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CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED COOM GREEN ENERGY PARK, COUNTY CORK

VOLUME 2 – MAIN EIAR

CHAPTER 10 – HYDROLOGY AND WATER QUALITY

Prepared for: Coom Green Energy Park Limited

Date: November 2020

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10. HYDROLOGY AND WATER QUALITY

10.1 Introduction

This chapter has been prepared to describe the existing hydrology and water quality of the local environment in the study area and to examine the aspects of the hydrology and water quality of the local environment that could be affected by the activities associated with the proposed Coom Green Energy Park.

Section 10.3 of this chapter provides details on the existing hydrology and water quality in the receiving environment including receiving waterbodies and catchments. It includes information on any historical flooding within the site, internal site drainage and cable route watercourse crossings.

Following an analysis of the receiving environment potential impacts during construction, operation and decommission phase are identified and discussed in Sections 10.4. Flood risk assessment is set out in Section 10.5.

Section 10.6 describes the proposed drainage layout and Section 10.7 identifies the proposed mitigation measures for impacts identified in Section 10.4 and 10.5.

10.1.1 Study Area

Coom Green Energy Park comprises 22 wind turbines with a tip height of up to 169 m, hardstanding areas, upgrade of existing tracks and construction of new access tracks, three borrow pits, two on-site substations, temporary compound and associated works.

The study area also includes the turbine delivery route and underground grid connection cable between proposed turbines and the proposed on-site substations and between on-site substation and the existing 110 kV Barrymore Substation. The grid cable route is largely located within the public road network. The grid route study area also includes proposed crossing methods over watercourses, identifying locations of the grid route within flood zones and identifying historical flooding in the proximity of the grid route. The EIAR also considers the impacts of the project associated with replanting obligations.

The site is located in Cork County approximately 11.5 km south east of Mallow. The development boundary covers an approximate area of 443.3 ha and ranges in elevation from 175 m OD to 390 m OD.

Surface runoff from the site drains to the Toor River, Coom River, Tooreen North, Inchinanagh and Bunnaglanna watercourses, and the Bride River. The Toor River is a tributary of the Coom River.

The Coom River and Inchinanagh and Bunnaglanna watercourses are tributaries of the Bride River.

Descriptions of the proposed development are provided in Chapter 3 – Volume 2 of the EIAR.

10.2 Methodology

The following sources of information were considered in this assessment:

- The design layout of the proposed development.
- Legislation and guidance, as described in Section 10.2.1 below.
- A desk-based assessment of the surface water hydrology and water quality in the catchments relevant to the development, including an assessment of the watercourses which will be intercepted by the layout of the Coom Green Energy Park and those which will receive surface water runoff from the proposed development.
- A field assessment of the existing hydrological environment, to both verify desk-based assessment and record all significant hydrological features.
- Cork County Development Plan 2014

10.2.1 Relevant Legislation and Guidance

10.2.1.1 Relevant EU Directives and Legislation

Water Framework Directive (WFD)

The WFD established a new system for the protection and improvement of water quality and water dependent ecosystems. It has influenced the management of water resources and has affected conservation, fisheries, flood defence, planning and development. It has endeavoured to ensure that all impacts on water resources – physical modification, diffuse and point source pollution, abstraction or otherwise – are controlled.

The overriding purpose of the WFD is to achieve at least 'good status' in all European waters and to ensure that no further deterioration occurs in these waters. European waters are classified as ground waters, rivers, lakes, transitional and coastal waters. The WFD has been implemented in Ireland by dividing the island of Ireland into eight river basin districts. These districts are natural geographical areas that occur in the landscape. River Basin Management Plan 2018-2021 has been prepared by Department of Housing, Planning and Local Government. The plan sets out the actions that Ireland will take to improve water quality and achieve 'good' ecological status in water bodies (rivers, lakes, estuaries and coastal waters) by 2027.

The WFD has been transposed into Irish law following:

- European Communities (Water Policy) Regulations, 2003 (S.I. No. 722 of 2003)[1]
- European Union (Water Policy) Regulations 2014 (S.I. No. 350 of 2014)
- European Communities Environmental Objectives (Surface Waters) Regulations, 2009 (S.I. No. 272 of 2009)[2]
- European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010)[3]
- European Communities (Good Agricultural Practice for Protection of Waters) Regulations 2010 (S.I. No. 610 of 2010)[4]

[1] Amended in 2005 (S.I. No 413/2005), 2008 (S.I. No. 219/2008) and 2010 (S.I. No. 93/2010)

[2] Amended in 2012 (S.I. No. 327/2012) and 2015 (S.I. No. 386/2015)

[3] Amended in 2011 (S.I. No 389/2011), 2012 (S.I. No 149/2012) and 2016 (S.I. No 366/2016)

[4] Amended in 2014 (S.I. 31/2014)

- European Communities (Technical Specifications for the Chemical Analysis and Monitoring of Water Status) Regulations, 2011 (S.I. No. 489 of 2011).

To ensure no further deterioration of water occurs it is required to address possible impacts of the development and propose mitigation measures within the EIAR.

Water Framework Directive Waterbody Status

The European Communities Environmental Objectives (Surface Water) Regulations 2009 (S.I. No. 272 of 2009)[5] (the Surface Water Regulations), give effect to the criteria and standards used for classifying surface waters in accordance with the WFD. There are five categories of surface water status: 'High', 'Good', 'Moderate', 'Poor' and 'Bad'.

A surface waterbody must achieve both good ecological status and good chemical status before it can be considered to be of good status. The chemical status of a waterbody is assessed based on certain chemical pollutants. The ecological status is assessed based on Biotic Indices or Quality (Q) Values. The EPA Biological Quality Rating System for Rivers (Q Rating System) and its relationship with the WFD Status is shown in Table 10-1.

Table 10-1: EPA Q Rating System and WFD Status

Q-Value	Water Quality	WFD Status
Q5	Pristine	High
Q4-5	Very good	
Q4	Good	Good
Q3-4	Slightly Polluted	Moderate
Q3	Moderately Polluted	Poor
Q2-3	Moderate to Poor	
Q2	Poor	Bad
Q1-2	Poor to bad	
Q1	Bad	

In accordance with the Surface Water Regulations, water classified as 'High' or 'Good' must not be allowed to deteriorate. Water classified as less than good must be restored. The Surface Water Regulations also state that, for the purpose of classification, a status of less than good is assigned in the case of a waterbody where the environmental objectives are not met.

[5] Amended in 2012 (S.I. No. 327 of 2012) and 2015 (S.I. No. 386 of 2015)

Water Framework Directive Risk Assessments

A baseline risk assessment was completed of the water bodies within each River Basin District in 2005. This assessment involved using information on water pollution indicators, point and diffuse pollution sources, water abstraction and existing commercial activities.

10.2.1.2 Relevant Guidance

The following guidelines were considered in the development of this chapter to identify relevant objectives relating to hydrology and surface water quality:

- Guidelines on the information to be contained in Environmental Impact Assessment Reports - Draft, Environmental Protection Agency (EPA), August 2017
- Advice Notes for Preparing Environmental Impact Statements, EPA, Draft September 2015
- Wind Energy Development Planning Guidelines - Department of the Environment, Heritage and Local Government, 2006
- Best Practice Guidelines for the Irish Wind Energy Industry - Irish Wind Energy Association, 2012.

In addition to considering the documents above, the methodology for the baseline assessment has been devised with due consideration of the following guidelines:

- Greater Dublin Strategic Drainage Study (GDSDS): New Development Policy, Dublin Drainage, March 2005
- The Planning System and Flood Risk Management - Guidelines for Planning Authorities - Department of Environment, Heritage and Local Government (DoEHLG) and the Office of Public Works (OPW), November 2009
- Environmental good practice on site guide (fourth edition) (C741) - Construction Industry Research and Information Association (CIRIA), January 2015)
- River Basin Management Plan 2018-2021 (Department of Housing, Planning and Local Government)
- Best Practice Guide BPGCS005 Oil Storage Guidelines (Enterprise Ireland)
- Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes (National Roads Authority, 2005)
- Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (Inland Fisheries Ireland, 2016)
- The SuDS Manual (C753) - Construction Industry Research and Information Association (CIRIA), 2015
- Control of water pollution from linear construction projects (C648) - Construction Industry Research and Information Association (CIRIA), December 2001
- Control of water pollution from construction sites. Guidance for Consultants and Contractors (C532) - Construction Industry Research and Information Association (CIRIA), December 2001
- PUB C571 Sustainable construction procurement - a guide to delivering environmentally responsible projects - Construction Industry Research and Information Association (CIRIA), January 2001
- UK Guidance for Pollution Prevention (GPP):
    - GPP2: Above ground oil storage tanks (Natural Resources Wales (NRW), Northern Ireland Environment Agency (NIEA), the Scottish Environment Protection Agency (SEPA), Energy Institute, Oil Care Campaign, January 2018)

- GPP4: Treatment and disposal of wastewater where there is no connection to the public foul sewer (NRW, NIEA, SEPA, November 2017)
- GPP5: Works and maintenance in or near water (NRW, NIEA, SEPA, January 2017)
- GPP8: Safe storage and disposal of used oil (NRW, NIEA, SEPA, July 2017)
- GPP21: Pollution Incident Response Plans (NRW, NIEA, SEPA, July 2017)
- GPP22: Dealing with Spills (NRW, NIEA, SEPA, October 2018)
- GPP26: Safe storage of Drums and intermediate Bulk Containers (IBCs), (NRW, NIEA, SEPA, February 2019)

- GE-INT-01003- Introduction to the NRA Design Manual for Roads and Bridges (Transport Infrastructure Ireland, December 2013)
- Coillte (2009): Forrest Operations & Water Protection Guidelines.

10.2.2 Desk Study

The desk top study involved an examination of the hydrological aspects and water quality aspects of the following sources of information:

- Current and historic Ordnance Survey Ireland mapping, and ortho-photography.
- Science and Stories about Integrated Catchment Management (https://www.catchments.ie/)
- OPW Indicative Flood Maps (https://www.floodinfo.ie/map/floodplans/).
- Geological Survey of Ireland (www.gsi.ie).
- Review of the WFD online mapping and data (available at http://www.wfdireland.ie/maps.html).
- Review of the EPA online mapping (https://gis.epa.ie/EPAMaps/).
- History of flooding and status of drainage in the vicinity of the proposed development (available at http://www.floodinfo.ie/map/floodmaps/).
- Met Eireann Meteorological Database (available at https://www.met.ie).

10.2.3 Field Assessment

A site walkover survey was carried out on 20th and 25th June 2019 to establish the pattern of existing drainage and to record existing hydrology features of the proposed development. During the site visit, the GPS coordinates, descriptions, and photographs of the hydrological features were recorded. The site walkover involved an initial review of available information gathered in the desk study followed by a site visit. A site visit was carried out on 17th January 2020 to access areas which could not be addressed properly due to heavy vegetation during the site visits carried out in June 2019. Additional site visit was carried out on 12th August 2020.

No significant constraints were noted in terms of hydrology and water quality during the site visits.

10.2.4 Evaluation Criteria

The sensitivity of receptors, the quality of impacts the magnitude of impacts, the probability and duration of the impacts are assessed for the proposed development to determine significance of the impacts.

Thresholds for assessing the sensitivity of the environment and magnitude of impacts are outlined in Figure 10-1.

Quality of effect of an impact is either 'Positive, 'Neutral' or 'Negative' and may have influence in the 'Momentary', 'Short', 'Medium' or 'Long-term'. Impacts may also be either 'Temporary' or 'Permanent'.

The probability of impact can be either 'Likely' or 'Unlikely'.

10.2.4.1 Sensitivity of Receptors

The sensitivity of a hydrological receptor or attribute is based on its ability to absorb development without perceptible change. The hydrological environment of Coom Green Energy Park is considered to be of high sensitivity for receptors draining to the Bride River and the associated designated conservation areas downstream. The receptors which are part of Special Areas of Conservation are rated as 'high' sensitivity.[6]

Special Areas of Conservation (SAC), Special Protection Areas (SPA) and rivers supporting salmonid species are described in Chapter 8.

10.2.4.2 Assessment of Magnitude and Significance of Hydrological Impact

The assessment of the magnitude of an impact incorporates the timing, scale, size, duration and probability of the impact in accordance with the EPA Guidelines. The significance criteria for hydrological impacts are defined as set out in Table 10-2.

Table 10-2: Assessment of Magnitude of Hydrological Impact[7]

Impact Significance	Criteria
Imperceptible	An impact capable of measurement but without noticeable consequences
Not significant	An impact which causes noticeable changes in the character of environment but without significant consequences
Slight impacts	An impact which causes noticeable changes in the character of the environment without affecting its sensitivities
Moderate impacts	An impact that alters the character of the environment in a manner that is consistent with existing and emerging trends
Significant impacts	An impact which, by its character, magnitude, duration or intensity significantly alters a sensitive aspect of the environment
Very Significant	An impact which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment
Profound impacts	An impact which obliterates sensitive characteristics

[6] A handbook on environmental impact assessment Guidance for Competent Authorities, Consultees and others involved in the Environmental Impact Assessment Process in Scotland, Scottish Natural Heritage.

[7] Guidelines on the information to be contained in environmental impact assessment report Draft August 2017.

The diagram below, Figure 10-1, shows how comparison of the character of the predicted impact to the sensitivity of the receiving environment can determine the significance of the impact. Sensitivity of the receiving environment can be 'high', 'medium', 'low' or 'negligible'. Description of impact is defined by its character, magnitude, duration, probability and consequences. The magnitude of impact can be 'high', 'medium', 'low' or 'negligible'.

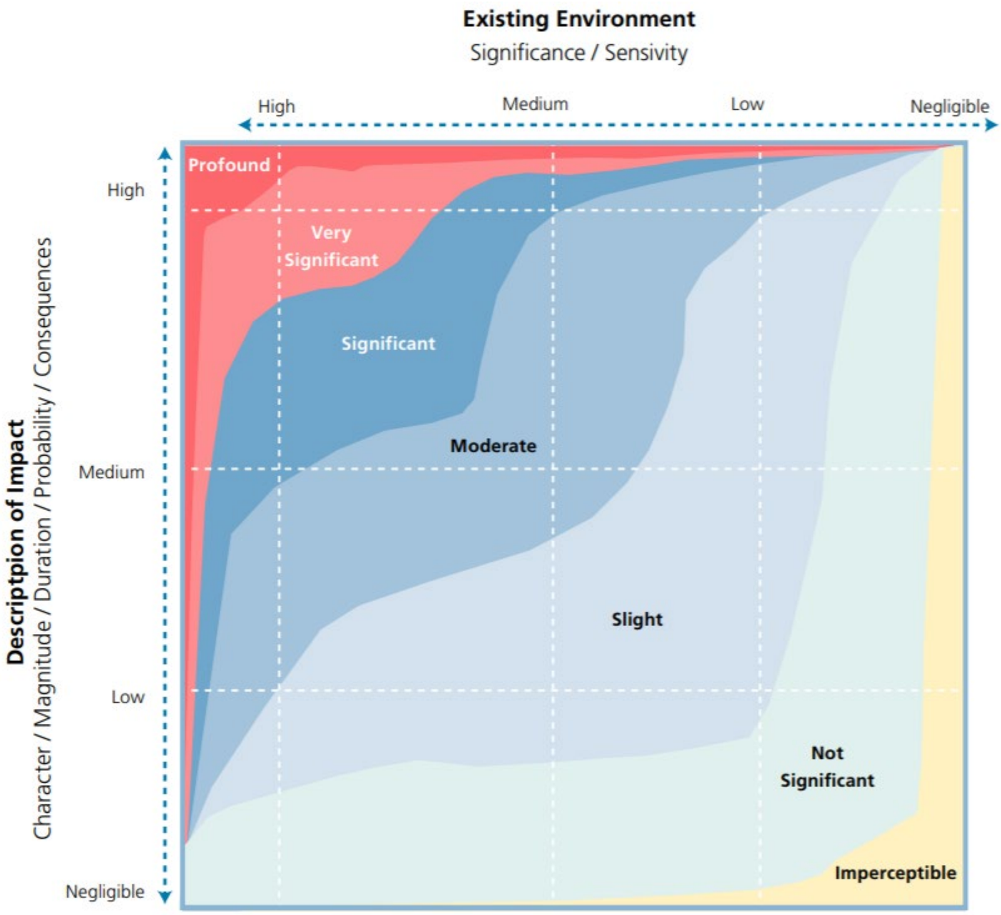

Figure 10-1: Classifications of the Significance of Impacts[8]

10.2.5 Consultation

This chapter considers the consultation responses as referred to in Chapter 5, with particular regard to concerns relating to hydrology and water quality. The scope of this appraisal has been informed by consultation with the Inland Fisheries Ireland (IFI).

A meeting was held on site with Inland Fisheries Ireland (IFI) on the 21st of August 2019 during which inspections took place of water crossing points, both on the public road and within the development site associated with the proposed grid connection cable route and the proposed internal access road network. Crossing points were inspected, and preferred design solutions and construction methodologies were agreed for both the examined crossing points and generally throughout the site.

[8] Guidelines on the information to be contained in environmental impact assessment report Draft August 2017

It was agreed at this meeting that a new watercourse crossing structure would comprise either a bottomless culvert or boxed culvert.

10.3 Existing Environment

This section describes the receiving environment and sets out a summary of historical flooding, protection policies and water quality of rivers within the study area.

10.3.1 General Description of the Catchments

Coom Energy Green Park is located within Hydrometric Area No. HA 18, Blackwater (Munster), of the Irish River Network System. It is situated in the South Western River Basin District (SWRBD). The average annual rainfall in period 1981-2010 in the area of development is 1,437 mm.

M5-60[9] at development location is 17.3 mm according to the Met Éireann rainfall data. This is the predicted rainfall depth in a sixty minute storm that will occur with a frequency of once every five years.

The site is situated within four sub-catchments as defined by the WFD. These waterbodies are known as:

- Bride (Waterford)_SC_010 (18_11)
- Blackwater (Munster)_SC_110 (18_14)
- Bride (Waterford)_SC_020 (18_25)
- Blackwater (Munster)_SC_080 (18_23)

Coom Green Energy Park is situated within eight sub-basins as defined by the WFD. These waterbodies are known as:

- Clyda_030 – IE_SW_18C020300
- Coom_010 - IE_SW_18C030400
- Bride (Blackwater)_010 - IE_SW_18B050050
- Bride (Blackwater)_020 – IE_SW_18B050320
- Ross (Killavullen)_010 – IE_SW_18R020500
- Blackwater (Munster)_180 – IE_SW_18B022100
- Blackwater (Munster)_190 – IE_SW_18B022300
- Bride (Blackwater)_030 – IE_SW_18B050400

Turbines T2, T3, T4, T5, T6, T7, T8, T9, T10, T11, T12, T13 and T14 are within Coom_010 - IE_SW_18C030400 waterbody catchment. Turbines T15, T16, T17, T18, T19, T20, T21 and T22 are within Bride (Blackwater)_010 – IE_SW_18B050050 sub-basin and turbine T23 is within Bride (Blackwater)_020 – IE_SW_18B050320 sub-basin.

[9] This is for a 5-year return period, with a 60-minute duration rainfall.

The cable route between the proposed on-site 110 kV substation at Knockacullata and proposed on-site 110 kV substation at Lackendarragh North is within four waterbodies (river sub-basins) catchments as defined by the WFD. These are:

- Bride (Blackwater)_010 - IE_SW_18B050050,
- Ross (Killavullen)_010 – IE_SW_18R020500,
- Bride (Blackwater)_020 – IE_SW_18B050320,
- Blackwater (Munster)_180 – IE_SW_18B022100 sub-basin.

The cable route between proposed 110 kV substation at Lackendarragh North and existing 110 kV substation at Barrymore is within four waterbodies (river sub-basins) catchments as defined by the WFD. These are:

- Bride (Blackwater)_020 – IE_SW_18B050320,
- Blackwater (Munster)_180 – IE_SW_18B022100,
- Blackwater (Munster)_190 – IE_SW_18B022300,
- Bride (Blackwater)_030 – IE_SW_18B050400 sub-basin.

Surface runoff from turbines T2, T3, T4 and T5 drains to the Coom River. The Coom River rises to an elevation of 270 m OD approximately 90 m west of the turbine T4. The river flows in an easterly direction for approximately 6.4 km, where it joins the Bride River.

Surface runoff from turbines T6, T7, T8, T9, T10, T11, T12, T13 and T14 drains to the Toor River. The Toor River rises to an elevation of 245 m OD approximately 110 m east of the turbine T11. From there it flows to the south for approximately 0.85 km before Mullenaboree stream joins, it then flows south-easterly for approximately 3.4 km, where it joins the Coom River.

The runoff from turbines T15 and T16 drain to the Lyravarrig stream which is a tributary of the Bride River. The Lyravarrig stream rises to an elevation of 190 m OD approximately 0.70 km south east of the turbine T16. The Lyravarrig stream flows in an easterly direction for 1.3 km, before joining Bride River.

The surface runoff from turbines T17, T18, T19, T20, T21 and T22 drain to the Bride River which is a tributary of the Blackwater River. The Bride River rises to an elevation of 240 m OD approximately 2.60 km west of the turbine T21. The river flows in a south-easterly direction for 5.1 km before Coom river joins it. Bride River continues to flow in easterly direction for approximately 41.7 km where it joins Blackwater River.

The runoff from turbine T23 drains to the Bunnaglanna River which is also a tributary of the Bride River. The river rises to an elevation of 260 m OD approximately 0.4 km south east of the turbine T23. The river flows in a southerly direction for 4.1 km before joining the Bride River.

The site entrance for TDR-West is in the sub-basin Clyda_030. The existing access road connecting the site entrance and CGEP will be widened. Approximately 465m of a new road will be constructed in the sub-basin Clyda_030. A temporary compound and a met-masts are planned in this sub-basin.

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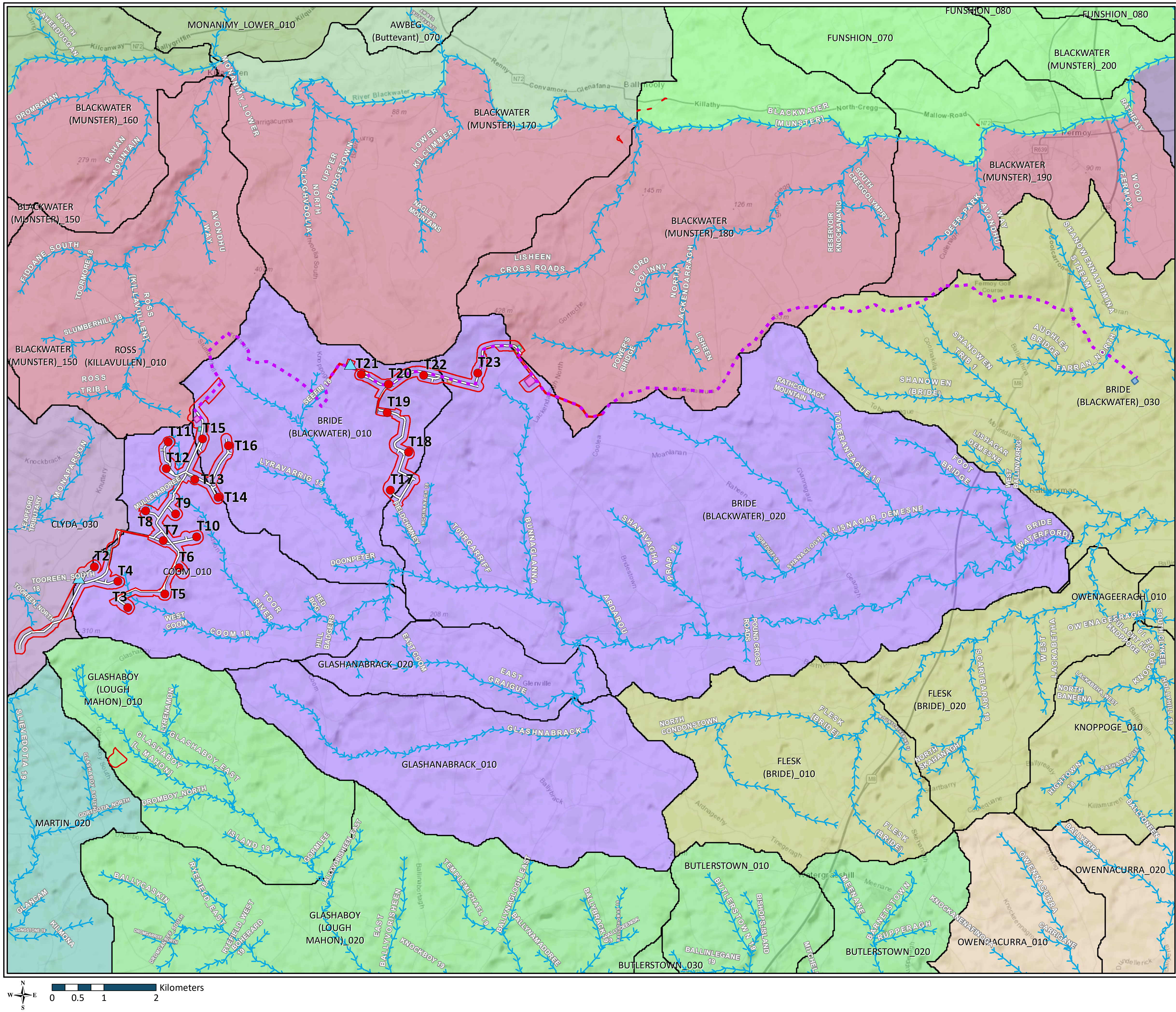

Proposed Turbine Layout
Proposed Permanent Met Masts
Proposed Cable Route
Proposed Development Boundary
Proposed Internal Roads
Proposed Borrow Pit
Proposed Temporary Compound
Proposed Substation
Existing Barrymore 110kV Substation
Rivers
WFD River Sub Basins

WFD Sub Catchments

Blackwater[Munster]_SC_080
Blackwater[Munster]_SC_090
Blackwater[Munster]_SC_100
Blackwater[Munster]_SC_110
Blackwater[Munster]_SC_120
Blackwater[Munster]_SC_130
Bride[Waterford]_SC_010
Bride[Waterford]_SC_020
Glashaboy[L.Mahon]_SC_010
Manin_SC_010
Owennacurra_SC_010

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10.3.2 Historical Flooding

The OPW has produced indicative flood mapping to assist in a preliminary flood risk assessment (PFRA).[10] The PFRA mapping was prepared as part of the high-level screening exercise to identify areas for further assessment under the Catchment Flood Risk Assessment and Management (CFRAM) Programme.

According to flood mapping the proposed turbines, hardstanding areas and substations are within 'Flood Zone C', -Low risk of flooding (less than 0.1%). However, the access road between turbine T9 and T13 and grid route approximately 740 m northwest of the existing 110kV Barrymore substation cross indicative floodplain 'Flood Zone A', high risk of flooding from rivers (1 in 100 years or 1%). The indicative flood mapping for Coom Green Energy Park is shown on Figure 10-3.

The national flood hazard mapping (www.floodmaps.ie), does not indicate any record of historical flooding along the tributaries of the Bride River running through the site, as shown on Figure 10-3.

The nearest flood incident has been recorded downstream in the main channel of the Bride River, just over 5.0 km south east of the closest turbine T17. This incident is east of Glenville at Glashanabrack River on road R614 (Flood ID 5102). Approximately 3.0 km southwest of the existing Barrymore substation two flood events have been recorded; Rathcormack Co. Cork 30/01/2009 and Flooding in Rathcormack 24/08/2012 as shown on Figure 10-3.

There are multiple recurring flood incidents in the vicinity of the grid cable along the route from the proposed 110 kV substation at Lackendarragh North to the existing 110 kV substation at Barrymore. These flood incidents are recorded under the name:

- Cregg Stream at Ballymacphilip Bridge
- Castelyons Kill Saint Annes
- River Bride at Bride Bridge
- Edgar's Cross.

The closest recurring flood incident to the grid route as per bullets above is Castelyons Kill Saint Annes approximately 1.5 km southeast of the existing 110 kV substation at Barrymore.

There are no areas defined as 'benefitting lands'[11] within the Coom Green Energy Park site in the OPW flood hazard mapping.

[10] http://www.floodinfo.ie/map/floodmaps/

[11] Benefitting lands are lands benefiting from Arterial Drainage Scheme

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Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
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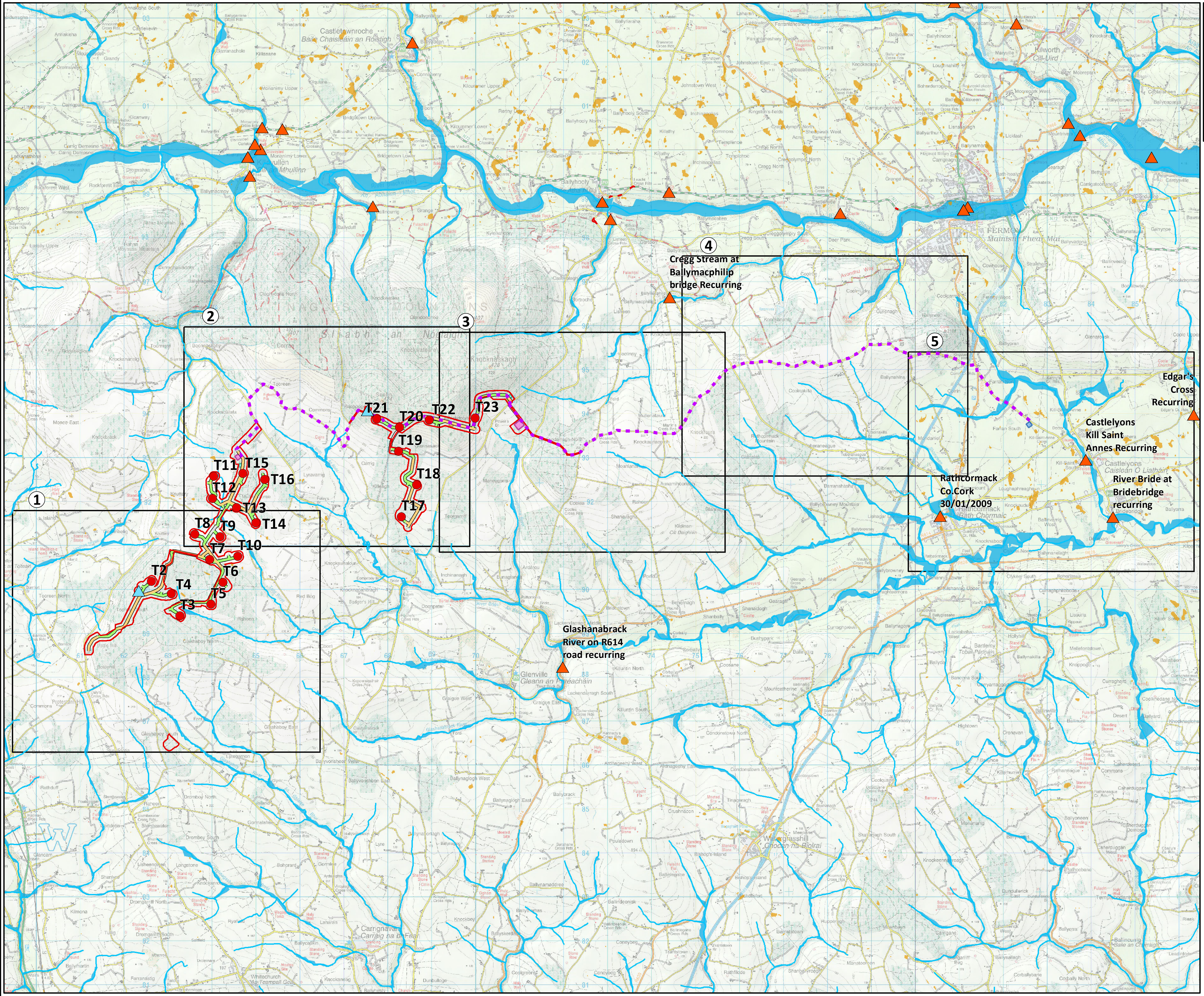

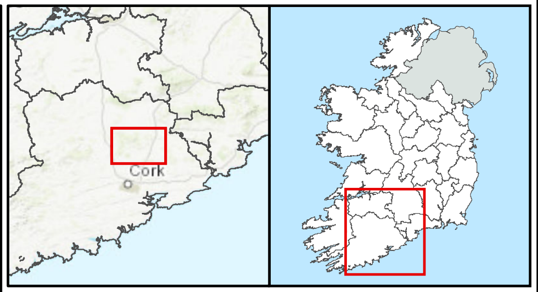

- OPW Historic Flood Points
- Proposed Turbine Layout
- Proposed Permanent Met Masts
- Proposed Cable Route
- Proposed Development Boundary
- Existing Road
- Proposed Existing Road Upgrade
- Proposed New Road
- Proposed Borrow Pit
- Proposed Temporary Compound
- Proposed Substation
- Existing Barrymore 110kV Substation
- Rivers
- PFRA/CFRAMS 1% AEP Pluvial Flood Extent
- PFRA/CFRAMS 1% AEP Fluvial Flood Extent

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Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
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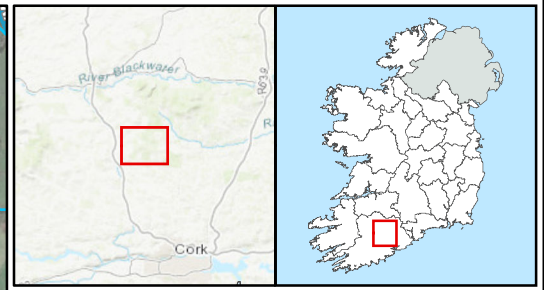

Proposed Turbine Layout
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Proposed Borrow Pit
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PFRA/CFRAMS 1% AEP Pluvial Flood Extent
PFRA/CFRAMS 1% AEP Fluvial Flood Extent

0 0.5 1 2 Kilometers

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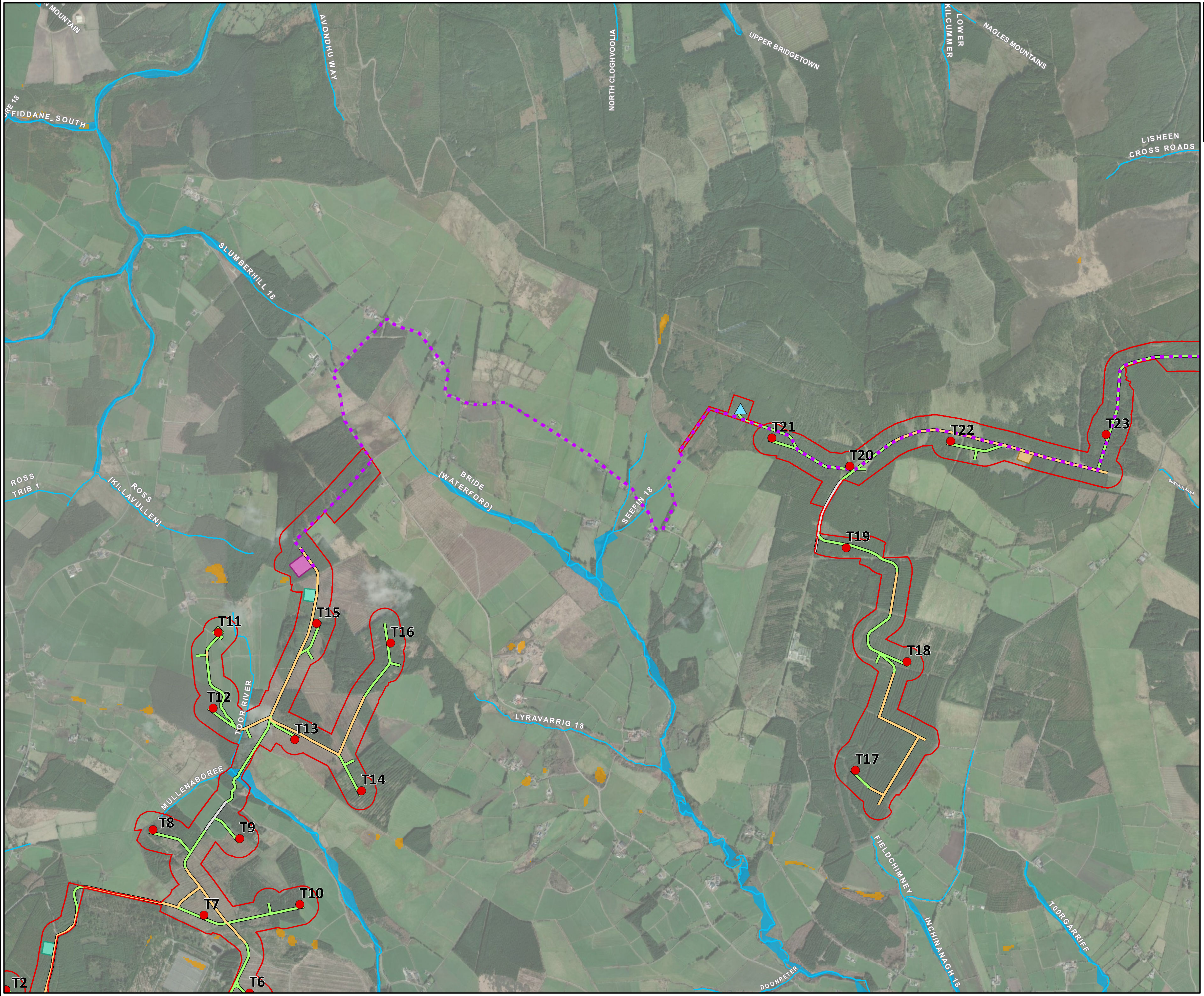

Proposed Turbine Layout
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PFRA/CFRAMS 1% AEP Pluvial Flood Extent
PFRA/CFRAMS 1% AEP Fluvial Flood Extent

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Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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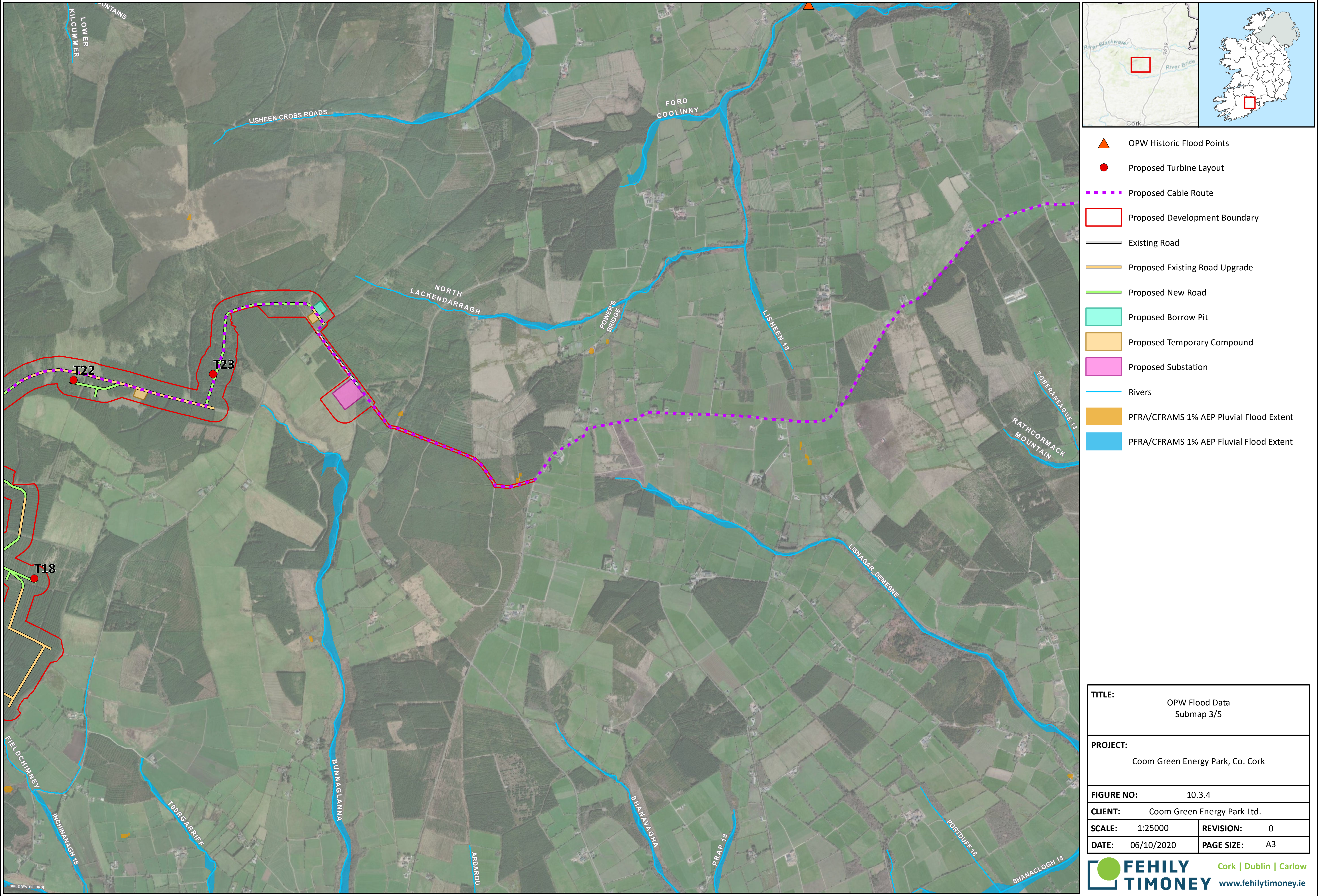

- OPW Historic Flood Points
- Proposed Turbine Layout
- Proposed Cable Route
- Proposed Development Boundary
- Existing Road
- Proposed Existing Road Upgrade
- Proposed New Road
- Proposed Borrow Pit
- Proposed Temporary Compound
- Proposed Substation
- Rivers
- PFRA/CFRAMS 1% AEP Pluvial Flood Extent
- PFRA/CFRAMS 1% AEP Fluvial Flood Extent

TITLE:	OPW Flood Data Submap 3/5
PROJECT:	Coom Green Energy Park, Co. Cork
FIGURE NO:	10.3.4
CLIENT:	Coom Green Energy Park Ltd.
SCALE:	1:25000
REVISION:	0
DATE:	06/10/2020
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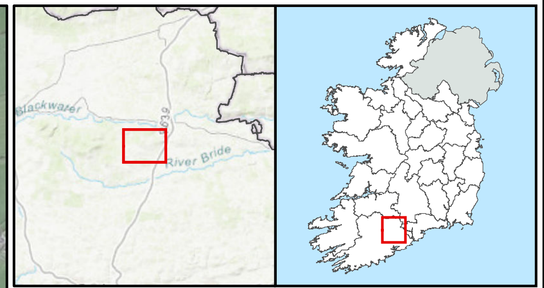

- OPW Historic Flood Points
- Proposed Cable Route
- Rivers
- PFRA/CFRAMS 1% AEP Pluvial Flood Extent
- PFRA/CFRAMS 1% AEP Fluvial Flood Extent

TITLE:	OPW Flood Data Submap 4/5
PROJECT:	Coom Green Energy Park, Co. Cork
FIGURE NO:	10.3.5
CLIENT:	Coom Green Energy Park Ltd.
SCALE: 1:25000	**REVISION:** 0
DATE: 06/10/2020	**PAGE SIZE:** A3

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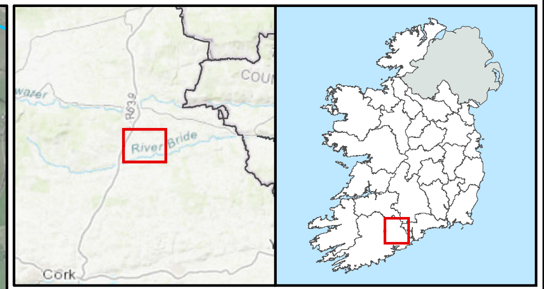

- OPW Historic Flood Points
- Proposed Cable Route
- Existing Barrymore 110kV Substation
- Rivers
- PFRA/CFRAMS 1% AEP Pluvial Flood Extent
- PFRA/CFRAMS 1% AEP Fluvial Flood Extent

TITLE:	OPW Flood Data Submap 5/5
PROJECT:	Coom Green Energy Park, Co. Cork
FIGURE NO:	10.3.6
CLIENT:	Coom Green Energy Park Ltd.
SCALE: 1:25000	**REVISION:** 0
DATE: 06/10/2020	**PAGE SIZE:** A3

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10.3.3 Water Quality

WFD water quality status and river waterbody risk within the study area is provided in Table 10-3:

Table 10-3 WFD River Status and River Waterbody Risk[12]

Waterbody	EPA CODE	River Status	Waterbody Risk
Tooreen North	18T33	Good	Not at Risk
Coom_010	18C03	Good	Not at Risk
Toor River	18T51	Good	Not at Risk
Lyravarrig	18L66	Good	Not at Risk
Bride (Waterford)	18B05	Good	Not at Risk
Bunnaglanna	18B07	Good	Review
Inchinanagh	18I16	Good	Review

The EPA scheme of Biotic Indices or Quality (Q) Values was developed to determine the status of organic pollution in Irish rivers by assessing the occurrence of macro-invertebrate taxa of varying sensitivity to pollution. Biological Water Quality data was examined as part of this assessment.[12]

The location of the EPA's Q-value stations for the receiving waters are shown on Figure 10-4.

Biological water quality ratings Q5, Q5-4 and Q4 relate to 'Unpolluted' status, Q3-4 relates to 'Slightly polluted', Q3 and Q2-3 relate to 'Moderately polluted' and Q2, Q1-2, Q1 relate to 'Seriously polluted' watercourse.[13]

Biological Water Quality Ratings at stations downstream of the site are outlined in Table 10-4. Q ratings range between Q4 to Q4-5 between 1990 and 2015 as the most recent available data. There is no recorded quality status data for Coom – Bridge u/s Coom Bridge (RS18C030300), Bride (Blackwater) – Bride Bridge (Old) (RS18B050100) and Bride (Blackwater) - Bridge south of Glanreagh Bridge (RS18B050200) since year 1990.

Table 10-4: EPA Biological Water Quality Ratings

Station ID	Location	1990	1994	1997	2000	2003	2006	2015
RS18C030100	Coom – Bridge u/s Toor River Confluence	4	4	4	4	4	4	-
RS18C030300	Coom – Bridge u/s Coom Bridge	4	-	-	-	-	-	-
RS18C030400	Coom Bridge	4	4	4-5	4	4	4	4
RS18B050050	Bride Bridge, Chimneyfield	4-5	4	4-5	4	4	4	4

[12] https://gis.epa.ie/EPAMaps/.

[13] http://www.epa.ie/QValue/webusers/

Station ID	Location	1990	1994	1997	2000	2003	2006	2015
RS18B050100	Bride (Blackwater) – Bride Bridge (Old)	4-5	-	-	-	-	-	-
RS18B050120	Bride (Blackwater) Keam Bridge	-	4-5	4	4	4	-	-
RS18B050200	Bride (Blackwater)- Bridge south of Glanreagh Bridge	4-5	-	-	-	-	-	-
RS18C020300	Bridge u/s Blackwater confluence	3	4	3-4	3-4	4	4	4

Path: R:\Map Production\2020\P20-099\Workspace\EIAR\P20-099_GIS_Fig10-4_WaterQualityMonitoringLocations_A3.mxd

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
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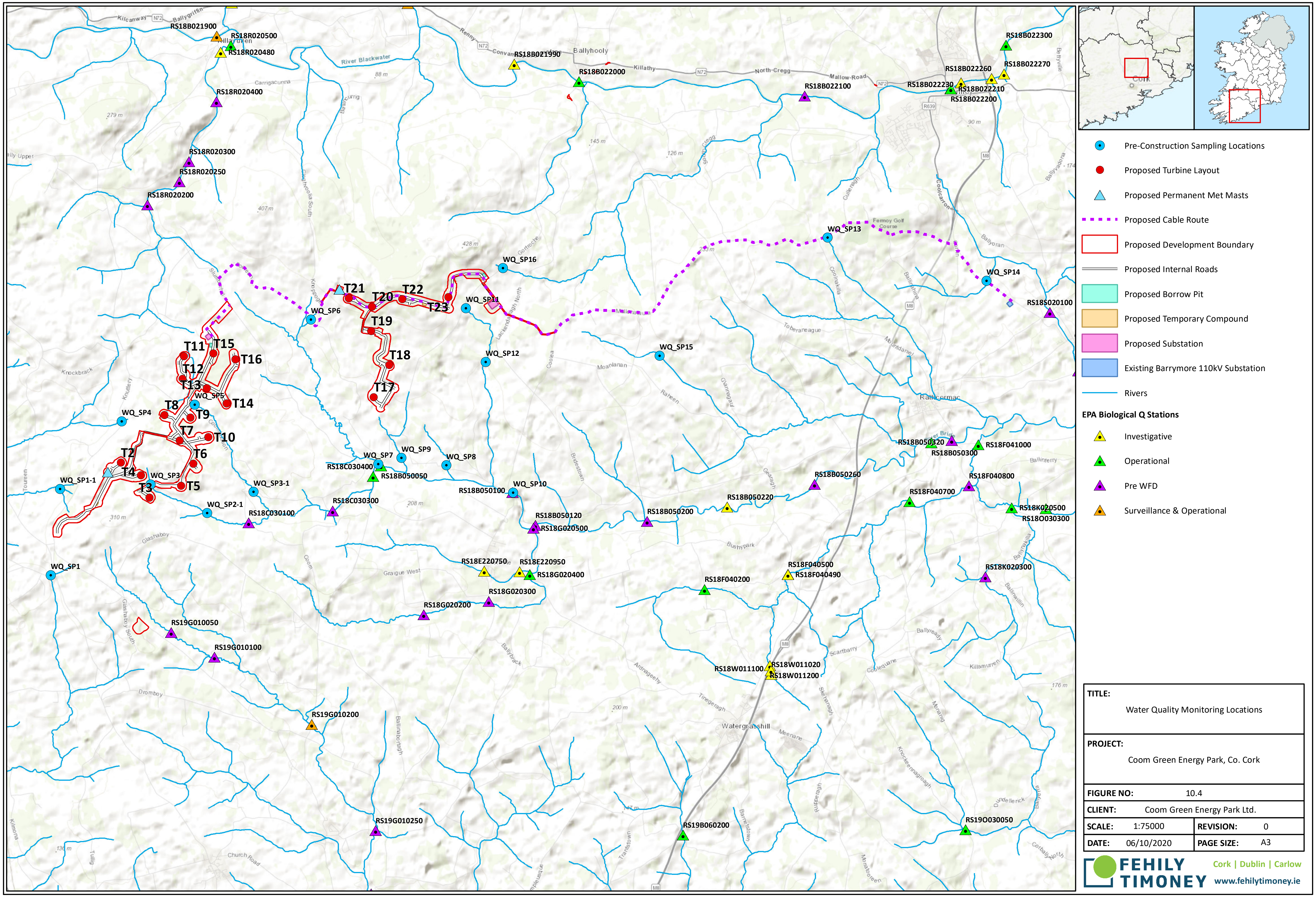

TITLE:	Water Quality Monitoring Locations
PROJECT:	Coom Green Energy Park, Co. Cork
FIGURE NO:	10.4
CLIENT:	Coom Green Energy Park Ltd.
SCALE:	1:75000
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10.3.4 Water Quality Monitoring Programme

A water quality monitoring programme was established for the proposed development to establish a baseline for water quality within the study area. Water sampling took place for dry weather condition on 31st August 2018 and for wet weather conditions on 8th March 2019 at 16 locations to establish baseline conditions. Additional water sampling was undertaken on 23rd August 2020 and 2nd October 2020 at 3 locations.

At monitoring locations as shown on Figure 10-4 the following parameters were measured:

- Biological oxygen demand (BOD)
- Chemical oxygen demand (COD)
- Ammonia as N
- Nitrate as N
- Nitrite as N
- Phosphate as P
- Metals Dissolved
- Suspended Solids
- pH
- Turbidity
- Total Phosphorus
- Conductivity.

Monitoring locations WQ_SP3 and WQ_SP5 were located within the site boundary. The monitoring point WQ_SP3 was located approximately 15m north of the location where the Coom River crosses new access road between proposed turbines T3 and T5. The monitoring point WQ_SP5 was located where the Toor River crosses new access road between proposed turbines T9 and T13.

At the location WQ_SP3 values of BOD, COD, phosphate as P, suspended solids, pH, turbidity, total phosphorus and conductivity were higher at dry condition compared to wet condition.

At the location WQ_SP5 values of Ammonia as N, Phosphate as P, pH and Conductivity were higher at dry condition compared to wet condition.

During the wet event at the location WQ_SP5 there was an increase in value of Nitrate and Nitrite as N. This increase mostly likely occurred due to agricultural lands being drained to watercourses.

The monitoring point WQ_SP2 is in the Martin_010 sub-basin and it is located approximately 2.3km southwest of the monitoring point WQ_SP1. No construction activities are planned in the sub-basin Martin_010. Results from WQ_SP2 are therefore not considered relevant for this project and WQ_SP2 is not shown on Figure 10-4.

Recorded monitoring data is included in Appendix 10.1.

10.3.5 Protected Ecological Environment

The site is not situated within any environmentally designated areas, however surface water running off the site drains into the Bride/Bunaglanna Valley (000079) Natural Heritage Area (NHA) and Blackwater River (Cork/Waterford) (002170) Special Area of Conservation (SAC). The development does not traverse any Special Protection Area (SPA). The closest SPA, Cork Harbour SPA (004030), is approximately 17.6km southeast of the site.

Special Areas of Conservation are described in Chapter 8.

10.3.6 Internal Site Drainage

A site walkover survey took place on 20th June 2019, on 25th June 2019 on 17th January 2020 and on 12th August 2020 to examine the existing drainage and hydrological features at the site. The visit involved a detailed walkover of the site by FT staff, recording existing drainage features and noting their locations. The locations of the hydrological features observed during the site visit are shown in Figure 10-5.

Observations from the site walkover do not give rise to any significant concerns. It was observed that none of the existing hydrological features would be adversely impacted on by the proposed development.

Photographs of existing hydrological features are included in Appendix 10.2.

Drains and existing road drainage

Turbines are situated within 3 sub-basins. Greenfield runoff drains to the Bride River and its tributaries. These tributaries are the Coom River, Lyravarrig, Inchinanagh stream and the Toor River which is a tributary of the Coom River.

Turbines are situated mostly within forestry lands. These lands are drained by forestry drains, draining to the tributaries of the Bride River.

The existing road between the proposed turbines T6 and T7 will cross a forestry drain at location WC026 as shown on Figure 10-5. The crossing structure of WC026 could not be identified during site visits due to vegetation.

The existing track between turbines T12 and T13 will cross the Toor River. Immediately upstream of the crossing point the dimensions of the stream are 1.5m wide and 1.8m deep with side slopes mostly vertical.

There is drainage located on both sides of the existing access track between turbines T13 and T14. The drain is 1.5m wide, 1m deep with side slopes 1:1.

At the location of the proposed 110kV substation at Knockacullata, the existing track has drainage ditches on both sides. These ditches are 0.5m wide, 0.3m deep with side slope 1:1.

The existing road between proposed turbines T20 and T22 includes drainage at the northern side of the road and the road is crossed at t locations WC031 and WC035. The drain is 0.9m wide and 0.6m deep with side slopes 1:1.

Existing tracks are present throughout the site. Some of these tracks are access tracks for the landfill which are approximately 5m in width. The majority of the access tracks located outside the landfill area are approximately 3.5 m wide and made up of sandstone/siltstone hardcore and are used for forest inspection, maintenance and access for tree felling and extraction. The existing track drainage consists of 'over the edge' drainage to roadside drains.

It is proposed to utilise the existing tracks in so far as possible to access the new turbines. The existing tracks may require strengthening and widening to achieve a track width of 5 m (minimum).

During the site visit undertaken on 17th January 2020, two additional streams were identified. One stream is located approximately 230m east of the proposed turbine T19 and it drains in southerly direction where it joins the Inchinanagh River. The other one is located approximately 480m northeast of turbine T23 and drains in a south-easterly direction for approximately 1.3km where it joins the Bunnaglanna River.

Just west of the location of proposed turbine T23 multiple handmade forestry drains are identified. These drains are mostly 0.2m wide and shallow. With the proposed drainage layout these drains will be connected to interceptor drains.

Stream Crossing Infrastructure

During the site visits 5 crossing points, over the streams, drains and watercourses were identified. The location and general description of these crossings are provided in Table 10-5:

Table 10-5: Existing Internal Site Stream Crossings

Feature ID	ITM_X	ITM_Y	General description
WC026	564122.70	590617.30	Inaccessible during site visit. Likely small diameter forestry pipe culvert as part of forestry drainage.
WC028	564171.10	591981.30	Concrete pipe, 600 mm diameter
WC030	568492.90	592029.20	Inaccessible during site visit. Likely small diameter forestry pipe culvert as part of forestry drainage.
WC031	568375.20	593820.90	Concrete pipe, 450 mm diameter
WC035	569019.61	593940.22	Concrete pipe, 450 mm diameter

Crossing WC026 is located within the existing road between proposed Turbines T6and T7. The existing road crosses over an unnamed stream which joins the Toor River approximately 670m southeast of the proposed Turbine T10. The crossing structure was inaccessible during the site visits due to heavy vegetation. The Toor River crosses the existing road towards proposed Turbine T12. The crossing WC028 is culverted with a 600 mm concrete pipe. The crossing WC030 is located within the existing road approximately 400m northeast of the proposed turbine T17. Crossings WC031 and WC035 are located along the road between proposed turbines T20 and T22.

The locations of stream crossings are shown on Figure 10-5.

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Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
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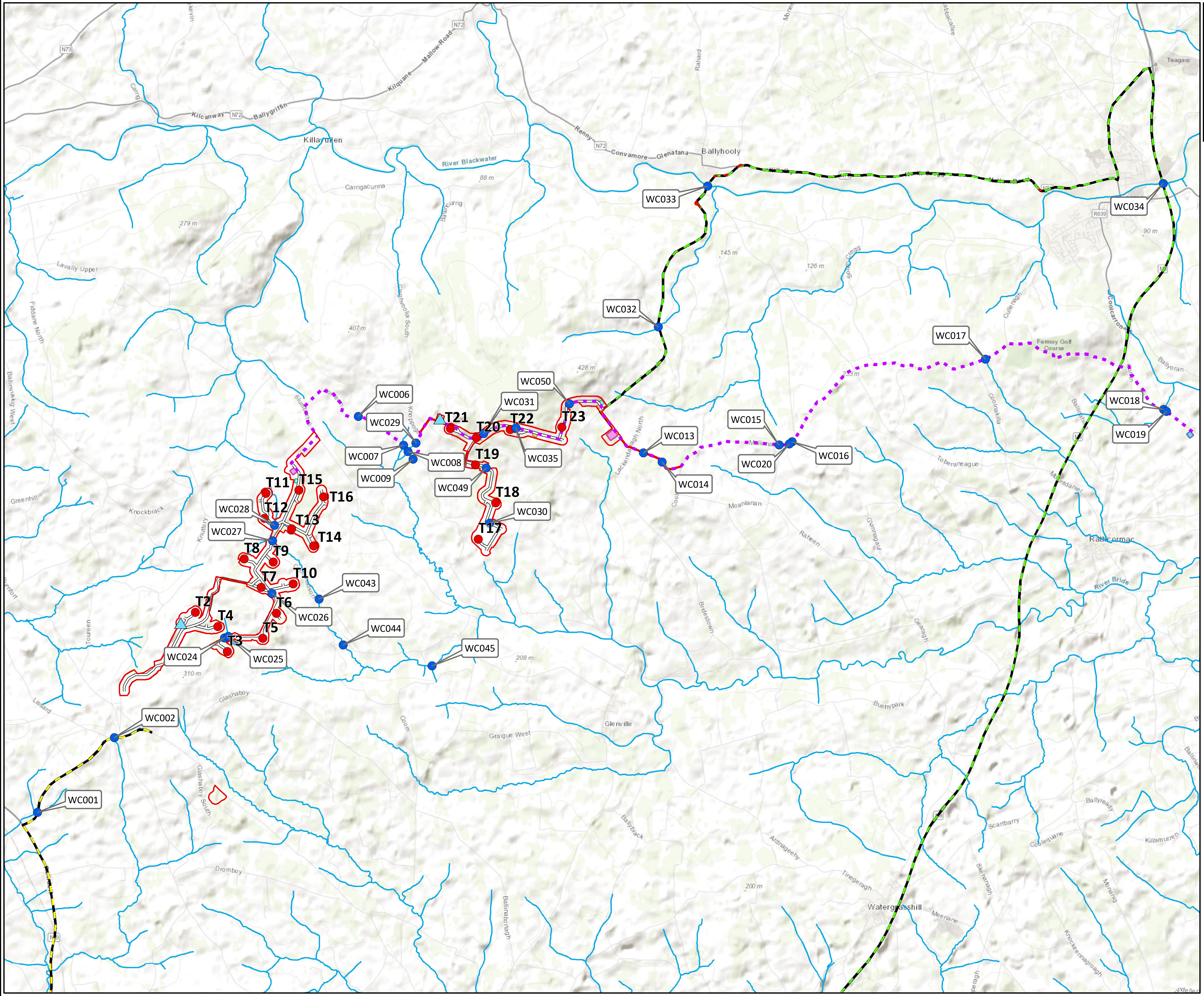

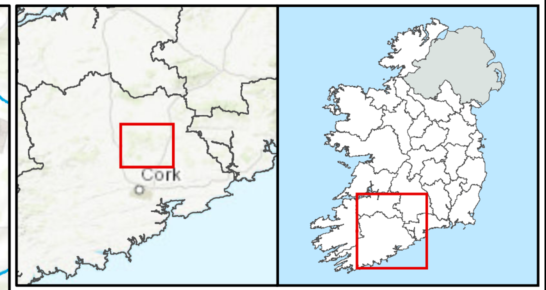

- Hydrological Features
- Proposed Turbine Layout
- Proposed Permanent Met Masts
- Proposed Cable Route
- Proposed Development Boundary
- Proposed Internal Roads
- Proposed Borrow Pit
- Proposed Temporary Compound
- Proposed Substation
- Existing Barrymore 110kV Substation
- Rivers

Proposed Turbine Delivery Route

- Route 1
- Route 2

TITLE: Hydrological Features Overview	
PROJECT: Coom Green Energy Park, Co. Cork	
FIGURE NO: 10.5	
CLIENT: Coom Green Energy Park Ltd.	
SCALE: 1:75000	**REVISION:** 0
DATE: 06/10/2020	**PAGE SIZE:** A3

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10.3.7 Cable Route

The grid connection route from the proposed 110kV substation at Knockacullata to the proposed 110kV substation at Lackendarragh North crosses watercourses at five locations as shown on Figure 10-5.

The grid route from the proposed 110 kV substation at Lackendarragh North to the existing Barrymore 110 kV substation crosses watercourses at eight locations as shown on Figure 10-5.

The proposed grid route will have 13 stream crossings. These crossings are listed in Table 10-6:

Table 10-6: Grid Route Crossing Method

Feature ID	ITM_X	ITM_Y	Proposed grid cable method crossing
WC006	565856.78	594166.05	Horizontal directional drilling (HDD) under structure within public road corridor. Alternative: Concrete bridge beam in road deck with ducts in flat profile. Reinstate bridge surface to same level as existing.
WC007	566767.03	593590.72	HDD under structure within public road corridor.
WC008	566855.33	593463.30	Trench in road above structure and reinstate road surface to existing levels.
WC009	566953.13	593308.63	Standard trench crossing under existing service
WC013	571579.31	593438.66	Standard trench crossing under existing service
WC014	571953.73	593251.56	Standard trench crossing under existing service
WC015	574302.28	593592.15	Standard trench crossing under existing service
WC016	574563.28	593659.12	Standard trench crossing under existing service
WC017	578448.83	595314.38	Standard trench crossing under existing service
WC018	582024.33	594307.32	Replace existing stone culvert with a reinforced concrete box culvert and bring ducts underneath.
WC019	582076.81	594271.41	HDD under structure within public road corridor. Alternative: Concrete bridge beam in road deck with ducts in flat profile. Reinstate bridge surface to approximately 100mm above existing.
WC020	574506.00	593616.00	Standard trench crossing under existing service.
WC029	567015.50	593633.90	Standard trench crossing above or below existing culvert.

The proposed grid route is situated within six sub-basins as defined by the WFD. These sub-basins are known as:

- Bridge (Blackwater)_010 – IE_SW_18B050050
- Ross (Killavullen)_010 – IE_SW_18R020500
- Bridge (Blackwater)_020 – IE_SW_18B050320
- Blackwater (Munster)_180 – IE_SW_18B022100

- Blackwater (Munster)_190 – IE_SW_18B022300
- Bridge (Blackwater)_030 – IE_SW_18B050400

According to the PFRA flood mapping, the grid route crosses the Flood Zone A and B approximately 740 m northwest of the existing 110kV Barrymore substation as shown on Figure 10-3.

The closest recurring flood incident is recorded under the name 'Castlelyons Kill Saint Anne's Recurring' approximately 1.5 km southeast of the 110 kV Barrymore substation.

Crossings for the cables in the internal access roads serving the proposed development, have been assessed as part of the proposed drainage for the wind farm development. These crossing locations are discussed in Section 10.6.4.

The grid connection trench will be approximately 850 mm wide and 1500 mm deep. Should any unidentified culvert be encountered, the grid cable will be installed above or below the culvert depending on its depth. The cable will be installed so as not to impact the culvert.

10.3.8 Turbine Delivery Route

As discussed in Section 13.4.5, turbine components from Ringaskiddy will be delivered along two distinct routes as shown on Figure 10.5. Crossings listed below were indentfied as being significant during the TDR inspection.

The route from the west crosses two significant hydrological features. These features are:

- Stream crossing of the Ballygrogan stream in the Martin_010 sub-basin – concrete pipe culvert
- Stream crossing of the Slievedotia stream in the Martin_020 sub-basin – concrete pipe culvert.

The route from the east crosses three significant hydrological features. These features are:

- Stream crossing of the Blackwater River in the Blackwater (Munster)_190 sub-basin – bridge
- Stream crossing of the Blackwater River in the Blackwater (Munster)_180 sub-basin – bridge
- Stream crossing of the Lisheen Cross Roads stream in the Blackwater (Munster)_190 sub-basin – bridge.

No modifications were identified as being required at these stream crossings.

Temporary accommodation works are required to widen the road bends; however, it is not anticipated that this will have any significant hydrological impact due to the distance of bends to streams.

According to EPA River Network mapping, the eastern turbine delivery route should cross the North Lackendarragh stream directly NE of the proposed Knockdoorty site entrance, as shown on the Figure 10-5. No existing crossing was discovered during two site visits conducted at different times of the year. It is determined that the North Lackendarragh stream was likely diverted in the past.

10.3.9 Replant Land

Replant sites have been identified at Moneygorm, Co. Cork and Ballard, Co. Wicklow.

The total area approved for replanting is 77.1 ha.

Hydrology and water quality assessment of these replant lands is provided in Appendix 3.3 of this EIAR.

Cumulative impact assessment of CGEP with replant lands is addressed in Section 10.4.6.

10.4 Potential Impacts

The potential impacts on the hydrological regime at the site and quality of waters draining the site are assessed in the following sections for the activities associated with each phase (construction, operation, maintenance and decommissioning) of the proposed development. The potential impacts are assessed in accordance with the evaluation criteria outlined in Section 10.2.4.

The potential impacts in relation to an increase in flooding, cumulative flood risk with neighbouring developments, as well as specific impacts during the various phases of the subject development are outlined below.

The summary of potential impacts, magnitude, duration, likelihood and whether it is of a direct or indirect nature is provided in Section 10.4.7.

10.4.1 Do Nothing Impact

If the proposed development does not proceed, the site will remain as predominantly forestry and agricultural land for the foreseeable future.

10.4.2 Potential Impacts during Construction

During the construction period, the development has the potential to lead to impacts on hydrology and water quality unless appropriate mitigations are applied. Inappropriate construction practices could also have the potential to impact the water quality and WFD status of existing waterbodies listed in Table 10-3 which includes the Blackwater River special area of conservation.

As some tree felling is required to facilitate construction, the potential impacts of both tree-felling and construction are examined below.

Tree felling, new access tracks and upgrade of existing tracks, turbine hardstanding areas, the on-site substations and other new, hard surfaces have the potential to contribute to the increase in runoff, as indicated in Table 10-7.

In order to assess potential increase in runoff, the estimated flow was calculated using Modified Rational Method. The peak runoff occurs for a storm event with duration equal to the time of concentration. Time of concentration at the location of development is estimated to be 180 min. 1-in-100 years storm event is used for flood risk assessment and Section 50 consent.

Therefore, the estimated increase in runoff was calculated for a 1-in-100 year storm event with a duration of 180-minutes at the proposed Coom Green Energy Park. This equates to rainfall with an intensity of 17.1 mm/h.

The estimated increase in runoff due to development is provided in Table 10-7.

As illustrated in Figure 10-2 the greenfield runoff from Coom Green Energy Park drains to eight waterbody catchments. Table 10-7 indicates the estimated changes in the amount of surface water runoff to each sub-catchment. It can be seen from Table 10-7 that there is no increase in runoff on three sub-basins, due to there being no changes in the area of impermeable surfaces.

Surface water runoff from impermeable surfaces of the subject development within the Coom_010 catchment will increase by 0.108 m^3/s (or 0.45%). It will increase by 0.078 m^3/s (or 0.28%) within Bride (Blackwater)_010 and by 0.039 m^3/s (or 0.04%) within Bride (Blackwater)_020. It will also increase by 0.003 m^3/s (or 0.01%) within Blackwater (Munster)_180 and by 0.006 m^3/s (or 0.01%) in Clyda_030 sub-basin.

There will be no increase in runoff within catchments Bride (Blackwater)_030, Blackwater (Munster)_190, and Ross (Killavullen)_010 because no new impermeable areas are envisaged to be constructed or existing roads upgraded.

The overall estimated increase in the runoff due to the development is 0.234 m^3/s (or 0.06 %).

As discussed in Section 10.2.4.1 the hydrological environment of the Coom Green Energy Park is considered to be of 'high' sensitivity for receptors draining to the Bride River. The effects of the increase in runoff has negligible magnitude on receiving waters because estimated increases in runoff are low compared to the flows of receiving waters.

The surface water runoff increase of 0.234 m^3/s (or 0.06%) due to Coom Green Energy Park is not significant. The increase in runoff will be mitigated with the drainage system.

Table 10-7: Increase in Surface Water Runoff

Coom Green Energy Park

Catchment	Scenario	Catchment Area	Construction Area	Overland	New tracks (5m wide)	Widening of existing tracks	Hardstanding, Compound and Substation Area	Turbine Foundation	Total Run-off Imp. Area	Rainfall Intensity	Run-off	Increase in Run-off	Increase in Run-off
		ha	ha	ha	ha	ha	ha	ha	ha	mm/hr	m^3/s	m^3/s	%
Increase in run-off to Clyda_030	Existing	5378	0.72	0.72					**0.22**	18.8	0.01		
	Post Development			0.00	0.40	0.11	0.21	0.00	**0.32**	18.8	0.02		
	Increase in Run-off											**0.006**	**0.01**
Increase in run-off to Coom_010	Existing	1548	13.42	13.42					**4.03**	18.8	0.21		
	Post Development			0.00	4.05	0.42	8.85	0.10	**6.10**	18.8	0.32		
	Increase in Run-off											**0.108**	**0.45**
Increase in run-off to ROSS (KILLAVULLEN)_010	Existing	2092	0.00	0.00					**0.00**	18.8	0.00		
	Post Development			0.00	0.00	0.00	0.00	0.00	**0.00**	18.8	0.00		
	Increase in Run-off											**0.000**	**0.00**
Increase in run-off to Bride (Blackwater)_010	Existing	1758	9.73	9.73					**2.92**	18.8	0.15		
	Post Development			0.00	2.39	0.28	6.99	0.06	**4.41**	18.8	0.23		
	Increase in Run-off											**0.078**	**0.28**
Increase in run-off to Bride (Blackwater)_020	Existing	5989	4.88	4.88					**1.46**	18.8	0.08		
	Post Development			0.000	0.65	0.145	4.08	0.01	**2.20**	18.8	0.12		
	Increase in Run-off											**0.039**	**0.04**
Increase in run-off to Blackwater (Munster)_180	Existing	4020	0.43	0.43					**0.13**	18.8	0.01		
	Post Development			0.00	0.06	0.02	0.36	0.00	**0.19**	18.8	0.01		
	Increase in Run-off											**0.003**	**0.01**
Increase in run-off to Bride (Blackwater)_030	Existing	3934	0.00	0.00					**0.00**	18.8	0.00		
	Post Development			0.00	0.00	0.00	0.00	0.00	**0.00**	18.8	0.00		
	Increase in Run-off											**0.000**	**0.00**
Increase in run-off to Blackwater (Munster)_190	Existing	1794	0.00	0.00					**0.00**	18.8	0.00		
	Post Development			0.00	0.00	0.00	0.00	0.00	**0.00**	18.8	0.00		
	Increase in Run-off											**0.000**	**0.00**
											TOTAL INCREASE:	**0.234**	**0.06**

Notes: *Impervious factor for overland flow is 0.3. For tracks and hardstanding areas impervious factor of 0.45 is applied; for turbine foundation the runoff coefficient of 1.00 is applied.*

Rainfall Intensity for 1-in-100 year return period storm of 180 minutes duration supplied by Met Eireann.

10% increase is applied to rainfall intensity to allow for climate change. [14]

Q100 flow derived using the Modified Rational method Q=2.78 x (Rainfall Intensity) x (Contributing Impervious Area.)

[14] Greater Dublin Strategic Drainage Study – Regional Drainage Policies – Volume 5 Climate Change

The relatively low increase in run-off has however, the potential to cause soil erosion and consequent sediment release into the receiving watercourses. Possible potential impacts on surface water quality during tree felling and construction activities include:

- Increased sediment loading of streams from personnel and traffic activities.
- Standing water in excavations could contain an increased concentration of suspended solids as a result of the disturbance of the underlying soils.
- Haul roads passing close to watercourses could allow the migration of silt laden runoff into watercourses.
- Silt carried on the wheels of vehicles leaving the site could be carried onto the public road.
- Tree felling could lead to an increase in sediment and nutrients in the surface water runoff, if the brash is left in place in the riparian buffer zones.
- Small diameter cross-drains could lead to blockages and consequent flooding and concentration of flows.
- Suspended solids could potentially lead to siltation and physical effects on flora and fauna in aquatic habitats.
- Refueling activities could result in fuel spillages which could pollute underground and surface water.
- There is the potential for fuel spill/leaks from storage tanks which will be stored on site for plant machinery. Fuel spill/leaks could infiltrate underground and pollute underground water. Fuel spills/ leaks could be drained to watercourses and pollute them.
- Sanitary waste could lead to contamination of receiving waters and groundwater.
- Inappropriate site management of excavations could lead to loss of suspended solids to surface waters.
- Inappropriate management of the excavated material could lead to loss of suspended solids to surface waters.
- Inappropriate management of the drainage of material storage areas could lead to loss of suspended solids to surface waters. This could result in blockage of cross drains which could lead to flooding.
- Overland flow entering excavations could increase the quantity of surface water to be treated for sediment removal.
- Overland flows entering roadside drains could result in a concentration of flows and subsequent erosion of drains
- Grid connection and internal cable trenches could act as a conduit for surface water flows.
- The velocity of flows in roadside drainage could cause erosion in steeply sloping roadside drains.
- Runoff from the borrow pit area could be silt laden, with the risk of draining into receiving watercourses, given the exposed nature of the borrow pit areas due to the excavation and haulage of stone from the area.
- Flows from the new drainage system could be impeded, should blockages occur in the existing roadside drains.
- Open bodies of water and saturated ground present a risk to the safety of site personnel and the public.
- The construction of new infrastructure has the potential to obstruct existing overland flow.
- A blockage in the proposed roadside drains could allow a break out of silt laden runoff to reach adjacent watercourses or streams.
- Wet concrete could lead to contamination of receiving waters and groundwaters. Concrete and other cement-based products are highly alkaline and corrosive and can have significant negative impacts on water quality. They generate very fine alkaline silt (pH 11.5) that can physically damage fish.

- Proposed roadside drains on the uphill side of new roads will have to convey all of the contributing runoff from the land above resulting in large drains being required in certain areas and mixing of overland flow with runoff from construction works. This would reduce the efficiency of any proposed stilling ponds.

10.4.2.1 Grid Cable Route Installation and Horizontal Directional Drilling

The following potential impacts could result from the construction activities related to grid route installation and watercourse crossings:

- Cable trench could act as a conduit for surface runoff
- Excavated soil could be mobilised in the surface water runoff during an extreme rainfall event
- Inadequate storage of fuels and oils could lead to contamination of surface water
- The excavation of trenches for cable laying, and the launch and reception areas for directional drilling, could lead to silt laden surface water run-off
- Silt carried on the wheels of vehicles could be carried onto the public roads
- Refuelling activities could result in fuel spillage
- Suspended solids drained to watercourse could potentially lead to siltation and physical effect on flora and fauna
- Works leading to erosion of the river banks/bed could negatively impact on the fisheries habitat
- Drilling fluids could pollute watercourse
- Sediment laden runoff during the launch pit and reception pit excavation works.

Duration and significance of the impacts on hydrology and water quality associated with grid cable route installation and HDD are provided in Table 10-8.

10.4.2.2 Potential Impacts During Turbine Delivery

No modifications were identified as being required at the stream crossings. Therefore, it is not anticipated that turbine delivery will not have any significant hydrological impact.

Modifications along the TDR involves the temporary removal of street furniture and removal of some vegetation in addition to the temporary local widening at bends using hardcore material. Inappropriate management of the carrying out of these modifications could result in blockages of existing roadside drainage.

The general locations of accommodation works are shown in Figure 3-3 and identified as “TDR Nodes”. Significant works will be required at the Node 2.8 and at rotor turning area located approximately 2.9km southeast of the proposed entrance for ‘TDR – West’. A temporary hardstanding area is envisaged at these locations. The area of hardstanding is 0.13ha and 1.04ha respectively. The estimated increase in runoff due to installation of temporary hardstanding areas is 0.017 m^3/s (0.01%) for 1 in 100 years storm event. This storm event is rare and it has a momentary effect, therefore the estimated increase in runoff is not significant.

The location and nature of proposed temporary accommodation works are described in further detail in Chapter 13.

Temporary accommodation work is required to widen the bends as per delivery route report. These are small local areas, therefore it is not anticipated that this will have any significant hydrological impact.

10.4.2.3 Potential Impacts During Tree Felling

It is estimated that 62.8 ha in total of existing forestry will be felled to allowed for development of the proposed wind farm infrastructure.

The main potential impacts during tree felling process are release of sediments and nutrients in watercourses. Tree felling process require trafficking of heavy machinery which can lead to pollution of watercourses due to spillage of fuels and hydrocarbons.

10.4.2.4 Potential Impacts During Installation of Meteorological Masts

Two permanent meteorological (met) masts shall be erected on site at Bottlehill and Knockdoorty as shown on Figure 3.1. Prior to installation of met masts, construction of new access roads and removal of vegetation is required. The access roads will be smaller than that required for serving the wind turbine construction. Construction of new access tracks will result in imperceptible increase in runoff.

The installation of met masts will result in trafficking and usage of heavy machinery which could lead to fuel and hydrocarbon spillages.

Drainage infrastructure shall be put in place prior to commence of works. Dirty water from roads will be drained to swales which will be connected to settlement pond with a diffused outfall.

There will be small usage of concrete for foundations and anchoring. During concrete pouring there is potential of its spillage which could lead to surface and underground water pollution. Concrete and other cement-based products are highly alkaline and corrosive and can have significant negative impacts on water quality.
However, met masts are not located in the close proximity of the receiving waters.

Concrete operations shall be carried out in accordance with the CEMP.

The effects of impacts are expected to be of imperceptible significance on hydrology and water quality due to installation of met masts.

10.4.3 Potential Impacts During Operation and Maintenance

The main hydrological impact of the development is estimated increasing runoff of 0.234 m^3/s (or 0.06%) as discussed in Section 10.4.2. Due to the insignificance of the increase in runoff from the development, the grassing over the drainage swales and revegetation of other exposed surfaces, and the non-intrusive nature of site operations, there is a negligible risk of sediment release to the watercourses during the operational stage.

During the operation stage, small quantities of oil will be used in cooling the transformers associated with the facility. There is therefore a potential for small oil spills.

It is not envisaged that the operation period will involve significant impacts on the water quality of the area. There is a potential risk of some hydrocarbons polluting the watercourses following run-off from the impermeable trafficked areas.

10.4.4 Potential Impacts During Decommissioning

In the event of decommissioning of the development, activities would take place in a similar fashion to the construction phase. Potential impacts would be similar to the construction phase but to a lesser degree.

There would be increased trafficking and an increased risk of disturbance to underlying soils at the wind farm, during the decommissioning phase, in this instance, leading to the potential for silt laden run-off entering receiving watercourses from the wheels of vehicles.

Any such potential impacts would be likely to be less than during the construction stage as the drainage swales would be fully mature and would provide additional filtration of runoff. Any diesel or fuel oils stored on site would be bunded.

The decommissioning phase is described in Chapter 3 of this EIAR and these works will be subject to a decommissioning plan, to be agreed with Cork County Council. A decommissioning plan can be found in the CEMP in Appendix 3.1.

It is proposed that turbine foundations and hardstanding areas are left in place and covered with local topsoil and revegetated. Removal of this infrastructure would result in considerable disruption to the local environment in terms of an increased possibility of sedimentation. It is considered that leaving the turbine foundations hardstanding areas in-situ will cause less environmental damage than removing them.

Decommissioning site activities will require heavy machineries to dismantle turbines. Oil leakage from these machineries may infiltrate underground and pollute underground waters.

Grid connection cables will be left in the ground, therefore no potential impacts during decommissioning stage are likely to occur.

It is proposed that the internal site access tracks will be left in place, subject to agreement with Cork County Council and the relevant landowners.

10.4.5 Potential Impacts of a Risk of Flooding

A flood risk assessment (FRA) was prepared for this site, to determine the impact of increased hard surfaces from this development on downstream flooding. The flood risk identification and assessment are included in Section 10.5.

10.4.6 Potential Cumulative Impact

At present, the nearest wind farm developments in the vicinity of the Coom Green Energy Park include the existing Castlepook and Knocknatallig Wind Farms 25 km to the north and Boggeragh Wind Farm 30 km to the west. Due to the 'Not significant' significance of runoff and hydrological distance between Coom Green Energy Park and Castlepook, Knocknatallig and Boggeragh wind farms, no significant cumulative hydrology impact is envisaged.

Permitted turbine at Moneygorm consists of 1 no. turbine wind generator, associated crane hardstanding area, electrical substation and access tracks. The turbine is located approximately 1.0 km south of the proposed 110 kV substation at Lackendarragh North. The substation at Lackendarragh North and permitted turbine at Moneygorm are located within Bridge (Blackwater)_020 sub-basin.

The increase in runoff due to construction of the turbine at Moneygorm is expected to be negligible due to the construction of only one wind turbine and ancillary facilities. The planning permission was granted in February 2013[15], the likelihood of this development being constructed is low. According to the Table 10-7 only small portion of development is located within Bride (Blackwater)_020 sub-basin and increase in runoff is estimated to be 0.039 m^3/s (or 0.04%) for 1 in 100 years storm event. The increase in runoff within this sub-basin is negligible. Therefore, no significant cumulative impact is envisaged.

Castlepook and Knocknatallig Wind Farms are approximately 25 km north of the Coom Green Energy Park. Castlepook and Knocknatallig Wind Farms are hydrologically connected with Coom Green Energy Park. They are located within the catchment Blackwater (Munster). However, they are not within the same sub-catchment. Due to the distance between developments and insignificant increase in runoff due to the construction of the CGEP no significant cumulative hydrological impact is envisaged.

The Bottlehill Landfill is located within the western part of the site boundary. The Landfill has its own drainage system which is separated from Coom Green Energy Park drainage system.

Due to the imperceptible significance of runoff of Coom Green Energy Park and drainage system of the Landfill, no significant cumulative hydrological impact is envisaged.

Replant sites have been identified at Moneygorm, Co. Cork and Ballard, Co. Wicklow. Replanting has a positive effect on reducing greenfield velocities and reducing peak runoff and consequently soil erosion.

Replanting at Moneygorm will decrease greenfield runoff within Bridge (Blackwater)_020 sub-basin and soil erosion. The estimated increase in runoff within this sub-basin for 1 in 100 years storm event is 0.039 m^3/s according to Table 10-7. Therefore, the cumulative effect is positive and not significant.

Replanting site at Ballard is not located within the same catchment and are not hydrologically linked. Therefore, no significant cumulative impact is envisaged.

The construction activities related to the replant lands and construction of the developments addressed in this section have potential to additionally increase the release of suspended solids, pollutions and nutrients in the receiving bodies. Proposed mitigation measures are provided for each phase of the CGEP and for activities related to replant lands. It is expected that the addressed developments will have their own mitigation measures. Thus, the proposed mitigation measures are adequate to ensure no significant cumulative impact.

No other significant developments in the vicinity of the proposed development are identified.

10.4.7 Summary of Unmitigated Hydrological Impacts on Sensitive Receptors

A summary of unmitigated potential impacts due to the proposed development is provided in Table 10-8.

[15] http://www.pleanala.ie/casenum/241037.htm

Table 10-8 Summary of Potential Hydrological Impacts on Sensitive Receptors

Activity	Potential Impact	Receptor	Quality / Duration	Magnitude/ Probability	Significance
Construction Phase					
Site tracks, turbine construction, substations	Increase in rate of runoff	Surface waters	Negative/ Reversible	Negligible	Not Significant
Site tracks, crossings, HDD, cabling, turbine construction, crane pad construction, substation, tree felling, borrow pits and management of material storage areas	Release of suspended solids into watercourse	Surface waters	Negative/ Temporary	Medium	Significant
Installation of Met Mast, substation and turbines construction	Release of concrete and cement based products into watercourses	Surface waters	Negative/ Temporary	Low	Slight
Tree felling	Release of nutrients into watercourse	Surface waters	Negative/ Temporary	Medium	Slight
Site tracks, crossings, HDD, cabling, turbine construction, crane pad construction, sub-station, tree felling and management of material storage areas	Release of hydrocarbons or fuel spill	Surface waters	Negative/ Brief	Low	Not significant
Drainage crossings, turbine hardstanding areas, substations, temporary compounds, borrow pits	Obstruct hydrological flow	Surface waters	Negative/ Reversible	Low	Not significant

Activity	Potential Impact	Receptor	Quality / Duration	Magnitude/ Probability	Significance
Operation & Maintenance					
Site access tracks, turbine hardstanding areas, substations	Increase in rate of runoff	Surface waters	Negative/ Reversible	Negligible	Imperceptible
Site access tracks, turbine hardstanding areas, substations	Erosion and sedimentation	Surface waters	Negative/ Temporary	Negligible	Imperceptible
Decommissioning					
Use of equipment for dismantling and removing turbine components	Release of hydrocarbons or fuel spill	Surface waters	Negative/ Temporary	Low	Not significant
Use of equipment for dismantling and removing turbine components	Release of suspended solids into watercourse	Surface waters	Negative/ Temporary	Low	Not significant

It can be observed from Table 10-8 that the impact of activities during the construction of CGEP, if unmitigated, would be 'Not significant' on receiving watercourses in terms of an increase in runoff. The risk of sedimentation in sensitive catchments has the potential to have a 'Significant' impact.

As discussed in Section 10.2.4.1, the hydrological environment of the CGEP is considered to be of 'high' sensitivity for receptors draining to the to the Bride River. The effects of the increase in runoff has negligible magnitude on receiving waters because estimated increases in runoff are low compared to the flows of receiving waters. Thus, the significance of the increased runoff is "Imperceptible'.

The release of sediments has 'Medium' magnitude on receiving waters. Therefore, the impact is of 'Significant' significance. During construction activities there is a low possibility of fuel spillage and release of hydrocarbons being released from plant. These volumes are likely to be small, therefore the significance is 'Not significant'.

Operation and maintenance and decommissioning activities are not expected to have a significant effect on the receiving watercourses.

The impact on hydrology and water quality will be reduced by implementing measures discussed in Section 10.6 and 10.7.

10.5 Flood Risk Identification and Assessment

As part of the flood risk identification the following elements of the project were assessed:

- Existing and proposed crossings within the site boundary and crossings downstream of the site
- Turbine delivery
- Grid connection route.

The cumulative impact on the flood risk of the replant land is also assessed.

10.5.1 Methodology

As discussed in Section 10.3.2 the access road between turbine T9 and T14 crosses indicative flood zone. In order that flood flows would not be obstructed, the proposed new crossings will be sized to convey a 1 in 100-year flood with a 20% allowance for climate change.

The flow capacity of crossing structure will be calculated for crossings located downstream of the wind farm. These crossings structures are 2 culverts (WC043 and WC044) and one bridge (WC045).

Existing and proposed crossings within the site and downstream of the site

As part of the flood risk assessment, calculations were completed for the existing culvert (WC028) on the Toor River, for the new crossing over the Toor River (WC027) and proposed new crossings as discussed in Section 10.5.2.

In order that flood flows would not be obstructed, the crossings were assessed to convey a 1 in 100-year flood event with a 20 % allowance for climate change.

A hydrological assessment was conducted using two methods of flow estimation for catchments less than 25km^2, to determine the 1 in 100-year flow at the proposed new crossing:

- Institute of Hydrology (IOH) 3-variable equation method (IH 124), where Q_{BAR} is multiplied by the appropriate design factor (standard error factor) which is 1.65.
- Flood Studies Supplementary Report (FSSR) 3-variable equation method, with a standard error factor of 1.5.

The greatest flow determined from the two methods was then multiplied by the regional growth factor of 1.96 to obtain the 100-year peak flow value. To accommodate the effect of future climate change in Ireland, the 100-year peak flow value was then multiplied by 1.2 to get the design 100-year flood value at the crossing. [16]

Turbine delivery route

As discussed in Section 10.3.8 no modifications are required at stream crossing infrastructure. The general locations of accommodation works are shown in Figure 3-3 and identified as "TDR Nodes". Significant works will be required at the Node 2.8. A temporary hard standing area is envisaged at this location. The area of hard standing is 0.13 Ha. The estimated increase in runoff due to its installation is 0.009 m^3/s for 1 in 100 years storm event. This storm event is unlikely to happen while the temporary works are in place, and it has a momentary effect, therefore the estimated increase in runoff is not significant.

Temporary accommodation works are required to widen the road bends. The total area of temporary road widening is approximately 0.45 Ha. This equates to 0.029 m^3/s increase in runoff for 1 in 100 years storm event. The temporary road widening area is small compared to hardstanding and substations areas. It will be in place for a short period of time and it is not concentrated in one point. Therefore, it is not anticipated that this will have any significant hydrological impact due increase in runoff. Therefore, no impacts on the flood risk is expected.

Grid connection route

The increase in runoff due to grid cable installation is not expected because the finished surfaces are not changed. Therefore, no impacts on the flood risk is envisaged.

10.5.2 Flood Flow Conveyance

The approximate catchment area and the flood flow estimated for 1 in 100 years flow including an allowance for climate change for each crossing is included in Table 10.9.

The existing crossings are assessed to determine if they are adequate to take the design flow. It is estimated that the existing crossing WC028 is not adequately sized to take the 1 in 100 year design flow.

Calculation of culvert design flow and its capacity is provided in Table 10.9.

Photos of crossings are provided in Appendix 10.2.

[16] Greater Dublin Regional Code of Practice for Drainage Works

Table 10.9: Preliminary Culvert Sizing[17]

Location	AREA	SAAR	SOIL	IH 124			FSSR 6 3-Term Equation			Max. Design 100 yr Flood	Comment
				Q_{BAR}	Q_{100}	Increase by 20% for Climate Change	Q_{BAR}	Q_{100}	Increase by 20% for Climate Change		
	km^2	mm	-	m^3/s	m^3/s		m^3/s	m^3/s		m^3/s	mm
WC024	0.34	1179	0.40	0.22	0.72	0.86	0.22	0.64	0.77	0.86	New box culvert - 900mm x 900mm
WC025	0.27	1179	0.40	0.18	0.59	0.70	0.18	0.52	0.63	0.70	New box culvert - 900mm x 900mm
WC027	2.20	1179	0.40	1.17	3.79	4.55	1.22	3.59	4.31	4.55	New box culvert, 2000mm x 1200mm + freeboard + embedment
WC028	0.52	1179	0.40	0.32	1.05	1.26	0.32	0.95	1.14	1.26	Existing 600 mm circular concrete culvert does not meet required flow capacity. Reconstruction required, box cuvert 1200mm x 900mm + freeboard+embedment
WC049	0.08	1168	0.40	0.06	0.19	0.22	0.05	0.16	0.19	0.22	New box culvert - 900mm x 900mm
WC050	0.29	1165	0.40	0.19	0.61	0.73	0.19	0.54	0.65	0.73	New box culvert - 900mm x 900mm

Note:

Catchment area is determined from OPW FSU web portal.

SAAR is provided from Met Eireann.

SOIL type index is determined from FSR Maps.

Flows include for climate change (20%) and standard factorial error.[18]

Calculation of preliminary design dimensions provided in Appendix 10.3.

[17] Refer to Figure 10-6 for locations.

[18] Greater Dublin Regional Code of Practice for Drainage Works

10.5.3 Flood Zones

As discussed in Section 10.3.2, no turbines, hardstanding areas and substations are located within flood Zone A or Flood Zone B. The proposed access track between turbines T9 and T14 and grid connection route will cross an area identified by OPW PFRA mapping as an indicative floodplain.

Only small part of the access roads of the development is located within 'Flood Zone A' as shown on Figure 10-3. Those elements of infrastructure are not sensitive to localised infrequent flooding. Crossing structure WC027 over the Toor River is designed to convey 1 in 100 year flows with additional climate change allowance.

10.5.4 Estimated Increase in Flood Risk

The estimated increase in runoff due to the construction of the wind farm is provided in Table 10-7. Although the increase in runoff is found to be of low significance (overall 0.234 m^3/s (or 0.05 %)), a predictive assessment was carried out at the watercourse crossings downstream of site boundary. The location of analysed crossings is shown on Figure 10-6.

As part of the flood risk assessment, the greenfield design flow for a 1 in 100-year return period was estimated using two methods of flood estimation for catchments less than 25 km^2, to determine the 1 in 100-year flood at the location of the crossing structure.

The two methods to estimate greenfield runoff are:

- Institute of Hydrology (IOH) 3-variable equation method, where Q_{BAR} is multiplied by the appropriate design factor (standard error factor) which is 1.65.
- Flood Studies Supplementary Report (FSSR) 3-variable equation method, with a standard error factor of 1.5.

The greatest flow determined from the two methods was then taken and multiplied by the regional growth factor of 1.96 to obtain the 100-year peak flow value. To accommodate the effect of future climate change in Ireland, the 100-year peak flow value was then multiplied by 1.2 to get the design 100-year flood value at the crossing.[19]

The increase in flow due to the proposed development was then estimated within the sub-catchments upstream of these structures. The pre and post development flows were then analysed for their impact on the capacity of the structure at the downstream crossing.

The flow calculations are set out in Table 10.10Table 10.10.

[19] Greater Dublin Regional Code of Practice for Drainage Works

Table 10.10: Q_{100} Flows at Downstream Structures[20], Pre and Post Construction

Location		WC043	WC044	WC045	
AREA		3.49	6.48	14.07	km^2
SAAR		1185	1190	1193	mm
SOIL		0.40	0.40	0.40	-
IH 124	Q_{BAR}	1.78	3.10	6.19	m^3/s
	Q_{100}	5.74	10.01	20.01	m^3/s
	Increase by 20% for Climate Change	6.89	12.02	24.02	m^3/s
FSSR 6	Q_{BAR}	1.87	3.33	6.82	m^3/s
	Q_{100}	5.51	9.80	20.04	m^3/s
	Increase by 20% for Climate Change	6.61	11.76	24.05	m^3/s
Max. Design 100 yr Flood		6.89	12.02	24.05	m^3/s
Estimated Increase in Design 100y flow due to Development		0.08	0.08	0.11	m^3/s
Post Development Design 100yr Flow		6.97	12.10	24.16	m^3/s

Note:

Catchment area is determined from OPW FSU web portal.

SAAR is provided from Met Eireann.

SOIL type index is determined from FSR Maps. Soil Type 3.

Climate change allowance is 20%.[21]

The estimated increase in runoff due to development is provided in Table 10.7. of this EIAR

The estimated increase in runoff to the Toor River is 75% of total increase in Coom_010 sub-basin.

10.5.4.1 Toor River – Crossing WC043

The structure crossing over Toor River is a clear single span bridge 3200 mm wide and 900 mm high.

A hydraulic analysis of the crossing structure was undertaken using Pipe Flow Advisor software to determine the capacity of the crossing structure, pre and post development.

It was found that in the existing scenario, the bridge meets required capacity to convey 1 in 100 years design flow. The design flow for pre development scenario is 6.89 m^3/s and for post development flow is 6.97 m^3/s. Water depth at the bridge location might increase from 726 mm to 731 mm due to development. The estimated increase in water depth at the crossing structure is 5 mm. The freeboard height for the pre works scenario is 174 mm and for the post works scenario is 169 mm. The estimated flow capacity is 8.73 m^3/s.

[20] Refer to Figure 10.6 for locations

[21] Greater Dublin Regional Code of Practice for Drainage Works

Any potential for an increase in flooding is therefore expected to be of low significance. The surrounding area is not expected to be flooded and this is consistent with OPW flood mapping. Further, this exercise does not take into account the mitigation proposed in the drainage design to reduce flows.

The calculations and results of the modelling are included in Appendix 10.3.

10.5.4.2 Toor River - Crossing WC044

The structure crossing over Toor River is a clear single span bridge 3850 mm wide and 700 mm high.

A hydraulic analysis of the crossing structure was undertaken using Pipe Flow Advisor software to determine the capacity of the crossing structure, pre and post development.

It was found that in the existing scenario, the bridge meets required capacity to convey 1 in 100 years design flow.

The design flow for pre development scenario is 12.02 m^3/s and for post development flow is 12.10 m^3/s. Water depth at the bridge location might increase from 628 mm to 632 mm due to development. The estimated increase in water depth at the crossing structure is 4 mm. The freeboard height for the pre works scenario is 72 mm and for the post works scenario is 68 mm. The estimated flow capacity is 13.07 m^3/s.

Any potential for an increase in flooding is therefore expected to be of low significance. The surrounding area is not expected to be flooded and this is consistent with OPW flood mapping. Further, this exercise does not take into account the mitigation proposed in the drainage design to reduce flows.

The calculations and results of the modelling are included in Appendix 10.3.

10.5.4.3 Coom River - Crossing WC045

The structure crossing over Coom River is a clear single span bridge 6400 mm wide and 4500 mm high.

A hydraulic analysis of the crossing structure was undertaken using Pipe Flow Advisor software to determine the capacity of the crossing structure, pre and post development.

It was found that in the existing scenario, the bridge meets required capacity to convey 1 in 100 years design flow.

The design flow for pre development scenario is 24.05 m^3/s and for post development flow is 24.16 m^3/s. Water depth at the bridge location might increase from 970 mm to 973 mm due to the proposed development. The estimated increase in water depth at the crossing structure is 3 mm. The freeboard height for the pre works scenario is 3530 mm and for the post works scenario is 3527 mm. The estimated flow capacity of the bridge is 334.22 m^3/s.

Any potential for an increase in flooding is therefore expected to be of low significance. The surrounding area is not expected to be flooded and this is consistent with OPW flood mapping. Further, this exercise does not take into account the mitigation proposed in the drainage design to reduce flows.

The calculations and results of the modelling are included in Appendix 10.3.

10.5.5 Essential Infrastructure

Essential Infrastructure is defined in Table 3.1 of *The Planning System and Flood Risk Management Guidelines for Planning Authorities, OPW, November 2009*, as 'Primary transport and utilities distribution, including electricity generating power stations and substations, water and sewage treatment, and potential significant sources of pollution (SEVESO site, IPPC sites, etc.) in the event of flooding'. The proposed substation in this development therefore comes under the category of 'Essential Infrastructure'.

The proposed substations are outside the Flood Zone A and B areas as shown on Figure 10-3.

10.5.6 Summary of Flood Risk Identification and Assessment

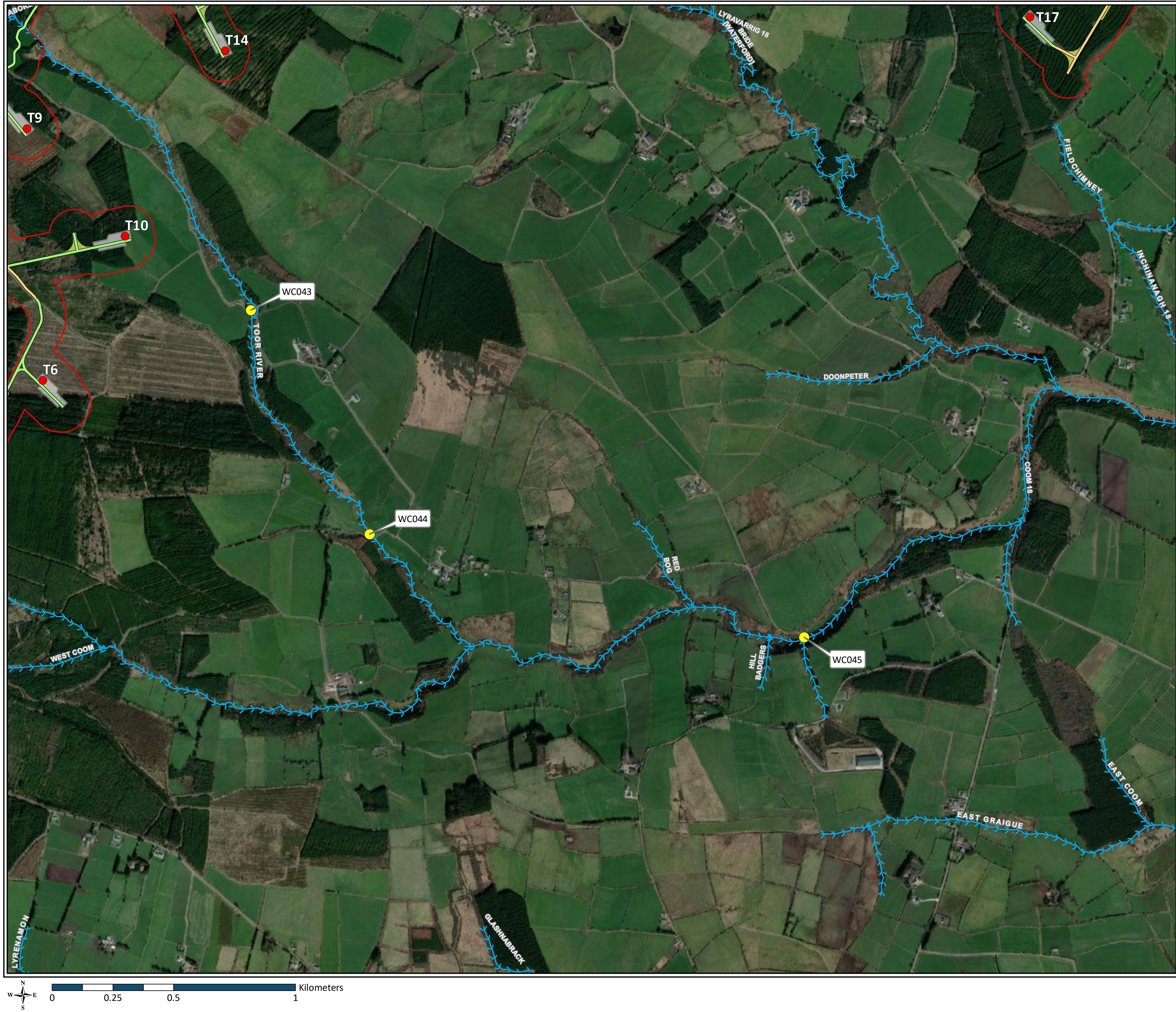
A flood risk assessment has been undertaken for this development which concludes that the proposed development has a minimal impact on flooding risk in the surrounding area.

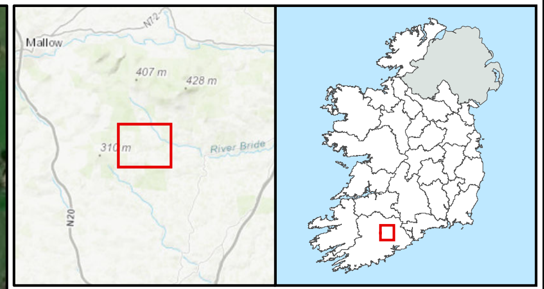
It was found that highest estimated increase in water (5 mm) is at the location WC043, and the lowest estimated increase in water (3 mm) at the location WC045 as stated above. The impact of development on the increase in water depth reduces, the further downstream the location of the analysed crossing. This is consistent with hydrology characteristics.

As discussed in Section 10.4.2,1, the increased surface water runoff due to development is negligible and these flows are further reduced with the proposed drainage system. Increase in the water elevation at the locations of crossing, as discussed in Section 10.5.4, is also negligible. Therefore, the proposed development has a minimal impact on flooding risk in the surrounding area.

According to flood mapping the grid route crosses the flood zone as shown on Figure 10-3. The increase in runoff due to grid cable installation is not expected because the finished surfaces are not changed. Therefore, no impacts on the flood risk is expected.

Path: R:\Map Production\2020\P20-099\Workspace\EIAR\PP20-099_GIS_Fig10-6_FRA_LocationsOfCrossings_A3.mxd





- Crossings
- Proposed Turbine Layout
- Proposed Permanent Met Masts
- Proposed Cable Route
- Proposed Development Boundary
- Existing Road
- Proposed Existing Road Upgrade
- Proposed New Road
- Proposed Turning Heads and Passing Bays
- Proposed Turbine Hardstanding Area
- Proposed Borrow Pit
- Proposed Temporary Compound
- Proposed Substation
- Rivers

TITLE: Flood Risk Assessment - Location of Crossings

PROJECT: Coom Green Energy Park, Co. Cork

FIGURE NO:	10.6		
CLIENT:	Coom Green Energy Park Ltd.		
SCALE:	1:15000	**REVISION:**	0
DATE:	01/10/2020	**PAGE SIZE:**	A3

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10.6 Proposed Drainage

The proposed drainage for the subject development has been addressed by the potential impacts, discussed in Section 10.4 and it has also been addressed by the flood risk assessment undertaken in Section 10.5. In addition to draining the development, the drainage design has the capacity to introduce hydrological links from the proposed development to the receiving environment.

An appropriate drainage design will be the primary mitigation measure for the subject development which will incorporate silt protection control measures and reduce the rate of surface water runoff from the proposed development. The proposed drainage for the Coom Green Energy Park is set out below.

The mitigation measures that follow in Section 10.7 refer to the drainage design and also include other best practice measures to mitigate any potential impacts from the development.

The proposed layout of the drainage for the development is shown in the Surface Water Management Plan (SWMP). Where possible, existing access roads and tracks have been utilised in the layout design for the proposed development to minimise the disturbance to soils.

The following types of surfaces are considered on this site in addressing the drainage for the proposed development:

1) existing hardcore tracks and surfaced access roads which might be widened
2) proposed new site access tracks and hard standings associated with the construction of turbines
3) proposed on-site substations
4) temporary site compounds
5) borrow pits

10.6.1 Interceptor Drains

It is not expected that overland flows will be obstructed to any great extent by the drainage layout, however, where required, interceptor drains will collect overland flows on the upslope side of the access tracks and hardstanding areas. The overland flow will then discharge diffusely on the downslope side over vegetated areas within the site boundary.

Existing forest track drainage is extensive throughout the site and shall be maintained wherever possible and upgraded as required to meet the requirements of the proposed CGEP drainage design. SuDS design approach shall ensure that existing drainage patterns shall be maintained throughout the site.

10.6.2 Existing Hardcore Tracks and Surfaced Access Roads

The drainage system for the existing tracks and roads will largely be retained. During the site walkover it was observed that most of the existing tracks were approximately 4 m wide. It is proposed to widen approximately 9.8 km of existing roads by approximately 1 m, with some additional widening at bends. All track widening will be undertaken using clean uncrushable stone with a minimum of fines. This will involve slight relocation of existing roadside drains to allow widening.

Still traps will be placed in the new roadside swales. Details of a silt trap are included in Appendix 10.4.

10.6.3 New Site Access Tracks and Hard Surfaces

It is proposed to construct approximately 15.1 km of completely new access track. Proposed new tracks and turbine hard standing areas will be drained as per the existing drainage system via roadside swales with stilling ponds at the end of the swale. These grassed swales will serve to detain flow and reduce the velocities of surface water flows. The swales will be 0.3 m deep with a bottom width of 0.5 m and side slope of 1 in 3. The swales will be constructed in accordance with CIRIA C698 Site Handbook for the Construction of SuDS.

Where roadside drains are laid at slopes greater than 2%, check damns will be provided. This will reduce effective slope and runoff velocities and any consequent potential for erosion.

Site drainage, including silt traps and stilling ponds, will be put in place in parallel with or ahead of construction, such that excavation for new infrastructure will have functional drainage system in place.

The stilling ponds will remain in place during construction phase. The stilling ponds will drain diffusely overland, over existing vegetated areas, within the site boundary. The stilling ponds will be filled in and the swales that were connected to them will be re-connected to the outfall once construction is completed.

The number of stilling ponds, dimensions and their locations are provided in the SWMP.

Silt fencing will be provided at strategic locations to further protect watercourses during the construction phase. The details on fencing are included in Appendix 10.4.

10.6.4 Proposed Watercourse Crossings

The proposed development layout will have 9 stream crossings within the site boundary. These crossings are listed in Table 10-11 and shown on Figure 10-5.

Existing crossing WC028 will be replaced with box culvert of minimum 1200 mm width and 400 mm height, with additional height required for embedment and freeboard. There will be one new proposed watercourse crossing WC024 over the unnamed tributary of the Coom River and one new proposed crossing WC025 over the Coom River required as a result of the development. There will be one new proposed watercourse crossing WC027 over the Toor River required as a result of the development.

The size of the stream crossings is estimated as part of the flood risk assessment. A summary of the culvert sizing is provided in Section 10.5.

A Section 50 application will be required to obtain the consent of the OPW for the construction of the stream crossing at WC025, WC027 and for replacement of the existing culvert WC028. The IFI were consulted at the planning stage and were satisfied with the proposed crossing structure.

Minor drains such as manmade agricultural and forest drains will be crossed using 450mm diameter pipes. Where cross drains are to be provided to convey the drainage across the track, the recommended sizes of these cross drains are 225 mm diameter pipes.

Silt Protection Controls (SPCs) are proposed at the location of the drain crossings. SPCs will consist of a minimum of silt traps containing filter stone and filter material staked across the width of the swales and upstream of the outfall to any watercourse.

Some drain clearing will be required at existing crossings, where they have become blocked, to maintain the continuity of flows. These existing pipes may need replacing if they are found to be in a collapsed state.

Table 10-11: Existing Internal Site Stream Crossings

Feature ID	ITM_X	ITM_Y	Existing/ Proposed	Feature/Activity	Proposed Method of Crossing
WC024	563175.65	589720.58	Prop	Grid cable crossing and proposed new access track crossing over the unknown tributary of the Coom River	New Crossing. Box culvert 900mm x 900mm. Cable over the culvert
WC025	563250.25	589754.30	Prop	Grid cable crossing and proposed new access track crossing over the tributary of the Coom River	New Crossing. Box culvert 900mm x 900mm. Cable over the culvert
WC027	564133.20	591667.40	Prop	Grid cable crossing and proposed new access track crossing over the Toor River	New Crossing. Box culvert 2000mmx1100mm + freeboard + embedment, cable over the culvert
WC028	564171.10	591981.30	Ext	Grid cable and proposed new access track crossing over the Toor River	Replace existing pipe with a box culvert of min 1200mmx400mm + freeboard + embedment, cable over the culvert
WC030	568492.90	592029.20	Ext	Grid cable and existing forestry track crossing over the forestry ditch, tributary of the Inchinanagh stream	Standard trench crossing above or below existing culvert.
WC031	568375.20	593820.90	Ext	Grid cable and existing forestry track crossing over the forestry ditch, in the proximity of the turbine T35	Standard trench crossing under existing service. Pipe to be extended to facilitate widening of existing access road or replaced with suitable pipe of same or greater diameter
WC035	569019.61	593940.22	Ext	Grid cable and existing forestry track crossing over the forestry ditch, in the proximity of turbine T20	Standard trench crossing under existing service. Pipe to be extended to facilitate widening of existing access road or replaced with suitable pipe of same or greater diameter.

Feature ID	ITM_X	ITM_Y	Existing/ Proposed	Feature/Activity	Proposed Method of Crossing
WC049	568425.66	593132.46	Prop	Grid cable and proposed new access track crossing over drain east of turbine T19	New Crossing. Box culvert 900mm x 900mm. Cable over the culvert
WC050	570093.25	594420.14	Prop	Grid cable and proposed new access track crossing over drain north of turbine T23	New Crossing. Box culvert 900mm x 900mm. Cable over the culvert

10.6.5 Drainage of On-site Substation

The proposed locations of the two substations are shown on Figure 10-6. It is proposed to drain the substation using shallow swales, with a stilling pond at the end of the swale run. The stilling pond will remain in place following the construction period.

At the upslope side of the substation, interceptor drains will be installed.

The runoff from roofs will be collected to water harvesting tanks. Wastewater will drain to a tank which will be regularly emptied and maintained. More details are provided in SWMP.

A suitable permanent petrol and oil interceptor will be installed to deal with all substation surface water drainage. A suitable unit is shown in SWMP.

10.6.6 Drainage of Temporary Site Compound

The site layout consists of 3 temporary site compounds as shown on Figure 10-6. The compounds are set back from the drains.

Drains around the hardstanding areas of the site compound will be in the form of shallow grassed swales to minimise the disturbance to sub-soils.

Surface water runoff from the compound will be directed through a Class 1 Full Retention Oil Interceptor before discharge to the ‘dirty’ water drainage system for the site. This ‘dirty' water drain flows to a stilling pond before final discharge over land.

During the construction phase, it will be necessary to provide bottled water for potable supply for the construction personnel. A water tanker will supply water used for other purposes.

Portaloo and/or containerised toilets and welfare units with storage tanks will be used to provide toilet facilities for site personnel during construction.

All portaloo units located on site during the construction phase will be operated and maintained in accordance with the manufacturer’s instructions and will be serviced under contract with the supplier. All such units will be removed off-site following completion of the construction phase.

10.6.7 Drainage of Borrow Pits

The proposed borrow pits are located as shown on Figure 10-6. The borrow pits are set back a minimum 320 m from any streams. At the upslope of the borrow pit interceptor drains will be installed. It is proposed to drain the borrow pits to stilling ponds.

The site drainage system will be put in place prior to excavation, therefore the discharge routes from any temporary stockpiling will be via the site drainage system as detailed in the planning drawings. There will be no permanent stockpiling of material on the site.

10.7 Proposed Mitigation Measures

10.7.1 Proposed Mitigation Measures for the Construction Stage

Proposed drainage measures to reduce, and protect the receiving waters from, potential impacts during the construction of the proposed development are as outlined in Section 10.6. These include measures to prevent runoff erosion from vulnerable areas and consequent sediment release into the nearby watercourses to which the proposed development site drains. Further details on mitigation measures are included in CEMP and SWMP documents.

The mitigation measures are outlined below.

- The increase in the rate of runoff along the route of the site access roads and hardstanding areas will be mitigated by the proposed drainage system which includes provision of stilling ponds to reduce concentration of suspended solids in the runoff from these areas. This has been further mitigated by avoidance through design, in the utilisation of existing tracks and existing drainage systems where possible. A minimum buffer of 50m from watercourses has been adopted, where possible, for all new site tracks that run parallel to a watercourse, with the existing tracks being widened in their existing locations.
- There is one location where proposed access and drainage infrastructure (in the vicinity of T17) are located within 50m of an existing drain. This flows into the Chimneyfield Stream which subsequently joins the River Bride. Due to the proximity of this infrastructure to a waterbody which flows into a downstream SAC, Blackwater River (Cork/Waterford), specific details of silt management mitigation measures for this area have been detailed in the CEMP. This includes proposed locations of temporary construction stage silt management infrastructure.
- Stilling ponds with a diffuse outflow detail will be put in place in advance as construction progresses across the site. Erosion control and retention facilities, including stilling ponds will be regularly maintained during the construction phase. The three-stage treatment train (swale – stilling pond – diffuse outflow) proposed to retain and treat the discharges from hard surface areas as a result of the development will reduce any risk of flooding downstream.
- A water quality monitoring programme will be established to ensure that water quality is maintained throughout the construction phase. The details of this programme are outlined below. This programme will ensure that designed measures including stilling ponds are working, and existing water quality is maintained.
- Where haul roads pass close to watercourses, silt fencing will be used to protect the streams.
- Silt traps will also be provided at outfalls from roadside swales to stilling ponds.
- A suitably qualified person will be appointed by the developer to ensure the effective operation and maintenance of drainage and other mitigation measures during the construction process. The operations management of the subject development will include regular monitoring of the drainage system and maintenance as required.
- Standing water, which could arise in excavations, has the potential to contain an increased concentration of suspended solids as a result of the disturbance to soils. The excavations for turbines will be pumped into the site drainage system (including stilling ponds), which will be constructed at site clearance stage, in advance of excavations for the turbine bases.
- Drains around hardstanding area will be shallow to minimise the disturbance of sub soil.
- The developer will ensure that erosion control, namely silt-traps, silt fencing, swales, stilling ponds and diffuse outflow areas are regularly maintained during the construction phase.

- Interceptor cut-off drains will be provided on the upslope side of the access roads to prevent the mixing of overland flows with the drainage for the proposed development. These interceptor drains will discharge diffusely over land to avoid concentration of runoff. The roadside drains will therefore only carry the site access road runoff and so avoid carrying large volumes of water and concentrating flows.
- Interceptor cut-off drains will be provided around borrow pits to divert overland flow to the nearest watercourse and prevent it from entering the borrow pits.
- Cross drains of 450 mm will be provided to prevent a risk of clogging for drainage crossings and conveying flow from agricultural drains and forestry drains under access track roads.
- Where new cross-drains are proposed on this site to convey surface water from roadside swales to stilling ponds, these will be sized at a minimum of 225 mm diameter to avoid blockages.
- Roadside swales will serve to attenuate any increase in surface water runoff.
- Silt fencing will be erected at the locations of the drain crossings for the duration of the construction period.
- All open water bodies adjacent to proposed construction areas will be protected by fencing including the proposed stilling ponds.
- Excavated subsoil material not required for in-site reinstatement will be removed to the designated material storage areas at the borrow pit locations.
- Site access tracks have been laid out to reduce longitudinal slope of roadside drains where possible. Where roadside drains are laid at slopes greater than 2%, check damns will be provided. This will reduce effective slope and runoff velocities and any consequent potential for erosion.
- Where agricultural tracks and forestry roads will be used to access the development, the roadside drains alongside these roads will be cleared of obstructions, should it be found that debris and vegetation are impeding flows.
- Any diesel, fuel or hydraulic oils stored on site will be stored in bunded storage tanks – the bund area will have a volume of at least 110 % of the volume of such materials stored.
- Refueling of plant during construction will only be carried out at designated refueling station locations on site.
- Prior to leaving the site, every truck delivering concrete to the site must wash the chute only to a lined pit provided at each turbine location.
- Silt fencing will be erected at the location of stream crossings along the cable route.
- Cables will be installed in trenches adjacent to the site access roads, or laid within the access road line, where required. Trenches will be excavated during dry periods in short sections and left open for minimal periods, to avoid acting as a conduit for surface water flows.
- The temporary storage of excavated material on site will be put at least 50 m from watercourses.
- Wet concrete operations are not required for this site within or adjacent to watercourses.
- Portaloos and/or containerised toilets and welfare units will be used to provide toilet facilities for site personnel. Sanitary waste will be removed from site via a licenced waste disposal contractor.
- Emergency drip trays and spill kits will be kept available on site, to ensure that any spills from vehicles are contained and removed off site. The emergency response procedure is provided in section 1.8 of SWMP.

All of the mitigation measures detailed above will ensure that the water quality status of the receiving waterbodies is not affected by the proposed development.

Proposed Mitigation Measures for Installation of New Crossings

- A suitably qualified person will be appointed by the developer to ensure the effective operation and maintenance of drainage and other mitigation measures during the construction process. The operations management of the subject development will include regular monitoring of the drainage system and maintenance as required.
- All open water bodies adjacent to proposed construction areas will be protected by fencing.
- Weather warnings will be monitored, and no construction will take place during extreme events to mitigate against potential flooding.
- Excavated subsoil material not required for in-site reinstatement will be removed to the designated material storage areas at the borrow pit locations.
- Any diesel, fuel or hydraulic oils stored on site will be stored in bunded storage tanks – the bund area will have a volume of at least 110 % of the volume of such materials stored.
- Refueling of plant during construction will only be carried out at designated refueling station locations on site.
- Additional protection will be provided in the form of silt fencing downslope during construction, to further ensure that there is no impact from the development to streams and rivers downslope of the site.
- Daily visual inspections of drains and streams will be performed during the construction period to ensure suspended solids are not entering the streams and rivers alongside the work area, to identify any obstructions to channels, and to allow for appropriate maintenance of the existing roadside drainage regime.

Water Quality Monitoring Programme

A monitoring programme will be established to ensure that water quality is maintained. The details of this programme are outlined below. This programme will ensure that designed measures are working, and water quality is not affected.

An Environmental Manager will be on-site during construction to monitor water quality. Turbidity meters will be installed prior to construction downstream of the site. Levels of turbidity were monitored pre-construction to determine existing levels in the waterbodies. Should the turbidity levels measured during construction be higher than the existing levels, construction will be stopped, and remediation measures will be put in place immediately, to include silt fencing.

Water samples will be taken monthly during ground disturbance works and will include measurement of the parameters provided in Table 10-12 below.

Table 10-12: Surface Water Quality Monitoring Parameters

Parameter	Maximum Value	Regulation
Turbidity	-	-
pH	6.0 < pH < 9.0	Surface Water Regulations 2009
BOD	High Status < 1.3 (mean) or <2.2 (95%ile) Good Status <1.5 (mean) or < 2.6 (95%ile)	Surface Water Regulations 2009
Total Suspended Solids (mg/l)	<25	Salmonid Water Regulations 1988
Total Ammonia (mg/l N)	High Status < 0.04 (mean) or <0.09 (95%ile) Good Status <0.14 (mean) or < 0.065 (95%ile)	Surface Water Regulations 2009
Nitrite (NO_2) (mg/l)	<0.05	Salmonid Water Regulations 1988
Molybdate Reactive Phosphorus (mg/l P)	High Status < 0.025 (mean) or <0.045 (95%ile) Good Status <0.035 (mean) or < 0.075 (95%ile)	Surface Water Regulations 2009

10.7.1.1 Proposed Mitigation Measures for Grid Cable Installation

The following mitigation measures are proposed during construction stage:

- Weather warnings will be monitored, and no construction will take place during extreme events to mitigate against potential flooding.
- Mitigation measures will be provided where surface water flows may be temporarily prevented from reaching gullies during trench excavation. Mitigation measures will include the provision of temporary over ground surface water channels using sand bagging for example to divert flows to downstream gullies.
- Trenches will be excavated during dry periods where possible in short sections and left open for minimal periods, to avoid acting as a conduit for surface water flows.
- Any excavated material will be used in the reinstatement of the cable trenches subject to approval. Surplus material will be removed from the site to an appropriate licenced facility. There will be no stockpiling of excavated material. For trenching within the domain of public roads, approved fill material will be imported in accordance with the method statement described in Section 3.
- All excavated soil material will be managed on site in accordance with the CEMP.
- Silt fencing will be provided around any exposed areas to prevent the ingress of suspended solids into adjacent watercourses. These mitigation measures will prevent surface water contamination and will prevent subsequent flows of contaminated water into watercourses.

- Additional protection will be provided in the form of silt fencing downslope where required during construction, to further ensure that there is no impact from the development to streams and rivers downslope of the site.
- Daily visual inspections of drains and streams will be performed during the construction period to ensure suspended solids are not entering the streams and rivers alongside the work area, to identify any obstructions to channels, and to allow for appropriate maintenance of the existing roadside drainage regime.

10.7.1.2 Proposed Mitigation Measures for Horizontal Directional Drilling (HDD)

The proposed mitigation measures during HDD are listed below:

- An Environmental Engineer with a "stop work" authority will be engaged to monitor the construction phase of the development when the water crossing is being undertaken.
- The working area around the bridge/culvert crossings will be fenced off prior to the commencement of works to avoid damage to bankside habitat
- Watercourses will be visually inspected
- Should increase levels of siltation be recorded within the watercourses during the course of the construction phase, the environmental auditor will seek to halt construction works until the source of the pressure can be found and remediated
- Surplus material will be removed from the site to an appropriate facility. There will be no stockpiling of excavated material. A setback distance of at least 20 m from watercourses will be adhered to when storing temporary spoil
- Prior to any works taking place near water courses the Inland Fisheries Ireland will be consulted
- Construction works onsite will be timed to occur outside periods where heavy rainfall would be expected
- Silt traps will be regularly maintained during the construction phase. All personnel working onsite will be trained in pollution incident control response.
- Appropriate signage will be placed along the proposed route outlining the spillage response procedure and a contingency plan to contain silt. A regular review of weather forecasts of heavy rainfall is required, and the contractor is required to prepare a contingency plan for before and after such events
- Visual inspection to take place at all times along the bore path of the alignment.
- Silt fences will be constructed around proposed work areas prior to commencement of works.
- No refueling will take place within 50m of the stream zone or any sensitive habitats.
- During the drilling process, a mixture of a natural, inert and fully biodegradable drilling fluid will be used.

10.7.1.3 Proposed Mitigation Measures for Tree Felling

Tree felling will be undertaken prior to the construction of site access tracks and hardstanding areas. The area of proposed felling is small relative to the overall area and is expected to develop a vegetation ground cover relatively quickly on areas which are not built upon. Thus, no significant increase in the rate of runoff is anticipated as a result of felling nor is there a risk of downstream flooding or sedimentation due to increased erosion.

Tree felling will be the subject of a felling license from the Forest Service and to the conditions of such a license. A Limited Felling License will be in place prior to works commencing on site.

To ensure a tree clearance method that reduces the potential for sediment and nutrient runoff, the construction methodology will follow the specifications set out in the Forest Service Forestry and Water Quality Guidelines (2000) and Forest Harvesting and Environmental Guidelines (2000).

Trees will be felled away from aquatic zones where possible. Brash mats will be used as necessary on any off-road harvesting routes, removed and replenished if they become worn. Branches, logs or debris will not be allowed to accumulate in aquatic zones and will be removed as soon as possible.

10.7.1.4 Proposed Mitigation Measures for Installation of Meteorological Mast

Drainage infrastructure shall be put in place prior to commencement of works. Dirty water from roads will be drained to swales which will be connected to a settlement pond with a diffused outfall.

- There will be small usage of concrete for foundations and anchoring. No batching of wet-cement products will occur on site. Ready-mixed supply of wet concrete product and where possible, emplacement of pre-cast elements, will take place.
- No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed.
- Use weather forecasting to plan dry days for pouring concrete
- Ensure pour site is free of standing water. Plastic covers will be ready in case of sudden rainfall event.

Concrete operations shall be carried out in accordance with the CEMP.

The effects of impacts are expected to be of imperceptible significance on hydrology and water quality due to installation of met masts.

10.7.2 Proposed Mitigation Measures for Operation and Maintenance Stage

The main hydrological impact of the development is an increase in runoff. This is mitigated by the drainage layout. Due to the insignificant increase in potential runoff from the site, there should be negligible release of sediment to the watercourses post-construction. When operational, the development will have a negligible effect on surface water quality as there will be no further disturbance of soils post-construction. The insignificant increase in runoff is mitigated with the drainage system. It is anticipated that the drainage system will increase time of concentration and consequently the peak runoff will be decreased. The drainage system will be left in-situ during operational stage.

When operational, the development will have a negligible effect on surface water quality as there will be no further disturbance of soils post-construction. During the operation stage, small quantities of oil will be used in cooling the transformers associated with the facility. There is therefore a potential for small oil spills. Risks of potential oil leakage and pollutions draining to the watercourse from the installed transformer is mitigated with transformer interceptor bund wall.

It is not envisaged that the maintenance period will involve any significant impacts on the hydrological regime of the area. The maintenance of the development will incorporate effective maintenance of the drainage system.

The maintenance regime will include inspecting the following:

- Drains, cross-drains and culverts for any blockages
- Outfalls to existing field drains and watercourses
- Existing roadside swales for any obstructions
- Swales
- Progress of the re-establishment of vegetation.

The maintenance regime will also include implementing appropriate remedial measures as required after the above inspections and testing the water quality at the outfalls at appropriate intervals. Visual inspections will be undertaken during the maintenance period in accordance with maintenance schedule in CIRIA C753.

10.7.3 Proposed Mitigation Measure for Decommissioning Stage

In the event of decommissioning of the Coom Green Energy Park, the access tracks may be used in the decommissioning process. Mitigation measures applied during decommissioning activities will be similar to those applied during construction but will be of reduced magnitude.

It is proposed that turbine foundations and hardstanding area should be left in place and covered with local soil/topsoil at decommissioning stage. It is considered that leaving the turbine foundations, access tracks and hardstanding areas in-situ will cause less environmental damage than removing them.

The grid connection cables will be left in the ground, therefore no potential impacts during decommissioning stage are likely to occur. Hence no mitigation measures are required.

10.7.4 Proposed Mitigation Measures for Flooding

The proposed access track between turbines T9 and T13 will cross an area identified in the OPW PFRA mapping as an indicative floodplain and therefore have the potential to obstruct flood flows. This impact will be avoided by design as follows; any stream crossings will be conveyed in culverts, sized to take the 1 in 100-year flood flow with a 20% allowance for climate change plus freeboard.

No construction personnel, operation or maintenance personnel will be permitted on this area of the site during extreme flood events.

Landowners will carry on their normal activities in the vicinity of the development and will take the usual precautionary measures as far as practicable during flood events. Emergency operations during a flood event are not envisaged on the development.

The FRA for Coom Green Energy Park concludes that the proposed development does not increase the flood risk.

10.8 Residual Impacts

The residual impacts are summarised in Table 10-13 below, using the impact assessment criteria outlined in Section 10.2.4.

Table 10-13 indicates that, following the implementation of mitigation measures, the residual risk to the receiving watercourses would be 'Imperceptible' and 'Not significant' during the construction, operation and decommissioning stage of the development.

By implementing the mitigation measures outlined in Section 10.7, there will be no deterioration in WFD classifications for the waterbodies described in Table 10-3, which includes the Blackwater River (Cork/Waterford)SAC.

10.8.1 Residual Impacts during Construction Stage

The increased surface runoff is mitigated with a drainage system as discussed in Section 10.6 and 10.7. Sedimentation and nutrient release are likely to occur due to disturbance of soils and tree felling. Increased releases to watercourses are mitigated with mitigation measures outlined in Section 10.7.1.

This will ensure that the residual impacts of the construction stage are 'Imperceptible' and 'Not significant'.

10.8.2 Residual Impacts during Operational and Maintenance Stage

There are no significant residual impacts relating to hydrology and water quality as the increased surface runoff measures are implemented and sedimentation release to watercourses is unlikely to occur as there is no disruption in soils.

10.8.3 Residual Impacts during Decommissioning Stage

The decommissioning plan will include a surface water management plan.

Negative or adverse effects on the receiving environment associated with decommissioning works at the main energy park site are considered to be temporary in duration and not significant following mitigation measures.

Decommissioning stage impacts will be much less than construction stage as drainage system is already in place and much less ground disturbance works as new tracks and hardstanding areas will be left in place and/or covered over and revegetated.

Infrastructure associated with the grid connection will form part of the national transmission network and will be left in-situ. Therefore, no impacts are envisaged.

A summary of residual impacts post-mitigation is presented in
Table 10-13.

Table 10-13: Residual Hydrological Impact Significance for Sensitive Receptors

Activity	Potential Impact	Receptor	Quality / Duration	Before Mitigation		After Mitigation	
				Magnitude/ Probability	Significance	Magnitude/ Probability	Residual Significance
Construction Phase							
Site tracks, turbine construction, substations	Increase in rate of runoff	Surface waters	Negative / Reversible	Negligible	Not Significant	Negligible	Imperceptible
Site tracks, crossings, HDD, cabling, turbine construction, crane pad construction, substation, tree felling, borrow pits and management of material storage areas	Release of suspended solids into watercourse	Surface waters	Negative / Reversible	Medium	Significant	Negligible	Not significant
Installation of Met Mast, substation and turbines construction	Release of concrete and cement based products into watercourses	Surface waters	Negative/ Temporary	Low	Slight	Negligible	Imperceptible
Tree felling	Release of nutrients into watercourse	Surface waters	Negative/ Temporary	Medium	Slight	Negligible	Not significant
Site tracks, crossings, HDD, cabling, turbine construction, crane pad construction, sub-station, tree felling and management of material storage areas	Release of hydrocarbons or fuel spill	Surface waters	Negative/ Brief	Low	Not significant	Negligible	Not significant

Activity	Potential Impact	Receptor	Quality / Duration	Before Mitigation		After Mitigation	
				Magnitude/ Probability	Significance	Magnitude/ Probability	Residual Significance
Drainage crossings, turbine hardstanding areas, substations, temporary compounds, borrow pits	Obstruct hydrological flow	Surface waters	Negative/ Reversible	Low	Not significant	Negligible	Imperceptible
Operation & Maintenance							
Site access tracks, turbine hardstanding areas, substations	Increase in rate of runoff	Surface waters	Negative/ Reversible	Negligible	Imperceptible	Negligible	Imperceptible
Site access tracks, turbine hardstanding areas, substations	Erosion and sedimentation	Surface waters	Negative/ Temporary	Negligible	Imperceptible	Negligible	Imperceptible
Decommissioning							
Use of equipment for dismantling and removing turbine components	Release of hydrocarbons or fuel spill	Surface waters	Negative/ Temporary	Negligible	Not significant	Negligible	Imperceptible
Use of equipment for dismantling and removing turbine components	Release of suspended solids into watercourse	Surface waters	Negative/ Temporary	Low	Not significant	Negligible	Imperceptible

10.9 Conclusion

As a result of the construction of the Coom Green Energy Park, surface water runoff is likely to increase by 0.234 m^3/s (or 0.06 %) due to changes to hard surfaces. Increase in runoff due to construction of the development is not significant and will be mitigated with the drainage system.

Release of sedimentation is likely to occur due to disturbance of soils. Sediment release to watercourses is related to the type of works being undertaken on the site. When the soil excavation is carried out, sediment release is likely to be higher than at a period when the turbines are being installed. Releasing surface runoff without implementing sediment control measures is not acceptable for receptors.

Surface water runoff drains to tributaries of the River Bride. The River Bride is part of a Special Area of Conservation. Following the implementation of mitigation measures described herein, the effects of impacts are expected to be of imperceptible significance. Proposed mitigation measures are outlined in Section 10.7.

By implementing the mitigation measures outlined in Section 10.7, there will be no deterioration in WFD classifications for the waterbodies described in Table 10-3 which includes the Blackwater River (Cork/Waterford) SAC. Surface water drainage measures, pollution control and other preventative measures have been incorporated into the project design to minimise significant adverse impacts on water quality and downstream designated sites. A 50m stream buffer was used during the layout of the proposed development, thereby avoiding sensitive hydrological features.

The Coom Green Energy Park is not expected to contribute to any significant, negative cumulative effects with other existing or proposed developments in the vicinity.

With mitigation measures, outlined in Section 10.7, put in place during construction, operational and decommissioning stage the proposed development will have imperceptible significance on the hydrology and water quality.

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