9th November 2022

FAO East Devon District Council
and/or Devon County Council Lead Local Flood Authority

Via Email

Our Ref: RMA/LC2482 – Hayes End West Hill FRS

Dear Sir/Madam,

RE: PROPERTIES AT 19 AND 21 HAYES END, WEST HILL, OTTERY ST MARY, DEVON, EX11 1GG – FLOOD RISK SCREENING REPORT

Further to our instruction to review the flood risk on behalf of the property owners at 19 and 21 Hayes End in West Hill near Ottery St Mary (refer to Figure 1), we have set out our findings in this Flood Risk Screening (FRS) Report.

It is understood that land to the north of the above properties is under consideration for future residential development within the East Devon District Council Local Plan (site references West_04 and West_06). The purpose of this screening exercise is to set out the broad flood risk issues for the above properties and proposed development sites, with the aim of identifying any significant sources of flooding and advising on appropriate mitigation.

In accordance with paragraph 159 of the National Planning Policy Framework (NPPF) *"Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere."*

Hydrology and Sources of Flood Risk

Local Hydrology

According to Ordnance Survey (OS) mapping, an unnamed watercourse is located approximately 400 m to the north of the site. This watercourse flows away from the site in an easterly direction.

A further unnamed watercourse is located approximately 500 m to the south of the site. The site lies within the catchment area of this watercourse, which flows in an easterly direction into the River Otter.

Aerial imagery indicates two linear features in the field to the north-east of the properties (West_06). The purpose of these features is not clear, but it is possible that they have been created to intercept surface water runoff and their function should be confirmed before their removal.

There are no other significant watercourses or water bodies shown on OS mapping within the surrounding area.

Sources of Flooding

The EA's flood map for planning indicates that site is located within Flood Zone 1 (low risk) and, therefore, indicates that the risk of flooding from rivers or the sea is low.

The EA's surface water flood map indicates that the site has a very low risk of surface water flooding. However, this is not considered to be accurate as surface water flooding has been observed by the property owners of 19 and 21 Hayes End along the northern boundaries of the property.

The site is not located within an area at risk of reservoir flooding according to the EA flood maps.

A review of the East Devon District Council Strategic Flood Risk Assessment (SFRA; Halcrow, 2008) and EA flood maps has identified that there are no other significant sources of flooding at the site (i.e. from groundwater or sewers).

The principal risk of flooding within the site is therefore considered to be from surface water flooding and this forms the focus of the assessment below.

Historic Flooding

A review of the SFRA (Halcrow, 2008) and the EA's Historic Flood Map identifies no records of flooding at the site.

The property owner of 21 Hayes End has reported regular surface water flooding along the northern boundary, resulting in flooding of the garage, basement and garden (video footage is available on request). Surface water flooding also affects the garden of 19 Hayes End along the northern boundary. This is discussed further below.

Site Topography

LiDAR (Light Detection and Ranging Data) indicates that the site slopes downwards towards the east. The highest ground level of approximately 134.50 metres Above Ordnance Datum (mAOD) is located at the western boundary of 19 Hayes End, falling to a level of approximately 124.50 mAOD at the eastern boundary of 21 Hayes End.

A Devon hedge with an elevated earth bank is located along the northern boundary of 19 and 21 Hayes End. Ground levels in the field proposed for residential development immediately to the north (West_04), slope in a south-easterly direction, meaning parts of the field drain towards the Devon hedge.

Surface Water

The EA's surface water flood map shows areas at low, medium and high risk which are defined as:

- **low risk** areas have between a 0.1% and 1.0% annual chance of occurring (or between the 1 in 1000 year and 1 in 100 year event);
- **medium risk** areas have between a 1.0% and 3.3% annual chance of occurring (or between the 1 in 100 year and 1 in 30 year event); and
- **high risk** areas have greater than a 3.3% annual chance of occurring (or greater than the 1 in 30 year event).

The EA's surface water flood map does not show any areas of 'low', 'medium' or 'high' risk of flooding in the location of the recorded surface water flooding discussed above. The EA's flood map has a number of limitations, i.e. it is coarse scaled and does not include the level of detail necessary to accurate predict all surface water flooding. For instance, the model is unlikely to include the impact of the Devon hedges which appear to intercept and re-route surface water flows at the site. For this reason, the EA's surface water flood map is considered to be inaccurate for the site.

It is understood that surface water flow paths form along both sides of the Devon hedge which borders the properties and the proposed development field West_04. The indicative routes of these flow paths are shown Figure 2.

On the southern side of the Devon hedge, surface water originates from the west and through the garden of 19 Hayes End, before passing beneath the fence into 21 Hayes End. This flow path follows the boundary of the Devon hedge and floods the garage of 21 Hayes End. It also enters the surface water drainage system of 21 Hayes End which compromises the capacity of the soakaway. This means the lower paved area at the eastern side of the property cannot drain away and results in flooding of the basement. The flow path continues towards the eastern end of the garden where it results in ponding at the eastern boundary.

The most significant flow path forms on the northern side of the Devon Hedge, as this side is where most of the surface water from the upstream catchment is intercepted (refer to Photographs in Appendix A). Of note is that the Devon hedge along the western boundary of West_04 is also likely to intercept runoff and route it towards the southern boundary. It is understood that a significant channel forms on the northern side of the Devon hedge (along the southern boundary of West_04) to the extent that water seeps through a number of rabbit holes in the bank into the garden of 21 Hayes End.

It is understood that surface water ponds at the south-eastern corner of West_04 and the eastern end of the 21 Hayes End's garden. From this point, it is understood that surface water flows overland across West_06.

Flow Estimates

At the eastern boundary of the 21 Hayes End and the development field West_04, the surface water flow path has a catchment area of approximately 0.044 km^2 (4.4 ha) formed mainly by agricultural fields on higher ground to the north-west (refer to Figure 2).

Given that the EA's surface water flood map is only indicative, flow estimates have been undertaken to better define the risk. The guidance provided in '*SC090031: Estimating flood peaks and hydrographs for small catchments'* (Environment Agency, 2012) recommends the use of the improved FEH statistical method for estimating flood flows in small catchments.

This involves defining the annual median flow (QMED) and applying a pooled growth curve to determine extreme flood flows. However, the study also indicates that the method can be simplified by relying on regional growth curves defined in FSSR14; this approach is considered acceptable at this stage as an initial estimate. QMED has been adjusted by a factor of 6.34 to allow for the urbanised part of the catchment in accordance with Bayliss *et al* (2006); however, it is noted that $URBEXT_{2000}$ is derived from a wider catchment area of the nearest watercourse which may not be representative of the development site's catchment and should be refined in any Flood Risk Assessment associated with the proposed residential development. The estimated surface water flows are shown in Table 1.

Table 1: Estimated Flows

Event	m^3/s
1 in 1 year	0.27
1 in 30 year (high risk)	0.67
1 in 100 year (medium risk)	0.83
1 in 1000 year (low risk)	1.34

Climate Change

The latest guidance on climate change for the East Devon management catchment states that flows could increase by 45% based on the peak rainfall allowances for small catchments (i.e. less than 5 km^2). This should be applied to the 1 in 100 year flow, which could increase to 1.20 m^3/s over the operational lifetime of the development (assumed to be 100 years).

It is concluded that the surface water flows are significant and should be mitigated as part of any proposed development.

Mitigation

No development, obstacles (including garden fences) or ground raising should be located along the southern boundary of West_04 where the surface water flow path occurs. This will ensure that the flow path is not impeded or diverted further towards existing properties.

It is recommended that an appropriately sized swale (a grassed linear depression) is located along the southern boundary of West_04, implemented as part of any proposed residential development (refer to Figure 3). The swale should be sized to convey the 1 in 100 year flow including 45% for climate change, as discussed above. This will allow surface water to be conveyed safely through the site.

Consideration should also be given to the likely extent of surface water ponding at the south-eastern corner of the site and whether this would still occur with the introduction of the swale. This part of the site would be best suited to areas of open space or parking.

Surface water from the impermeable areas of the proposed development should be managed separately and discharged to ground, to a watercourse or sewer.

Surface Water Drainage

The proposed drainage system for West_04 and West_06 should be designed for the 1 in 100 year rainfall event including climate change.

Runoff should be disposed of in accordance with the drainage hierarchy. Infiltration testing will need to be undertaken to confirm whether discharging surface water to the ground is feasible. If infiltration rates are insufficient, then surface water will need to be attenuated and discharged to a watercourse or sewer.

The discharge rate from the drainage system should be limited to the existing greenfield Qbar rate (the mean annual flood) for all events up to and including the 100 year storm including climate change. This will ensure that flood risk is not increased elsewhere.

A range of attenuation features such as basins, swales, geo-cellular storage, permeable paving, rain gardens etc should be included.

The drainage strategy should consider how exceedance routes will be managed if the proposed drainage system was to become blocked or an event above the design event occurs, such that existing properties are not adversely affected.

Summary

The conclusions of the appraisal are summarised as follows:

- it is understood that land to the north of 19 and 21 Hayes End is under consideration for future residential development within the East Devon District Council Local Plan (site references West_04 and West_06);

- the EA's surface water flood map indicates that the site has a very low risk of surface water flooding. However, this is not considered to be accurate as surface water flooding has been observed by the property owners of 19 and 21 Hayes End along the northern boundaries of the properties;

- the property owner of 21 Hayes End has reported regular surface water flooding along the northern boundary, resulting in flooding of the garage, basement and garden. Surface water flooding also affects the garden of 19 Hayes End along the northern boundary;

- it is understood that surface water flow paths form along both sides of the Devon hedge which borders the properties and the proposed development field West_04. The indicative route of the flow paths are shown Figure 2;

- the most significant flow path forms on the northern side of the Devon Hedge, as this side is where most of the surface water from the upstream catchment is intercepted. Of note is that the Devon hedge along the western boundary of West_04 is also likely to intercept runoff and route it towards the southern boundary. It is understood that a significant channel forms on the northern side of the Devon hedge (along the southern boundary of West_04) to the extent that water seeps through a number of rabbit holes in the bank into the garden of 21 Hayes End;

- it is understood that surface water ponds at the south-eastern corner of West_04 and the eastern end of the 21 Hayes End's garden. From this point, it is understood that surface water flows overland across West_06;

- aerial imagery indicates two linear features in the field to the north-east of the properties (West_06). The purpose of these features is not clear, but it is possible that they have been created to intercept surface water runoff and their function should be confirmed before their removal;

- it is concluded that the surface water flows are significant and should be mitigated as part of any proposed development;

- no development, obstacles (including garden fences) or ground raising should be located along the southern boundary of West_04 where the surface water flow path occurs. This will ensure that the flow path is not impeded or diverted further towards existing properties;

- it is recommended that an appropriately sized swale (a grassed linear depression) is located along the southern boundary of West_04, implemented as part of any proposed residential development. The swale should be sized to convey the 1 in 100 year flow including 45% for climate change, as discussed above. This will allow surface water to be conveyed safely through the site;

- consideration should also be given to the likely extent of surface water ponding at the south-eastern corner of the site and whether this would still occur with the introduction of the swale. This part of the site would be best suited to areas of open space or parking; and

- surface water from the impermeable areas of the proposed development should be managed separately and discharged to ground, to a watercourse or sewer.

I hope the above information is helpful, please do not hesitate to get in touch should you have any further questions.

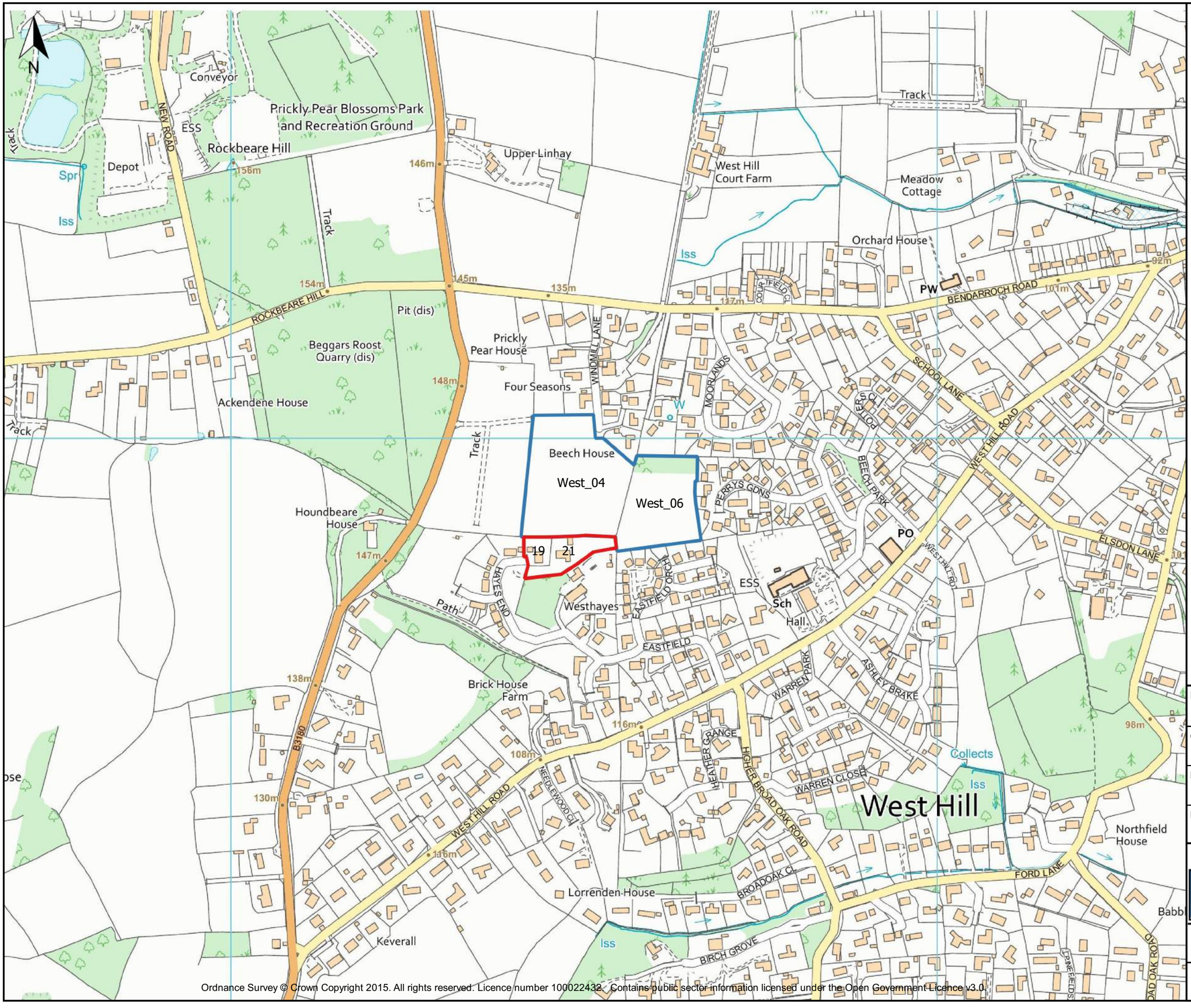
Yours sincerely

Nick Yeo
Senior Consultant

Encs: Figure 1: Site Location Plan
Figure 2: Surface Water Flooding

Figure 3: Mitigation

Figures



Key

- 19 and 21 Hayes End
- Proposed Development Site

Figure 1:	**Site Location**
Client:	**19 & 21 Hayes End**
Project:	**Hayes End West Hill FRS**
Project No.:	**C2482**

RMA ENVIRONMENTAL

Drawn:	Checked:	Date:	Scale:
NY	RM	08/11/2022	1:5000@A3

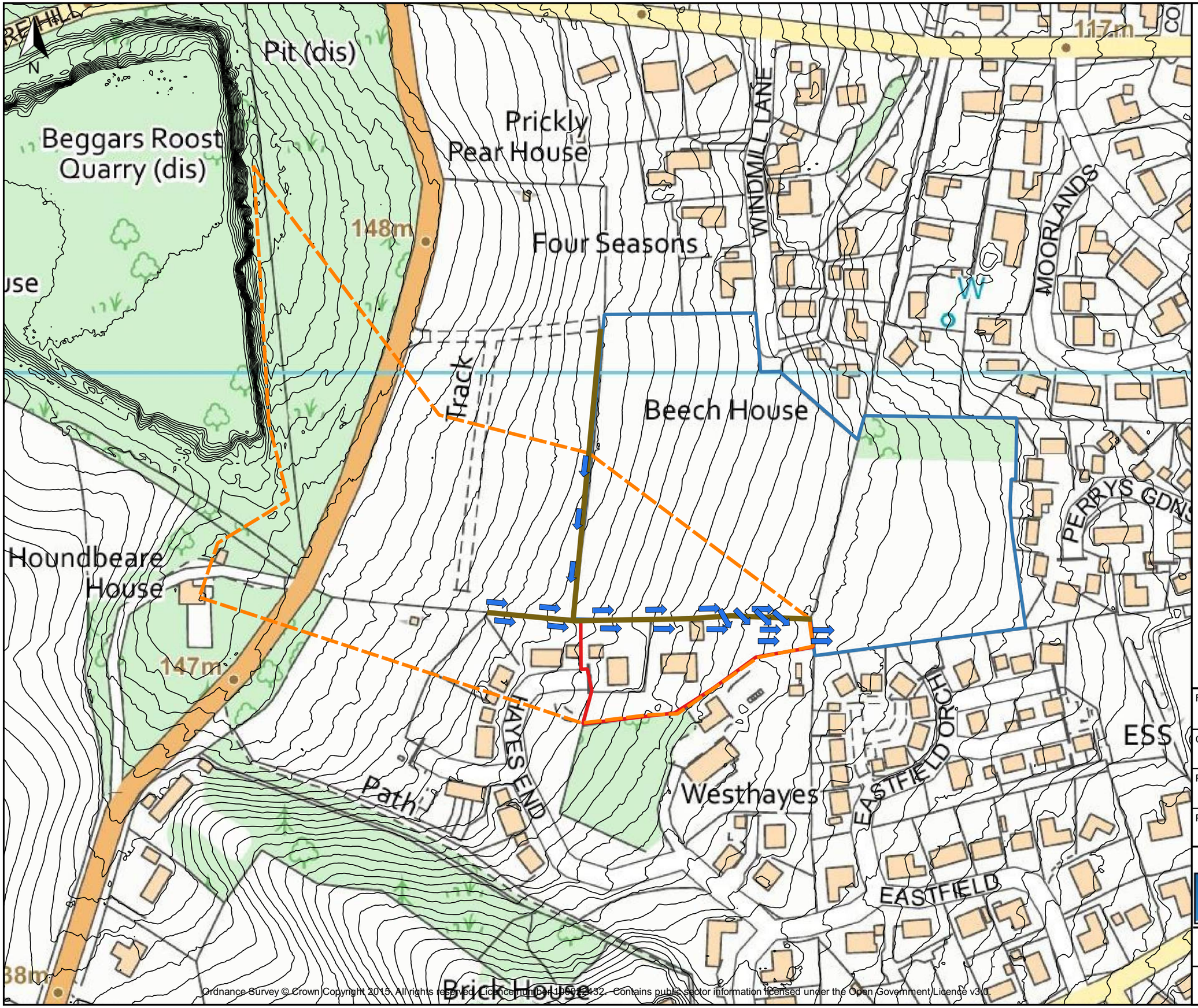


Figure 2:	**Surface Water Flooding**
Client:	**19 & 21 Hayes End**
Project:	**Hayes End West Hill FRS**
Project No.:	**C2482**

RMA ENVIRONMENTAL

Drawn:	Checked:	Date:	Scale:
NY	RM	08/11/2022	1:2000@A3

Pit (dis)

Beggars Roost Quarry (dis)

Prickly Pear House

WINDMILL LANE

117m

MOORLANDS

148m

Four Seasons

Track

Beech House

Indicative swale to convey surface water, dimensions subject to further design.

PERRYS GDNS

Houndbeare House

147m

HAYES END

Path

Westhayes

EASTFIELD ORCH

EASTFIELD

ESS

138m

Brick House

Key

- 19 and 21 Hayes End
- Proposed Development Site
- Indicative Swale

Figure 3:	**Mitigation**
Client:	**19 & 21 Hayes End**
Project:	**Hayes End West Hill FRS**
Project No.:	**C2482**

RMA ENVIRONMENTAL

Drawn:	Checked:	Date:	Scale:
NY	RM	08/11/2022	1:2000@A3

Appendix A