Appendix to Chapter 11: Water

Appendix 11.3: Flood Risk Assessment

The data and descriptions in this appendix have informed the cumulative evaluations in the EIA Main Report.

HYDRO ENVIRONMENTAL SERVICES

22 Lower Main St
Dungarvan
Co.Waterford
Ireland

tel: +353 (0)58 44122
fax: +353 (0)58 44244
email: info@hydroenvironmental.ie
web: www.hydroenvironmental.ie

APPENDIX 11.3

FLOOD RISK ASSESSMENT

UWF GRID CONNECTION, CO. TIPPERARY

FLOOD RISK ASSESSMENT
FINAL REPORT

PREPARED FOR:
ECOPOWER DEVELOPMENTS LTD

PREPARED BY:
HYDRO-ENVIRONMENTAL SERVICES

DOCUMENT information

DOCUMENT TITLE:	**UWF Grid Connection, Co. Tipperary FLOOD RISK ASSESSMENT**
ISSUE DATE:	**23RD JULY 2019**
PROJECT NUMBER:	**P1299-2**
PROJECT REPORTING HISTORY:	**NONE**
CURRENT REVISION NO:	**P1299-2_FINAL R0**
AUTHOR(S):	**MICHAEL GILL** **David Broderick**
SIGNED:	 _____ Michael Gill B.A., B.A.I., M.Sc., MIEI Managing Director – Hydro-Environmental Services

Disclaimer:
This report has been prepared by HES with all reasonable skill, care and diligence within the terms of the contract with the client, incorporating our terms and conditions and taking account of the resources devoted to it by agreement with the client. We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above. The flood risk assessment undertaken as part of this study is site-specific and the report findings cannot be applied to other sites outside of the survey area which is defined by the site boundary. This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies upon the report at their own risk.

TABLE OF CONTENTS

A11.3 1. INTRODUCTION

A11.3 1.1 BACKGROUND

Hydro-Environmental Services (HES) were requested by the Promoter, Ecopower Developments Ltd, to undertake a Flood Risk Assessment (FRA) for the proposed Upperchurch Windfarm (UWF) Grid Connection, Co. Tipperary. A site location map is shown below as **Figure A**.

This FRA is carried out in accordance with 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' (DoEHLG, 2009).

The UWF Grid Connection comprises the following main elements:

- Mountphilips 110kV Substation near Newport, Co. Tipperary
- Mountphilips – Upperchurch 30.5km 110kV Underground Grid Connection (UGC)
- Ancillary Works at Mountphilips Substation Site

A11.3 1.2 KEY OBJECTIVES

The primary objective of this FRA is to identify areas potentially prone to fluvial and pluvial flooding along the UWF Grid Connection 110kV UGC route and at the Mountphilips Substation site which includes a new permanent access road to the proposed Mountphilips Substation with a focus being on residual risk to permanent infrastructure that will be present during the operational phase of the development.

Of particular importance will be access to the UWF Grid Connection Mountphilips Substation and the 110kV UGC Joint Bays (and their communication and link box chambers) for testing, inspection and maintenance purposes. Access to the Joint Bays will be from the public road, while access to the Mountphilips Substation will be via a new permanent access road.

The second objective of this FRA is to assess whether the UWF Grid Connection project has the potential to increase flood risk locally or downstream of the development.

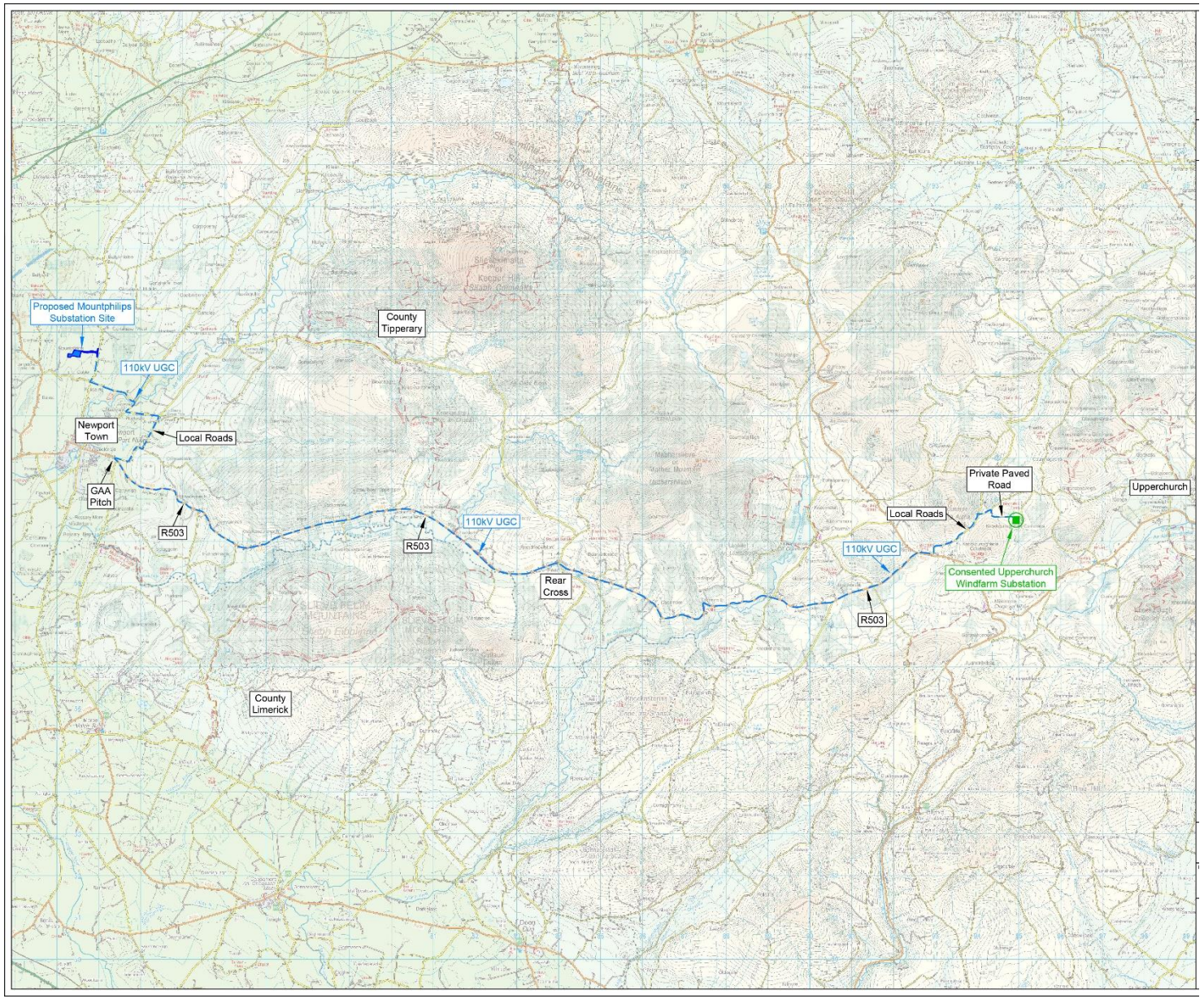


Figure A: Site Location Map

A11.3 1.3 STATEMENT OF EXPERIENCE

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

Michael Gill is an Environmental Engineer with 18 years environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological assessments for various developments across Ireland. Michael has significant experience in surface water drainage issues, SUDs design, and flood risk assessment.

David Broderick is a hydrogeologist with over 13 years environmental consultancy experience across Ireland. David has completed numerous Flood Risk Assessments for all types of developments, and he regularly uses HEC-RAS and FlowMaster modelling software.

A11.3 1.4 REPORT LAYOUT & METHODOLOGY

This FRA report has the following format:

- Section 2 describes setting and details of the proposed development;
- Section 3 outlines the hydrological and geological characteristics of the local surface water catchments in the vicinity of the proposed development;
- Section 4 deals with a site-specific flood risk assessment (FRA) undertaken for the proposed development which was carried out in accordance with the below-mentioned guidelines;
- Section 5 provides commentary in relation to the Justification Test; 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:

- Base maps – Ordnance Survey of Ireland;
- Flood Hazard Maps and flooding information for Ireland, www.floodmaps.ie;
- Office of Public Works (OPW);
- Geological Survey of Ireland (GSI) maps on superficial deposits;
- EPA hydrology maps;
- Preliminary Flood Risk Assessment (PFRA) Maps, and CFRAM maps and studies where available; and,
- Site walkover surveys

A11.3 2. BACKGROUND INFORMATION

A11.3 2.1 INTRODUCTION

This section provides a general overview of the proposed development along with a description of the local setting and topography.

A11.3 2.2 PROPOSED UWF GRID CONNECTION DEVELOPMENT DETAILS

The project comprises an 110kV substation at Mountphilips near Newport, the Mountphilips – Upperchurch 110kV Underground Grid Connection (30.5km), and Ancillary Works at the Mountphilips Substation site which include a new access road and new watercourse crossings.

The Mountphilips 110kV substation is proposed for a location 230m east of the existing Killonan - Nenagh 110kV line in agricultural grassland in Mountphilips townland, 2km north of Newport, Co. Tipperary which is approximately 23km west of the Upperchurch Windfarm (also in Co. Tipperary).

The 110kV UGC (30.5km) will connect the new substation at Mountphilips to the already consented substation at Upperchurch Windfarm (Consented UWF Substation) by underground cabling, mainly along public roads.

Starting at Mountphilips Substation, the route of the 110kV UGC follows the local road network around Newport town, joining the Limerick to Thurles road (R503) on the east side of Newport town, at the GAA club. From that point, the 110kV UGC will be installed in R503 as far as the turnoff for Borrisoleigh at Knockmaroe. From there, the 110kV UGC uses the local road network to the Consented UWF Substation, with the last section of the route along private paved road.

The route bypasses Newport; passes through the village of Rear Cross; passes through the Slieve Felim to Silvermines Mountain SPA; crosses the boundary of the Lower River Shannon SAC at 6 points; and will be installed under or over 65 existing watercourse crossing structures (65 of the 68 no. watercourse crossings along the 110kV UGC are existing culverts/bridges under paved roads).

In total, there will be 68 No. watercourse crossing required for the 110kV UGC. 3 no. watercourse crossings are at the Mountphilips Substation site, 1 no. new temporary, 2 no. new permanent. There will be 63 no. crossings along the public roads between the Mountphilips Substation site and the turn off for the Consented UWF Substation site. The remaining 2 no. crossings (existing culverts) are on the private paved road to the Consented UWF Substation site.

The watercourses intersected by the 110kV UGC along the public road network range from drains / small headwater streams to larger rivers such as the Newport River, Clare River and Bilboa River, and are crossed by various crossing structures, including 15 No. bridges and 48 No. are culverts (both box culverts and pipe culverts). At Mountphilips Substation, 3 watercourses will be crossed by 1 no. new temporary crossing and 2 no. new permanent crossings. Along the private paved road to the consented UWF Substation, the 110kV UGC crossings 2 No. existing culvert crossings.

Crossing existing bridges: There is sufficient cover (depth of road) at the 13 no. of the 15 no. bridges to install the 110kV UGC within the existing road surface and therefore no instream works are required. 2 of the 15 bridges (W8, W9) do not have sufficient cover to accommodate the installation of the 110kV UGC over the bridge in the road. At these two locations the 110kV UGC will cross underneath the watercourse using horizontal directional drilling techniques, whereby a hole is bored by a drilling rig under the water channel, and the ducting is pulled through. Using this technique means that there is no interference with the water channel or instream works.

Of the 13 no. bridges with sufficient cover, 3 no. require the road level to be raised slightly and associated parapet wall works (W7, W36 and W53). These works will all be carried out from the road surface over the bridge structures.

The 110kV UGC will be laid either under or over the 50 No. culverts. 13 no. of the 50 no. culverts (all comprising old masonry culverts) may need to be replaced during construction works for the cables trench.

A11.3 2.3 PROJECT LOCATION AND TOPOGRAPHY

The proposed Mountphilips 110kV Substation is located in the townland of Mountphilips which exists approximately 2km to the north of Newport Town in Co. Tipperary. The site is located on a relatively low-lying, north-south trending ridge with the slope of the site being to the west/southwest. The current land use is grassland. The elevation of the site is at approximately 70m OD.

The UWF Grid Connection 110kV UGC runs in an easterly direction from the Mountphilips Substation site and crosses through the southern hills of the Silvermine Mountains towards the consented Upperchurch Windfarm substation. The straight line distance between the proposed Mountphilips Substation and the Upperchurch Windfarm Substation is ~23km while the actual length of the 110kV UGC is ~30.5km. The topography along the public road is hilly with an overall elevation range of between 70 and 310m OD (Ordnance Datum). The 110kV UGC follows a mix of agricultural grassland (c.0.5km- under the new access road at the Mountphilips Substation site), public roads (c.29.3km) and private road (c.0.7m).

A11.3 3. EXISTING ENVIRONMENT AND CATCHMENT CHARACTERISTICS

A11.3 3.1 INTRODUCTION

This section gives an overview of the hydrological and geological characteristics in the area of the UWF Grid Connection.

A11.3 3.2 BASELINE HYDROLOGY

A11.3 3.2.1 Regional and Local Hydrology

The majority of the footprint of the UWF Grid Connection is located within the River Shannon surface water catchment, with the remainder located in the River Suir surface water catchment. Within the River Shannon catchment, the Mountphilips Substation site and c.29km of the 110kV UGC exist within the Lower Shannon & Mulkear hydrometric area (HA25D). The sub-catchments within the Lower Shannon & Mulkear hydrometric area include, (listed from west to east) the Killeengarriff_SC_010, Newport (Tipperary)_SC_010 and the Bilboa_SC_010. Within the River Suir catchment, the remaining c.1.5km of the 110kV UGC route is located within the Suir_SC_030 sub catchment. These sub catchments are further divided into river sub basins as tabulated in Table A.

There is a total of 68 no. watercourses within the construction works area boundary associated with the UWF Grid Connection, 3 no. of these are at the Mountphilips Substation site (2 no. of these watercourses are new crossings located along the new access road to Mountphilips Substation, 1 no. watercourse crossing between Mountphilips and the End Masts). 63 no. watercourse crossings are located along the route of the 110kV UGC on the public road network (road numbers: L2166-10, L6013-0, L2156-0, L2157-0, L6009-0, R503, L2264-50 and L6188-0) and the remaining 2 no. are located along the private paved road close to the Consented UWF Substation on the eastern extremity of the 110kV UGC route.

Due to the primarily upland nature of the study area, the majority of the watercourses intercepted by the UWF Grid Connection are either drains or minor headwater (1st - 2nd order) streams. Three larger watercourse crossings of note will occur, these watercourses include the Newport River at Rockvale Bridge (W7) on the L2156-0 north of Newport town; the Clare River at Tooreenbrien Bridge (W36) on the R503 near Lackamore; and the Bilboa River at Anglesey Bridge (W53) on the R503 near Kilcommon. These rivers will be crossed by installing the trench in the road over the bridges.

A summary of regional and local surface water bodies as defined by the EPA GIS Mapping that the UWF Grid Connection passes through and the number of watercourse crossings required in each surface water body are shown on Table A below. Mountphilips Substation is located in the Ballyard_010 catchment. The Ballyard_010 catchment drains into the Newport River (at a point below Newport town) c. 6km downstream of the Mountphilips Substation site. It is located in the Killeengarrif_SC_010 sub catchment. The occurrence of the 110kV UGC and number of watercourse crossings in each catchment are detailed in Table A below.

Table A: Summary of Regional Hydrology, Local Hydrology and Proposed Infrastructure along the UWF Grid Connection (110kV UGC)

Regional Catchment	EPA Sub-Catchments[1]	EPA - Local Surface Water Bodies[2]	Length of 110kV UGC (km)	No. Water-course Crossings
Shannon	Killeengarriff_SC_010	Ballyard_010	1.3	4
	Newport (Tipperary)_SC_010	Newport_040	3.5	5
	Killeengarriff_SC_010	Annagh(Tipperary)_030	4	7
		Annagh(Tipperary)_020	8.4	23
	Bilboa_SC_010	Bilboa_010	6.4	18
		Inch (Bilboa)_010	5.4	6
Suir	Suir_SC_030	Clodiagh (Tipperary)_010	1.5	5

[1] Catchments are listed from west to east along the UWF Grid Connection route from the Mountphilips Substation to the Consented UWF Substation
[2]Catchment areas as now defined in https://gis.epa.ie/EPAMaps/

A11.3 3.2.2 Rainfall and Evaporation

The SAAR (Standard Average Annual Rainfall) recorded at Silvermine Mountains (Curreeny) (station no: 4819), which is located approximately 4.2km north of the 110kV UGC, is 1,713mm. The average potential evapotranspiration (PE) at Shannon Airport is taken to be 543mm and AE is calculated to be 516mm. Using the above figures the ER for the area is calculated to be 1,197mm.

A11.3 3.3 GEOLOGY

The superficial geology (*i.e.* overburden) along the UWF Grid Connection, comprises mainly mineral or organic topsoil over glacial tills. Alluvium and fluvio-glacial sand and gravels are present at the larger watercourse crossings (Bilboa River, Clare River and Newport River) which are intercepted by the 110kV route. Bedrock is close to the surface along much of the 110kV UGC route. Some pockets of blanket peat are mapped along the central section of the 110kV UGC on the regional road R503. Peat probes undertaken in Summer 2019 found that the road is predominantly constructed on competent ground.

The underlying bedrock along the UWF Grid Connection comprises sandstone, limestone and Silurian meta-sediments with the latter been most predominant.

A11.3 4. SITE SPECIFIC FLOOD RISK ASSESSMENT

A11.3 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 stages of a flood risk assessment are:

- *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.

Further to this, a Stage 2 assessment involves the confirmation of sources of flooding, appraising the adequacy of existing information and determining what surveys and modelling approach may be required for further assessment.

A11.3 4.2 FLOOD ZONE MAPPING

Flood zones are geographical areas within which the likelihood of flooding is in a particular range. There are three types or levels of flood zones defined for the purposes of according to OPW guidelines:

- Flood Zone A – where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% 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% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% 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% 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.
- Flood Risk Identification

A11.3 4.2.1 Soils Maps – Fluvial Maps

A review of the soil types in the vicinity of the 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 flood plain and hence the presence of these soils is a good indicator of potentially flood prone areas.

Alluvial is typically mapped at the larger streams and rivers along the route of the UWF Grid Connection with the most extensive areas being mapped at the Newport River, Clare River and Bilboa River. It should be noted that the UWF Grid Connection crosses these watercourses via existing structures.

Soils maps, however, tend to be generalised and therefore are not definitive, and further analysis is required as outlined below.

A11.3 4.2.2 Historical Mapping

There is no text on local available historical 6" or 25" mapping for the route that identify areas that are "*prone to flooding*".

A11.3 4.2.3 OPW National Flood Hazard Mapping

The OPW National Flood Hazard maps have no records of recurring flood incidences within the UWF Grid Connection works area boundary or immediately downstream of it (
Figure B below refers). The closest mapped recurring flood event is mapped at Derryleigh, 350m south of the UWF Grid Connection 110kV UGC route.

There are further afield recurring flood incidences mapped to the west of the Substation and west of the UWF Grid Connection Route in the town of Newport.

Figure B: OPW Flood Hazard Mapping (www.floods.ie)

A11.3 4.2.4 CFRAM Maps – Fluvial and Coastal Flooding

Where complete the Catchment Flood Risk Assessment and Management (CFRAM)[1] OPW Flood Risk Assessment Maps are now the primary reference for flood risk planning in Ireland and supersede the Preliminary Flood Risk Assessment Maps (PFRA) maps.

Only very limited CFRAM mapping is available for the area of the UWF Grid Connection around Newport town and the mapped flood zones are largely downstream of the works area. Therefore the area of the development is examined using the PRFA mapping, as detailed below.

A11.3 4.2.5 Preliminary Flood Risk Assessment Maps – Fluvial and Pluvial Flooding

The OPW PFRA mapping can be viewed at www.myplan.ie

The PFRA mapping indicates that fluvial flooding along the 110kV UGC route is relatively localised to the larger stream and river crossing locations, namely; crossing locations W5, W7 (Newport River), W8, W9, W33, W36 (Clare River), W49 and W53 (Bilboa River) which are all mapped to be within the 100-year flood zone (Flood Zone A). All of these watercourse crossings within mapped 100-year flood zones are along the public road at existing bridges. These bridges will be crossed by installing a cable within the existing bridge structure, with the exception of W8 and W9, which will be directional drilled below the watercourse.

There are 38 no. joint bays (and their communication and link box chambers) located along the 110kV UGC and only 1 no. of the joint bay locations (J6) is located within a mapped fluvial flood zone. This joint bay location is assessed further below. The Mountphilips Substation site or its access road is also not located within a mapped fluvial flood zone.

There are no significant mapped pluvial flood zones along the UWF Grid Connection route. Due to the elevated and hilly nature of the topography in the area of the UWF Grid Connection development and the fact the majority of the route is along public roads (with road drainage) no significant pluvial flooding is anticipated. None of the proposed joint bays are located within a mapped pluvial flood zone.

A11.3 4.3 SUMMARY – FLOOD RISK IDENTIFICATION

Based on the information gained through the flood identification process, it appears that fluvial flood zones mapped along the UWF Grid Connection route are typically associated with the larger stream and river crossing locations. This is based largely on the PFRA mapped flood zones. However, the OPW Flood Hazard Mapping, which has no reports of actual flood incidents at any of these locations, is likely to be a more accurate reflection of the actual flood risk.

The route of the 110kV UGC passes through these flood zones via existing crossing structures (i.e. bridges/culverts), however no permanent over ground infrastructure (associated with UWF Grid Connection) are mapped within these flood zones (*i.e.* 100-year and Extreme Event flood zones). All works at these flood zones will either involve installing cables within the bridge structure or directional drilling at 2 no. watercourse crossings. Only 1 no. joint bay (J6) is located within a mapped fluvial flood zone. This is discussed further in **Section 4.4** below where a site-specific flood risk assessment was carried out to further assess the risk of potential flooding at the proposed development site.

[1] *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.*

A11.3 4.4 INITIAL FLOOD RISK ASSESSMENT

A11.3 4.4.1 Site Survey

A detailed survey of all watercourse crossings along the UWF Grid Connection was completed as part of this assessment. The walkover surveys were completed in the January, May and July 2019 and therefore streams and rivers were seen in medium to high flow conditions.

Due to the upland nature of the majority of the UWF Grid Connection areas, many of the watercourses in proximity of the works area are small headwater streams or drains. A summary of the watercourse types intercepted by the UWF Grid Connection are shown in **Table B**Error! Reference source not found..

63 no. of the 68 no. watercourse crossings are located within the public road network. The main watercourse crossings along the grid connection include the Newport River, Clare River and the Bilboa River. These rivers will be crossed by installing the 110kV cable within the existing bridge structure

There was no evidence of past significant flood events at any of the watercourse crossing location at the level of the public road surface. The J6 joint bay location was also assessed on the ground and there are no indications of past flooding events. The topography of the local area around J6 and the elevated nature of the road surface above the local land and watercourse would suggest that the risk of flooding is low

Table B: Watercourse Crossing Types along the UWF Grid Connection works areas

Class	Watercourse Description	Total No.
1	EPA mapped blue line, major river or stream (fisheries value)	13
2	Headwater Stream Equivalent to EPA blue line but not mapped (fisheries value)	3
3	Sub-optimal, heavily vegetated with low or no flow during dry periods (low fisheries value)	27
4	Drain (no fisheries value)	25
	Total	**68**

A11.3 4.4.2 Hydrological Flood Conceptual Model

Potential flooding in the vicinity of the proposed development can be described using the Source – Pathway – Receptor Model ("S-P-R"). The primary potential source of flooding in this area, and the one with most consequence for the proposed development, is fluvial.

The primary potential pathway would be overbank flooding of the various larger watercourses intersected by the UWF Grid Connection infrastructure during significant rainfall events. The potential receptors in the area are infrastructure and land as outlined below.

A11.3 4.4.3 Summary – Initial Flood Risk Assessment

Based on the information gained through the flood identification process and Initial Flood Risk Assessment process the sources of flood risk for the site are outlined and assessed in **Table C**.

Table C: S-P-R Assessment of Flood Sources for the site

Source	Pathway	Receptor	Comment
Tidal	Not applicable	Land and infrastructure.	The UWF Grid Connection route is at least 25km from the coast and there is no risk of coastal flooding.
Fluvial	Overbank flooding of the various watercourses in the area of the UWF Grid Connection	Land and infrastructure.	There are 8 no. watercourse crossing locations mapped within a fluvial flood zone (Flood Zone A) along the 110kV route, including 1 no. joint bay (J6). All fluvial flood zones are at existing bridges. The UWF Grid Connection 110kV cables will be installed within or underneath the bridge structure. There is no permanent above ground level infrastructure located within a mapped fluvial flood zone (*i.e.* new permanent culverts).
Pluvial	Ponding of rainwater / surface water	Land and infrastructure.	There is no significant risk of pluvial flooding at the proposed development areas as the topography is elevated and sufficiently sloped to adequately convey waters during heavy rainfall events. The majority is also along public roads which have road drainage. There is no permanent infrastructure located within a mapped pluvial flood zone
Surface water	Surface ponding/ Overflow	Land and infrastructure	Same as above (pluvial).
Groundwater	Rising groundwater levels	Land and infrastructure.	Based on local hydrogeological regime, elevated nature of the majority of the development and PFRA mapping, there is no apparent risk from groundwater flooding.

A11.3 4.5 DEVELOPMENT INFRASTRUCTURE AND FLOOD RISK

A11.3 4.5.1 Introduction

The proposed UWF Grid Connection development largely involves the installation of underground cables and joint bays for the 110kV UGC. These elements of the development have no potential to increase flood risk due to their subsurface nature. The public road and agricultural land will be reinstated back to its original condition and level after the works are completed.

Culvert replacement works are looked at below in terms of flood risk.

A11.3 4.5.2 New Culverts and Replacement Works at Watercourse Crossing

65 no. of the 68 no. watercourse crossings are existing bridges or culverts within the public roads and paved forestry road. Of the 65 no, 13 no. may require culvert replacement. There will also be 2 no. new permanent culverts along the new access track to Mountphilips Substation.

The following measures are proposed to ensure that there is no increased flood risk locally:

- All new permanent watercourse culverts at the Mountphilips Substation site and any re-placement culverts along the public road for the 110kV UGC will be sized to cope with a mini-mum 100-year flood event.;
- At a minimum, all new pipe culverts will be 900mm in diameter regardless of the anticipated flood flow (i.e. minimum 900mm culvert will be used in Type 3/Type 4 watercourses regardless of flows);
- As agreed during a telephone consultation carried out by the EIA Coordinator with OPW, Limerick office, (February 2018), a Section 50 application will be submitted to the OPW for new crossings and up-grades following the receipt of planning permission for the UWF Grid Connection. The Section 50 applications will be accompanied by a hydraulic assessment of the new crossing structures to ensure they are adequate from a flood prevention perspective.
- Culvert design and construction will adhere to best practise and conform to the OPW (2013) guidance document “Construction, Replacement or Alteration of Bridges and Culverts

A11.3 4.5.3 Permanent Hardstanding Areas

The only permanent hardstand areas associated with the UWF Grid Connection is the Mountphilips Substation compound, access road (c.450m) and 2 No. end masts, all of which will occur within the Mountphilips Substation site in Coole and Mountphilips townlands. This permanent infrastructure is not expected to increase flood risk for the following reasons:

- The permanent hardstanding areas are negligible in comparison to the area of the local surface water body;
- It is proposed that the permanent access roads will have permanent road side drains in place which will include check dams for reduction of runoff rates; and,
- It is proposed that the Mountphilips Substation will have a permanent surface water drainage network in place which will allow for surface water attenuation.

A11.3 5. PLANNING POLICY AND JUSTIFICATION TEST

A11.3 5.1 PLANNING POLICY AND THE NORTH TIPPERARY COUNTY DEVELOPMENT PLAN

The following policies in **Table D** below are defined in North Tipperary County Development Plan (CDP) 2010-2016 in respect of flooding, and we have outlined in the column to the right how these policies are provided for within the proposed developments design.

Table D: North Tipperary CDP Policies and Project Responses

No.	Policy	Development Design Response
CEF8	Management of Flood Risk It is the policy of the Council to apply a sequential approach to the assessment of developments in areas of flood risk. Developments on lands identified as being at risk of flooding shall be subject to a Flood Risk Assessment in accordance with The Planning System and Flood Risk Management Guidelines for Planning Authorities, (DEHLG 2009) and any amendment thereof*, and shall include a Justification Test and have regard to non-vulnerable uses. *Flood Risk Assessments will be required, as appropriate, in areas identified to be of risk of flooding.	This site-specific FRA is consistent with the DoEHLG/OPW guidelines and its accompanying technical appendix.
TI9	Storm Water Disposal It is the policy of the Council to require the implementation of Sustainable Drainage Systems (SuDS) as an integral part of the design of new developments to reduce the generation of storm water run-off, and to ensure that all storm water generated is disposed of on-site or is attenuated and treated prior to discharge to an approved storm water system.	All drainage proposals for permanent infrastructure will be consistent with SUDs principles and best practice SUDs drainage design.

A11.3 5.2 REQUIREMENT FOR A JUSTIFICATION TEST

The matrix of vulnerability versus flood zone to illustrate appropriate development and that required to meet the Justification Test[2] is shown in **Table E** below.

Table E: Matrix of Vulnerability versus Flood Zone *(Taken from Table 3.2 (DoEHLG, 2009))*

	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

Bold/yellow background: *Applies to this project.*

[2] 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).

It may be considered that the proposed development is a 'Highly Vulnerable Development – utilities distribution'. While all of proposed above ground permanent infrastructure such as the Mountphilips Substation is located in Flood Zone C (Low Risk), there are sections of the 110kV UGC route mapped in Fluvial Flood Zone A and these are typically at the larger river crossings such the Newport River, Clare River and Bilboa River and some of the larger unnamed streams.

The permanent infrastructure (*i.e.* 110kV UGC cabling and 1 no. joint bay) within the mapped fluvial flood zones will be placed below ground level (within a trench) and/or beneath the watercourse and as such no impacts on the proposed developments are expected.

65 no. of the 68 no. watercourse crossings are existing culverts or bridges. Where culverts need replacing, this will be done as set out in **Section 11.3.4.5.2** above. The construction of the cable trench will be temporary and transient (not all occurring at once). Also, there will be no potential of increased flood risk as a result of the proposed UWF Grid Connection development for the reasons described in **Section 11.3.4.5** above.

Notwithstanding this and in the interest of being conservative, a justification test is presented in **Table F** below. The Justification Test is carried out in accordance with the "The Planning System and Flood Risk Management Guidelines" (PSFRM Guidelines). The format of the Justification Test has been adapted for this report from Box 5.1 of the PSFRM Guidelines, which outlines the criteria required to complete the "Justification Test".

Table F: Format of Justification Test for Development Management

Box 5.1 Justification Test for Development Management (to be submitted by the applicant)
When considering proposals for development, which may be vulnerable to flooding, and that would generally be inappropriate as set out in Table 3.2, the following criteria must be satisfied: 1. The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines. 2. The proposal has been subject to an appropriate flood risk assessment that demonstrates: i. The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk; ii. The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible; iii. The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access; and iv. The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes. The acceptability or otherwise of levels of residual risk should be made with consideration of the type and foreseen use of the development and the local development context.

Referring to Point 1 and Points 2 (i) to (iv) inclusive:

1. The sections of the UWF Grid Connection 110kV UGC route (including Joint Bay J6) located in the mapped flood zones are along the public road. The 110kV UGC cables and J6 joint bay will be installed within the structure of the existing bridge and road.

2. The proposed developments has been the subject of a flood risk assessment (this report) and this assessment shows that the infrastructure design proposed for these watercourse crossings is appropriate in areas of the route mapped in Fluvial Flood Zone A.

    i. The proposed developments is predicted to have **No Impact** on flood risk elsewhere in the locality.

        a. The UWF Grid Connection largely involves the installation of underground cables and joint bays for the 110kV UGC which have no potential to increase flood risk;
        b. The footprint of the permanent above ground infrastructure (i.e. Mountphilips Substation compound, new permanent access road and end masts – all at the Mountphilips Substation site) is minimal and therefore associated surface water runoff will not result in increased downstream flood risk; and,
        c. Where existing culvert replacement is required, the hydraulic capacity of the culvert will be suitably designed for peak flood flows.

    ii. The nature of the proposed developments means there will be no flood risk to people, property, the economy or the environment during extreme flood events.

        a. The proposed developments have no potential to increase flood risk for the reasons outlined in (i) above; and
        b. Where the proposed route of the 110kV UGC passes through mapped fluvial flood zones, there are no permanent over ground infrastructure, within these flood zones (i.e. 100-year and Extreme Event flood zones). Therefore, there is no risk to property or people during the operation of the development;

    iii. There will be no residual risks to the area and to the proposed development during extreme flood events.

        a. The proposed UWF Grid Connection will largely involve the installation of underground cables and joint bays for the 110kV UGC and therefore there will be no residual risk;
        b. Where existing culverts are being replaced, the hydraulic capacity of the culvert will be suitably designed for peak flood flows.

    iv. The proposed development is compatible with the wider planning objectives of the area.

        a. The proposed development will serve the Upperchurch Windfarm which has been granted permission. The Upperchurch Windfarm is consistent with the County Development Plan on renewable energy.

A11.3 6. CONCLUSIONS

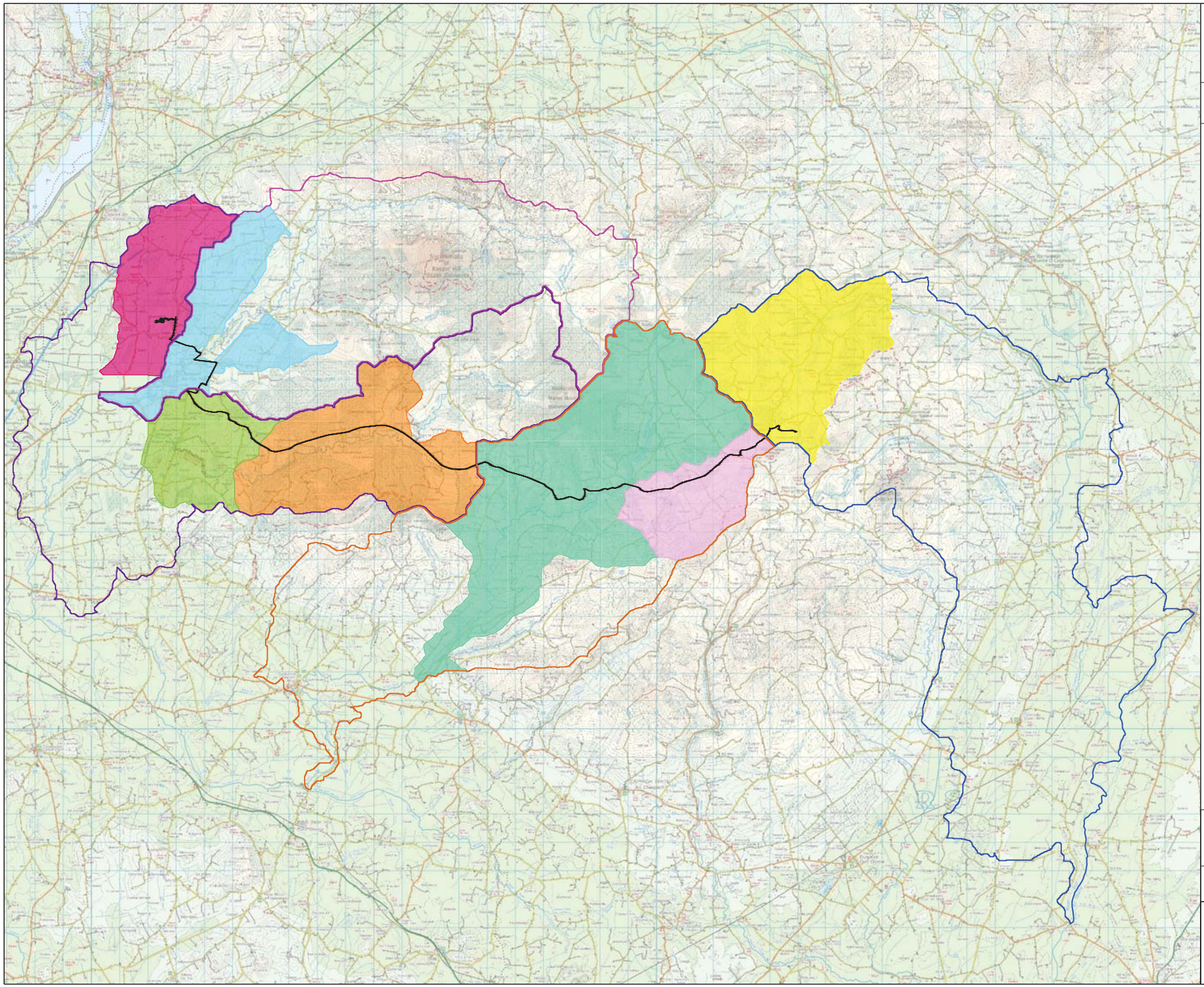
- A flood risk identification study was conducted to identify potential flood risks associated with the proposed UWF Grid Connection, Co. Tipperary. From this study:
    - No instances of historical flooding were identified in historic OS maps;
    - No instances of recurring flooding were identified on OPW maps along the proposed 110kV UGC route or at the Mountphilips Substation Site; and,
    - Sections of the UWF Grid Connection 110kV UGC route were identified with the PFRA Flood Zones as described.
- The available Preliminary Flood Risk Assessment (PFRA) mapping indicates that there are sections of the 110kV UGC route located in the fluvial Flood Zone A (100-year flood zone) and these are largely associated with the larger stream and river crossings;
- The 8 no. sections of the UWF Grid Connection 110kV UGC route (and joint bay J6) in the areas of the mapped fluvial flood zones involve placing cables and joint bay J6 within the existing bridge structure and road. i.e. no instream works are required;
- Construction at each crossing will be short duration (temporary) and transient (will not occur at all crossing locations at once) in nature;
- As outlined in Section A11.3.5 above, the proposed development is consistent with the relevant planning objectives and policies from the North Tipperary County Development Plan;
- No impact on the proposed development is expected as a result of potential flooding. Also, there will be no potential of increased local flood risk as a result of the proposed development as the majority of the UWF Grid Connection works are underground and the footprint of the over ground permanent infrastructure at the Mountphilips Substation site is minimal and outside of mapped flooding areas.
- Where existing culverts require replacement for the UWF Grid Connection along the 110kV UGC route, the hydraulic capacity of the culvert will be suitably designed for peak flood flows of the watercourse.

* *

A11.3 7. REFERENCES

AGMET	1996	Agroclimatic Atlas of Ireland.
DOEHLG	2009	The Planning System and Flood Risk Management.
Met Eireann	1996	Monthly and Annual Averages of Rainfall for Ireland 1961-1990.

A11.3 8. FIGURES



Title:

Figure 1

Local Hydrology Map

Scale 1 : 125,000

Legend:

- UWF Grid Connection Construction Works Area

EPA Sub-Catchment:

- Kileengarrif_SC_010
- Newport[Tipperary]_SC_010
- Bilboa_SC_010
- Suir_SC_030

EPA Local Surface Water Bodies:

- Ballyard_010
- Newport_040
- Annagh (Tipperary)_030
- Annagh (Tipperary)_020
- Bilboa_010
- Inch (Bilboa)_010
- Clodaigh (Tipperary)_010

N

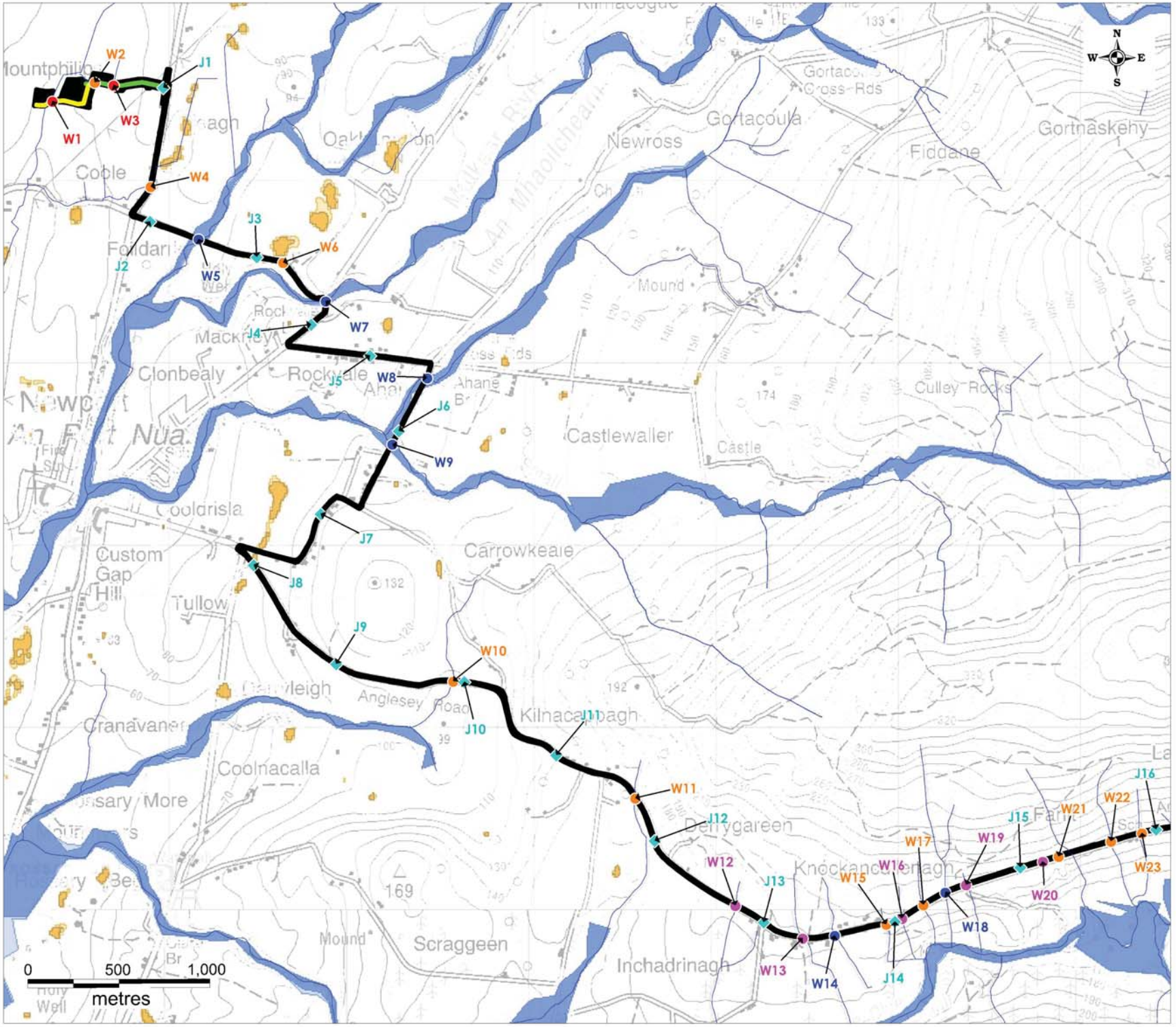
Project:

UWF Grid Connection

Drawn by:	Checked by:	Date:	Sheet Size:
AB	JB	14-Aug-19	A3

Aoife Butler
Ecopower Developments Ltd
Zetec House,
Purcellsinch Business Park, Kilkenny
TEL: +353 56 7750140
MOB: +353 83 8803644

ECOPOWER

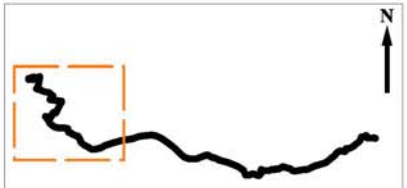


Legend

- UWF Grid Connection Construction Works Area Boundary
- Permanent Access Road 110kV
- Temporary Access Road 110kV
- Joint Bay Locations
- Watercourse
- Fluvial - 1% AEP Event
- Fluvial - Extreme Event
- Pluvial - 1% AEP Event
- Pluvial - Extreme Event

Watercourse Crossing Class Type

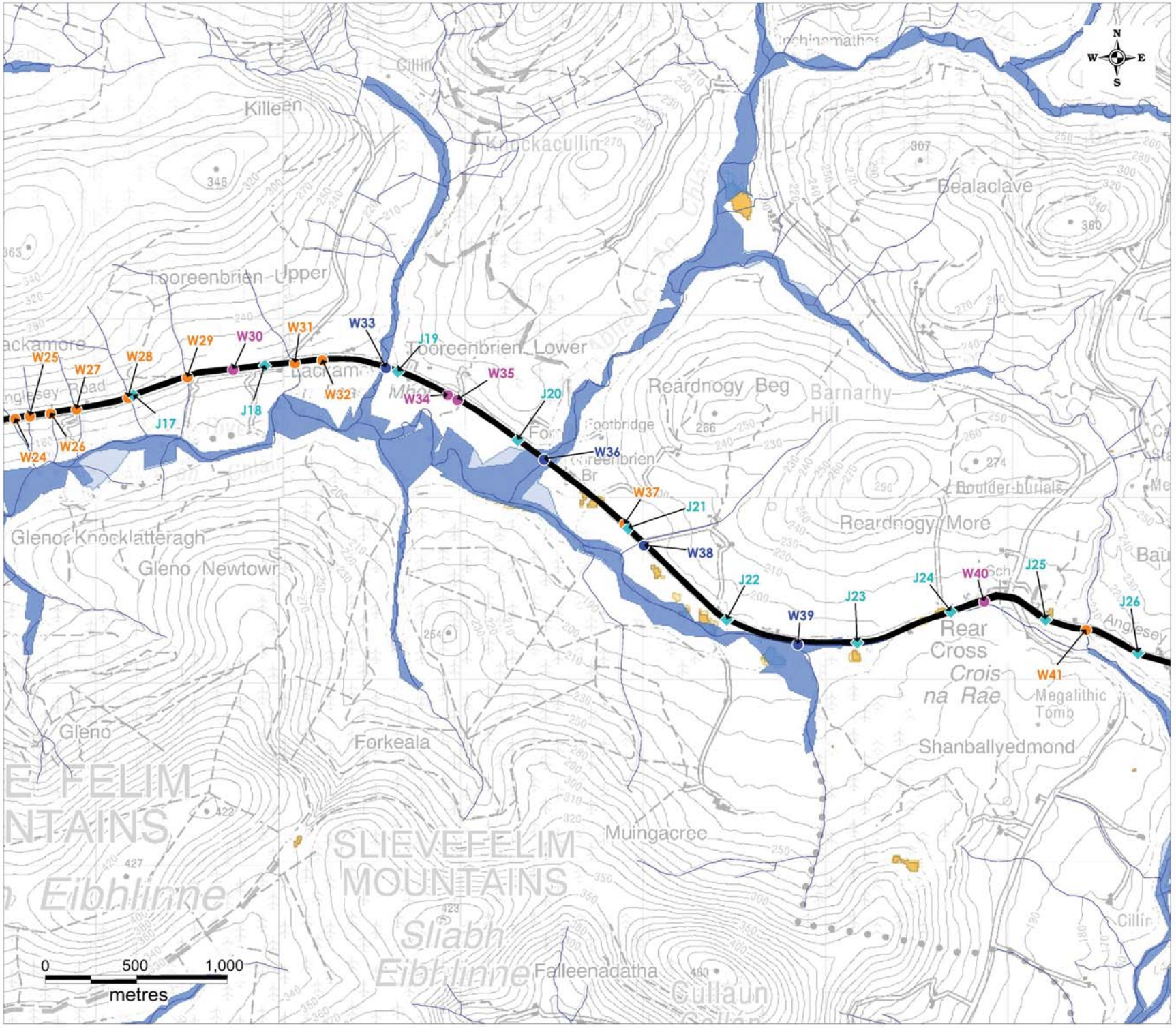
- Class 1_EPA Blueline
- Class 2_EPA Blueline Equivalent
- Class 3_Sub Optimal/Ephemeral
- Class 4_Drainage Ditch

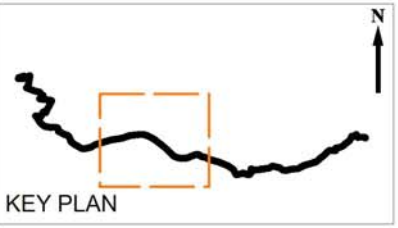


KEY PLAN

HYDRO ENVIRONMENTAL SERVICES
22 Lower Main St
Dungarvan
Co.Waterford
Ireland
tel: +353 (0)58 44122
fax: +353 (0)58 44244
email: info@hydroenvironmental.ie
web: www.hydroenvironmental.ie

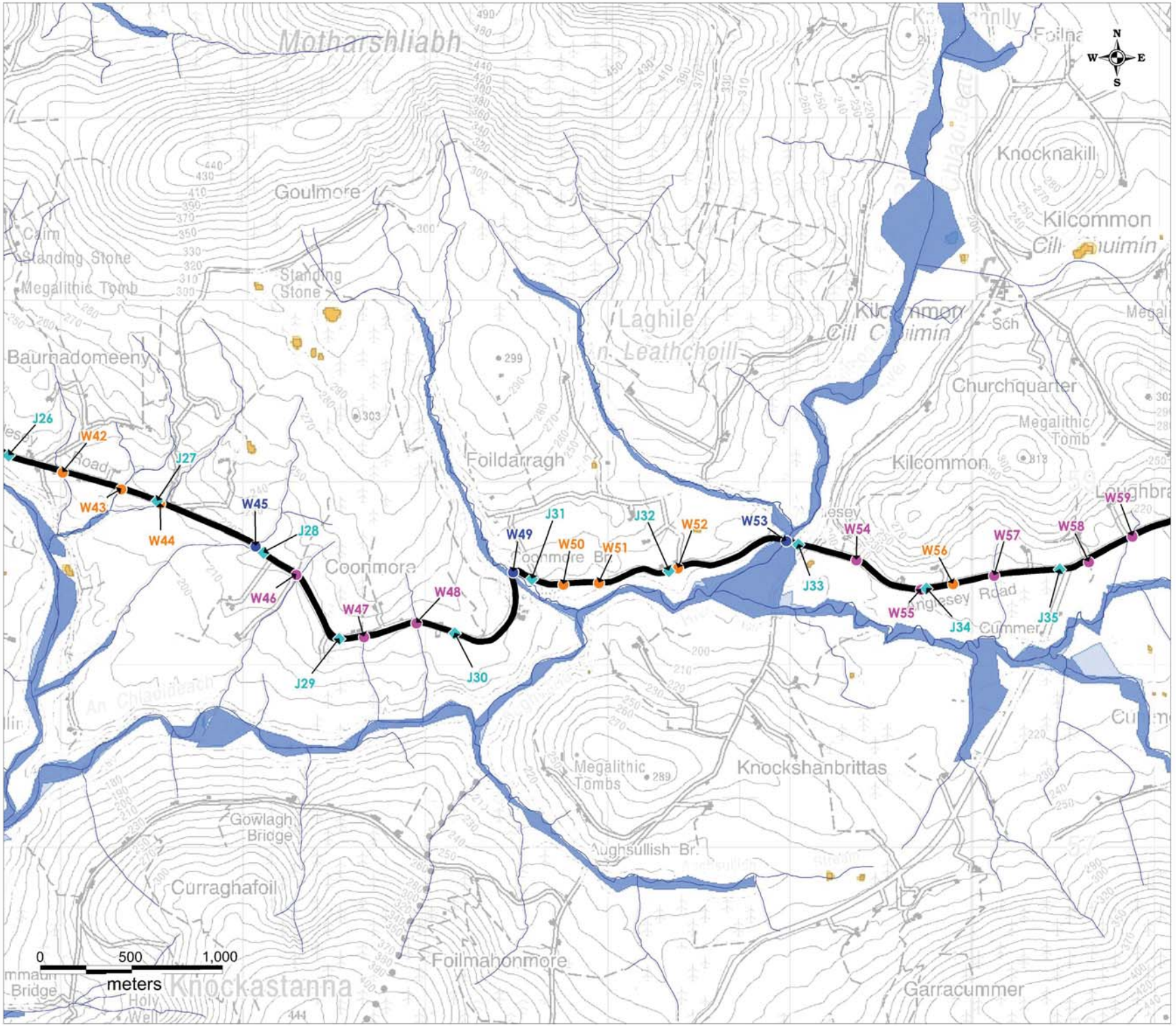
Client: Ecopower Developments Ltd.	
Job: Upperchurch WF Grid Connection	
Title: PFRA Flood Mapping 1	
Figure No: Figure 2	
Drawing No: P1299-4-0719-Fig-2-A3-0A	
Sheet Size: A3	Project No: P1299-4
Scale: 1:20,000	Drawn By: GD
Date: 22/07/2019	Checked By: MG





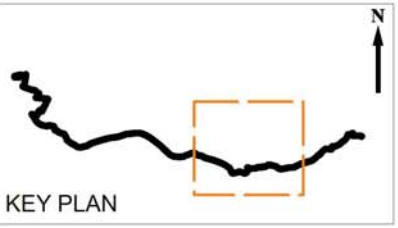
HYDRO ENVIRONMENTAL SERVICES
22 Lower Main St
Dungarvan
Co.Waterford
Ireland
tel: +353 (0)58 44122
fax: +353 (0)58 44244
email: info@hydroenvironmental.ie
web: www.hydroenvironmental.ie

Client: Ecopower Developments Ltd.	
Job: Upperchurch WF Grid Connection	
Title: PFRA Flood Mapping 2	
Figure No: Figure 3	
Drawing No: P1299-4-0719-Fig-3-A3-0A	
Sheet Size: A3	Project No: P1299-4
Scale: 1:20,000	Drawn By: GD
Date: 22/07/2019	Checked By: MG



Legend

- UWF Grid Connection Construction Works Area Boundary
- Joint Bay Locations
- Watercourse
- Fluvial - 1% AEP Event
- Fluvial - Extreme Event
- Pluvial - 1% AEP Event
- Pluvial - Extreme Event
- Class 1_EPA Blueline
- Class 2_EPA Blueline Equivalent
- Class 3_Sub Optimal/Ephemeral
- Class 4_Drainage Ditch



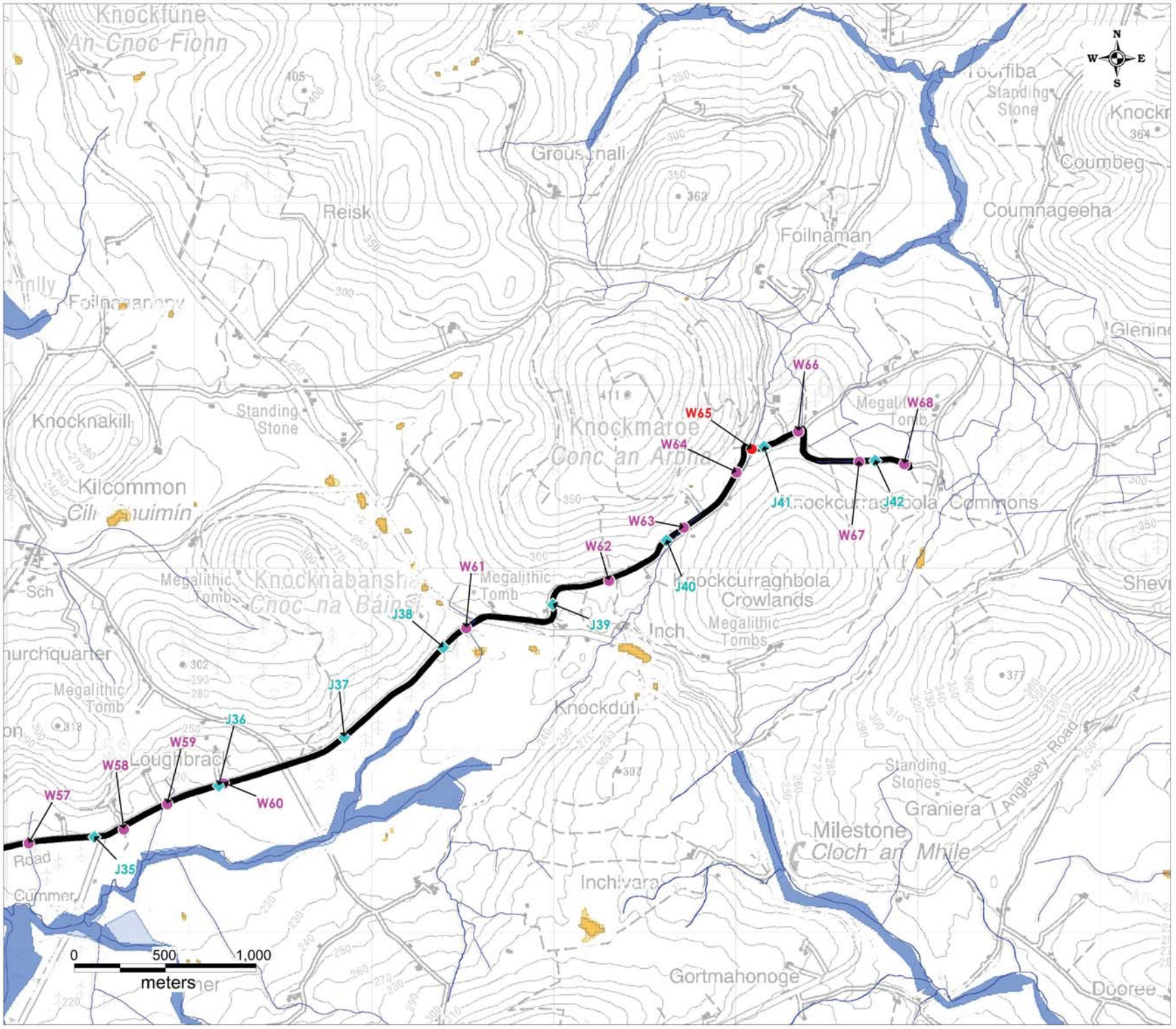
KEY PLAN

HYDRO ENVIRONMENTAL SERVICES

22 Lower Main St
Dungarvan
Co.Waterford
Ireland

tel: +353 (0)58 44122
fax: +353 (0)58 44244
email: info@hydroenvironmental.ie
web: www.hydroenvironmental.ie

Client: Ecopower Developments Ltd.	
Job: Upperchurch WF Grid Connection	
Title: PFRA Flood Mapping 3	
Figure No: Figure 4	
Drawing No: P1299-4-0719-Fig-4-A3-0A	
Sheet Size: A3	Project No: P1299-4
Scale: 1:20,000	Drawn By: GD
Date: 22/07/2019	Checked By: MG

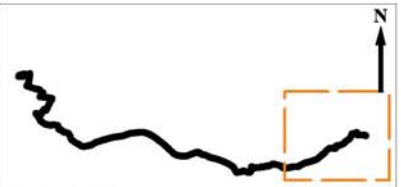


Legend

- UWF Grid Connection Construction Works Area Boundary
- Join Bay Locations
- Watercourse
- Fluvial - 1% AEP Event
- Fluvial - Extreme Event
- Pluvial - 1% AEP Event
- Pluvial - Extreme Event

Watercourse Crossing Class Type

- Class 1_EPA Blueline
- Class 2_EPA Blueline Equivalent
- Class 3_Sub Optimal/Ephemeral
- Class 4_Drainage Ditch



KEY PLAN

HYDRO ENVIRONMENTAL SERVICES

22 Lower Main St
Dungarvan
Co.Waterford
Ireland

tel: +353 (0)58 44122
fax: +353 (0)58 44244
email: info@hydroenvironmental.ie
web: www.hydroenvironmental.ie

Client: Ecopower Developments Ltd.	
Job: Upperchurch WF Grid Connection	
Title: PFRA Flood Mapping 4	
Figure No: Figure 5	
Drawing No: P1299-4-0719-Fig-5-A3-0A	
Sheet Size: A3	Project No: P1299-4
Scale: 1:20,000	Drawn By: GD
Date: 22/07/2019	Checked By: MG