Former Seiont Brickworks

Caernarfon - Phase II

Flood Consequences Assessment

December 2016

Waterco Ltd, Eden Court, Lon Parcwr Business Park, Ruthin, Denbighshire LL15 1NJ
tel: 01824 702220 email: enquiries@waterco.co.uk web: www.waterco.co.uk

DOCUMENT VERIFICATION RECORD

CLIENT:

Jones Bros Ruthin (Civil Engineering) Co Ltd

SCHEME:

Flood Consequences Assessment for a development at Seiont Brickworks, Seiont Mill Road, Caernarfon, LL55 2YL. The purpose of this report is to support the Planning Application.

INSTRUCTION:

The instruction to carry out this Flood Consequences Assessment was received from Mr Graham Gibson of Jones Bros Ruthin (Civil Engineering) Co Ltd.

REPORT FORMAT:

This report has been prepared in accordance with Technical Advice Note 15: Development and Flood Risk (TAN15).

ISSUE HISTORY:

Issue Date	Comment
02/02/2016	First issue
05/02/2016	Second issue
19/04/2016	Third issue
16/12/2016	Fourth issue

DOCUMENT REVIEW & APPROVAL

Prepared by Jordan Jones BSc (Hons)

Checked by Chris Lewis CEng MICE

Approved by Aled Williams BSc (Hons)

Waterco Document Reference Number..... .w1910-161216-FCA Stage 2.docx

Contents

Appendices

List of Tables

Supporting Documents:

Welsh Government Technical Advice Note (TAN) 15: Development and Flood Risk (2004)

Anglesey & Gwynedd Joint Strategic Flood Consequences Assessment (May 2013)

Abbreviations

AEP	*Annual Exceedance Probability*
CC	*Climate Change*
CCA	*Climate Change Allowance*
DCWW	*Dwr Cymru Welsh Water*
EA	*Environment Agency*
FCA	*Flood Consequences Assessment*
HMR	*Hydraulic Modelling Report*
LiDAR	*Light Detection and Ranging*
m AOD	*metres Above Ordnance Datum*
NRW	*Natural Resources Wales*
SFCA	*Strategic Flood Consequences Assessment*
SuDS	*Sustainable Drainage Systems*
TAN15	*Welsh Government Technical Advice Note 15: Development & Flood Risk*

1 Introduction

1.1 Waterco Consultants have been instructed to prepare a Flood Consequences Assessment report in respect of a proposed development at Seiont Brickworks, Seiont Mill Road, Caernarfon, LL55 2YL (grid reference: 249037E 361545N). A location plan and an aerial image of the site are included in Appendix A.

1.2 The existing site covers an area of 15.9ha and comprises of the former Seiont Brickworks factory (now demolished) and associated brickyards, an access road, quarry void and agricultural land. The quarry void contains a body of water, with an overflow channel into the Afon Seiont. The site is bordered by the Afon Seiont and Peblig Industrial Estate to the north, agricultural land to the east and south, and the Afon Seiont to the west.

1.3 Site levels vary from a low of 13.0metres Above Ordnance Datum (m AOD) in the west to a high of 51.3m AOD to the east. Levels in the quarry void reach a low of -1.5m AOD. The existing water level in the quarry void is 12.9m AOD. A Topographical Survey is included in Appendix B.

1.4 The proposed development is for Phase II of a temporary construction compound required in connection with the proposed Caernarfon and Bontnewydd bypass road. It is understood that the temporary planning permission is for 5 years. Indicative development plans are included in Appendix B. To summarise, the proposals comprise of:

- Office accommodation, welfare facilities and car parking for construction personnel;
- Storage and maintenance space for construction plant, haulage vehicles and imported construction materials and components;
- A fuel storage and plant maintenance area;
- Extraction of minerals for bypass construction;
- Mineral processing and stockpile area;
- Construction of haul roads;
- A concrete batching plant;
- A new permanent access road which would eventually make the existing access redundant;
- Capacity to deposit suitable soils to restore the quarry on completion. The quarry void will be restored and re-graded to ensure stable slopes.
- Closure of the overflow channel connecting the quarry void to the Afon Seiont.

1.5 Planning permission already exists for the extraction of minerals and restoration of the quarry until 2042.

2 Flood Zone Category and Justification

2.1 The Welsh Government Development Advice Map included in Appendix C shows that the north-western extent of the site and the quarry void are located within Flood Zone C2 – an area at flood risk, without significant defence infrastructure, with a 0.1% (1 in 1000) chance or greater of flooding in any given year. The remainder of the site is located within Flood Zone A – an area considered to be at little or no risk of fluvial or coastal / tidal flooding.

2.2 The Natural Resources Wales (NRW) Flood Risk (including defences) map (Appendix C) shows that the north-western extent of the site is located within Flood Zone 3 – an area at risk with a 1% chance or greater of fluvial flooding in any given year. The north-western extent of the site is also shown to be located within Flood Zone 2 – an area at risk with between a 1% and 0.1% chance of fluvial flooding in any given year. The remainder of the site is located outside of the extreme extent of flooding, with a less than 0.1% chance of fluvial flooding in any given year.

2.3 The proposed construction compound is considered 'less vulnerable' development in accordance with Figure 2 of the Welsh Government's Technical Advice Note 15 - Development and Flood Risk (TAN15).

2.4 TAN15 states that less vulnerable development can be considered in Flood Zone C2, subject to the application of the justification test and acceptability of consequences.

Justification

2.5 Development will be justified if it can be demonstrated that:

i. Its location in Zone C is necessary to assist, or be a part of, a local authority regeneration initiative or a local authority strategy required to sustain an existing settlement; **or**,

ii. Its location in Zone C is necessary to contribute to key employment objectives supported by the local authority, and other key partners, to sustain an existing settlement or region; **and**,

iii. It concurs with the aims of PPW and meets the definition of previously developed land; and,

iv. The potential consequences of a flooding event for a particular type of development have been considered, and in terms of the criteria contained in sections 5 and 7 and appendix 1 (of TAN15) found to be acceptable.

2.6 It is considered that this development satisfies the justification test because the temporary construction compound is required in this location to support the development of a bypass road (a local authority initiative). There are no readily available alternative sites. The existing site comprises of a former brickworks and quarry and meets the definition of previously developed land.

2.7 The acceptability of flooding consequences are discussed further in this report.

3 TAN15 Acceptability Criteria

3.1 TAN15 section 9 'Summary of Policy Requirements' states that for 'less vulnerable' development in Zone C2 the following Acceptability Criteria should be satisfied:

- Acceptable consequences for nature of use
- Flood defences adequate
- Agreement for construction and maintenance costs secured
- Occupiers aware of flood risk
- Escape/evacuation routes present
- Effective flood warning provided
- Flood emergency plans and procedures
- Flood resistant design
- No increase in flooding elsewhere

3.2 The above criteria are considered in subsequent sections, but firstly the potential sources of flooding are considered below to provide context for the assessment.

4 Potential Sources of Flooding and Probability

Fluvial

4.1 The nearest watercourse is the Afon Seiont which is located immediately north and west of the site. The Afon Seiont flows to its confluence with the Menai Strait approximately 1.7km north-west of the site.

4.2 Fluvial flooding could occur if the Afon Seiont overtopped its banks during or following an extreme rainfall event.

4.3 The Strategic Flood Consequences Assessment (SFCA) contains no records of fluvial flooding affecting the site.

Waterco Hydraulic Modelling

4.4 A 2-Dimensional (2D) hydrodynamic model of the Afon Seiont and its surrounding floodplain has been constructed to estimate flood levels, extents, depths and velocities for the site. As stated in NRW correspondence dated 22nd July 2015 (Appendix C) there is no need to consider climate change due to the temporary nature of the development proposals. For the same reason, a 2D-only model is considered appropriate. The latest version of industry standard hydraulic modelling software, TUFLOW has been used (2013 12 AE).

4.5 The 2D digital terrain model (DTM) of the study area has been constructed from high resolution LiDAR data (1m) and available topographical data (Appendix B).

4.6 To fully investigate the fluvial flood risk at the existing site, two fluvial events have been simulated; namely the 1% (Q100) and the 0.1% (Q1000) AEP events.

4.7 To provide the required model inflows, a detailed hydrological assessment of the predicted flows in the Afon Seiont has been completed in accordance with the Flood Estimation Handbook (FEH) and NRW/EA guidelines, namely 'Flood Estimation Guidelines, Technical guidance 197_08, v5 (2015)'. Both the FEH Statistical and ReFH flow estimation methods have been used. The completed hydrological calculations, summarised in a Flood Estimation Calculation (FEC) Record, are included in Appendix D. Peak flow estimates are given in Table 1 overleaf.

Table 1 – Primary Simulation Summary

Fluvial Event (AEP)	Peak Flows (m3/s)
1% (Q100)	100.01
0.1% (Q1000)	185.92

4.8 In addition to simulating the watercourse under normal conditions, the hydraulic modelling also investigated the potential blockages of the two access bridges to the site; Seiont Mill Road Bridge (west) and Access Road Bridge (south). For both scenarios a 66% blockage of the structures was considered for the 1% AEP event.

4.9 It should be noted that the quarry pond in the centre of the site has also been included within the model for completeness. The body of water, remote from the watercourse and predicted floodplain, has been set at a constant water level of 12.9m AOD as per the topographical survey. This feature will be filled as part of the proposed scheme.

Waterco Flood Mapping

4.10 The modelling results, including flood depth, velocity and hazard mapping are included in Appendix E with map extracts provided overleaf.

4.11 As shown in Figure 1, the developable site area including its access off Seiont Mill Road Bridge is flood free during the 1% AEP event.

4.12 The topographical survey (Appendix B) shows the water level within the quarry void as 12.9m AOD. The water level in the quarry void is not impacted during the 1% AEP event.

4.13 As shown in Figure 2 overleaf, a 66% blockage of the Seiont Mill Road Bridge during the 1% AEP event does not significantly impact flood depths or extents on site. Seiont Mill Road is shown to flood, with depths of up to 0.6m and velocities of up to 2.4 m/s estimated. Flood depths in the brickyard in the south-west remain less than 600mm.

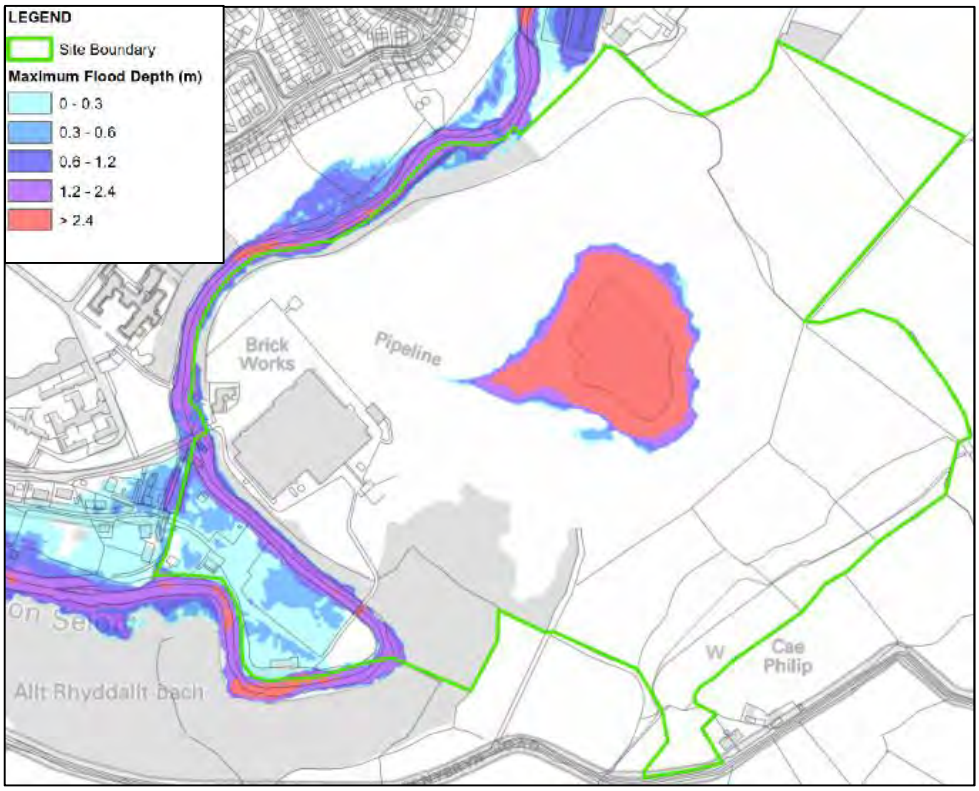

Figure 1 – Maximum Flood Depth – 1% AEP event

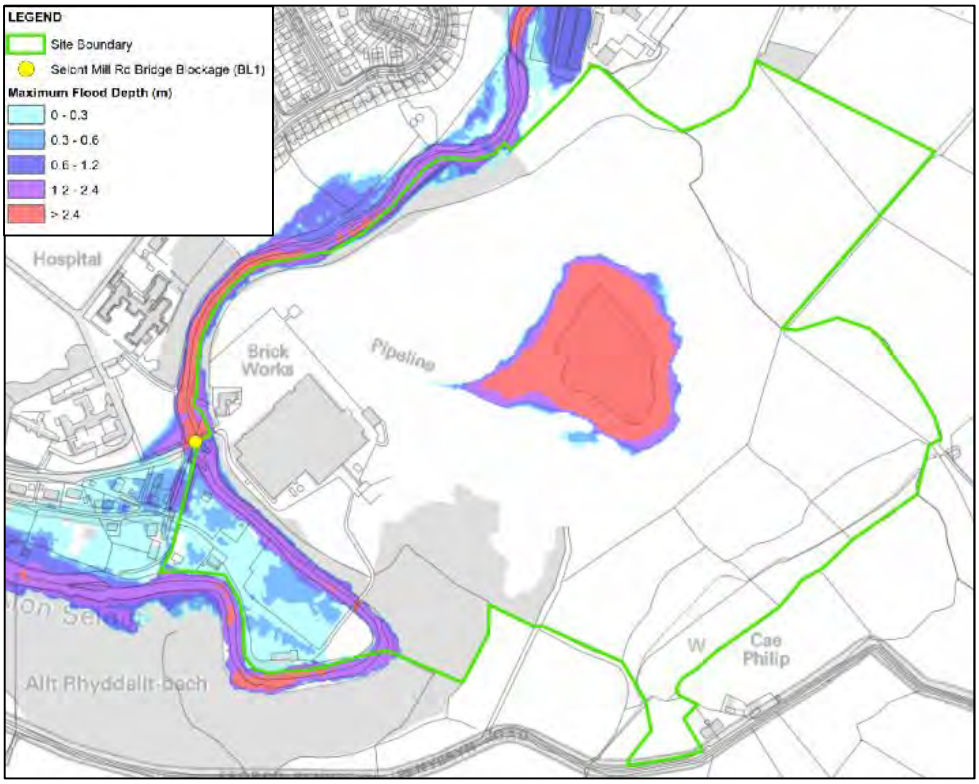

Figure 2 – Maximum Flood Depth – 1% AEP; 66% Blockage of Seiont Mill Rd Bridge

4.14 As shown in Figure 3 below, a 66% blockage of the Brickyard access bridge does not impact on flood extents in the developable area of the site.

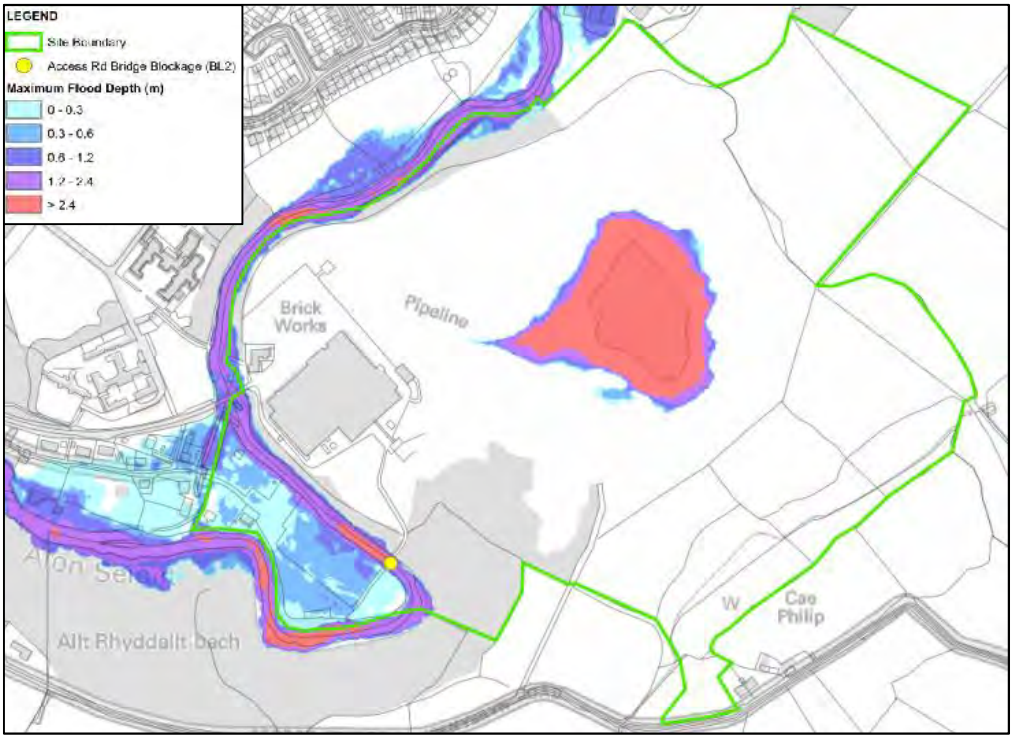

Figure 3 – Maximum Flood Depth – 1% AEP; 66% Blockage of Access Rd Bridge

4.15 As shown in Figure 4 overleaf, the site is shown to flood during the 0.1% AEP event. Flood depths of up to 1.2m are experienced in a localised low point in the north-western extent of the site. The developable area of the site is shown to be flood free. The sites access at Seiont Mill Road is also shown to be flood free.

4.16 During all modelled events a former brickyard in the south-western extent of the site (west of the Afon Seiont) is shown to flood with depths up to 1.2m. This part of the site will serve to provide flood storage. The flood storage capacity will be increased in this area through removal of materials.

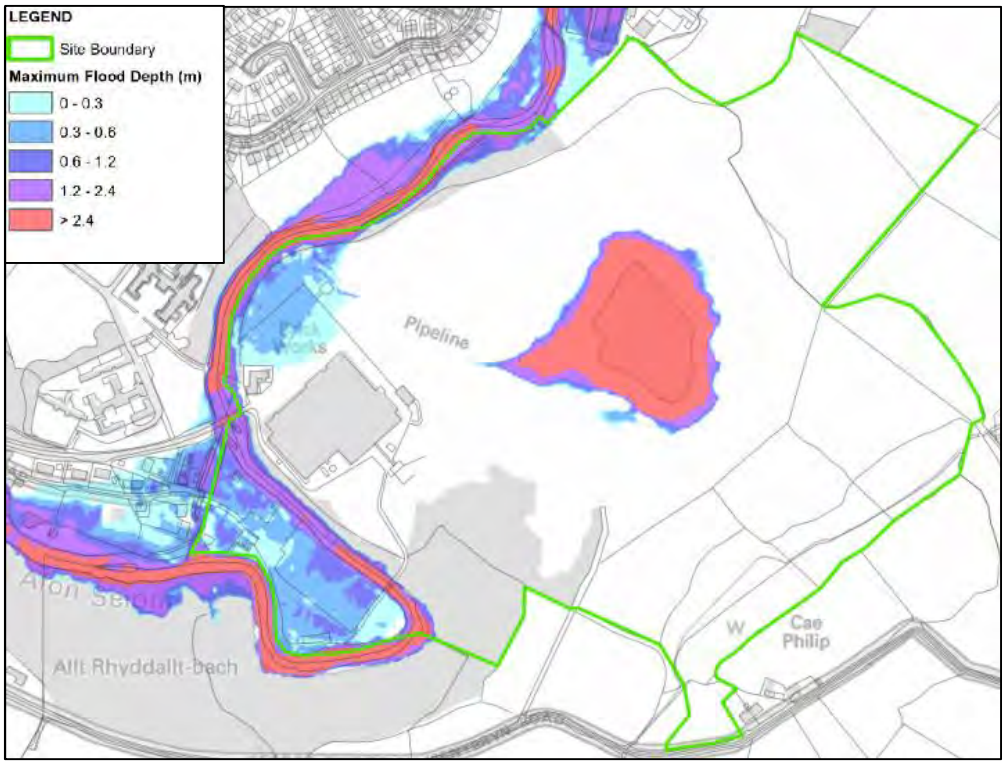

Figure 4 – Maximum Flood Depth – 0.1% AEP event

Tidal

4.17 There are no records of tidal flooding affecting the site. The site, excluding the quarry void, is situated at or above 13m AOD and is above extreme tidal levels. The site is therefore not at risk of tidal flooding.

Pluvial flooding

4.18 This is defined as local flooding in areas not normally associated with natural or manmade watercourses, which result from rainfall-generated overland flow before the runoff enters any watercourse or sewer. It is usually associated with high intensity rainfall events, but can also occur with lower intensity rainfall or melting snow, where the ground is saturated, frozen or developed, resulting in overland flow and ponding in depressions in topography. Pluvial flooding is unpredictable to the extent that the localised heavy rainfall can occur anywhere without warning. However, flow paths and depths can be determined by consideration of contours and relative levels.

4.19 The NRW 'Risk of flooding from surface water' map (Appendix C) shows a flow route from an unnamed land drain to the south of the site, to the quarry void. The risk associated with this flow route is low, meaning it has between a 0.1% and 1% chance of flooding in any given year. An isolated area of the site, south-east of the former brickworks factory, is identified at low risk. The remainder of the site is not at risk.

4.20 There are no records of surface water flooding at the site. It can therefore be concluded that the risk of surface water flooding is low.

Groundwater flooding

4.21 Groundwater flooding occurs when water levels underneath the ground rise above normal levels. Prolonged heavy rainfall soaks into the ground and can cause the ground to become saturated. This results in rising groundwater levels which leads to flooding above ground.

4.22 The Envirocheck flood report (Appendix F) shows that the site is at negligible risk of groundwater flooding. The SFCA states that 'in general groundwater flooding is not considered to be significant source of flooding across the joint local development plan area (Anglesey and Gwynedd).'

4.23 A detailed ground contamination investigation was carried out by e-geo Solutions Ltd (ref: E0756.SCRGCRA.R1) in January 2016 for the former brickworks factory and its immediate vicinity. No groundwater was found within the 11no. test pits constructed across the site.

4.24 A detailed geological ground investigation was carried out by e-geo Solutions Ltd (ref: E0756.GGI.R1) in February 2016 for the borrow pit area located north-east of the existing quarry pond. Groundwater was encountered within two of the four boreholes at depths of 6m below ground level (m bgl) rising to 5.25m bgl (BH3) and 2m bgl (BH04). In both boreholes the groundwater strikes were recorded in the Siltstone. The other two boreholes (BH01 & BH02) were also drilled into the Siltstone, however these remained dry, indicating that the groundwater is not continuous across the site, but more likely present in discrete lenses of more permeable material. Based on the limited information provided it can be concluded that the risk of groundwater flooding is likely to be low.

Sewer flooding

4.25 Flooding from sewers can occur when a sewer is overwhelmed by heavy rainfall, becomes blocked, is damaged or is of inadequate capacity. This is mostly applicable to combined and surface water sewers.

4.26 The Dwr Cymru Welsh Water (DCWW) sewer records show that there are no public sewers crossing the site. The nearest public sewer is a 150mm public combined sewer located to the west of the site, on the western side of the Afon Seiont.

4.27 There are no records of sewer flooding at the site. It can therefore be concluded that the risk of sewer flooding is low.

Artificial sources of flooding

4.28 There are no canals in this area. The NRW 'Risk of flooding from reservoirs map' (included in Appendix C) shows that the site is not at risk of flooding from reservoirs. It can therefore be concluded that the risk of flooding from artificial sources is low.

Summary of Potential Flood Sources

4.29 It can be concluded that fluvial flooding from the Afon Seiont during the 0.1% AEP event is considered to be the main source of flood risk to the site. This has been accounted for in mitigation design as discussed below.

5 Acceptable Consequences for Nature of Use

5.1 In accordance with section A1.14 of TAN15 there is a frequency threshold of flooding below which flooding of development should not be allowed. The following table, taken from TAN15, provides indicative guidance as to what the frequency threshold could be for different types of development in terms of annual probability of occurrence.

Table 2 – TAN15 Flood frequency thresholds

Type of Development	Threshold Frequency (Years)	
	Fluvial	**Tidal**
Residential	1%	0.5%
Commercial/Retail	1%	0.5%
Industrial	1%	0.5%
Emergency Services	0.1%	0.1%
General Infrastructure	1%	0.5%

5.2 According to the table, no flooding should occur for commercial and industrial development during the 1% AEP event. The site is not at risk during the 1% AEP event, and is therefore compliant with A1.14 of TAN15.

5.3 In accordance with section A1.15 of TAN15, beyond the threshold frequency (beyond the 1% AEP event in this case) the proposed development would be expected to flood under extreme conditions. The following table, taken from TAN15, provides indicative guidance on what is considered tolerable conditions for different types of developments.

Table 3 – TAN15 Tolerable conditions

Type of Development	Max depth of flooding (mm)	Max rate of rise of floodwaters (m/hr)	Max speed of inundation of flood risk area (hrs)	Max velocity of floodwaters (m/s)
	Property Access			**Property Access**
Residential (habitable rooms)	600 600	0.1	4	0.15 0.3
Commercial & Retail	600 600	0.3	2	0.15 0.3
Industrial	1000 1000	0.3	2	0.3 0.45
Emergency Services	450 600	0.1	4	0.15 0.3
General Infrastructure	600 600	0.3	2	0.3 0.3

5.4 The 0.1% AEP event has been used for the assessment under A1.15 of TAN15. The developable part of the site is not at risk during the 0.1% AEP event and is therefore compliant with A1.15 of TAN15.

5.5 Areas within the site boundary, including the brickyard in the south-west, the quarry void and an isolated low point in the north-west of the site are shown to flood with depths exceeding the TAN15 guidelines. No development is proposed within the brickyard or isolated low point in the north-west. The quarry void is not estimated to flood during the 0.1% AEP event, and therefore the removal / addition of material will not impact on flood risk elsewhere.

6 Flood Resistant Design / Consideration of Layout

6.1 All machinery and material stores will be located outside of the 0.1% AEP flood extent.

7 Flood Warnings, Emergency Plans and Procedures

7.1 The NRW flood alerts service covers this area. NRW flood alerts is a free service that provides flood alerts by telephone, mobile, email, SMS text message and fax. Site management should register to receive flood alerts.

7.2 The site management should prepare a Flood Plan detailing what to do in the event of a flood in the former brickyard to the south-west and to detail safe evacuation routes.

7.3 Upon receiving a flood alert, site users in the former brickyard to the south-west should evacuate to an area outside the 0.1% AEP flood extent and utilise the nearest evacuation route. Evacuation routes are available from the Access Road Bridge. An evacuation route plan is included in Appendix G.

8 No Increase in Flooding Elsewhere

8.1 No development will be located within the 0.1% AEP flood extent. Therefore the development will not be depriving flood storage space from the floodplain. Stockpiles of bricks within the brickyard will be removed, increasing the flood storage capacity in this area.

8.2 It is therefore reasonable to conclude that there will be no increase in flooding elsewhere as a result of the proposed development.

9 Surface Water – No Adverse Impact

9.1 The existing site currently comprises of the former Seiont Brickworks, quarry and concrete brick storage yard. The proposed development will not increase the impermeable area on site and will therefore not increase surface water runoff rates or volumes. Surface water will be managed separately for 'clean' and 'dirty' activities associated with the construction compound.

Clean Surface Water Management

9.2 Surface water runoff from the 'clean' car park and temporary site buildings will drain onto the surrounding hard-standing as per the existing situation, with runoff draining into the ground through voids or into the Afon Seiont during an extreme rainfall event.

Dirty Surface Water Management

9.3 Surface water runoff from the 'dirty' car park and 'dirty' haulage routes will be directed into the quarry void or an existing attenuation basin in the south-eastern extent of the site. The quarry void will be pumped during the construction of the bypass to accommodate runoff from the disturbed quarry slopes and haulage routes. The drainage ditch connecting the quarry void to the Afon Seiont will be closed off to ensure no discharge directly to the watercourse.

9.4 The refuelling area and plant servicing area will drain into the quarry void via oil interceptors.

9.5 Silt traps will be placed within the quarry void to provide treatment to the runoff. Once passed through the silt traps, water will be pumped to the attenuation basin in the south-western extent of the site, where water will discharge into the Afon Seiont via an existing outfall.

9.6 Once fully restored, surface water from the site will infiltrate into the ground or discharge into the Afon Seiont.

10 Agreement for Construction and Maintenance Costs Secured

10.1 The site is not located in an area which benefits from flood defences. No new flood defences are proposed as part of this development.

11 Summary and Conclusions

11.1 The development at Seiont Brickworks, Caernarfon is for Phase II for a temporary construction compound required in connection to the proposed Caernarfon and Bontnewydd bypass road. Restoration of the quarry will take place upon completion of the bypass road.

11.2 The site is located within Flood Zone C2 and Flood Zone A on the Welsh Government Development Advice Map. The proposals are classified as 'less vulnerable' development in accordance with TAN15. Less vulnerable development is considered to be acceptable in Zone C2 subject to satisfying specific TAN15 criteria.

11.3 All potential sources of flooding have been considered as part of this report. Fluvial flooding from the Afon Seiont is considered to be the primary source of flood risk to the site.

11.4 Hydraulic modelling of the Afon Seiont has been undertaken to establish the flood extent, depths and velocities on site. The developable part of the site, including the temporary site buildings and car parks, is shown to be flood free during all events up to and including the 0.1% AEP event. The development is therefore compliant with A1.14 and A1.15 of TAN15.

11.5 No temporary offices, car parking, stock piles or machinery will be located within the 0.1% AEP flood extent.

11.6 Material will be removed from an existing brickyard in the western extent of the site, and will therefore increase the flood storage capacity.

11.7 The proposed development will not increase the impermeable area of the site. Surface water runoff from the 'clean' car park and temporary site offices will drain onto the surrounding hard-standing as per the existing situation. Runoff will then enter the ground via voids or drain into the Afon Seiont during an extreme rainfall event. Dirty surface water associated with the construction works on site will be treated on site and pumped into an attenuation pond prior to discharge into the Afon Seiont via an existing outfall. Oil interceptors and silt traps will be utilised to provide treatment.

12 Recommendations

12.1 Prepare a Flood Plan to provide advice on what to do in the event of a flood including details of a safe evacuation route.

12.2 Register for flood alerts.

12.3 Submit this Flood Consequences Assessment Report to the Local Planning Authority in support of the planning application.