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REDROCK QUARRY AT CLOGRENNANE, CO. CARLOW

STAGE II - FLOOD RISK ASSESSMENT

FINAL REPORT

Prepared for:
MILFORD QUARRIES LTD

Prepared by:
Hydro-Environmental Services

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1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) was engaged by Tom Philip's and Associates (TPA) to undertake a Stage II Flood Risk Assessment (FRA) for the Proposed Developemnt at Clogrennane, Co. Carlow.

The following FRA is carried out in accordance with 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' (DoEHLG, 2009). This FRA is also completed in accordance with the Surfaace Water Drainage / SuDS policies (SWP1 to SWP6) and the Flood Risk Management policies (FRP1-FRP6) as detailed in the Carlow County Council Development Plan (2022-2028).

This Stage II FRA report has been completed to identify the flood risk at the Proposed Development Site. Flood risk identification is an important part of the flood risk assessment process and identifies any areas of the Proposed Development Site (if any) which may be at risk of flooding.

1.2 STATEMENT OF EXPERIENCE

Hydro-Environmental Services ("HES") are a specialist geological, hydrological, hydrogeological and environmental practice which delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford.

Our core area of expertise and experience is hydrology and hydrogeology, including flooding assessment and surface water modelling. We routinely work on surface water monitoring and modelling and prepare flood risk assessment reports.

This report was prepared by Michael Gill, Conor McGettigan and Nitesh Dalal.

Michael Gill (BA, BAI, Dip Geol., MSc, MIEI) is an Civil/Environmental Engineer, Hydrologist and Hydrogeologist with 22 years' environmental consultancy experience in Ireland. Michael has a degree in Civil and Environmental Engineering, a MSc in Engineering hydrology from TCD and a MSc in Applied Hydrogeology from Newcastle University. Michael has completed numerous (60+) hydrological and hydrogeological assessments relating to bedrock quarries and sand and gravel pits. Recent examples include Ardfert quarry in County Kerry, Middleton Quarry in County Cork, and Rathcore and Clonard Quarries in County Meath.

Conor McGettigan (BSc, MSc) is an Environmental Scientist, with over 5 years' experience in the environmental sector in Ireland. Conor holds an MSc in Applied Environmental Science and a BSc in Geology from University College Dublin. Conor routinely completes hydrological and hydrogeological assessments for a wide range of developments including sand and gravel pits and bedrock quarries.

Nitesh Dalal (B.Tech, PG Dip., MSc) is an Environmental Scientist with over 7 years' experience in environmental consultancy and environmental management in India. Nitesh holds a M.Sc. in Environmental Science from University College Dublin (2024), a PG Diploma in Health, Safety and Environment from Annamalai University, India (2021) and B.Tech. in Environmental Engineering (2016) from Guru Gobind Singh Indraprastha University, India (2016).

1.3 REPORT LAYOUT & METHODOLOGY

This FRA report has the following format:

- Section 2 describes the setting and details of the Proposed Development Site;
- Section 3 outlines the hydrological and geological characteristics of the surface water catchment and existing site drainage;
- Section 4 presents a site-specific flood risk assessment (FRA) undertaken for the Proposed Development Site which was carried out in accordance with the above-mentioned guidelines;
- Section 5 presents Planning policy and responses to that policy outlined in this FRA; and,
- Section 6 presents the FRA report conclusions.

As stated above, this FRA is carried out in accordance with 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' (DoEHLG, 2009). The assessment methodology involves researching and collating flood related information from the following data sources:

- Geological Survey of Ireland (GSI) geological databases and Teagasc soils map (www.gsi.ie);
- EPA Hydrological Databases (www.epa.ie);
- OPW National Flood Mapping Databases (www.flood.info); and,
- Carlow County Development Plan 2021 – 2027.

2. BACKGROUND INFORMATION

2.1 INTRODUCTION

This section provides details on the topographical setting of the Proposed Development Site along with a description of the Proposed Development.

2.2 SITE LOCATION AND TOPOGRAPHY

The Proposed Development Site is located in the townland of Clongrenan, Co. Carlow, and lies immediately to the south of the Laois – Carlow county border. The Proposed Development Site is located ~1.5km east of the small village of Bilboa, Co. Laois which was historically a coal-mining settlement. The Proposed Development Site also lies ~5km southwest of Carlow town and ~7.5km northwest of the town of Leighlinbridge, Co. Carlow. The Proposed Development Site has a total area of 41.86 hectares (ha). A site location map is included as **Figure A**.

The Proposed Development Site can be accessed via the L3896/L7134 which is located ~300m to the east. An existing access road branches off this local road to the east and runs along the northern boundary of the quarry, providing access to the existing quarry void.

The Proposed Development Site currently comprises of an existing quarry void which is surrounded by agricultural lands. Red Rock Quarry was previously used to extract sandstone bedrock, with extraction ceasing in 2014. The floor of the existing quarry stands at ~304mOD (metres above Ordnance Datum). The existing quarry contains several large stockpiles of spoil which have vegetated in places. An access track passes through the centre of the existing void. Some old plant, machinery and workshops are located to the east of the Proposed Development Site, adjacent to the L3896/L7134. Meanwhile, the lateral expansion lands are located predominantly to the south and southwest of the existing void. These lands comprise of rough agricultural pastures. Meanwhile, the lands to the east of the Proposed Development Site comprise of good agricultural pastures.

The Proposed Development Site is located on the eastern edge of the Castlecomer Plateau, an upland area in north Co. Kilkenny which also extends into Co. Laois and Co. Carlow at its northern edge. Locally, natural ground elevations within the Proposed Development Site range from ~319mOD in the west to ~310mOD in the east. Natural ground elevations have been altered in the existing quarry void due to the previous removal of overburden, extraction of bedrock and stockpiling of spoil material. The existing topography in the east of the lateral extension lands slopes steeply to the east. Meanwhile, the rough agricultural pastures to the southwest of the existing quarry void are relatively flat.

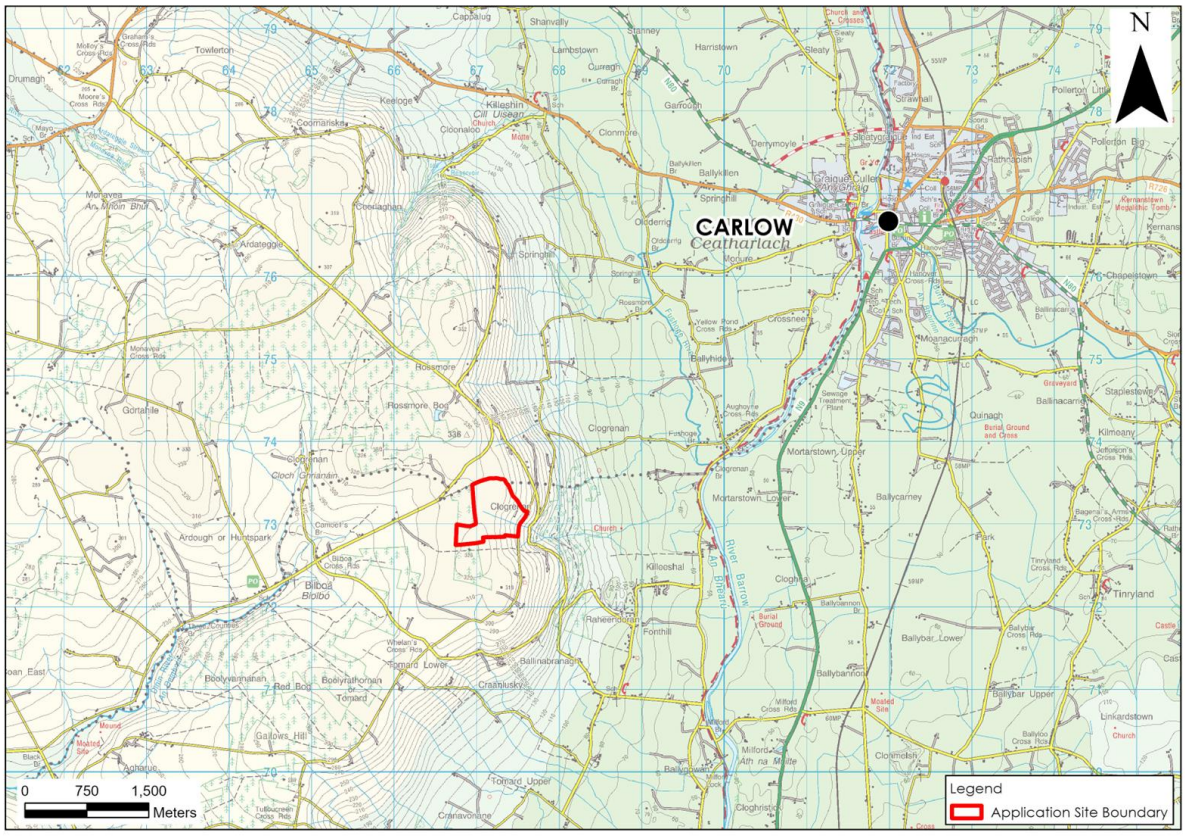

Figure A: Site Location Map

2.3 PROPOSED DEVELOPMENT DETAILS

The Proposed Development is described in full in Chapter 3 of the EIAR.

The development site consists of an area of 41.86 ha within a total landholding of 45.68 ha, of which c. 41.86 ha is currently subject to an application for substitute consent under Section 177E of the Planning and Development Act 2000 (As amended) to regularise previous unauthorised development. The proposed development will consist of further quarry extraction over a total area of 16.17 ha to include the pre-existing quarry and additional agricultural lands with a projected lifespan of c. 20 years.

The proposed development will involve blasting, extraction and processing of rock using mobile primary crushing / screening and associated plant on the proposed quarry floor. The proposed quarry void will be extracted over 4 no. phases to a depth of 2 no. benches of c. 10m each to a quarry depth of c. 300m AOD with a proposed rate of extraction of c. 200K tonnes per annum. The proposed development will include for construction of earthen screening berms, soil storage areas and will utilise existing quarry entrance from the northern boundary linking to the L7130 local road to the east. Existing and proposed access tracks and existing settlement ponds will be utilised as part of the proposed development. The proposed development will be accompanied by a phased restoration plan.

3. EXISTING ENVIRONMENT AND CATCHMENT CHARACTERISTICS

3.1 INTRODUCTION

This section gives an overview of the hydrological and geological characteristics in the area of the Proposed Development Site.

3.2 BASELINE HYDROLOGY

3.2.1 Regional and Local Hydrology

Regionally, the majority of the Proposed Development Site is located within the River Barrow surface water catchment and Hydrometric Area 14 of the Southeastern River Basin District. Meanwhile, a small portion in the west of the Proposed Development Site is located within the Nore River surface water catchment and Hydrometric Area 15 of the Southeastern River Basin District.

More locally, within the River Barrow surface water catchment, the Proposed Development Site is mapped within the Barrow_SC_110 sub-catchment and Barrow_170 WFD river sub-basin. Within this WFD river sub-basin, the EPA map a small 1st order stream, referred to by the EPA as the Raheendoran Stream (EPA Code: 14R41) to flow through the centre of the Proposed Development Site. The stream is mapped to flow from northwest to southeast across the existing quarry void before continuing to the south, crossing the L7134, flowing to the east through Clogrennane Woods for ~3km, before discharging into the River Barrow. However, based on site walkover surveys and drainage mapping, the course of this stream has been altered by the previous quarrying activities. No watercourse crosses the existing quarry void. Water gathers in the floor of the existing quarry and drains out from an existing pond in the north of the quarry. From here the stream/quarry discharge flows to the southeast along the existing quarry access road. The drain is culverted under the access road and flows to the east where it joins the EPA named Mortarstown Stream (EPA Code: 14M40) ~670m to the east. This stream flows to the east and discharges into the Fushoge River (EPA Code: 14F03) just upstream of its confluence with the River Barrow.

Within the Nore River surface water catchment, the Proposed Development Site is mapped within Dinin[South]_SC_010 sub-catchment and Dinin (South)_010 WFD river sub-basin. Within this river sub-basin the closest EPA mapped stream is an unnamed stream located ~1.3km west of the Proposed Development Site. This stream flows for ~1km before discharging into Dinin (South) River (EPA Code: 15D08). Inspection of local 6" and 25" basemaps for the local area shows that this watercourse, referred to on these maps as the Dinin River, rises ~500m west of the Proposed Development Site. There is no existing (and/or proposed) discharge from the quarry within the River Nore catchment. However, runoff from some areas in the west of the Proposed Development Site may currently flow to the west towards the Dinin River.

A local hydrology map is shown as **Figure B** below.

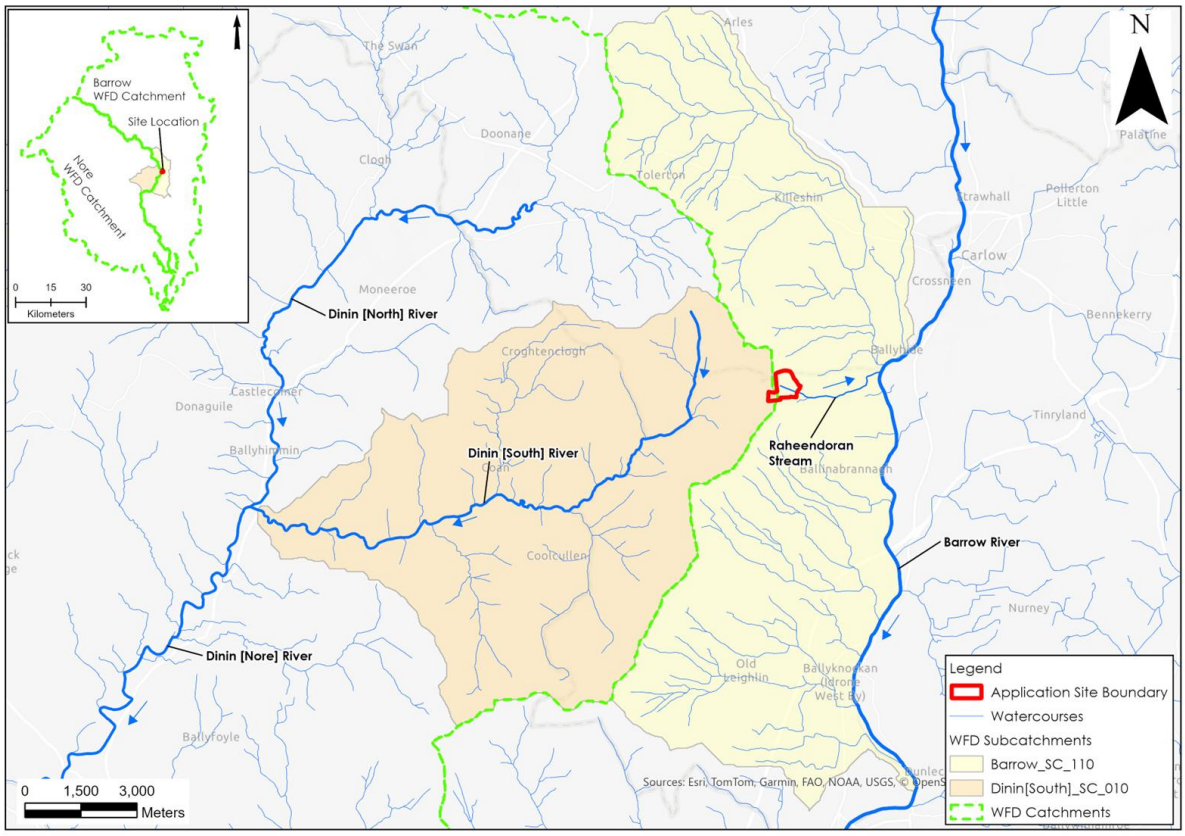

Figure B: Local Hydrology Map

3.2.2 Rainfall and Evaporation

Long term Average Annual Rainfall (AAR) and evaporation data was sourced from Met Éireann. The 30-year annual average rainfall (AAR) recorded at Coon, ~7.5km west-southwest of the Proposed Development Site is 1056.2mm/year.

Met Éireann also provide a grid of AAR for the entire country for the period of 1991 to 2020. Based on this more site-specific modelled rainfall values, the AAR at the Proposed Development Site is 1,118mm/year (this is considered to be the most accurate estimate of average annual rainfall from the available sources).

The closest synoptic[1] station where the average Potential Evapotranspiration (PE) is recorded is at Kilkenny, ~22km southwest of the Proposed Development Site. The long-term average PE for this station is 458.8mm/year. This value is used as a best estimate of the site PE. Actual Evaporation (AE) at the project site is estimated as 435.9mm/year (which is 0.95 × PE).

The Effective Rainfall (ER)[2] represents the water available for runoff and groundwater recharge. The ER for the Proposed Development Site is calculated as follows:

Effective Rainfall (ER) = Average Annual Rainfall (AAR) – Actual Evapotranspiration (AE)

= 1,118mm/year – 435.9mm/year

ER = 682.1mm/year

[1] Meteorological station at which observations are made for synoptic meteorology and at the standard synoptic hours of 00:00, 06:00, 12:00, and 18:00.

[2] *ER – Effective Rainfall is the excess rainfall after evaporation which produces overland flow and recharge to groundwater.*

In addition to average rainfall data, extreme value rainfall depths are available from Met Eireann. **Table A** below presents return period rainfall depths for the area of the Proposed Development Site. These data are taken from https://www.met.ie/climate/services/rainfall-return-periods and they provide rainfall depths for various storm durations and sample return periods (1-year, 5-year, 30-year, 100-year).

Table A: Proposed Development Site - Return Period Rainfall Depths (mm)

	Return Period (Years)			
Duration	**1**	**5**	**30**	**100**
5 mins	3.4	5.5	9.0	12.1
15 mins	5.6	9.0	14.7	19.8
30 mins	7.3	11.5	18.2	24.3
1 hours	9.6	14.7	22.7	29.7
6 hours	19.1	27.5	39.8	50.1
12 hours	25.0	35.0	49.5	61.3
24 hours	32.6	44.6	61.5	75.0
2 days	40.1	53.6	72.1	86.6

3.3 GEOLOGY

The published Teagasc soil maps (www.gsi.ie) for the local area shows that the majority of the Proposed Development Site is overlain by shallow, rocky, peaty/non-peaty mineral complexes (mainly acidic) (AminSRPT) and shallow, peaty, poorly drained mineral soils (mainly acidic) (AminSPPT). A small portion in the northwest of the Proposed Development Site is overlain by blanket peat (BktPt). To the east of the Proposed Development Site Teagasc map the presence of shallow, well drained mineral soils (mainly acidic) (AminSW), with smaller areas mapped to be overlain by poorly drained mineral soils (mainly acidic) (AminPD) and shallow poorly drained mineral soils (mainly acidic) (AminSP).

The published GSI subsoil maps (www.gsi.ie) for the local area shows that the majority of the Proposed Development Site is underlain by bedrock outcrop or subcrop (Rck) with small pockets of till derived from Namurian sandstones and shales (TNSSs) and blanket peat (BktPt) to the west.

The GSI's bedrock geology map for the local area (www.gsi.ie) shows that the majority of the Proposed Development Site is underlain by the Moyadd Coal Formation described as shale, siltstone and minor sandstone. Meanwhile, the southwest of the Proposed Development Site, and some small areas in the east, are mapped to be underlain by the Bregaun Flagstone Formation. The Bregaun Flagstone Formation is described by the GSI as being comprised of thick flaggy sandstone and siltstone. The GSI map 1 no. northwest to southeast orientated fault to dissect the southwest of the Proposed Development Site. Another fault of similar orientation is mapped ~40m to the north of the Proposed Development Site.

3.4 DESIGNATED SITES & HABITATS

Within the Republic of Ireland designated sites include Natural Heritage Areas (NHAs), Proposed Natural Heritage Areas (pNHAs), Special Areas of Conservation (SACs), candidate Special Areas of Conservation (cSAC) and Special Protection Areas (SPAs).

The Proposed Development Site is not located within a Ramsar site or a designated site of national (Natural Heritage Area (NHA) / Proposed Natural Heritage Area (pNHA)) or European importance (Special Area of Conservation (SAC) / Special Protection Area (SPA).

However, there are downstream hydrological connections with some Natura 2000 sites within the River Barrow surface water catchment. Designated sites that lie downstream of the site include:

- River Barrow and River Nore SAC (Site Code: 002162), is hydrologically linked within the Proposed Development Site. This SAC is located ~1.8km east and ~5.6km southwest of the Proposed Development Site. The length of the hydrological connection between the Proposed Development Site and the SAC is ~2.7km via the Mortarstown Stream. This stream received discharge from the Proposed Development Site. The lower reaches of this stream and the Fushoge River form part of the SAC.
- Cloghristick Wood pNHA (Site Code: 000806) located ~3.48km southeast of the Proposed Development Site and on the eastern banks of the River Barrow. The length of the hydrological flowpath between the Proposed Development Site and thos pNHA is ~6.3km.
- River Nore SPA (Site Code: 004233) is located downstream and ~22km southwest of the Proposed Development Site in the River Nore catchment. Any potential hydrological pathway would be in excess of 30km in length. There is no surface water discharge from the Proposed Development Site to any tributary of the Dinin River.

Other protected sites located within 10km of the Proposed Development Site but are not directly linked via surface water pathways are considered below:

- Coan Bogs NHA (Site Code: 002382) located ~5km west of the Proposed Development Site.

4. SITE SPECIFIC FLOOD RISK ASSESSMENT

4.1 INTRODUCTION

The following assessment is carried out in accordance with '*The Planning System and Flood Risk Management Guidelines for Planning Authorities*' (DoEHLG, 2009). The basic objectives of these guidelines are to:

- Avoid inappropriate development in areas at risk of flooding;
- Avoid new developments increasing flood risk elsewhere, including that which may arise from surface water run-off;
- Ensure effective management of residual risks for development permitted in floodplains;
- Avoid unnecessary restriction of national, regional or local economic and social growth;
- Improve the understanding of flood risk among relevant stakeholders; and,
- Ensure that the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management.

A stage 1 assessment of flood risk requires an understanding of where the water comes from (*i.e.* the source), how and where it flows (*i.e.* the pathways) and the people and assets affected by it (*i.e.* the receptors). It is necessary to identify whether there may be any flooding or surface water management issues related to the proposed site that may warrant further detailed investigation.

As per the guidance (DOEHLG, 2009), the stage 1 of a flood risk assessment comprises:

- *Flood risk identification* – identify whether there are surface water flooding issues at a site; and,
- *Initial flood risk assessment* - confirm sources of flooding that may affect a proposed development.

4.1 FLOOD ZONE MAPPING

This section of the report details the site-specific flood risk assessment carried out for the site and surrounding area. The primary aim of the assessment is to consider all types of flood risks and the potential impact on the development. As per the relevant guidance (DOEHLG, 2009), the stages of a flood risk assessment are:

- *Flood risk identification* – identify whether there are surface water flooding issues at a site;
- *Initial flood risk assessment* - confirm sources of flooding that may affect a proposed development; and,
- *Detailed flood risk assessment* – quantitative appraisal of the potential risk to a proposed development.

As per the Guidelines, there are essentially two major causes of flooding:

Coastal flooding, which is caused by higher sea levels than normal, largely as a result of storm surges, resulting in the sea overflowing onto the land. Coastal flooding is influenced by the following three factors, which often work in combination:

- High tide level;

- Storm surges caused by low barometric pressure exacerbated by high winds (the highest surges can develop from hurricanes); and,

- Wave action, which is dependent on wind speed and direction, local topography and exposure.

Coastal Flooding is not applicable to the Proposed Development Site.

Inland flooding which is caused by prolonged and/or intense rainfall. Inland flooding can include a number of different types:

- Overland flow occurs when the amount of rainfall exceeds the infiltration capacity of the ground to absorb it. This excess water flows overland, ponding in natural hollows and low-lying areas or behind obstructions. This occurs as a rapid response to intense rainfall and eventually enters a piped or natural drainage system.

- River flooding occurs when the capacity of a watercourse is exceeded or the channel is blocked or restricted, and excess water spills out from the channel onto adjacent low-lying areas (the floodplain). This can occur rapidly in short steep rivers or after some time and some distance from where the rain fell in rivers with a gentler gradient.

- Flooding from artificial drainage systems results when flow entering a system, such as an urban stormwater drainage system, exceeds its discharge capacity and the system becomes blocked, and/or cannot discharge due to a high-water level in the receiving watercourse. This mostly occurs as a rapid response to intense rainfall. Together with overland flow, it is often known as pluvial flooding. Flooding arising from a lack of capacity in the urban drainage network has become an important source of flood risk, as evidenced during recent summers.

- Groundwater flooding occurs when the level of water stored in the ground rises as a result of prolonged rainfall to meet the ground surface and flows out over it, i.e. when the capacity of this underground reservoir is exceeded. Groundwater flooding tends to be very local and results from interactions of site-specific factors such as tidal variations. While water levels may rise slowly, they may be in place for extended periods. Hence, such flooding may often result in significant damage to property rather than be a potential risk to life.

- Estuarial flooding may occur due to a combination of tidal and fluvial flows, i.e., the interaction between rivers and the sea, with tidal levels being dominant in most cases. A combination of high flow in rivers and a high tide will prevent water flowing out to sea, tending to increase water levels inland, which may flood over riverbanks.

The Flood Risk Management Guidelines (DoEHLG, 2009) provide direction on flood risk and development. The guidelines recommend a precautionary approach when considering flood risk management and the core principle of the guidelines is to adopt a risk-based sequential approach to managing flood risk and to avoid development in areas that are at risk. The sequential approach is based on the identification of flood zones for inland and coastal flooding.

Flood zones are geographical areas within which the likelihood of flooding is in a particular range, and they are a key tool in flood risk management within the planning process as well as in flood warning and emergency planning.

There are three types or levels of flood zones defined within the guidelines:

Flood Zone A – where the probability of flooding from rivers and the sea is highest (greater than 1% (AEP)[3] or 1 in 100 for river flooding or 0.5% (AEP) or 1 in 200 for coastal flooding);

Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 0.1% (AEP) or 1 in 1000 and 1% (AEP) or 1 in 100 for river flooding and between 0.1% (AEP) or 1 in 1000 year and 0.5% (AEP) or 1 in 200 for coastal flooding); and,

Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 0.1% (AEP) or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

Once a flood zone has been identified for a site, the guidelines set out the different types of development appropriate to each identified zone (pg. 25, Table 3.1 of the Guidelines). Exceptions to the restriction of development due to potential flood risks are provided for through the application of a Justification Test (JT), where the planning need and the sustainable management of flood risk to an acceptable level must be demonstrated by the applicant.

The Justification Test (JT) has been designed to rigorously assess the appropriateness, or otherwise, of particular developments that, for the reasons outlined above, are being considered in areas of moderate or high flood risk. The test is comprised of two processes.

- The first is the **Plan-making Justification Test** described in chapter 4 of the Guidelines and used at the plan preparation and adoption stage where it is intended to zone or otherwise designate land which is at moderate or high risk of flooding. Plan making Justification Tests are made at Plan/Policy development stage such as County Development Plans, or Local Area Plans.

- The second is the **Development Management Justification Test** described in chapter 5 of the Guidelines and used at the planning application stage where it is intended to develop land at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be inappropriate for that land. For example, application of Development Management Justification Test would be required at a site-specific level, such as for this FRA assessment, if a Justification Test is required.

4.2 FLOOD RISK IDENTIFICATION

4.2.1 Historical Mapping

To identify those areas as being at risk of flooding, historical mapping (*i.e.* 6" and 25" base maps) were consulted. There was no identifiable map text on local available historical 6" or 25" mapping for the Proposed Development Site that would identify lands that are "liable to flood" within or in the vicinity of the site.

4.2.2 Soils Maps – Fluvial Maps

A review of the soil types in the vicinity of the Proposed Development Site was undertaken as soils can be a good indicator of past flooding in an area. Due to past flooding of rivers deposits of transported silts/clays referred to as alluvium build up within the floodplain and hence the presence of these soils is a good indicator of potentially flood-prone areas.

[3] AEP – Annual Exceedance Probability

Based on the EPA/Teagasc soil maps (www.epa.ie/www.gsi.ie) for the area it appears that there are no areas of mineral alluvium located within the Proposed Development Site or in the surrounding lands. The closest mapped area of mineral alluvium soils (fluvial deposits) is mapped along the River Barrow ~1.5km east of the Proposed Development Site.

4.2.3 OPW Past Flood Event Mapping

The OPW's Past Flood Events Map does not record any recurring or historic flood incidents within the Proposed Development Site (refer to **Figure C** below).

The nearest past flood event (Flood ID:12779) is located at the Fonthill, ~1.45km southeast of the Proposed Development Site. This flood event is undated and no details are available on www.floodinfo.ie.

Another past flood incident (Flood ID: 11338) dating from 15th Novemebr 2009 is located at Fonthill, Raheendoran, Co Carlow, ~2.6km southeast of the Proposed Development Site. A recurring flood event (Flood ID: 2742) is also mapped on the Fushoge River upstream of its confluence with the Mortarstown Stream. Meanwhile, further to the southeast and downstream of the Proposed Development Site, several recurring flood incidients are mapped along the River Barrow.

No areas within the Proposed Development Site is mapped as an OPW Drainage District (i.e. an area where drainage schemes to improve land for agricultural purpose) or as Benefiting Lands (i.e. land identified by the OPW as potentially benefitting from the implementation of Arterial (Major) Drainage Schemes and an indicator of land subject to flooding and poor drainage).

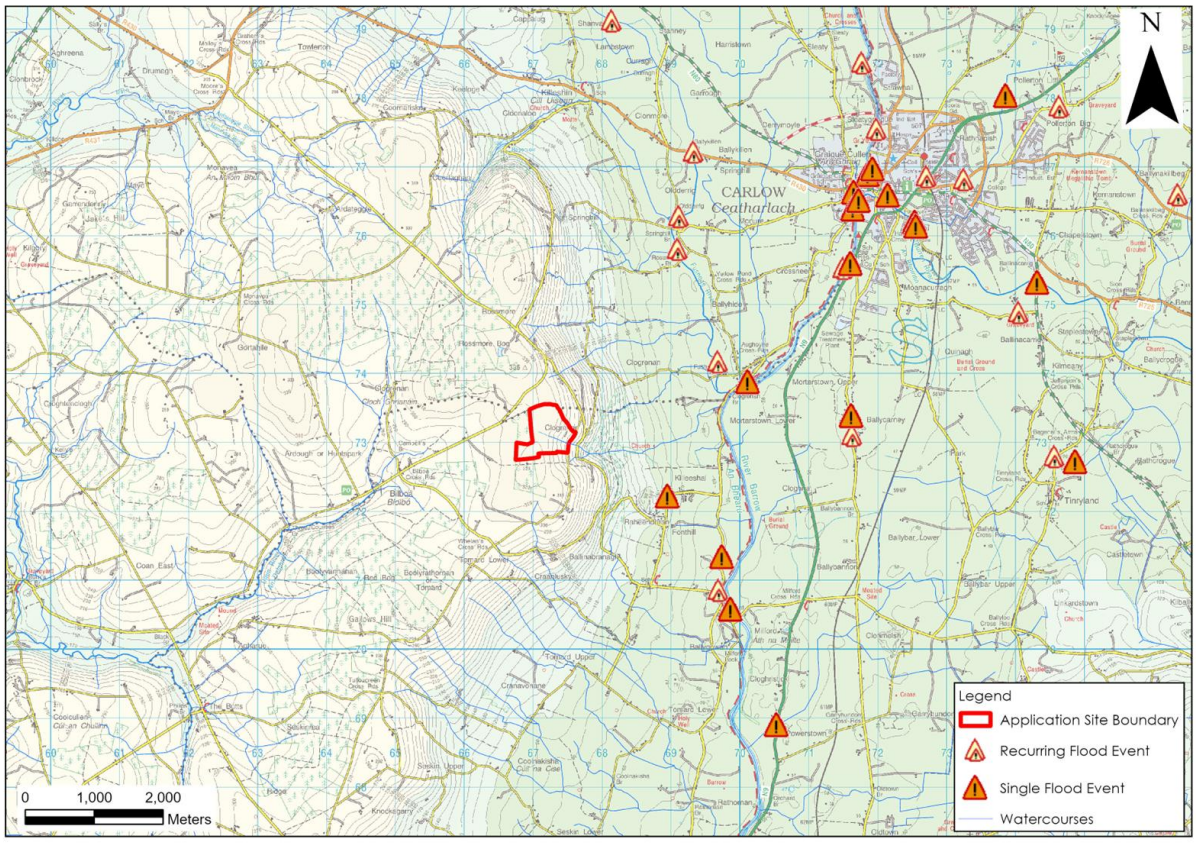

Figure C: OPW Past Flood Event Map

4.2.4 GSI Winter (2015/2016) Surface Water Flood Mapping

The GSI Winter (2015/2016) Surface Water Flooding Map[4] shows areas of fluvial and pluvial flood extents during the Winter 2015/2016 flood event, which was the largest recorded flood event in many areas.

The GSI Winter (2015/2016) Surface Water Flooding Map does not record any flood zones within the Proposed Development Site. The closest GSI Winter Surface Water Flooding is recorded ~900m northwest of the Proposed Development Site and is associated with a lake feature in Rossmore Bog (refer **Figure D** below)

[4] GSI Historical flood mapping principally developed using Sentinel-1 Satellite Imagery from the European Space Agency Copernicus Programme as well as any available historic records (from winter 2015/2016 or otherwise)

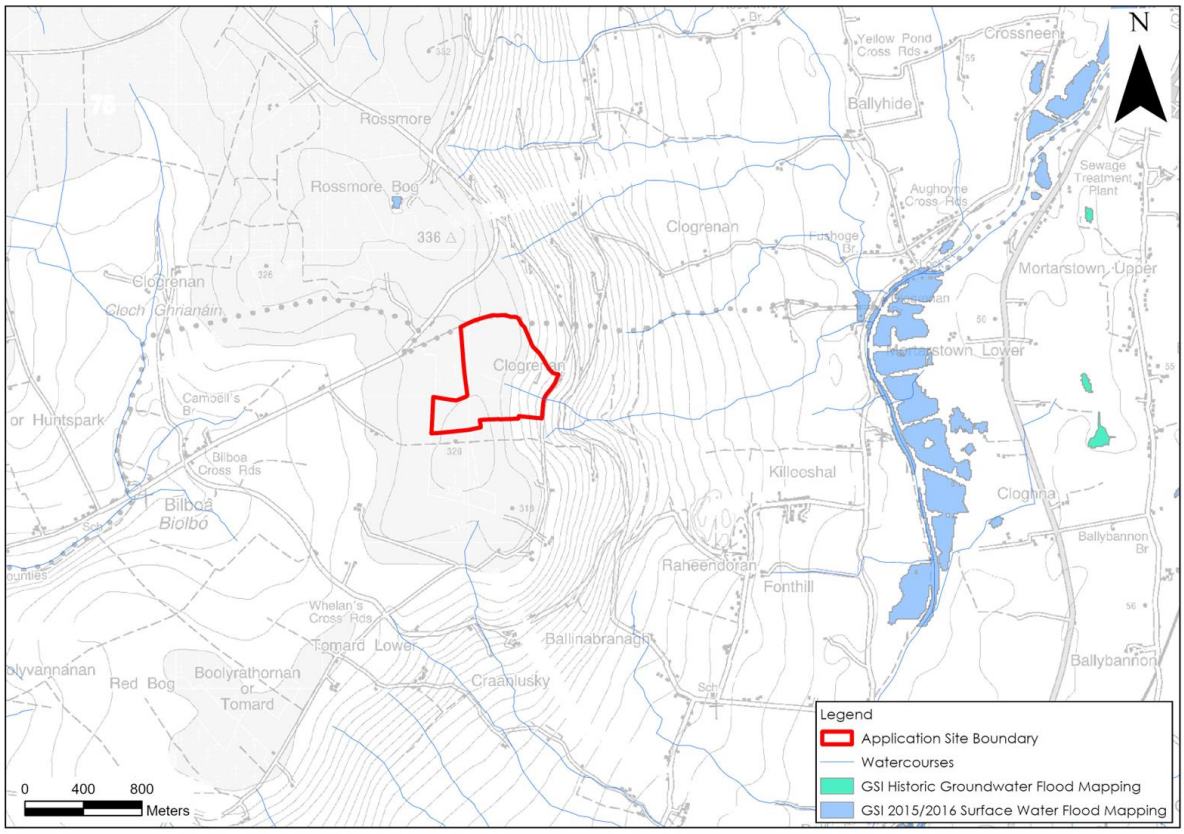

Figure D: GSI Winter 2015/2016 Surface Water Flood and Ground Water Flood Mapping

4.2.5 CFRAM Maps – Fluvial and Pluvial Flooding

Catchment Flood Risk Assessment and Management (CFRAM)[5] OPW Flood Risk Assessment Maps are now the primary reference for flood risk planning in Ireland and supersede the previous PFRA[6] maps. CFRAM mapping of river flood extents are available at www.floodinfo.ie.

CFRAM mapping has not been completed for the area of the Proposed Development Site. There is no CFRAM Fluvial Flood Zones mapped within the Proposed Development Site. The nearest downstream CFRAM fluvial flood zones are mapped along the River Barrow, ~1.75km to the east of the Proposed Development Site.

A map showing the CFRAM Mapping for the present-day scenario is included as **Figure E** below.

4.2.6 National Indicative Fluvial Flood Mapping

National Indicative Fluvial Mapping (www.floodinfo.ie) shows probabilistic fluvial flood zones for catchments greater than 5km^2 for which flood maps were not produced under the CFRAM Programme.

The Present-Day Scenario has been generated using methodologies based on historic flood data and does not consider the potential changes due to climate change. The potential effects of climate change on flooding have been separately modelled (see **Section 4.2.9** below.)

[5] *CFRAM is Catchment Flood Risk Assessment and Management. The national CFRAM programme commenced in Ireland in 2011 and is managed by the OPW. The CFRAM Programme is central to the medium to long-term strategy for the reduction and management of flood risk in Ireland.*
[6] *Preliminary Flood Risk Assessment mapping.*

For the Present-Day Scenario, no medium (1 in 100) and low probability (1 in 1,000) fluvial flood zones have been mapped to encroach upon the Proposed Development Site. The Proposed Development Site is mapped entirely within Fluvial Flood Zone C.

A map showing the National Indicative Fluvial Mapping for the present-day scenario is included as **Figure E** below.

Based on the combined CFRAM and NIFM fluvial flood zones, the Proposed Development Site is located in Fluvial Flood Zone C, where the probability of fluvial flooding is low (less than 0.1%).

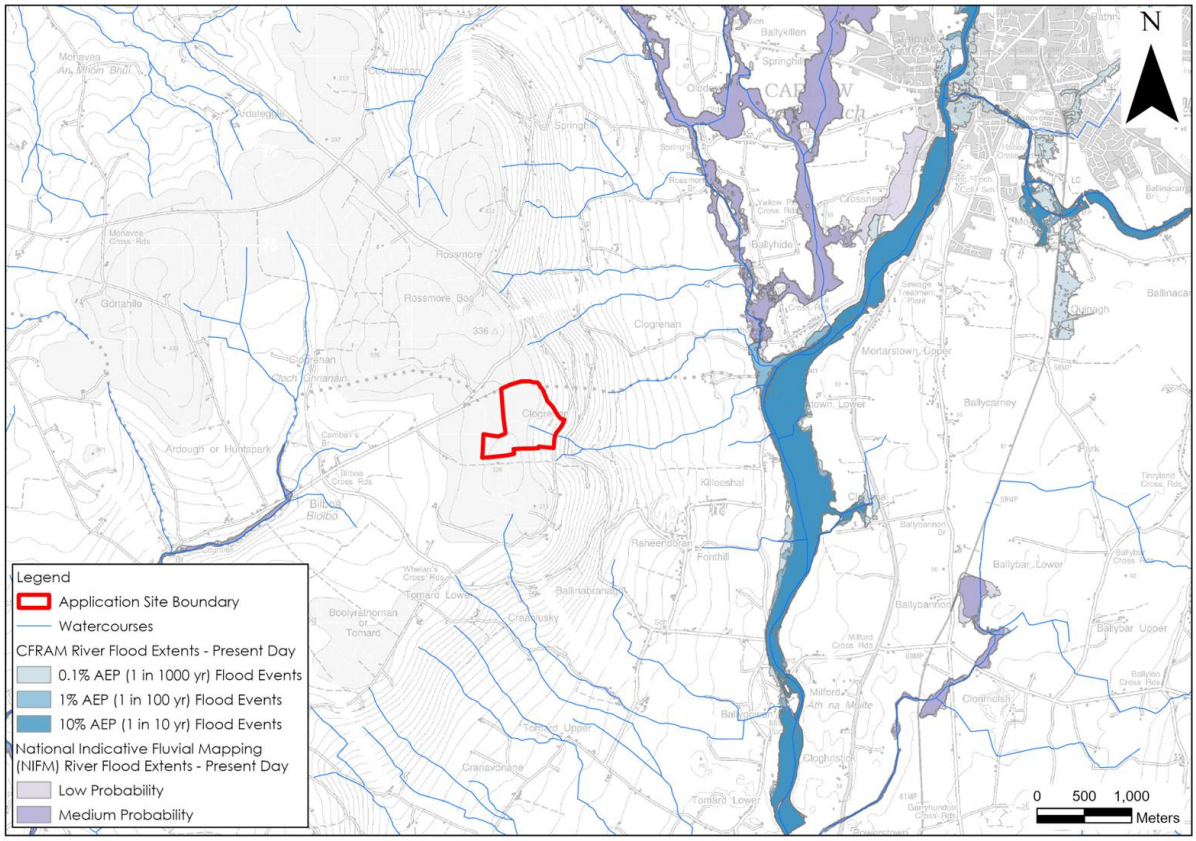

Figure E: CFRAM and National Indicative Fluvial Mapping (www.floodinfo.ie)

4.2.7 Groundwater Flooding

The GSI Historical Groundwater flood map and the modelled groundwater flood extents map (www.floodinfo.ie) do not show the occurrence of any groundwater flooding within the site.

In terms of historic groundwater flooding, the GSI's Maximum Historic Groundwater Flood Map (www.gsi.ie) does not show any groundwater flooding within the Proposed Development Site. The closest historic groundwater flooding is located ~3.36km east of the Proposed Development Site.

4.2.8 Coastal Flooding

The Proposed Development Site is located ~58km inland and at a significant elevation. Therefore, the Proposed Development Site is not at risk of coastal / tidal flooding.

4.2.9 Climate Change

Fluvial flood modelling has also been completed to consider future climate scenarios where the potential effects of climate change can increase rainfall.

The National Indicative Fluvial Flood Mapping Mid-Range Future Scenario models flood extents based on a 20% increase in rainfall. Similarly, the National Indicative Fluvial Flood Mapping High-End Future Scenario models flood extends based on a 30% increase in rainfall. Both of these modelled flood extents show similar flood zones to the Present Day Scenario discussed above in **Section 4.2.6.** Therefore, flood zones at the Proposed Development Site are unlikely to be significantly impacted by future climate change.

The CFRAM flood mapping has also been completed for the Mid-Range and High-End Future Scenarios. Both of these modelled flood extents show similar flood zones to the Present Day Scenario discussed above in **Section 4.2.5**. Therefore, flood zones at the Proposed Development Site are unlikely to be significantly impacted by future climate change.

4.2.10 Summary – Flood Risk Identification

Based on the information gained through the flood identification process, no parts of the Proposed Development Site are mapped within any fluvial flood zones (Flood Zones A - B). The Proposed Development Site is located above the mapped 1,000-year flood level and therefore all infrastructure are located in Flood Zone C (Low Risk).

4.3 INITIAL FLOOD RISK ASSESSMENT

4.4 SITE DRAINAGE

4.4.1 Site Walkover Survey

Detailed walkover surveys of the Proposed Developemnt Site and the surrounding areas were undertaken by HES on 13th December 2024, 18th February, 25th March. 29th April, 29th May, 25th June, 23rd July, 14th August, 25th September and 12th November.

During these walkover surveys the landcover at the Proposed Development Site was verified and note to comprise of a former bedrock quarry surrounded by agricultural pastures.

Contrary to EPA mapping, no watercourse crosses the existing quarry void. Currently water gathers in the floor of the existing quarry and drains out from 2 no. existing ponds. The existing quarry void has 2 no. separate outfall locations however these merge downgradient of the quarry. HES completed flow monitoring on the existing quarry outfalls and the flows are small, recorded as <2l/s,

The combined quarry discharge then flows to the southeast along the existing quarry access road. The drain is culverted under the access road and flows to the east where it joins the EPA named Mortarstown Stream (EPA Code: 14M40) ~670 to the east. This stream flows to the east and discharges into the Fushoge River (EPA Code: 14F03) just upstream of its confluence with the River Barrow.

No evidence of flooding was recorded on the outfall stream or in the proposed quarry extension lands.

4.4.2 Summary – Initial Flood Risk Assessment

Based on the information gained through the flood identification process and Initial Flood Risk Assessment process it has been determined that flooding is unlikely to be problematic in

the area of the Proposed Development Site. The potential sources of flood risk for the site are outlined and assessed in **Table B.**

Table B: S-P-R Assessment of Flood Sources for the Proposed Development Site

Source	Pathway	Receptor	Comment
Fluvial	Overbank flooding of the rivers and streams that are close to Proposed Development Site	Land & infrastructure	The Proposed Development Site is located in Fluvial Flood Zone C. The Proposed Development Site is not at risk of fluvial flooding.
Pluvial	Ponding of rainwater on Proposed Development Site	Land & infrastructure	There is very little risk of pluvial flooding within the Proposed Development Site as drainage moves relatively freely due to the sloping topography of the Proposed Development Site. Rainwater gathers in the floor of the existing quarry and is attenuated prior to release.
Surface water	Surface ponding/ Overflow	Land & infrastructure	Same as above (pluvial).
Groundwater	Rising groundwater levels	Land & infrastructure	Based on local hydrogeological regime and GSI mapping, there is no risk of groundwater flooding at the Proposed Development Site.
Coastal/tidal	Overbank flooding	Land, People, property	The Proposed Development Site is located ~58km inland from the sea. So no coastal flooding will be possible.

4.5 JUSTIFICATION TEST

The matrix of vulnerability versus flood zone to illustrate appropriate development and that required to meet the Justification Test[7] is shown in **Table C** below.

The Proposed Development can be categorised as "Less Vulnerable Development". The Proposed Development Site is not located in a mapped Flood Zone C and there is no recorded history of flooding at the site.

Therefore, the Proposed Development is appropriate from the flood risk perspective and a Justification Test is not required.

Table C: Matrix of Vulnerability versus Flood Zone

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification test	Justification test	Appropriate
Less vulnerable development	Justification test	Appropriate	**Appropriate**
Water Compatible development	Appropriate	Appropriate	Appropriate

Note: Taken from Table 3.2 (DoEHLG, 2009)
***Bold:** Applies to this project*

[7] *A 'Justification Test' is an assessment process designed to rigorously assess the appropriateness, or otherwise, of particular developments that are being considered in areas of moderate or high flood risk, (DoEHLG, 2009).*

5. DOWNSTREAM FLOOD RISK ASSESSMENT

The Proposed Development involves the lateral expansion of an existing bedrock quarry. All extraction and associated processing operation will be completed above the local groundwater table. No dewatering is required. As per the existing hydrological drainage system there will be a discharge to surface waters associated with the quarry. All rainfall falling within the quarry void will be directed to attenuation ponds on the floor of the quarry. These ponds will be increased in size to cater for the Proposed Development. All discharge from the quarry will be attenuated to greenfield runoff rates. There will be no increase in the downstream flood risk as a result of the Proposed Development.

6. FRA CONCLUSIONS

- A flood risk identification study was undertaken to identify existing potential flood risks associated with the Red Rock Quarry, Clogrennane, Co. Carlow. From this study:
    - No instances of historical flooding were identified in historic OS maps for the Development;
    - No instances of recurring or historic flooding were identified on OPW maps within the Proposed Development Site;
    - No GSI Winter 2015/2016 Surface Water Flooding recorded within the Proposed Development Site;
    - The GSI Groundwater flood mapping does not record any groundwater flood zones within the Proposed Development Site;
    - No CFRAM Fluvial Flood Zones is mapped within the Proposed Development Site;
    - No NIFM fluvial flood zones are mapped within the Proposed Development Site.
- The entire Proposed Development Site is mapped as being located in Fluvial Flood Zone C;
- The Proposed Development Site will not contribute to the flooding as discharges from the quarry will be attenuated, and will occur at greenfield runoff rates, and,
- It may be considered that the Proposed Development Site can be categorised as "*Highly Vulnerable Development*". As such, any proposed infrastructure located in mapped flood zones will require Justification test as per the PSFRM Guidelines (DoEHLG, 2009). If required, such Justification Test will be presented in subsequent iterations of this FRA.

* *

7. REFERENCES

DOEHLG	2009	The Planning System and Flood Risk Management.
Natural Environment Research Council	1975	Flood Studies Report (& maps).
Cunnane & Lynn	1975	Flood Estimated Following the Flood Studies Report
CIRIA	2004	Development and Flood Risk – Guidance for the Construction Industry.
OPW	Not Dated	Construction, Replacement or Alteration of Bridges and Culverts. A Guide to Applying for Consent under Section 50 of the Arterial Act, 1945.
Institute of Hydrology	1994	Flood Estimation in Small Catchments (IH 124).
Fitzgerald & Forrestal	1996	Month and Annual Averages of Rainfall for Ireland 1961 – 1990.
Met Eireann	1996	Monthly and Annual Averages of Rainfall for Ireland 1961-1990.
Carlow County Council	2022	Carlow County Development Plan 2022-2028

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