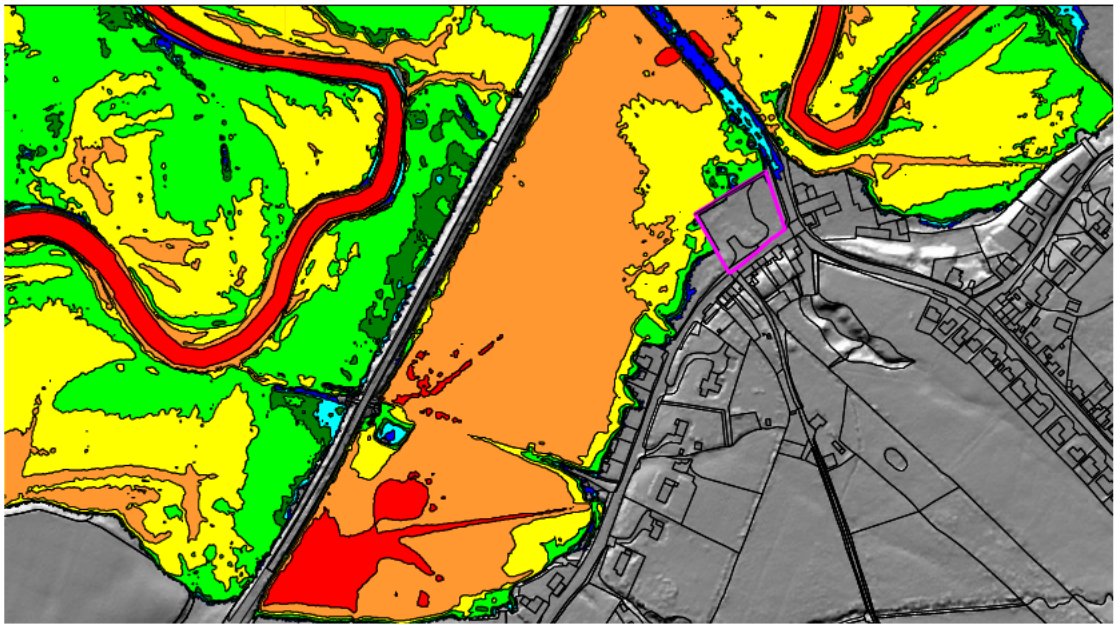
Francis Sant

Cwmann Fuel Station and Convenience Store
Flood Consequence Assessment Report



May 2018
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Client	Mr Kevin Davies
Consultant	Francis Sant Limited
Office	[redacted]
Author	Ceirion Herbert
Telephone	[redacted]
e-mail	[redacted]

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Signed ……

Date ……

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1 INTRODUCTION

The client wishes to redevelop a section of land at the intersection between the A485 and the A482 at Cwmann near Lampeter. The site has previously had planning permission to construct a car showroom, a fuel station and related infrastructure and originally was the location of a farm house and auxiliary buildings. The client wishes to replace the proposed development with a scheme to build a convenience store with a fuel station. They have been advised, however, that the site lies within a Zone C2 flood area as defined by the development advice maps (see Figure 1.1) referred to in Technical Advise Note 15, Development and Flood Risk (TAN 15). This means that the area is considered to be at risk of flooding during at least the 1 in 1000 year event and is not afforded protection from recognised significant flood defences.

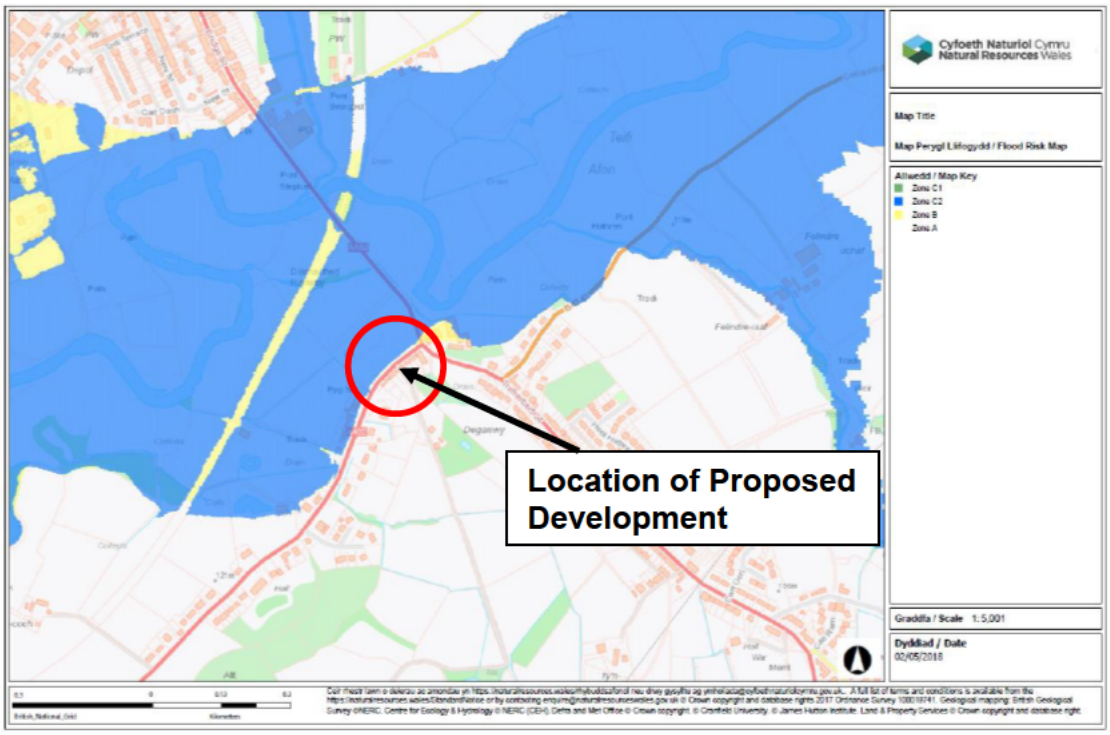

Figure 1.1 - Development Advice Flood Map

The development advice maps are based on Natural Resources Wales Flood Risk Maps (see Figure 1.2) supplemented by sediment data, held by the British Geological Survey (BGS), of historical flooding. The maps adopt the precautionary principle and are based on the best known information available at the time. However, a detailed examination of a site can refine an area's risk of flooding.

Considering its proximity the site potentially could be at risk of flooding from the Teifi. With this in mind, the client recognises the need to undertake a Flood Consequence Assessment to evaluate the risk and implication of any flooding on the site. The assessment should be in accordance with the requirements of Section 7 and Appendix 1 of TAN 15. Francis Sant have been employed to undertake this task.

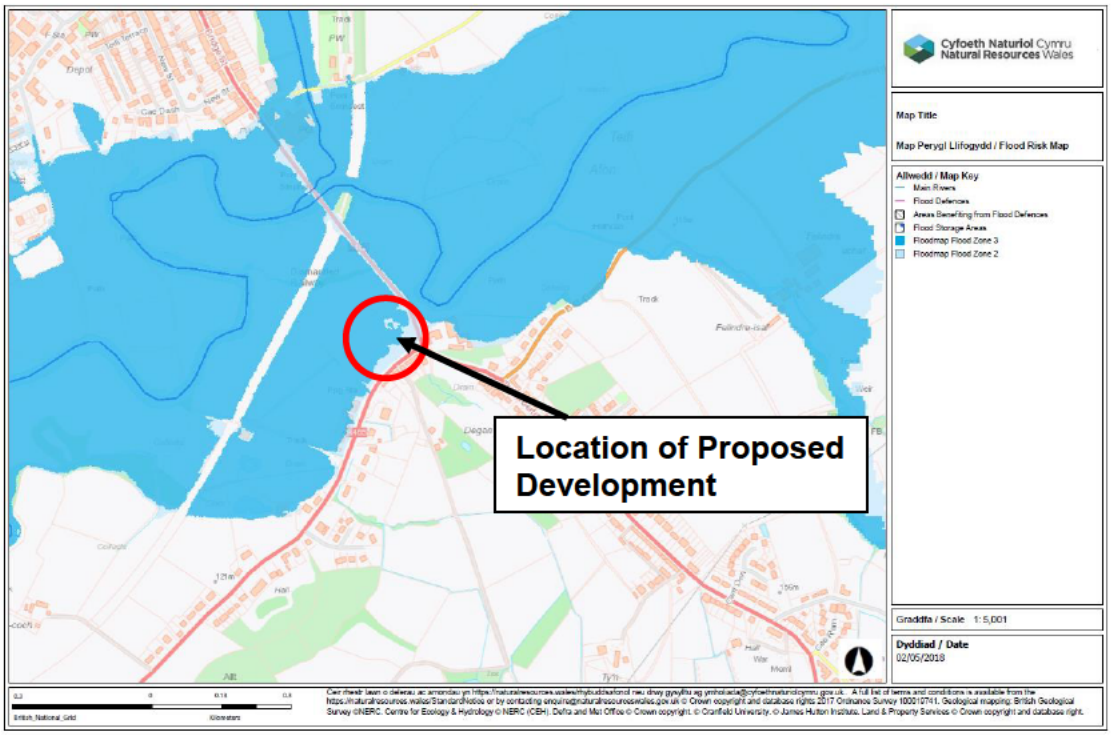

Figure 1.2 - NRW Flood Map

Section 2 of this report describes the location of the site while the method and risk of flooding from various sources are considered in Section 3. Potential flood proofing measures are discussed in Section 4 and the conclusions of the study, along with the main recommendations, are provided in Section 5.

2 THE DEVELOPMENT

Location

It is proposed to develop a fuel station and convenience store at a site off the A485, Cwmann (coordinates 258200 247320). The site is close to the junction with the A482 (see Figure 2.1, 2.2 and Plate 2.1) and was previously granted planning for the construction of a petrol station and car showroom (construction initiated) which would be superseded by the development. Some 150m to the north west of the proposed development the old Carmarthen to Lampeter railway line runs in a south west to north east direction. Although the line itself has been dismantled the embankment remains in place which gradually increases in elevation close to the A482, although the bridge over the road has long since been removed. The Afon Teifi meanders down the valley near Lampeter and is about 100m away from the site at its nearest location, just north of the A482. The river flows from a north east direction and runs underneath the old railway bridge, some 300m north of the site, and promptly runs beneath the A482 road bridge. Just downstream of the road bridge the Dulas stream merges with the Teifi.

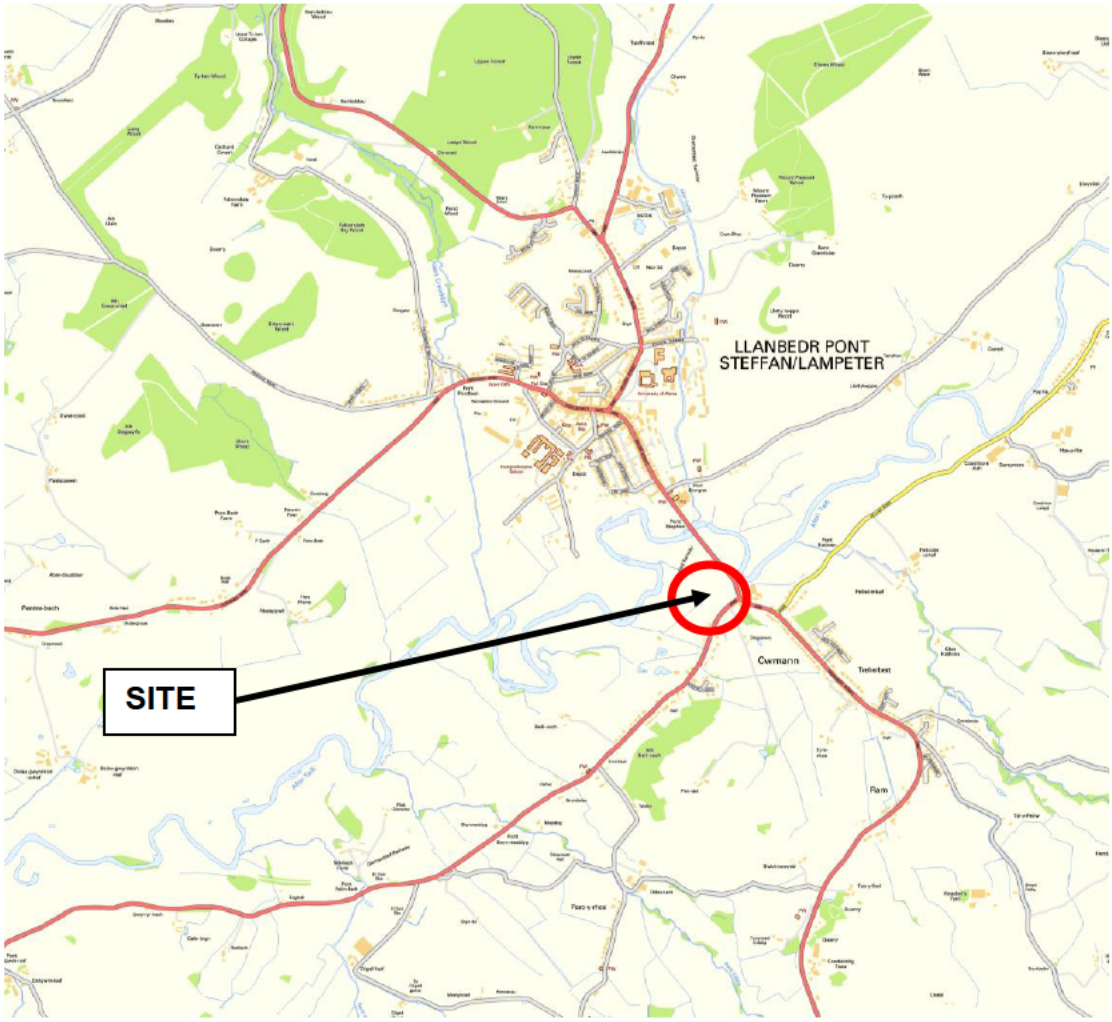

Figure 2.1 – Location Plan

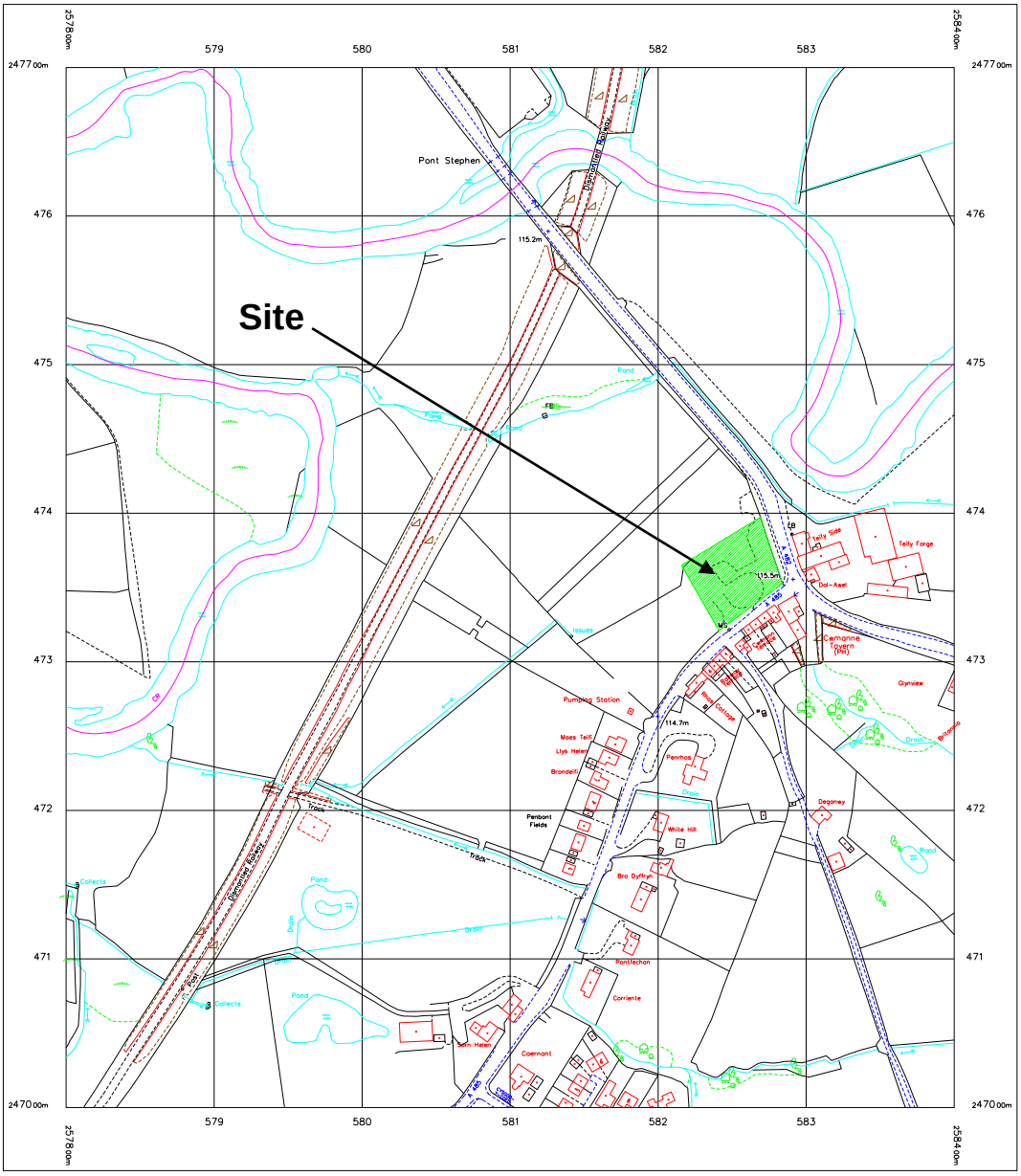

Figure 2.2 – Location of Site

The Teifi, at 122km in length, is one of the longest rivers in Wales and one of its most productive salmon and sea trout fisheries. It has a total catchment area of 1012 square kilometres with its source at an altitude of 455m at Llyn Teifi in the Cambrian Mountains, some 27km north east of the development. Initially the river descends steeply, 285m in 7km, through moorland and forestry to the geologically and ecologically important basin of Cors Caron. Beyond this raised bog, the river generally flows on a gradient of 150 meters in 100 kilometers. The river flows into Cardigan Bay a few killometer downstream of Cardigan. The flow in the river is partially regulated by the Teifi Pool reservoir but essentially the river flow can be considered to be natural.

Plate 2.1 - Aerial Photograph

Topography

LIDAR data indicates that the existing ground level of the site generally ranges between 113.8m AOD and 116.0m AOD (see Figure 2.4).

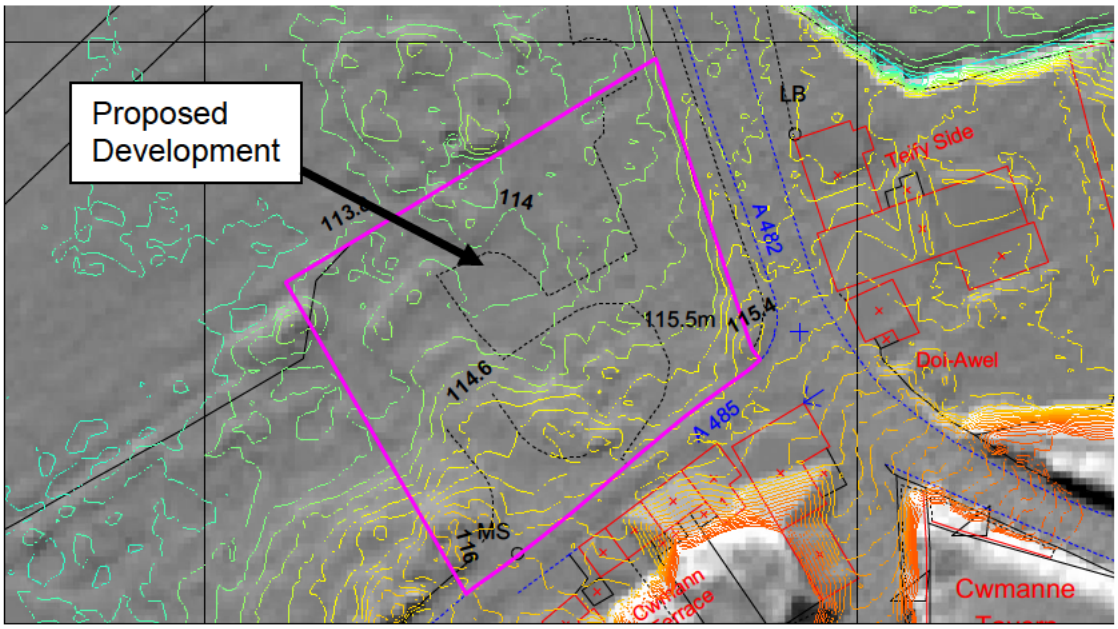

Figure 2.3 – LIDAR Data of the Site

Proposals

As mentioned the proposed development consists of a petrol station and a convenience store as shown on Figure 2.4. As part of the development it is proposed to raise the development to at least 115.0m AOD

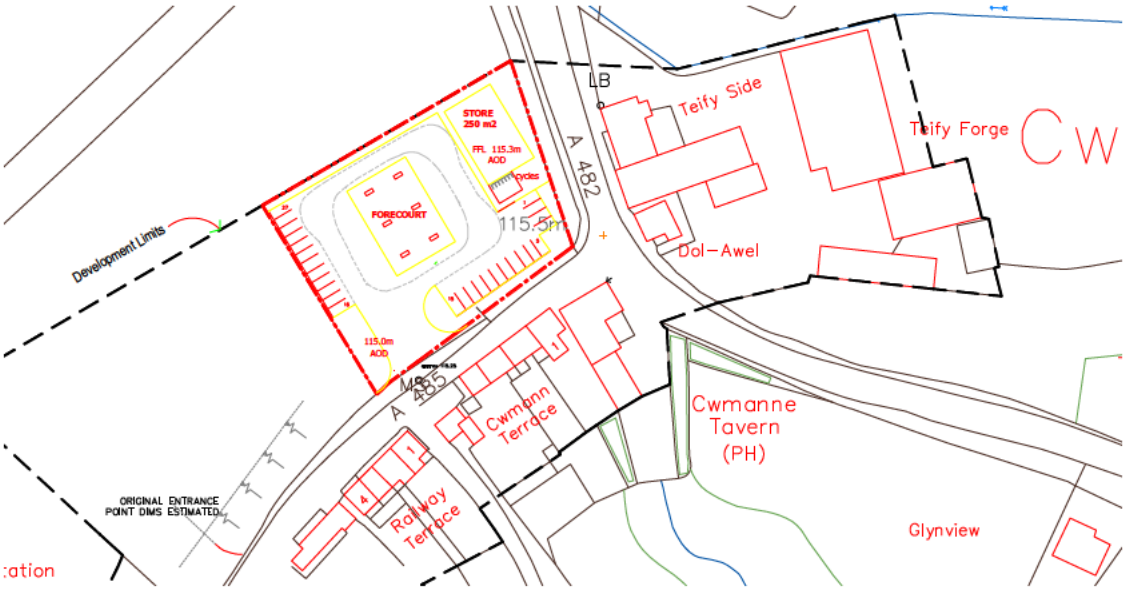

Figure 2.4 -Proposed Plan of Site

3 FLOOD RISK

Flooding can occur from several sources, some of which are considered in this section. A flood map (Figure 3.1), obtained from NRW, shows that the site is affected during the 1 in 1000 fluvial event (Q1000 event or 0.1% event) although a significant part of the site is expected to be flood free during the 1 in 100 (Q100) year event. The maps are believed to be based on the results of a 2D TUFLOW model.

Figure 3.1 – NRW Flood Map of the Area

Fluvial

The results from the latest NRW 2D TUFLOW model suggests that about 40% the site could be affected during the Q100 event (see Figure 3.2 and Table 3.1) with flood depths of over 300mm and nearly 600mm when taking climate change into consideration (see Figure 3.4). The corresponding velocity, however, is expected to be less than 0.15m/s (see Figure 3.3 and 3.5). During the Q1000 event some 60% of the site is affected with flood depths generally less than 600mm although a small section could be slightly greater (see Figure 3.6). The corresponding flow velocity is still expected to be less than 0.15m/s (see Figure 3.7).

As part of the development it is proposed to raise the site above the flood line. This is not expected to have a detrimental impact beyond the site during the considered events (see Figure 3.8 to 3.16).

A flood free access is available from the site to higher land.

Table 3.1 Velocity and Depth Key			
Region	**Depth**	**Region**	**Velocity**
	0-0.1m		0 - 0.15m/s
	0.1m-0.2m		0.15m/s - 0.3m/s
	0.2m-0.3m		0.3m/s - 0.45m/s
	0.3m-0.6m		0.45m/s - 0.6m/s
	0.6m-1m		0.6m/s - 1m/s
	1m-2m		1m/s - 2m/s
	2m-3m		2m/s - 3m/s
	> 3m		> 3m/s

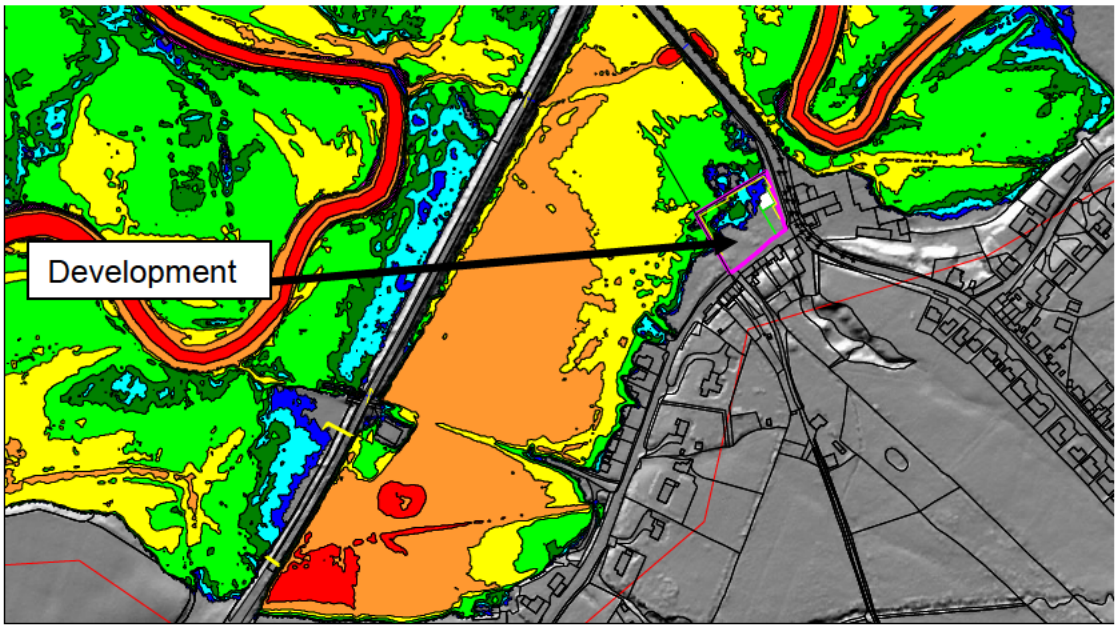

Figure 3.2 - Existing Q100 - Depth

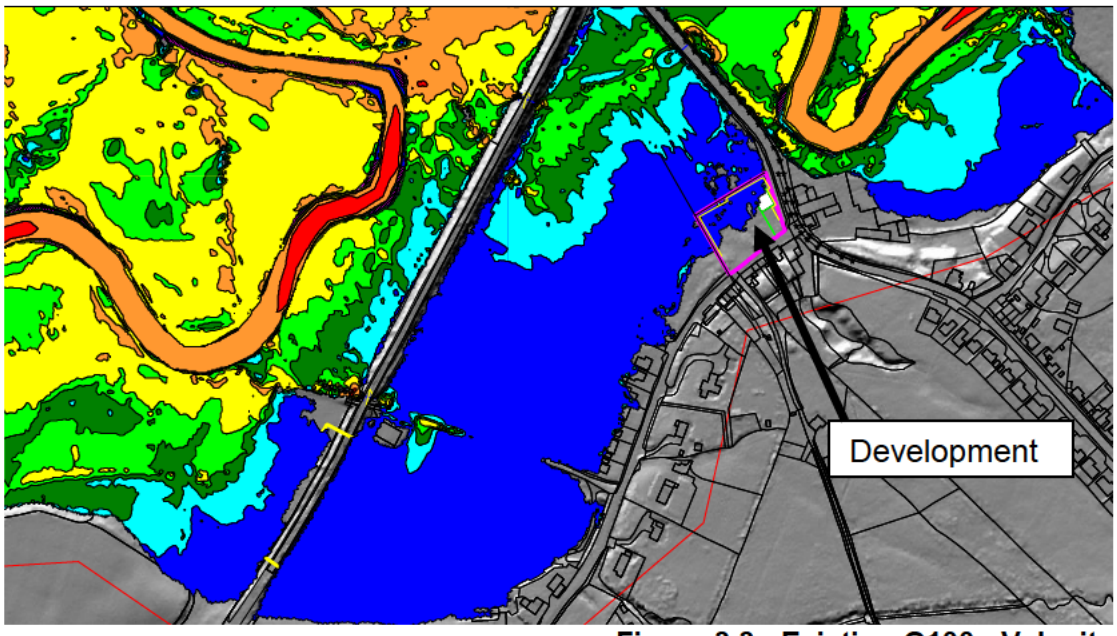

Figure 3.3 - Existing Q100 - Velocity

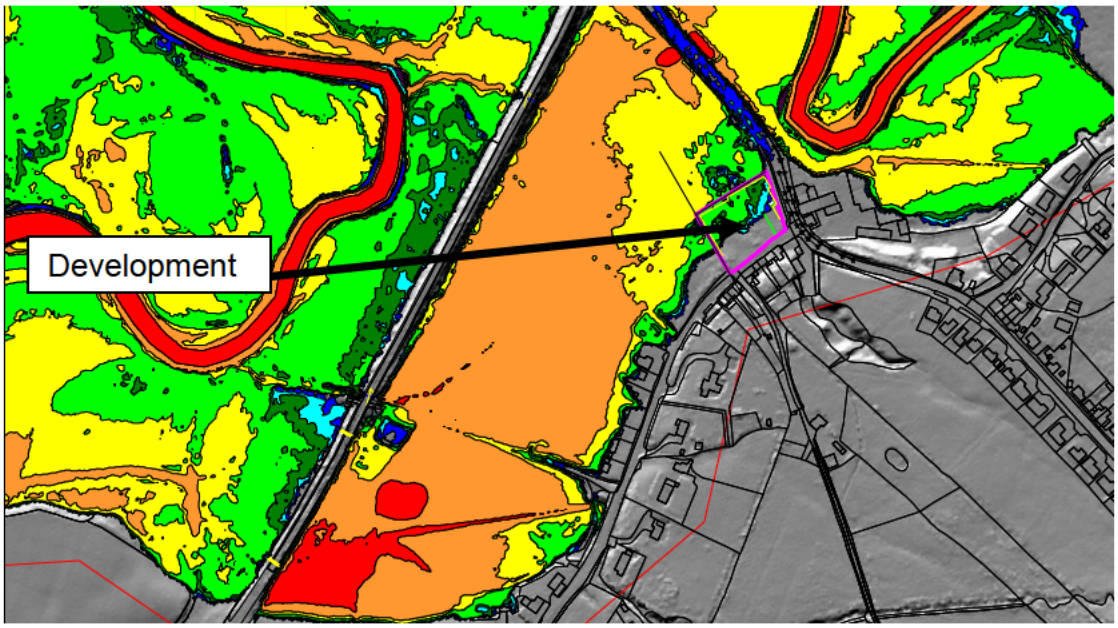

Figure 3.4 - Existing Q100 With Climate Change - Depth (Key on Table 3.1)

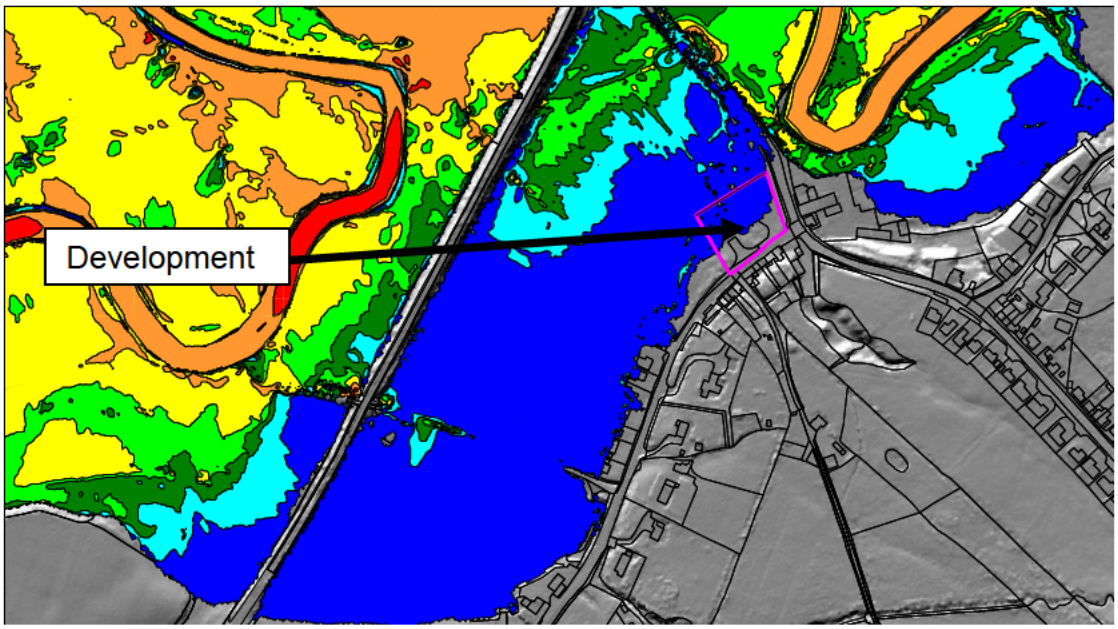

Figure 3.5 - Existing Q100 With Climate Change - Velocity (Key on Table 3.1)

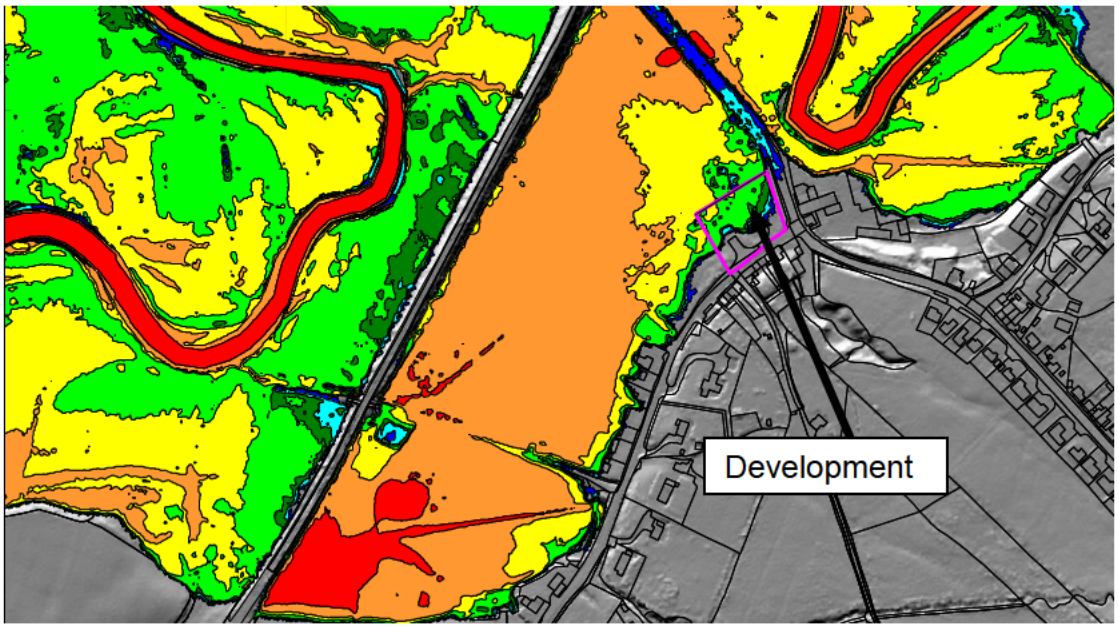

Figure 3.6 - Existing Q1000 - Depth (Key on Table 3.1)

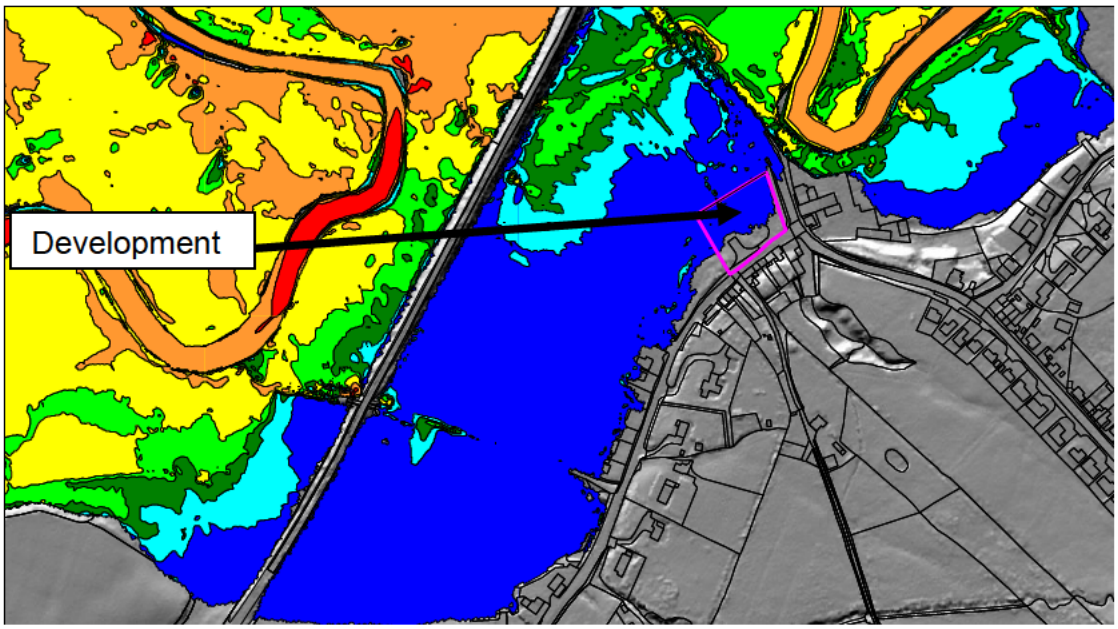

Figure 3.7 - Existing Q1000 Velocity (Key on Table 3.1)

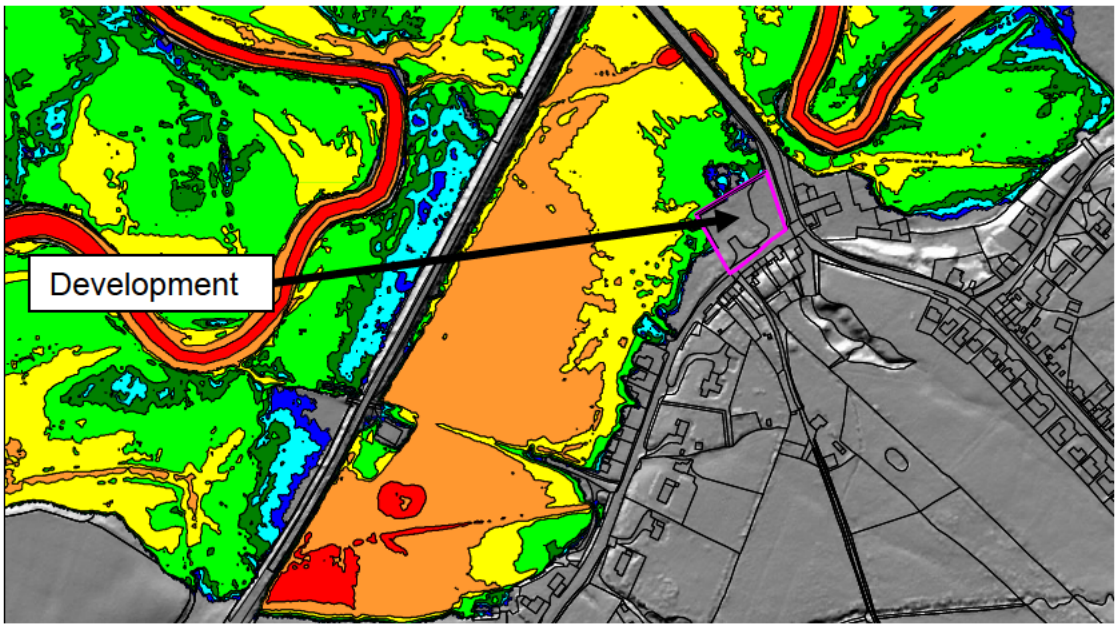

Figure 3.8 - Proposed Q100 - Depth

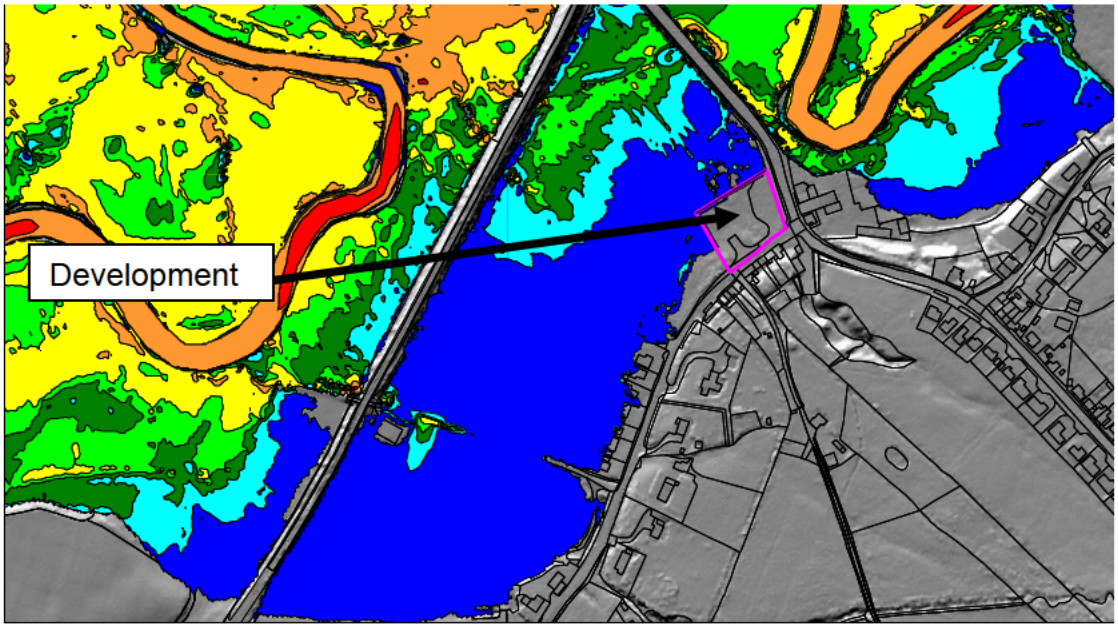

Figure 3.9 - Proposed Q100 - Velocity

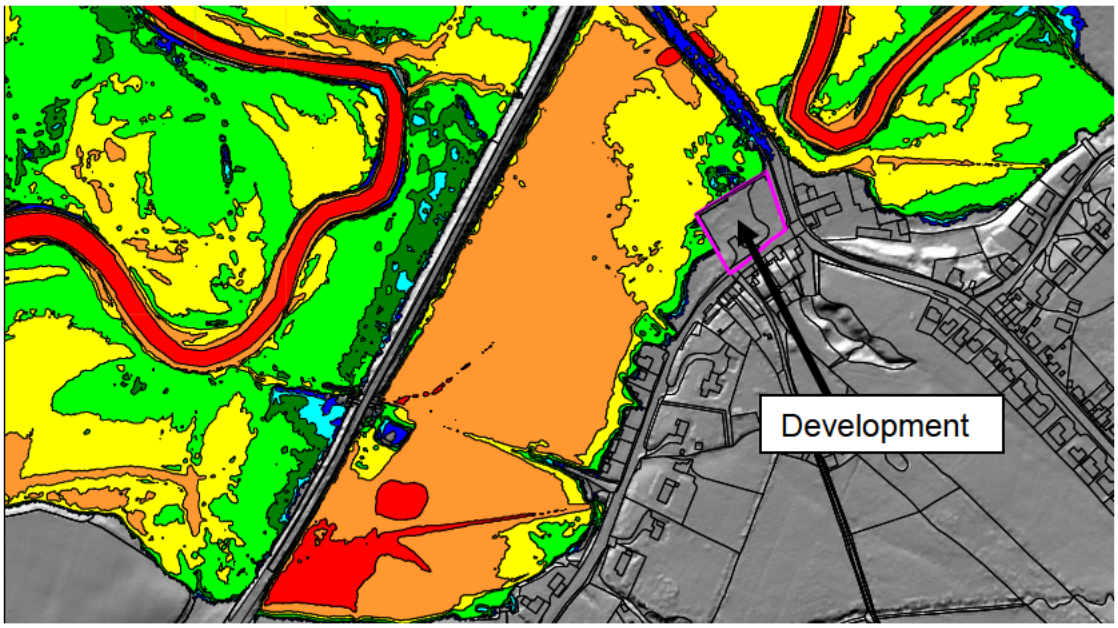

Figure 3.10 - Proposed Q100 With Climate Change - Depth (Key on Table 3.1)

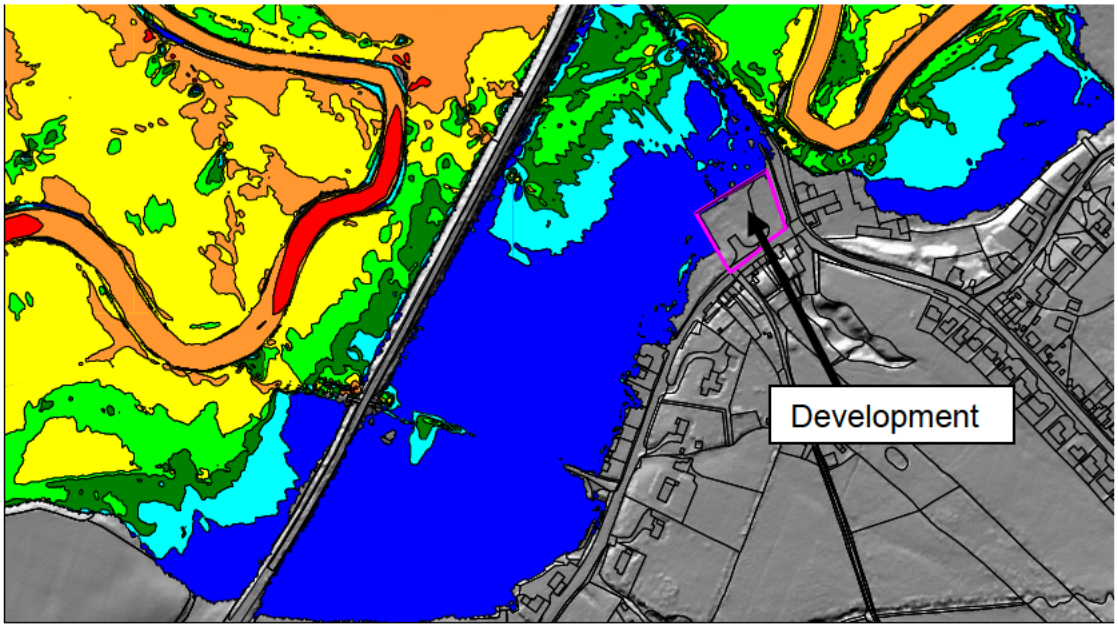

Figure 3.11 - Proposed Q100 With Climate Change - Velocity (Key on Table 3.1)

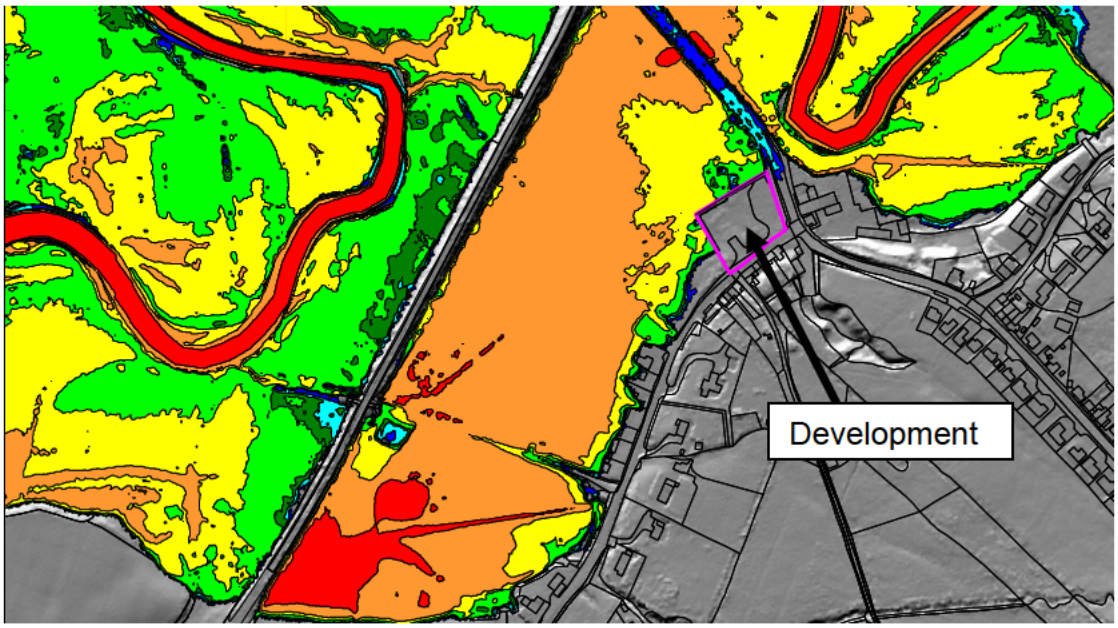

Figure 3.12 - Proposed Q1000 - Depth (Key on Table 3.1)

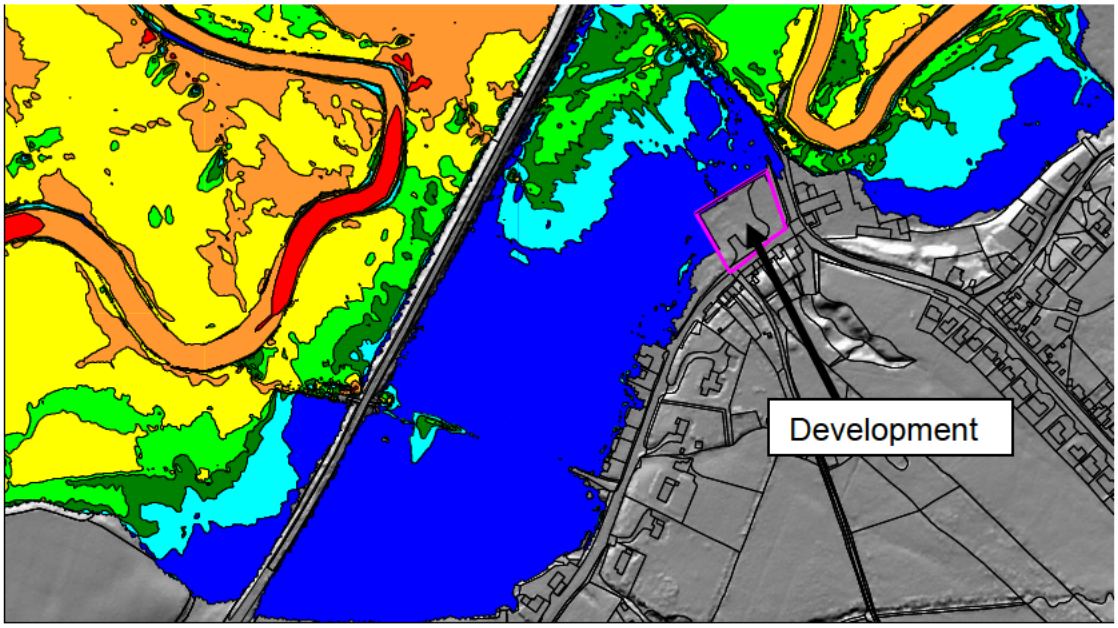

Figure 3.13 - Proposed Q1000 - Velocity (Key on Table 3.1)

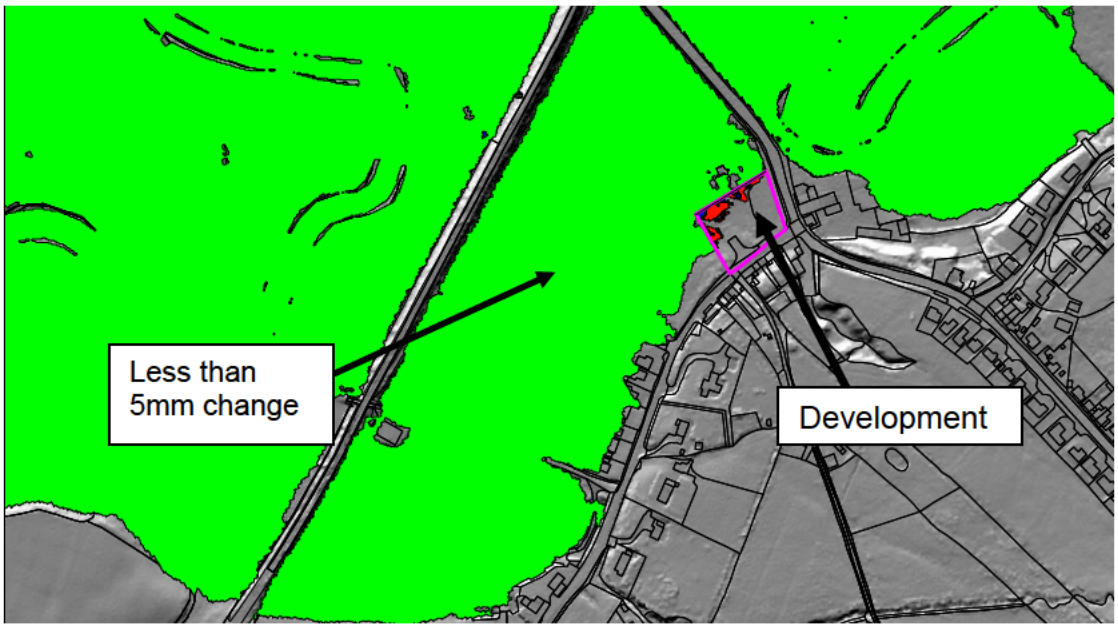

Figure 3.14 - Difference Between Existing and Proposed Q100 Depth

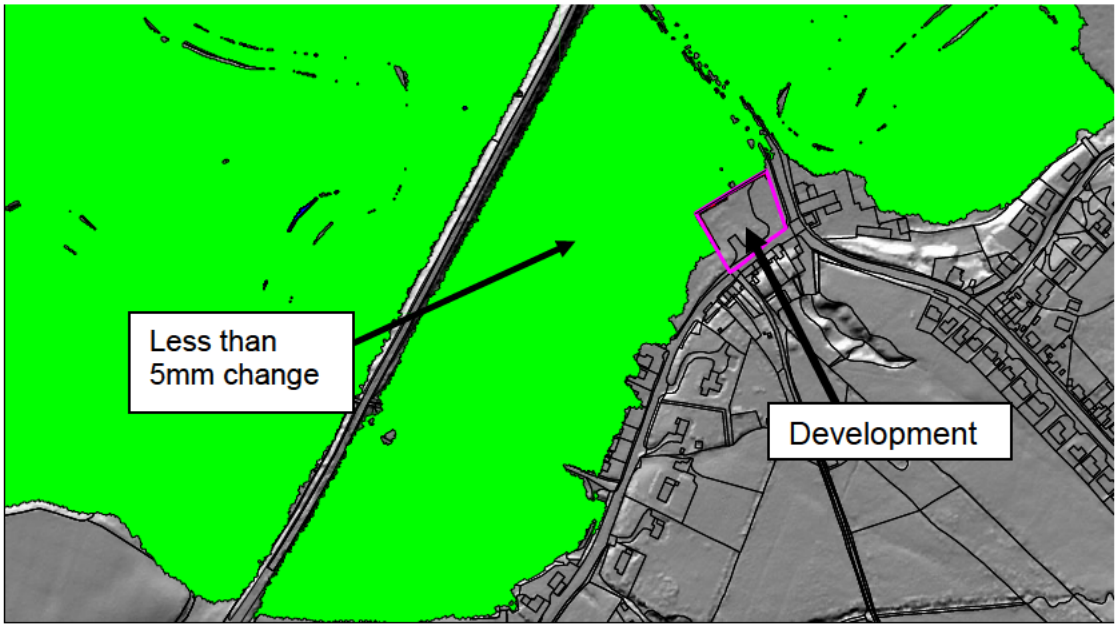

Figure 3.15 - Difference Between Existing and Proposed Q100CC Depth

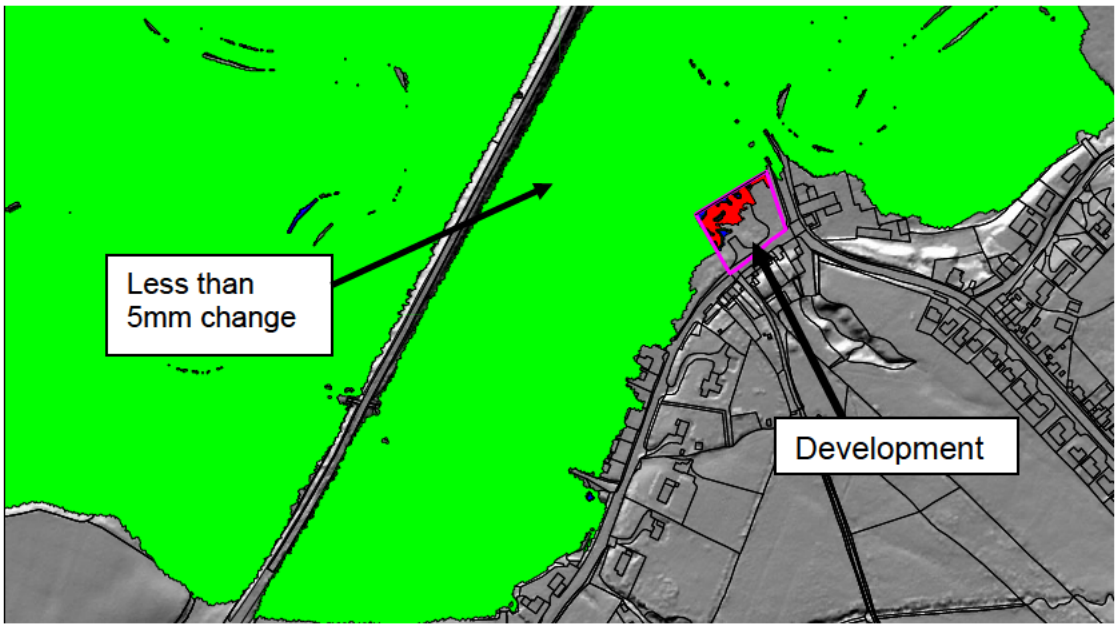

Figure 3.16 - Difference Between Existing and Proposed Q1000 Depth

Tidal
The site is not expected to be at risk from tidal flooding.

Ground Water
The bedrock geology consists of Interbedded Mudstone and Sandstone of the Devil's Bridge Formation (see Figure 3.17) overlain by superficial material of Clay, Silt, Sand and Gravel from Alluvium (see Figure 3.18). Potentially water could seep through a band of sand or gravel, however, considering the terrain the risk of ground water flooding is assessed to be low.

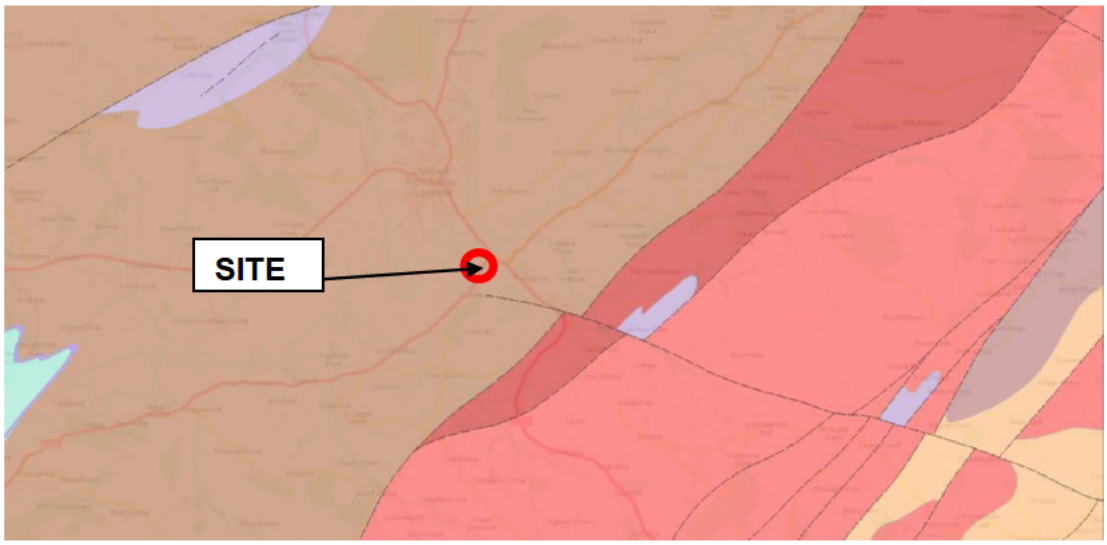

Figure 3.17 - Bedrock Geology

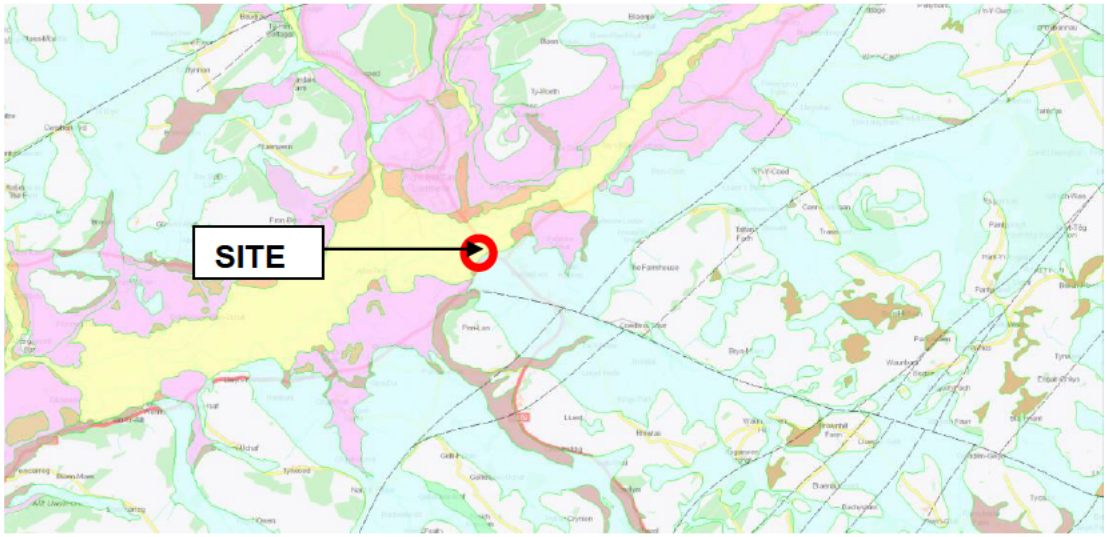

Figure 3.18 - Superficial Geology

Surface Water

The NRW surface water maps indicate that the proposed development is not generally considered to be at risk from surface water flooding, although there is a low risk of localised pooling with a return period of greater than 1 in 100 (see Figure 3.19). It is considered that standard precautions against surface water flooding would be sufficient.

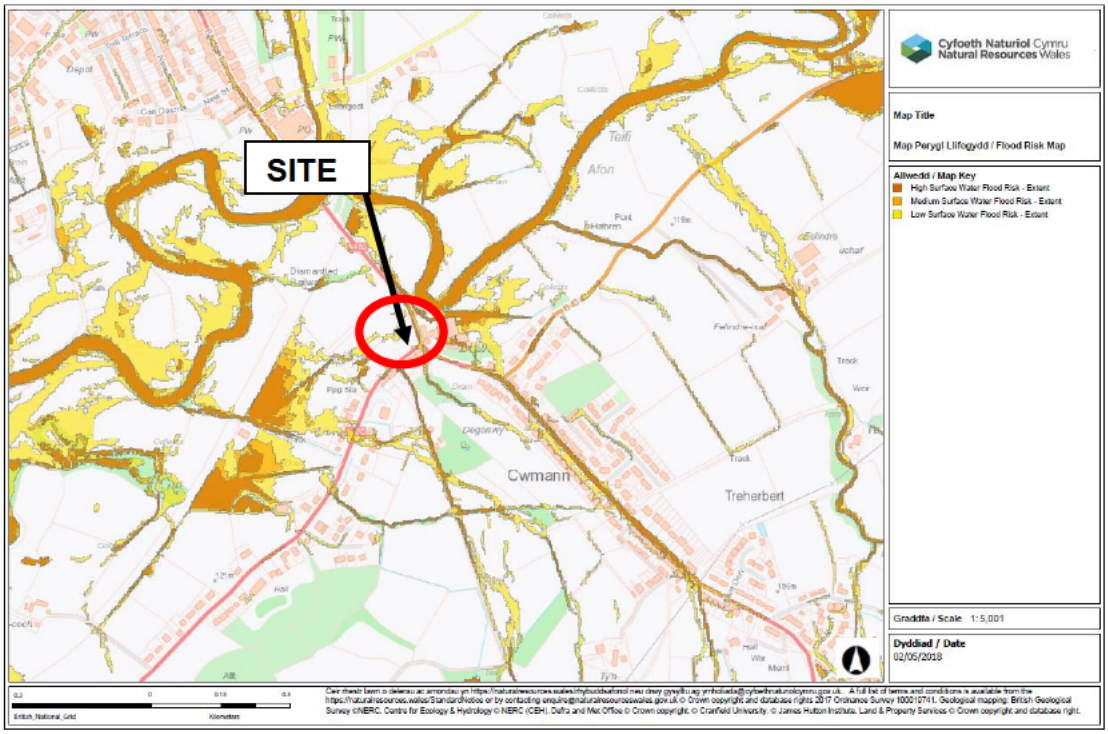

Figure 3.19 - NRW Surface Water Map

Sustainable Drainage

It is possible that the development could result in a reduction of permeable land which could increase the rainfall runoff rate. If this is the case a sustainable drainage system will be required designed in accordance with the Welsh Government Standards and the SUDS Manual. It is noted, however, that much of the land is

already impermeable being the yard of the original farm. The matter should be assessed.

Sewage Backflow.
The proposed development will require a new connection to the main sewer. Care should be taken to ensure that ground water can't enter the system and that the sewage is able to drain away. Safeguards could be put in place to prevent sewage from backing up into the development during flood conditions.

Risk From Reservoir Failure
The site is not considered to be at risk from reservoir failure.

4 FLOOD PROOFING MEASURES

Section 3 indicates that the site is not expected to be at risk even during a Q1000 event, nevertheless the risk can not be completely removed. Flooding can result in the need for expensive repairs. As well as the direct damage caused to the building, flooding can impact on a business in many other, and possibly more costly, ways. The inconvenience of cleaning up a building, the inability to trade and the loss of goodwill can be immeasurable. There are methods, however, to limit and mitigate against the consequence of flood damage. Some of these are discussed in this section and should be considered when building the proposed development.

Employment of Flood Proof Procedures

Water can enter a building:

- Around the edges of closed doors;
- Through airbricks;
- Back flowing through overloaded sewers;
- Seeping through walls, especially cracks;
- Seeping through the ground;
- Around cables and entrance of services into the building.

Dryproofing - Preventing the water from entering the building.

In the first instance it is possible to take measures to prevent the ingress of water (dryproof) which include the following.

- There are several expensive proprietary barriers available, however, it would be more appropriate to ensure that the walls of the building are capable of acting as a barrier themselves. Care should be taken to ensure that the external walls are kept in good order and that all cracks and gaps around cables and ducts entering the building are sealed.
- Temporary covers could be provided to any air vents. These covers should be removed once the risk of flooding is over.
- A temporary barrier could be erected in front of any external doors.
- A valve could be installed allowing the sewer system to be shut preventing any back flow during an event.

In this instance the site will be located above the Q1000 flood plain.

Wetproofing - Reducing damage once the water has entered.

It might not be practical to completely remove the risk of flooding, however, it is possible to take steps to limit the damage should this occur (wetproof). These would include:

- Moving valuable items to a higher level;
- Having solid concrete floors. Suspended floors are more difficult to clean and dry underneath;
- Having tiled floors in the store;
- Using water resistant render and plaster for walls;
- Where applicable (eg kitchens and bathrooms), using ceramic tiles for wall coverings;
- Avoiding the use of timber frame walls as they are expensive to repair and dry;
- Using non water absorbing insulation;
- Using corrosion resistant fittings such as galvanised or stainless steel in place of mild steel;
- Ensuring electric cables are fed from above;
- Applying an appropriate damp proof course;

- Installing plant (eg fridges) with motors high up from the floor;
- Installing effectively sealed solid internal and external doors;
- Avoiding the use of storage heaters;
- Ensuring boilers are off the ground.

The risk of flooding at the site is considered so small that even wetproofing measures may not be considered necessary.

5 CONCLUSIONS AND RECOMMENDATION

Conclusions

The client wishes to redevelop a section of land at the intersection between the A485 and the A482 at Cwmann near Lampeter. However, the site partially lies within a Zone C2 flood area, in accordance with the development advice maps, and is considered to be at risk of flooding during at least the 1 in 1000 year event and is not afforded protection from recognised flood defences. Francis Sant were, therefore, requested to evaluate the consequence of flooding at the site.

NRW's 2D hydraulic model suggest that part of the site is expected to remain flood free even during the Q1000 event although part of the site could be at risk during the Q100 event. To ensure that the site remains flood free during all considered events it is proposed to raise the site levels. To evaluate the impact the NRW TUFLOW model was obtained, amended, and ran with and without the scheme in place. Modelling showed that this had no detrimental impact on third parties (impact on flood depth less than 5mm). A flood free access from the site is also expected during the considered events.

The development is not expected to be at risk from tidal, surface water, or ground water flooding. It's also not expected to be at risk from reservoir failure.

A summary of the adherence of the development with the requirements of Section 7 and Appendix A1 of TAN 15 is summarised in Table 5.1.

Table 5.1 - Adherence With Section 7 and Appendix A1 of TAN 15

	Requirement	Comment
1	Is the development flood free during a Q100 event	Yes.
2	Is the flood depths at the development less than 1000mm during a Q1000 event	Yes. Expected to be flood free.
3	Is the flood velocity at the development less than 0.3m/s during a Q1000 event	Yes. Expected to be flood free.
4	Is the flood depths on the access route less than 1000mm during a Q1000 event	Yes
5	Is the flood velocity on the access route less than 0.45m/s during a Q1000 event	Yes
6	Is the maximum rate of rise of flood waters less than 0.3m/hr	Not on site
7	Is the maximum speed of inundation of flood risk area less than 2hrs	No. Site is not expected to flood
8	Will the development have an impact on third parties	No (impact on flood depth less than 5mm).
9	Will there be a loss of flood storage capacity	Potentially a comparatively small amount considering the size of the floodplain

The need for a sustainable drainage system, to mitigate against any increase in rainfall runoff, will need to be considered. If incorporated into the development the system should be designed in accordance with the Welsh Government Standards and the SUDS manual.

Recommendations

In developing the site it is recommended that:

- consideration is given for the inclusion of wet proofing measures identified in Section 4;
- a cut off valve is placed on the foul drainage system;
- the site is raised above the flood plain as proposed;
- consideration be given for the inclusion of a sustainable drainage system.