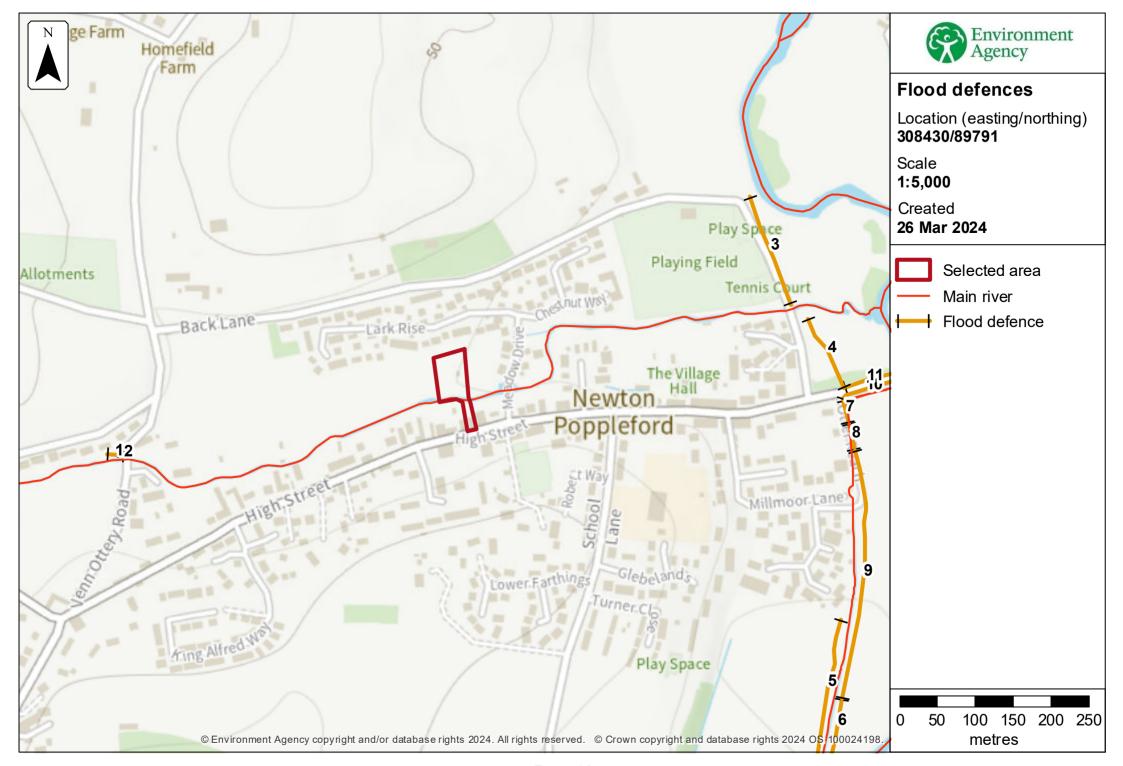
The flood defences map shows the location of the flood defences present.

The flood defences data table shows the type of defences and their condition. It shows the height above sea level of the top of the flood defence (crest level). The height is In mAOD which is the metres above the mean sea level at Newlyn, Cornwall.

It's important to remember that flood defence data may not be updated on a regular basis. The information here is based on the best available data.

Use this information:

- to help you assess if there is a reduced flood risk for this location because of defences
- with any information in the modelled data section to find out the impact of defences on flood risk



Page 10

Flood defences data

Label	Asset ID	Asset Type	Current condition	Downstream actual crest level (mAOD)	Upstream actual crest level (mAOD)	Effective crest level (mAOD)
1	403455	Embankment		36.90	36.90	
2	403456	Bridge Abutment		36.90	36.90	
3	42398	Embankment		23.85	23.99	
4	42397	Embankment		24.22	23.76	
5	144832	Embankment		22.10	22.68	
6	4155	Embankment		19.90	20.85	
7	4157	Embankment		22.57	23.93	
8	4156	Embankment		21.87	22.56	
9	42568	Embankment		20.86	21.84	
10	42396	Embankment		23.98	25.65	
11	4159	Embankment		25.52	24.23	

Any blank cells show where a particular value has not been recorded for an asset.

Modelled data

About the models used

Model name: JFLOW

Date: 2007

Model name: Devon Hydrology Strategy

Date: 2012

This model contains the most relevant data for your area of interest.

You will need to consider the <u>latest flood risk assessment climate change</u> <u>allowances</u> and factor in the new allowances to demonstrate the development will be safe from flooding.

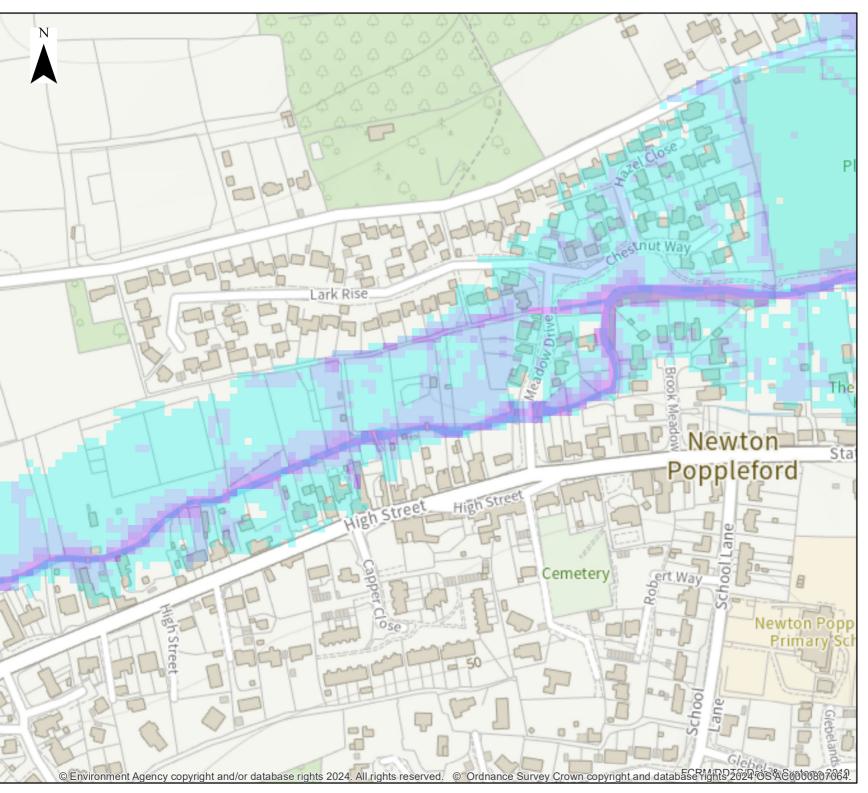
Terminology used

Annual exceedance probability (AEP)

This refers to the probability of a flood event occurring in any year. The probability is expressed as a percentage. For example, a large flood which is calculated to have a 1%chance of occurring in any one year, is described as 1% AEP.

Metres above ordnance datum (mAOD)

All flood levels are given in metres above ordnance datum which is defined as the mean sea level at Newlyn, Cornwall.





Undefended Modelled Fluvial Depth Map

Location (easting/northing) 308430/89791

Scale Created 1:2,600 28 Mar 2024

Model name JFLOW 2007

Legend

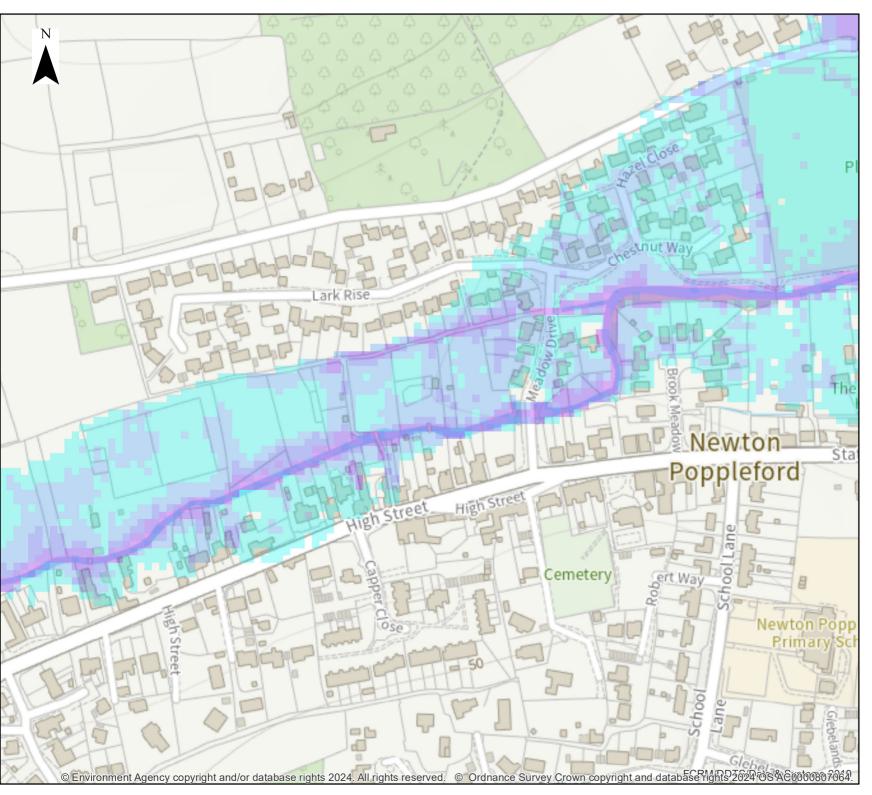
East Devon Undefended Q100 Depths Meters



0.6 - 0.8

1.5 - 2.5

2.5 +





Undefended Modelled Fluvial Depth Map

Location (easting/northing) 308430/89791

Scale Created 1:2,600 28 Mar 2024

Model name JFLOW 2007

Legend

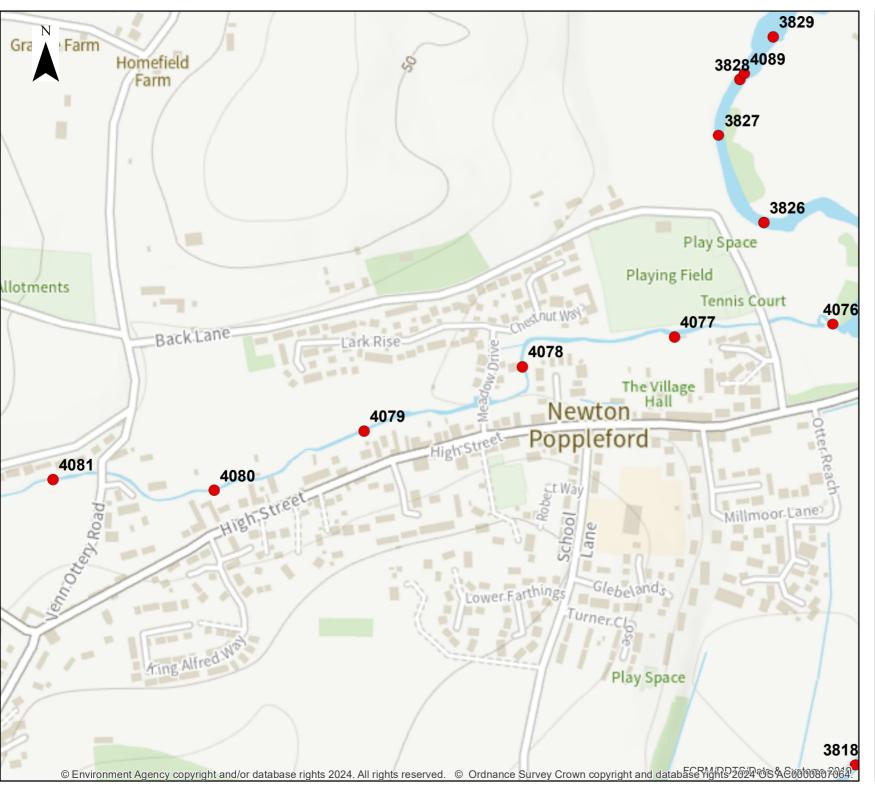
East Devon Undefended Q1000 Depths
Meters



0.3 - 0.6

0.8 - 1.5

1.5 - 2.5





Flow Node Map

Location (easting/northing) **308430/89791**

Scale Created 1:5,000 28 Mar 2024

Model name

Devon Hydrology Strategy 2012

Legend

Devon Hydrology Strategy Nodes

Modelled Flood Flows

Node	Easting	Northing	Area (km²)	Modelled Flood Flows, in m3/s (undefended model run)					Source	Confidence		
Reference				QMED	10yr	25yr	50yr	100yr	250yr	1000yr	Source	Confidence
3826	308872	90020	188.43	68.84	114.48	143.40	168.87	198.27	245.57	330.44	Dotton	High
3829	308884	90265	185.07	68.48	113.46	141.86	166.84	195.64	241.90	325.05	Dotton_FennyBr_joined	Medium
3828	308840	90208	188.28	68.60	113.80	142.37	167.52	196.51	243.12	326.85	Dotton_FennyBr_joined	Medium
3827	308812	90135	188.37	68.72	114.14	142.89	168.20	197.39	244.35	328.65	Dotton_FennyBr_joined	Medium
4081	307933	89681	8.23	3.19	5.38	6.83	8.14	9.70	12.22	17.36	Goosemoore	High
4080	308146	89667	8.36	3.24	5.45	6.93	8.26	9.84	12.40	17.61	Goosemoore_Extended	Medium
4079	308344	89745	8.6	3.29	5.53	7.03	8.38	9.98	12.58	17.86	Goosemoore_Extended	Medium
4078	308553	89830	8.69	3.33	5.61	7.13	8.50	10.12	12.75	18.11	Goosemoore_Extended	Medium
4077	308754	89869	8.8	3.38	5.69	7.23	8.62	10.27	12.93	18.37	Goosemoore_Extended	Medium
4076	308963	89886	8.83	3.43	5.77	7.33	8.74	10.41	13.11	18.62	Goosemoore_Extended	Medium
4089	308846	90216	3.19	1.91	3.22	4.09	4.88	5.81	7.32	10.40	TrendAnalysisRegion_C2a2_B	Medium_Trend

Data in this table comes from the Devon Hydrology Strategy 2012 created 28/03/2024

Strategic flood risk assessments

We recommend that you check the relevant local authority's strategic flood risk assessment (SFRA) as part of your work to prepare a site specific flood risk assessment.

This should give you information about:

- the potential impacts of climate change in this catchment
- areas defined as functional floodplain
- flooding from other sources, such as surface water, ground water and reservoirs

About this data

This data has been generated by strategic scale flood models and is not intended for use at the individual property scale. If you're intending to use this data as part of a flood risk assessment, please include an appropriate modelling tolerance as part of your assessment. The Environment Agency regularly updates its modelling. We recommend that you check the data provided is the most recent, before submitting your flood risk assessment.

Flood risk activity permits

Under the Environmental Permitting (England and Wales) Regulations 2016 some developments may require an environmental permit for flood risk activities from the Environment Agency. This includes any permanent or temporary works that are in, over, under, or nearby a designated main river or flood defence structure.

Find out more about flood risk activity permits

Help and advice

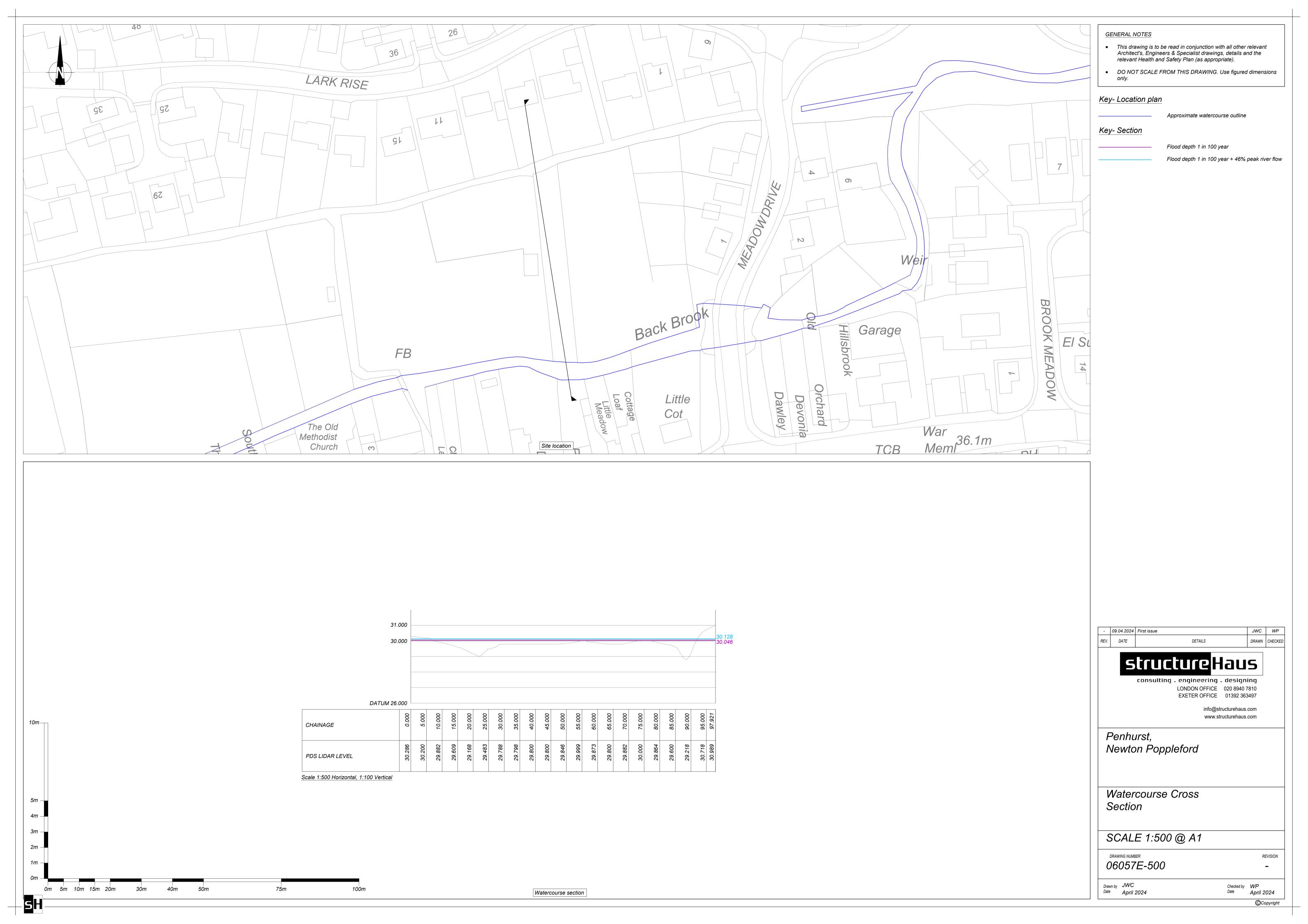
Contact the Devon Cornwall and the Isles of Scilly Environment Agency team at dcisenquiries@environment-agency.gov.uk for:

- more information about getting a product 5, 6, 7 or 8
- general help and advice about the site you're requesting data for



APPENDIX B

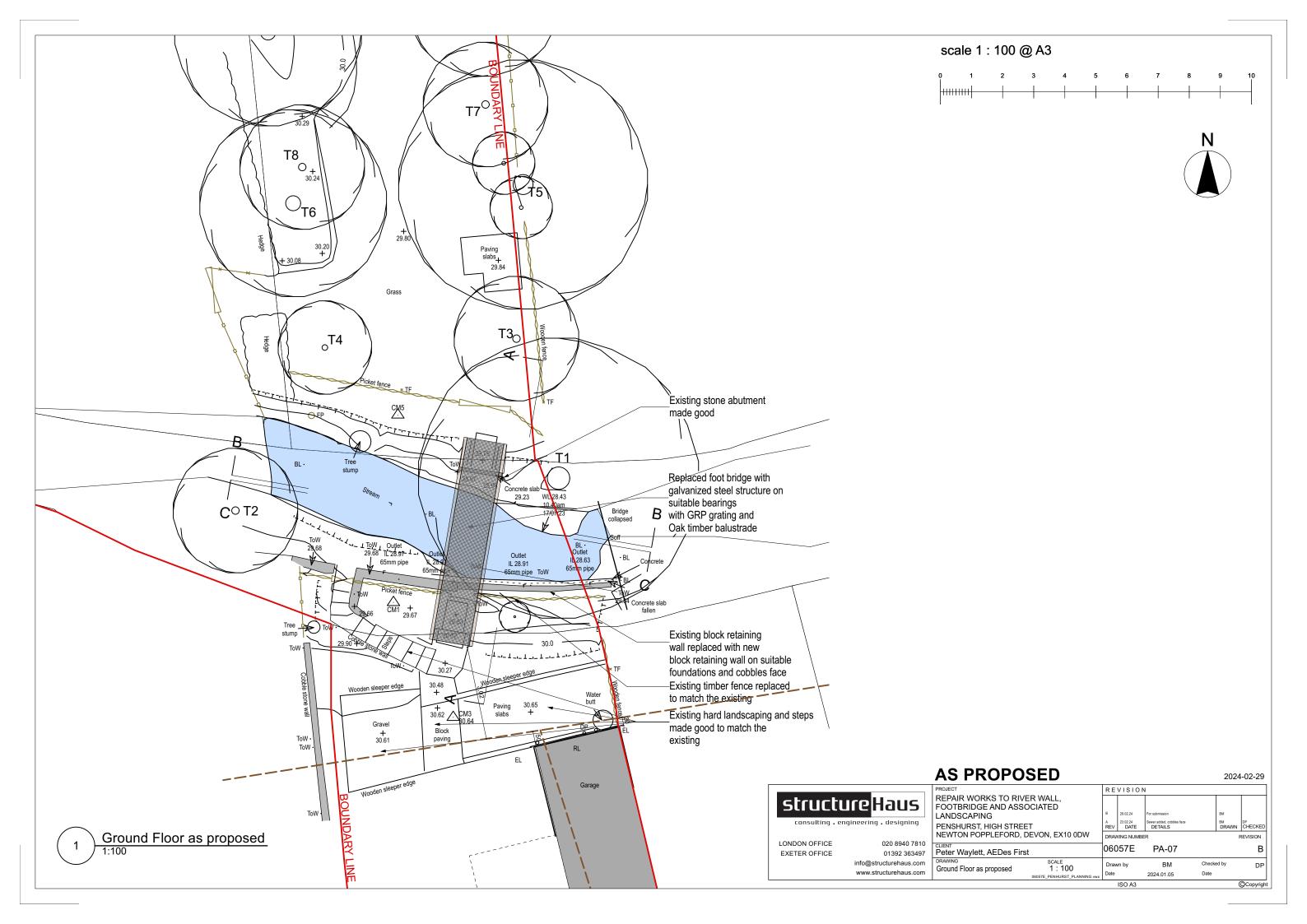
Watercourse Cross Section

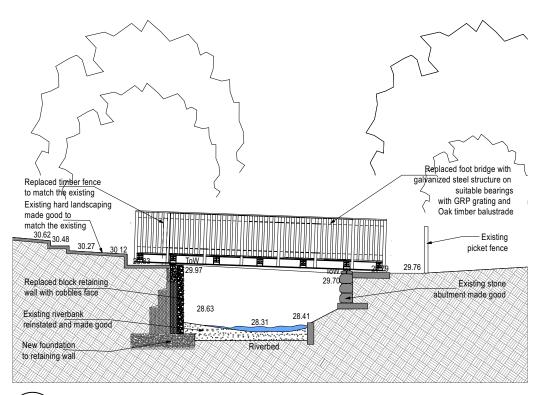




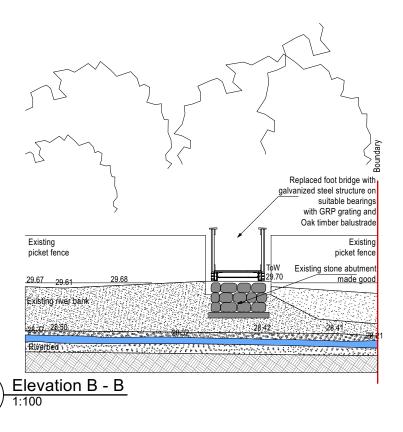
APPENDIX C

Proposed Layout

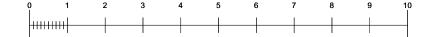


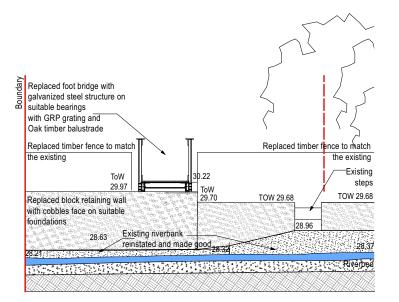


1 Elevation A - A



scale 1:100 @ A3

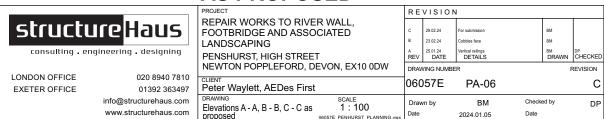






AS PROPOSED

2024-02-29



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