APPENDIX A:
Natura Impact Statement (NIS)

In support of the
Appropriate Assessment Process

Natura Impact Statement

PROPOSED SOLAR FARM AT DRUMDOWNEY, CO. KILKENNY

in support of the Appropriate Assessment Process

Prepared for:

Drumdowney Solar Farm Ltd.

Prepared by:

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ecologyireland

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Natura Impact Statement

PROPOSED SOLAR FARM AT DRUMDOWNEY, CO. KILKENNY

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Executive Summary

This Natura Impact Statement (NIS) is presented as part of the appropriate assessment process to identify whether significant impacts on a Natura 2000 site are likely to arise from a proposed solar farm development by Drumdowney Solar Farm Limited in the townlands of Ataeemore or Blackneys, Ballyhobuck, Ballyrahan, Carriganurra, Charlestown, Davidstown, Drumdowney Lower, Drumdowney Upper, Gorteens, Grogan, Kilmurry, Nicholastown, Rathpatrick, Scartnamoe, Tinvaucoosh and Treanaree in County Kilkenny. The site is made up of four separate land parcels totalling c. 189 hectares. 'Parcel 3' is the substation site which includes underground cabling associated with the solar farm. The proposed 110kV GIS substation, interface towers and grid connection will be subject to a Strategic Infrastructure Development (SID) application to An Bord Pleanála in accordance with section 182A of the Planning and Development Act 2000. For completeness purposes, this infrastructure is considered in the various technical reports informing the solar farm planning application to Kilkenny County Council. The existing land use is agricultural with a mixture of tillage and pasture.

The distinct field parcels, which will be connected by means of 5 no. 33kV underground interconnector cables. These will be contained in solar farm access tracks, within private lands and within the L3429, L7523, L7563, L7469, L7466, L3406, L3407, L3414, L3415, L7483, N25 and N29 public roads.

The site is not located within any designated nature conservation sites. Land Parcel 4 is closely proximate to the Lower River Suir SAC and the River Barrow & River Nore SAC. No other European designated sites are located within 10km of the proposed application site. The estuary of the River Barrow is located to the east of Parcel 4 and the River Suir estuary is located south of Parcel 4. The Suir joins the estuarine part of the Barrow to the southeast of Parcel 4 and the water flows south into Waterford Harbour.

The solar farm will contribute directly to a carbon dioxide emission reduction of 41,647 tonnes per annum or the equivalent of approximately 1,665,917 tonnes of CO_2 over the lifetime of the project.

The operational lifespan of the solar farm will be 40 years and planning permission is requested for this duration.

The proposed landscaping and Biodiversity Management Plan (BMP) for this development includes a net gain in hedgerow habitat as well as a suite of other biodiversity enhancement and monitoring commitments, which will improve overall species diversity on the site as they mature. A total of 285 linear metres of hedgerow will be permanently removed throughout the site alongside 191 square meters of scrub/woodland to facilitate site entrance, access tracks and underground cabling. This will be offset by 2,718 linear metres of new hedgerow planting (Type 2), as well as the bolstering of an additional 22,470 linear metres where necessary, to fill any gaps in existing hedgerows. Flora, fauna and habitats on the site will be further fostered to deliver significant biodiversity gains to the receiving environment through the establishment of focused ecological biodiversity areas and species rich grasslands.

Having carried out the Stage 1 Appropriate Assessment Screening, the competent authority may determine that a Stage 2 Appropriate Assessment of the Proposed Development is required as it cannot be excluded, on the basis of objective scientific information following screening under this Regulation 42 of the European Communities (Birds and Natural Habitats) Regulations 2011, as amended, that the

Proposed Development, individually or in combination with other plans or projects, will have a significant effect on any European site.

The proposed development site has hydrological connectivity and is proximate to two Natura 2000 sites (Lower River Suir SAC and River Barrow & River Nore SAC) and potential for significant effects during the project construction and operational phase cannot be discounted without the implementation of best practice construction, operational and decommissioning phase design and control measures. Therefore, it cannot be concluded, that the proposed project will not have a significant effect on these Natura 2000 sites, without the consideration and analysis of further information. Therefore Stage 2 NIS (AA) is required.

A Natura Impact Statement (NIS) is presented to provide scientific examination of the project to enable the competent authority to undertake an AA. The NIS examines potential effects to Natura 2000 sites screened in as part of this Screening for Appropriate Assessment, i.e., Lower River Suir SAC and River Barrow & River Nore SAC. Having taken into consideration the details of the proposed project and the construction and decommissioning phase mitigation measures, it is concluded that this development will not give rise to any significant effects to designated sites. The construction and operation of the proposed development will not impact on the conservation objectives or features of interest of Natura 2000 sites. Detailed field and desktop surveys were carried out to inform the accompanying EcIA and this NIS.

It can be objectively concluded that no significant effects arising from the proposed development are likely to occur in relation to the Natura 2000 sites (i.e., Lower River Suir SAC and River Barrow & River Nore SAC) or indeed any other Natura 2000 site in the wider hinterland.

1 Introduction

Ecology Ireland Wildlife Consultants Ltd. (Ecology Ireland) were commissioned by Drumdowney Solar Farm Ltd., to undertake an appraisal of the potential impacts of a proposed solar farm development in the townlands of Atateemore or Blackneys, Ballyhobuck, Ballyrahan, Carriganurra, Charlestown, Davidstown, Drumdowney Lower, Drumdowney Upper, Gorteens, Grogan, Kilmurry, Nicholastown, Rathpatrick, Scartnamoe, Tinvaucoosh and Treanaree in County Kilkenny on designated European conservation sites in the wider area. This assessment was undertaken as part of an application by the client for planning permission, where European designated conservation sites are present in the wider surrounding area.

Drumdowney Solar Farm will be subject to a planning application to Kilkenny County Council. The proposed development will consist of ground mounted panels on frames, inverter/transformer stations and all ancillary development works. The solar farm planning application includes the 33kV UGC Interconnectors as described in this report.

It is proposed that the solar farm will be served by an onsite 110kV GIS substation and loop-in infrastructure comprising underground 110kV cabling and 2 no. interface towers which will connect into the existing 110kV Great Island to Waterford overhead line. This infrastructure shall be the subject of a separate planning application to An Bord Pleanála. Notwithstanding the dual consent process, this report considers both the solar farm development and the substation and grid connection development for the purposes of completing a robust assessment of the entire project.

A screening assessment is part of an appropriate assessment process that consists of up to four stages, where each stage follows on from the preceding one. In Stage 1, a screening process is undertaken to identify whether significant impacts on a Natura 2000 site are likely to arise from the project or plan in question. If significant impacts are likely to occur, then the process moves on to Stage 2 where an appropriate assessment (AA) considers potential mitigation measures for adverse impacts. If it is considered that mitigation measures will not be able to adequately minimise potential adverse impact on a Natura 2000 site, then an assessment of alternative solutions is considered in Stage 3. This may then be followed by Stage 4 of the process in the event that adverse impacts remain, and the proposed activity or development is deemed to be of Imperative Reasons of Overriding Public Interest (IROPI), allowing an assessment of compensatory measures to be considered. The outcome of a Stage 2 and higher assessment is presented in a report known as a Natura Impact Statement (NIS).

The first part of the assessment is a screening process to identify whether significant[1] effects on a Natura 2000 site are likely to arise from the project or plan in question, in view of best scientific knowledge and in light of the conservation objectives of any relevant European sites, when considered as an individual project or in combination with other plans and projects. If significant effects are likely to occur or if it is

[1] A European Court of Justice ruling in 2013 (Case C-258/11) has stated the following regarding significant effect: "Where a plan or project not directly connected with or necessary to the management of a site is likely to undermine the site's conservation objectives, it must be considered likely to have a significant effect on that site."

unclear whether significant effects are likely to occur, then the process moves onto the next phase where the project is subject to an appropriate assessment (AA) to determine whether the plan or project would directly affect the integrity of a European site. At this stage, potential mitigation measures for adverse impacts identified in Screening are considered. Typically, a Natura Impact Statement (NIS) is prepared by consultants on behalf of the promoter/developer of a plan or project, and this is part of the information used by the competent authority in carrying out an Appropriate Assessment of the proposed plan or project. If the competent authority is satisfied that the plan or project will not adversely affect the integrity of the site concerned, it may approve the project. If it is considered that mitigation measures will not be able to satisfactorily reduce potential adverse impact on a Natura 2000 site, then an assessment of alternative solutions is considered in third phase of the assessment process. If adverse impacts remain and the proposed activity or development is deemed to be of Imperative Reasons of Overriding Public Interest (IROPI), the final assessment step permits consideration of permission for development with consideration of compensatory measures.

While a screening assessment appraisal or NIS may be provided by the advocate of the plan or project in question, the AA itself is undertaken by the competent authority (*e.g.,* the planning authority and An Bord Pleanála). So, in this case, the Appropriate Assessment for the project, described herein, is undertaken by Kilkenny County Council; informed by this Screening for AA and NIS and any other relevant information provided to the statutory body.

1.1 Methodology

This report presents in brief the outcome of a Screening for AA. The subsequent Natura Impact Statement (NIS) is prepared to identify whether the proposed solar development, in view of best scientific knowledge and in light of the conservation objectives of any relevant European sites, when considered as an individual project or in combination with other plans and projects, will have an adverse effect on the integrity of any European Site. It is important to emphasise that a screening assessment does not have to ascertain the existence of a significant effect or impact on a Natura 2000 site as such; it only has to establish whether a significant effect or impact is possible or may occur (as per judgement by Ms. Justice Finlay Geoghegan; see guidelines below). At the NIS stage, all mitigation measures necessary to avoid, reduce or offset negative effects are considered.

The conservation objectives of Natura 2000 sites have been compiled by the National Parks & Wildlife Service (NPWS) in relation to the habitats and species (*i.e.,* qualifying interests) for which the sites are selected. These conservation objectives are referred to when carrying out appropriate assessments for plans and projects that might impact on these sites.

1.1.1 Guidance

Documents associated with the proposed development and relevant ecology databases were consulted as part of this assessment. Field assessments were also completed at the proposed development site from December 2024 and May 2025 in order to inform the EcIA and Screening Assessment. The following guidelines and legal judgements were used in the completion of this assessment;

- Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites – European Commission Methodical Guidance on the provisions of Article 6(3) and 6(4) of the 'Habitats' Directive 92/43/EEC (European Commission 2001)

- Office of the Planning Regulator (OPR) Practice Note PN01, Appropriate Assessment Screening for Development Management (2021).
- Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities (DoEHLG 2009)
- Integrated Biodiversity Impact Assessment – Streamlining AA, SEA and EIA Processes: Practitioner's Manual (EPA 2013)
- European Court of Justice Ruling 11th April 2013 Case C-258/11 Peter Sweetman and Others v An Bord Pleanála - Criteria to be applied when assessing the likelihood that N6 Galway City Outer Bypass Road scheme will adversely affect the integrity of Lough Corrib SAC
- High Court Ruling 25th July 2014 by Ms. Justice Finlay Geoghegan; Neutral Citation [2014] IEHC 400; High Court Record No. 2013 802 JR; Kelly -v- An Bord Pleanála – Judicial review of grant of planning by An Bord Pleanála for two wind farm phases in County Roscommon
- High Court Ruling 24th November 2014 by Mr. Justice Hedigan; Neutral Citation [2014] IEHC 557; High Court Record No. 2014 320 JR; Rossmore Properties Limited & Anor -v- An Bord Pleanála
- High Court Ruling 25th February 2016 by Mr. Justice Barton. Neutral Citation [2016] IEHC 134; High Court Record No. 2013 450 JR; Balz & Anor -v- An Bord Pleanála.
- European Court of Justice ruling 12th April 2018 in respect of Case C-323/17 (People Over Wind & Sweetman) - it is not appropriate for the purposes of Appropriate Assessment (AA), at the screening stage, to take account of the measures intended to avoid or reduce the harmful effects of a plan or project.
- European Court of Justice ruling 19th April 2018 in respect of Case C-164/17, Compensation vs Mitigation, Grace & Sweetman Vs ABP.
- High Court Ruling 8th February 2019 by Justice Barniville in respect of Kelly -v- An Bord Pleanála & anor. The Court concludes "*as a matter of fact and law, that SUDS are not mitigation measures which a competent authority is precluded from considering at the stage 1 screening stage*". The Irish High Court ([2019] IEHC 84)
- Heather Hill Management Company CLG v An Bord Pleanála (Burkeway Homes Limited as Notice Party) [2019] IEHC 450. Mr. Justice Garrett Simons granted an order of certiorari setting aside the decision of the BoÁrd to grant permission for a residential development of 197 units at Bearna Co. Galway, on the basis that it was a material contravention of the Galway County Development Plan (the CDP), it failed to carry out a 'justification test' as required and failed to carry out proper Appropriate Assessment screening.
- European Commission. *Managing Natura 2000 Sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC*, (21-11-18) C (2018) 7261 Final. Commission Notice Brussels.

1.1.2 Information Consulted for this Report

This assessment has been informed by the following sources of data:

- Desk based surveys and site surveys of the proposed development site;
- The Ecological Impact Assessment completed for the proposed development;
- Information on the location, nature and design of the proposed project as provided by the client;

- Department of Housing, Planning, Community and Local Government (DHPCLG) online land-use mapping (www.myplan.ie/en/index.html);
- Office of Public Works (OPW) National Flood Hazard Mapping website (www.floodmaps.ie)
- Environmental Protection Agency (EPA) geoportal mapping tool (https://gis.epa.ie/EPAMaps/);
- National Parks and Wildlife Service protected site and species information and data (https://www.npws.ie/protected-sites);
- National Biodiversity Data Centre (www.biodiversityireland.ie); and
- Ordnance Survey of Ireland mapping and aerial photography (www.osi.ie).

2 Stage 1: Screening for Appropriate Assessment

2.1 Brief Description of the Site & Project

2.1.1 Site Location

The proposed development site is located in the townlands of Atateemore or Blackneys, Ballyhobuck, Ballyrahan, Carriganurra, Charlestown, Davidstown, Drumdowney Lower, Drumdowney Upper, Gorteens, Grogan, Kilmurry, Nicholastown, Rathpatrick, Scartnamoe, Tinvaucoosh and Treanaree in County Kilkenny (See **Error! Reference source not found.**). The site is c. 189 hectares in area.

The dominant landuse within the proposed development site is agricultural lands with improved agricultural grassland and some arable lands.

It is proposed to access the proposed solar farm during the construction phase via 5 no. existing entrances for Parcel 1 (L3429), Parcel 2 (L7469), Parcel 3 (L7466) and Parcel 5 'the substation site' (L34142). Separate construction access via either the Port of Waterford or the L4783 are proposed for Parcel 4.

Parcel 4 at the south of the proposed solar farm is closely adjacent to the estuarine sections of two European designated sites, the Lower River Suir SAC (to the south) and the River Barrow and River Nore SAC (to the east). The Suir estuary joins the Barrow estuary to the southeast of Parcel 4.

The proposed development is located in two separate catchment areas: the Suir Catchment (to the west) and the Nore catchment (to the east). The relevant sub-catchments are the Blackwater(Kilmacow)_SC-010 subcatchment of the Suir catchment and the Nore_SC_010 subcatchment of the Nore catchment. The location of local watercourses is shown in Figure 2-2. The solar farm site is divided into four land parcels (See Figure 2-3) which will be connected by underground cable.

The Luffany_010 river flows to the Suir estuary just east of Parcel 4, with the interconnector route and access track both crossing this minor watercourse. The Nicholastown/Smartcastle Stream flows just east of Parcel 3 and this joins the Blackwater River a short distance upstream of its confluence with the Suir Estuary. The Smartcastle watercourse has a Water Framework Directive (WFD) condition of 'At Risk' with the WFD 2016-2021 'moderate' status. The Luffany Stream has a WFD appraisal of 'under review' and a WFD 2016-2021 'moderate' status. The two estuaries are transitional waterbodies with an 'At risk' appraisal and a 'moderate' WFD 2016-2021 status. The groundwater status in this area is currently 'Good'.

2.1.2 Proposed Development

Drumdowney Solar Farm Limited intend to apply for a 10 Year Planning Permission for a solar farm with a total area of circa 189 hectares in the townlands of Atateemore or Blackneys, Ballyhobuck, Ballyrahan, Carriganurra, Charlestown, Davidstown, Drumdowney Lower, Drumdowney Upper, Gorteens, Grogan, Kilmurry, Nicholastown, Rathpatrick, Scartnamoe, Tinvaucoosh and Treanaree in County Kilkenny. The proposed layout of the solar farm is shown in Figure 2-3.

The solar farm will consist of solar panels on ground mounted frames, 27 no. single storey electrical inverter/transformer stations, 5 no. single storey spare parts containers, 3 no. Ring Main Units, 5 no.

weather stations, underground electrical ducting and cabling within the development site, private lands and within the L3429, L7523, L7563, L7469, L3407, L3414, L34144, L7466, L3406, L7483, L3415, N25 and N29 public roads to connect solar farm field parcels, security fencing, CCTV, access tracks, 7 no. watercourse/drain deck crossings and 4 no. horizontal directional drill crossings (under the N25 and N29 public roads and the Luffany River), temporary construction compounds, landscaping and all associated ancillary development and drainage works. Construction and operational access will be via 7 no. existing entrances from the L3429, L7469, L7466, L4783 and L34142 which will be subject to entrance upgrade works. Separate construction phase access options are proposed for Parcel 4 via Port of Waterford and the L4783 The operational lifespan of the solar farm will be 40 years and planning permission is requested for this duration. A Natura Impact Statement (NIS) has been prepared and will be submitted to the Planning Authority with the application.

2.1.3 Solar Panels

The working title for the project is Drumdowney Solar Farm. The civil works for the panels themselves use a simple, ground-mounted system that avoids undue ground disturbance and works with the existing site topography. The PV panels will sit on angled racks comprised of galvanized steel arranged in portrait or landscape configuration depending on the final system deployed[2]. It is envisaged that these will be screw or driven-piled following geotechnical assessment[3]. The panels will be positioned on the rack at a minimum height of 0.8m above the ground and rise to a maximum height of up to 3.25m. The PV panels will be orientated to the south in order to capture maximum solar energy. The panels will be positioned at a tilt angle between 10-25 degrees from the horizontal having regard to natural site topographical and orientation conditions to ensure the best solar absorption. The panels will be stationary with no movable parts. Low voltage direct current cabling will connect the panels to the inverter/transformer stations across the site.

2.1.4 Inverters / Transformers / Ring Main Units

A total of 27 no. inverter/transformer stations are incorporated into the layout to convert direct current generated by the PV panels into alternating current which can be subsequently used by the electricity network. These units are manufactured offsite and delivered installation ready. These will have a maximum floor area of approximately 29.8m^2. There will also be 3 no. Ring Main Units. These units are similar to kiosks and will have an area of approximately 2.4m^2. The design also includes 5 no. equipment containers, also 29.8m^2 in area, to store spare parts.

2.1.5 Interconnector Cabling

The solar farm comprises four distinct field parcels, which will be connected by means of 5 no. 33kV underground interconnector cables. These will be contained in solar farm access tracks, within private lands and within the L3429, L7523, L7563, L7469, L7466, L3406, L3407, L3414, L3415, L7483, N25 and N29 public roads. The specification for these cable routes is set out in the submitted drawings and

[2] Refer to technical drawings DWNY-SD-DR-04 for panel and array system options. Final technical specification to be agreed with Kilkenny County Council prior to construction. The final design will be subject to standard micro-siting arising from site survey work.
[3] The exact nature of the foundations will be determined at detailed design stage. Other alternative foundations arrangements include ballasting systems and piles. Final foundation type will be confirmed with Kilkenny County Council prior to construction.

Drumdowney Solar Farm Electrical Infrastructure - Construction Methodology. As detailed, the route of underground cabling will include 4 no. horizontal directional drill crossings under the N25 and N29 public roads and the Luffany River.

2.1.6 Access

A compacted gravel access track up to 4.5 metres wide will provide internal access to the solar arrays and associated infrastructure. This will extend to approximately 4,903 linear metres of new track across the land parcels, with 1,384 linear metres of refurbished track also utilised. Stripped soil arising from the construction of these access tracks will be sustainably reused across the site as part of landscaping, filling in the verges of access tracks and grass reinstatement in the areas of temporary construction compounds. As noted above, the access track will require 7 no. drain crossings within Parcel 1, Parcel 3 and Parcel 4 through a 'dry' construction deck crossing, the construction of which requires no instream/drain works.

A compacted gravel access track up to 4.5 metres wide will provide internal access to the solar arrays and associated infrastructure. This will extend to approximately 4,903 linear metres of new track across the land parcels, with 1,384 linear metres of refurbished track also utilised. Stripped soil arising from the construction of these access tracks will be sustainably reused across the site as part of landscaping, filling in the verges of access tracks and grass reinstatement in the areas of temporary construction compounds. As noted above, the access track will require 7 no. drain crossings within Parcel 1, Parcel 3 and Parcel 4 through a 'dry' construction deck crossing, the construction of which requires no instream/drain works.

It is proposed to access the proposed solar farm during the construction phase via 5 no. existing entrances for Parcel 1 (L3429), Parcel 2 (L7469), Parcel 3 (L7466) and Parcel 5 (L34142) which will be subject to upgrade works.

Separate construction access via either the Port of Waterford or the L4783 are proposed for Parcel 4. These are also existing entrances. Two options are considered in the planning application for construction access to Parcel 4. The Port of Waterford and Suir Shipping have provided agreements in principle to use their lands for accessing Parcel 4 during construction (Access 4b). However, until such time as those agreement are formalised, the Applicant has also considered the scenario where the L4783 is used for construction access (Access 4a). It should be noted that the L4783 is the only option considered for the operational phase of the solar farm.

2.1.7 Other Infrastructure

A perimeter fence up to 2.4m in height will be erected to provide security and restrict unauthorised entry. This fence will be stock proof in nature, sympathetic to the agricultural character of the site. The footings for the fence will either be pre-moulded or localised in-situ concrete, to be determined once a contractor is appointed. The installed fencing will incorporate mammal friendly access, with a maximum 200mm gap retained at the bottom between the fence and the ground, as per the submitted technical plans.

The proposed development will be an unmanned facility; however, the facility will be monitored 24 hours a day remotely by the Applicant's operation system and the Engineer Procurement and Construction provider. The site will be subject to routine inspections. The CCTV will be orientated towards this

infrastructure rather than any third-party lands. There is no requirement for potable water or wastewater treatment facilities as part of the constructed solar farm[4].

The proposed layout includes 5 no. weather monitoring stations. These are centrally located within the solar farm and will reach a maximum height of 5 metres. These stations measure ambient temperatures, wind speeds and direction, direct and diffuse irradiance etc. as part of standard operational monitoring of the solar farm.

2.1.8 Landscaping & Biodiversity

A total of 285 linear metres of hedgerow will be permanently removed throughout the site alongside 191m^2 of scrub/woodland to facilitate site entrance, access tracks and underground cabling. This will be offset by 2,718 linear metres of new hedgerow planting (Type 2), as well as the bolstering of an additional 22,470 linear metres where necessary, to fill any gaps in existing hedgerows. Ecological diversity on the site will be further fostered to deliver significant biodiversity gains to the receiving environment through the establishment of focused ecological biodiversity areas and species rich grasslands.

The solar farm will contribute directly to a carbon dioxide emission reduction of 41,647 tonnes per annum or the equivalent of approximately 1,665,917 tonnes of CO_2 over the 40-year lifetime of the project.

2.1.9 Substation and Grid Connection

The proposed 110kV GIS substation, interface towers and grid connection will be subject to a Strategic Infrastructure Development (SID) application to An Bord Pleanála in accordance with section 182A of the Planning and Development Act 2000. For completeness purposes, this infrastructure is considered in the various technical reports informing the solar farm planning application to Kilkenny County Council.

Substation

The 110kV substation compound will consist of a two storey GIS substation building, IPP Control Room buildings, High Voltage (HV) electrical equipment and associated infrastructure including palisade fences and concrete post and rail fences. The installation of HV electrical equipment will include a transformer with associated equipment along with:

- Lightning Masts (LM);
- Back-Up Diesel Generator;
- Harmonic filters if required by EirGrid;
- Capacitor Bank if required by EirGrid;
- Fire/Blast Wall;
- Telecoms Pole;
- 110kV underground cable which will connect into the existing 110kV Great Island to Waterford overhead line via 2 no. new Interface Towers.

[4] There is a requirement for potable water for the substation, the application for which will be made to An Bord Pleanala.

The substation compound has a total area of 5,335m^2. Earthworks will be undergone so the compound is level.

Further information on the substation and grid connection are described in detail in the 'Drumdowney Solar Farm Electrical Infrastructure - Construction Methodology' (Terra Solar 2025)

Grid Connection

The substation will connect into the national grid via a 'loop-in / loop-out' underground 110kV cable grid connection which will connect into the existing Great Island to Waterford overhead line. Two new interface towers are required to achieve this. The interface towers are approximately 15m apart, therefore the similar length of the existing Great Island to Waterford line will need to be decommissioned. The proposed substation will connect into each interface tower via an underground 110kV cable. This cable is comprised of 3 no. power ducts, 2 no. telecom ducts and 1 no. earth continuity duct. The cables to each interface tower are 68m and 83m in length.

2.1.10 Decommissioning & Restoration

As described in the decommissioning and restoration plan that accompanies the planning application there are two options for the solar farm at the end of its 40-year lifetime. These are:

- Option 1: Extending the operational lifetime of the solar farm. This will require either a new planning permission or amendment planning permission from Kilkenny County Council and would be subject to the requirements of the Council and other planning legislative requirements at that time; or
- Option 2: Decommissioning the solar farm and ensuring its lands are restored to an agreed baseline.

Option 1 would be subject to a future planning permission in 40 years' time which would supersede any permission associated with the current application to Kilkenny County Council. For that reason, this option is not considered further in this report.

Option 2 is directly relevant to any planning permission attached to the current application to Kilkenny County Council. This report is aimed at demonstrating compliance with same.

At the time of decommissioning and restoration, the Applicant will ensure that any related activities in support of same are undertaken with such due care and diligence in order to reduce or eliminate risk to the environment. The decommissioning and restoration plan present the approach to the process which will be applied and the assumptions that underpin the assessment of the decommissioning and restoration phase.

Figure 2-1 Site location Map and interconnector routes.

Figure 2-2 Watercourse locations in vicinity of the application site.

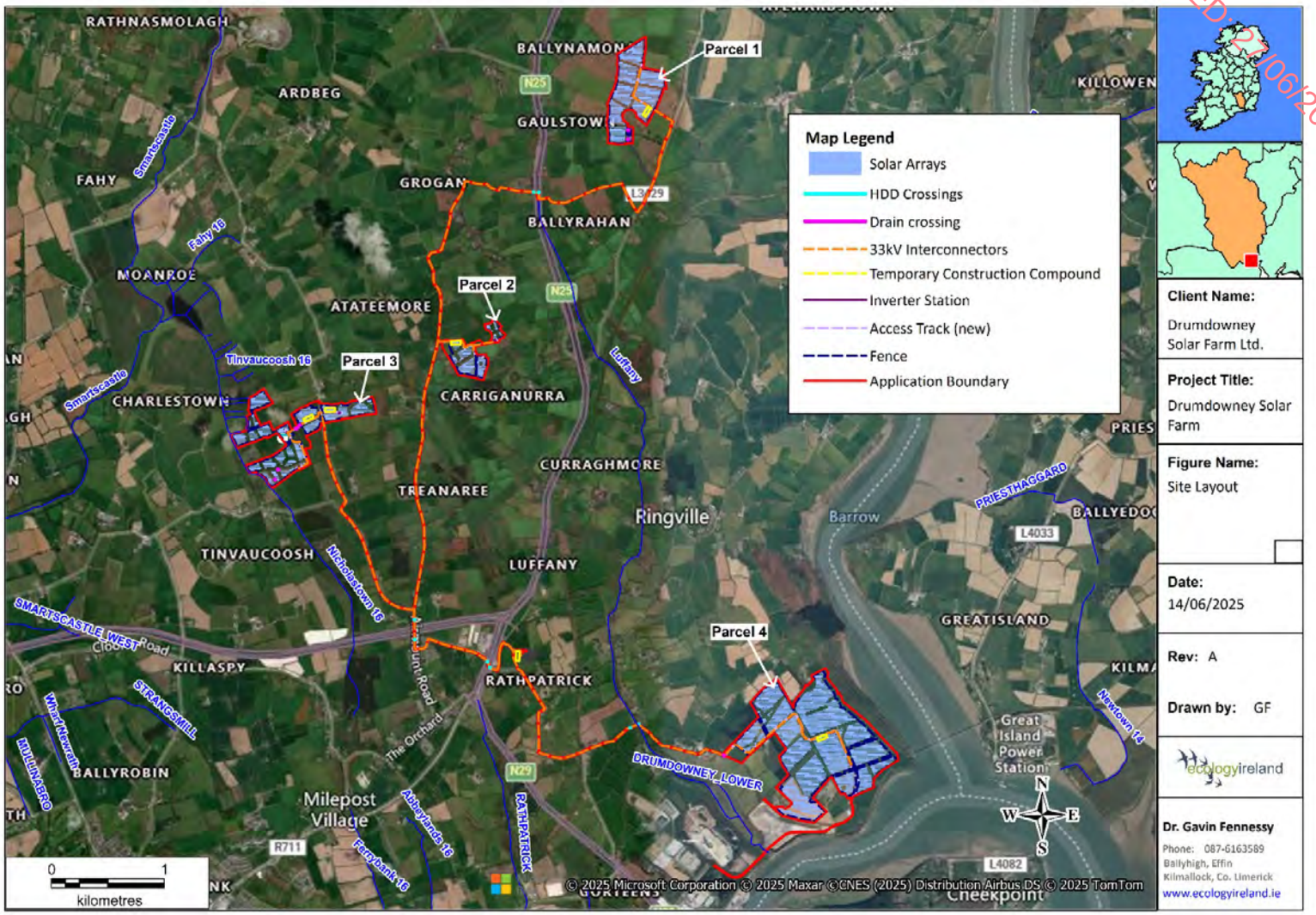

Figure 2-3 Proposed solar farm layout.

2.2 Site Details

As described in the accompanying EcIA a detailed desktop review and baseline ecological survey of the site was carried out. This included winter and breeding bird surveys, mammal surveys (including bat detector and trail camera deployment) and detailed habitat and botanical walkovers. An objective of the field assessments was to gain an overview of the development site (*i.e.,* the application site and surrounding lands), as well as to note ecological points of interest such as the presence of invasive plant species and species that are protected or are part of the qualifying interests of the Natura 2000 sites relevant to this assessment.

An Ecological Impact Assessment (EcIA) has been prepared by Ecology Ireland and accompanies the planning application for this development. No Annex I habitats listed under the EU Habitats Directive are present within the study site. The dominant habitats present are primarily of local importance (lower to higher value) ecological value. No botanical species protected under the Flora (Protection) Order 2022, listed in Annex II or IV of the EU Habitats Directive (92/43/EEC), or Red listed in Ireland were recorded. All species recorded during the botanical survey are considered common for similar habitats in the general area.

Transect surveys were carried out across the entirety of the application site between December 2024 and May 2025. Birds seen or heard on and near each transect were noted, as well as birds observed at greater distances, on and off the application site. A total of 39 species were recorded during the winter season surveys. The bird species recorded represent a fairly typical farmland/woodland bird community with the most abundant species including Rook, *Corvus frugilegus*, Woodpigeon, *Columba palumbus* and Starling, *Sturnus vulgaris*. Three of the species recorded are Red-listed: Redwing, *Turdus iliacus*, Kestrel, *Falco tinnunculus* and Snipe, *Gallinago gallinago*. Redwing were recorded on three of the survey transects, while Kestrel was present on two of the survey transects. A small number of day-roosting Snipe were flushed on the two western transects (T3 & T4). Most of the species recorded during the winter season are common locally and nationally. Several species are winter migrants including Fieldfare, *Turdus pilaris* and Redwing. There were a small number of records of waterbirds such as Cormorant, *Phalocrocorax carbo* associated with the estuary near Parcel 4. There was one sighting of field feeding/roosting Black-headed Gulls, *Chroicocephalus ridibundus* in a field at the northern end of Parcel 4 on December 19th 2024. That sighting apart there was no evidence of the fields being used by waterbirds to feed or roost.

A total of 43 species were recorded during the breeding season surveys. Most of the species are common birds of farmland and woodland. The breeding season bird community included a number of summer migrants including Swallow, *Hirundo rustica*, Chiffchaff, *Phylloscopus collybita* and Whitethroat, *Sylvia communis*. The highest species diversity recorded on transect (on Transect 5) was influenced by distant (>100m) records of six species, mostly waterbirds associated with the Suir Estuary. Two Red-listed species were recorded: Redwing and Kestrel, with a further 8 Amber-listed species observed. A single Kestrel was recorded on Transect 1 (Parcel 1) on one of the survey occasions. A small number of Redwing, as mentioned above, were still present in small numbers on the first breeding season survey visit. As in the winter season, the most abundant species recorded were Rook, Corvus frugilegus and Woodpigeon. Apart from occasional observations of commuting birds such as Herring Gull and Lesser Black-backed Gull, *Larus fuscus* there were very few records of waterbirds on transect. Some waterbirds were seen or heard at distance on the transects near the estuary (Parcel 4) and a pair of Mallard was observed flying towards the watercourses west of Parcel 3.

The study area (particularly the hedgerows and treelines) contains suitable foraging, commuting, nesting and perching habitats for terrestrial bird species in general. Similar habitats are also present in the wider landscape (*e.g.,* field boundaries). Most bird species are protected under the Irish Wildlife Acts (1976 – 2012), where it is an offence to hunt, interfere with or destroy their breeding or resting places (unless under statutory licence/permission).

Initial walkovers of the lands recorded evidence of an active Badger, *Meles meles*, sett at the margin of Parcel 3. The setting had 6 entrances and some fresh bedding. Badger tracks and a latrine were also located in the immediate area. No solar farm infrastructure is proposed within 50m of the burrow entrances identified. Subsequent deployment of trail cameras in this area did not record Badger activity. However, field signs of Badger were recorded, including footprints and latrines, including at Parcels 1, 3 and 4. No additional active sett was located, but an additional old disused sett was recorded within the hedgerow in Parcel 1. It is clear that Badgers commute across these lands and forage within several of the land parcels.

Field signs were widely recorded of Fox, *Vulpes vulpes*, with direct sightings of Fox within Parcel 2, near the proposed substation and at Parcel 4. Otter , *Lutra lutra* footprints were recorded from the stream edge to the west of Parcel 3 and spraint was also noted along this watercourse. Otter spraint was also recorded on the edge of the Luffany watercourse in December 2024. No holt was recorded.

Old Rabbit burrows, were recorded along the hedgerows at locations in Parcel 1 and Parcel 4, but there was no direct sightings of Rabbits made during the walkover visits.

Analysis of the trail cameras deployed confirmed the presence of a number of non-volant mammal species. Fox was recorded at all of the deployment locations. The deployment location with the greatest diversity of species was by the river in Parcel 3 (TC3) where in addition to Fox, Brown Rat, *Rattus norvegicus*, Mink, *Mustela vison*, Otter, Pine Marten, *Martes martes* and Red Squirrel, *Sciurus vulgaris* were active. Sika Deer, *Cervus nippon*, was detected at TC4 in Parcel 4.

Five species were confirmed to be present with both Common Pipistrelle, *Pipistrellus pipistrellus* and Soprano Pipistrelle, *Pipistrellus pygmaeus*, recorded at all of the deployment locations. Other species identified were less frequently active and less widely detected. Leisler's Bat, *Nyctalus leisleri* was detected at BD2 and BD3. A few detections of Brown Long-eared Bat, *Plecotus auritus*, were also recorded at BD2. There were also a small number of detections of Myotids at BD1 and BD2.

In general, the level of activity was relatively modest for the time of year (given the length of the effective deployment c. 25 nights). However, the level of activity recorded at BD3 (Parcel 3) was an obvious outlier, with an especially high number of registrations of Common Pipistrelle (3,822). The detector was deployed close to a watercourse at the west of Parcel 3, the land parcel with drainage ditches, areas of damper grassland and field boundaries with mature trees and areas of mixed broadleaf/conifer woodland (WD2). It is likely that the area represent a significantly more attractive foraging location for bats and it is also possible that there is a Common Pipistrelle roost located proximate to Parcel 3.

There are no structures on the proposed development site that are attractive for roosting for bats, however there are mature and semi-mature trees present that have the potential to provide roosting opportunities for bats within the proposed development site. The hedgerows and treelines on the site offer suitable foraging and commuting habitat for bats, however many of the large agricultural fields are considered to be

of low suitability for bats, due to the lack of linear vegetated features that are favoured by bats for commuting and foraging.

A number of butterfly species were recorded during the May 2025 walkover visits including Orange Tip, *Anthocharis cardamines*, Green-veined White, *Pieris napi*, Speckled Wood, *Pararge aegeria* and Small Tortoiseshell, *Aglais urticae*. Common Frog, *Rana temporaria* was recorded as frog spawn in ephemeral pools along the edge of a farm track in Parcel 4 in March 2025. It is assumed that drains and watercourses present provide suitable habitat Frogs, Smooth Newt, *Lissotriton vulgaris* and potentially European Eel, *Anguilla anguilla*.

2.3 Description of the Natura 2000 Sites

Proposed Development Site

The proposed development site is located closely adjacent to two European designated sites: River Barrow & River Nore SAC (002162) and Lower River Suir SAC (002137; Table 2-1). Both of these linked estuarine sites are adjacent to Parcel 4 (Figure 2-4). No other European designated site is located within 11km of the application boundary. The location of the designated sites in the wider hinterland is shown in Figure 2-4.

There are a total of five SACs and three SPAs located within 15km of the application site boundary. Due consideration was given to the potential for likely significant effects on more distant Natura 2000 sites using the Source-Pathway-Receptor (SPR) model. No likely significant effects on more distant sites were identified.

Table 2-1 Designated sites located in the wider hinterland of the site and their distance from the site boundary.

Site Name	Site Code	Minimum Distance (km)
Natura 2000 sites		
River Barrow and River Nore SAC	002162	Closely adjoining Parcel 4 (to the east)
Lower River Suir SAC	002137	0.04
Tramore Dunes and Backstrand SAC	000671	11.3
Tramore Back Strand SPA	004027	11.3
Bannow Bay SAC	000697	12.2
Bannow Bay SPA	004033	12.7
River Nore SPA	004233	13.9
Hugginstown Fen SAC	000404	14.8
Seas off Waterford SPA	004237	15.1
Hook Head SAC	000764	15.5
Nationally Designated sites		
Lough Cullin pNHA	000406	Closely adjoining Parcel 3
Barrow River Estuary pNHA	000698	Closely adjoining Parcel 4
King's Channel pNHA	001702	2.9
Grannyferry pNHA	000833	3.5
Ballyhack pNHA	000695	4.6
Waterford Harbour pNHA	000787	5.0

Site Name	Site Code	Minimum Distance (km)
Ballykelly Marsh pNHA	000744	5.3
Kilbarry Bog pNHA	001700	6.0
Oaklands Wood pNHA	000774	7.0
Duncannon Sandhills pNHA	001738	8.0
Belle Lake pNHA	000659	8.2
Brownstown Wood pNHA	000827	8.3
Kylecorragh Wood pNHA	000842	9.2
Boley Fen pNHA	000699	10.5
Tramore Dunes & Backstrand pNHA	000671	11.3
Lower River Suir (Coolfinn, Portlaw) pNHA	000399	11.8
Bannow Bay pNHA	000697	12.2
Rathsnagadan Wood pNHA	000409	12.2
Tintern Abbey pNHA	000711	12.5
Dunmore East Cliffs pNHA	000664	13.2
Murphy's Of The River pNHA	000844	13.9
Kilkeasy Bog pNHA	000839	14.3
Hook Head pNHA	000764	14.3
Fiddown Island pNHA	000402	14.5
Hugginstown Fen pNHA	000404	14.9

The proposed development is located in two separate catchment areas: the Suir Catchment (to the west) and the Nore catchment (to the east). The relevant sub-catchments are the Blackwater(Kilmacow)_SC_010 subcatchment of the Suir catchment and the Nore_SC_010 subcatchment of the Nore catchment. The location of local watercourses is shown in Figure 1-2. The Luffany_010 river flows to the Suir estuary just east of Parcel 4, with the interconnector route and access track both crossing this minor watercourse. The Smartcastle Stream flows just east of Parcel 3 and this joins the Blackwater River a short distance upstream of its confluence with the Suir Estuary.

The proposed development will require dry-deck crossing of a number of land drains and HDD crossings of the Luffany watercourse and N25 road at the intersection with the L7469. No in-stream works are proposed. As shown in Figure 2-5, Parcel 4 is located closely adjacent to the two European designated estuarine SAC sites. Surface water within the application site percolates to ground and/or flows over-land or is conveyed by small drains and streams to these designated sites.

Given the proximity of the application lands to River Barrow & River Nore SAC and Lower River Suir SAC and the crossing of (or close-proximity to) drains or watercourses upstream of these sites, it is concluded that there a potential impact-receptor pathway between the proposed application site and these two European designated sites.

Table 2-2 presents the qualifying and special conservation interests of the designated sites located within 15km of the application site.

There is no hydrological link between the application site and the more distant SAC sites located >11km from the proposed solar farm. Given the distances involved and the lack of a hydrological pathway it is concluded that there is no likelihood of any significant effects on these distant SACs.

Similarly, given the distances involved there is no likelihood of any direct disturbance effects on any of the faunal species at the more distant European designated sites. Ex-situ disturbance impacts (*i.e.* where highly mobile species from the designated sites may occur at the development site to forage or commute) must also be considered. This effect is only applicable to designated sites where such fauna are relevant (*e.g.* birds, bats), and where the development site supports habitats of ecological interest for the fauna in question. The SPA sites located in the wider hinterland are all relatively distant from application site: Tramore Back Strand SPA (11.3km), Bannow Bay SPA (12.7km) and River Nore SPA (13.9km). The first two of these European sites are designated for wintering bird species and the River Nore SPA is designated for the conservation of breeding Kingfisher, *Alcedo atthis*. The site walkovers carried out during the overwintering period did not record any regular use of the application lands by any of the SCI species of these SPA sites located in the wider hinterland area. No flocks of SCI wading bird species were recorded at rest in any of the lands within the application site. There is no evidence that these lands are of value for any ex-situ foraging or roosting species associated with the SPAs in the wider receiving environment. Relatively modest numbers of wading birds were recorded in the estuaries adjoining Parcel 4 but no field-feeding flocks of any of these species were observed. It is concluded that there is no likelihood of any significant ex-situ disturbance/displacement effects of birds associated with the distant SPAs in the wider receiving environment.

The proposed development site is located in close proximity to the Natura 2000 sites River Barrow & River Nore SAC and Lower River Suir SAC and there is a hydrological connection to these European designated sites. Significant effects including water-quality mediated effects and construction phase disturbance/displacement effects cannot be discounted without the implementation of appropriate mitigation, design and environmental controls. Therefore, it cannot be concluded, that the proposed project, individually or in combination with other plans or projects, will not have a significant effect on these Natura 2000 sites, without the consideration and analysis of further information. Therefore Stage 2 NIS (AA) is required.

Table 2-2 Natura 2000 Sites within 15km of the proposed development

Site Name & Code	Conservation Summary	Minimum Distance from Site (km)
River Barrow and River Nore SAC (002162)	The conservation objectives of this site relate to maintaining or restoring the favourable conservation condition of the following qualifying interests; • Estuaries [1130] • Mudflats and sandflats not covered by seawater at low tide [1140] • Reefs [1170] • Salicornia and other annuals colonising mud and sand [1310] • Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] • Mediterranean salt meadows (*Juncetalia maritimi*) [1410] • Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260] • European dry heaths [4030] • Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]	Directly bordering Parcel 4 to the East

Site Name & Code	Conservation Summary	Minimum Distance from Site (km)
	• Petrifying springs with tufa formation (Cratoneurion) [7220] • Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0] • Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) [91E0] • Desmoulin's Whorl Snail *Vertigo moulinsiana* [1016] • Freshwater Pearl Mussel *Margaritifera margaritifera* [1029] • White-clawed Crayfish *Austropotamobius pallipes* [1092] • Sea Lamprey *Petromyzon marinus* [1095] • Brook Lamprey *Lampetra planeri* [1096] • River Lamprey *Lampetra fluviatilis* [1099] • Twaite Shad *Alosa fallax fallax* [1103] • Salmon *Salmo salar* 1106] • Otter *Lutra lutra* [1355] • Killarney Fern *Trichomanes speciosum* [1421] • Nore Freshwater Pearl Mussel, *Margaritifera durrovensis* (After NPWS 2025)	
Lower River Suir SAC (002137)	The conservation objectives of this site relate to maintaining or restoring the favourable conservation condition of the following qualifying interests; • Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] • Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260] • Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430] • Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0] • Alluvial forests with *Alnus glutinosa* and Fraxinus excelsior (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0] • *Taxus baccata* woods of the British Isles [91J0] • Freshwater Pearl Mussel *Margaritifera margaritifera* [1029] • White-clawed Crayfish *Austropotamobius pallipes* [1092] • Sea Lamprey *Petromyzon marinus* [1095] • Brook Lamprey *Lampetra planeri* [1096] • River Lamprey *Lampetra fluviatilis* [1099] • Twaite Shad *Alosa fallax fallax* [1103] • Salmon *Salmo salar* 1106] • Otter *Lutra lutra* [1355] (After NPWS 2017)	0.04
Tramore Dunes and Backstrand SAC (000671)	The conservation objectives of this site relate to maintaining or restoring the favourable conservation condition of the following qualifying interests; • Mudflats and sandflats not covered by seawater at low tide [1140] • Annual vegetation of drift lines [1210] • Perennial vegetation of stony banks [1220] • Salicornia and other annuals colonising mud and sand [1310] • Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] • Mediterranean salt meadows (*Juncetalia maritimi*) [1410] • Embryonic shifting dunes [2110] • Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120] • Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130]	11.3

Site Name & Code	Conservation Summary	Minimum Distance from Site (km)
	(After NPWS 2013a)	
Tramore Back Strand SPA (004027)	The conservation objectives of this site relate to maintaining or restoring the favourable conservation condition of the following Special conservation interests; • Light-bellied Brent Goose *Branta bernicla hrota* [A046] • Golden Plover *Pluvialis apricaria* [A140] • Grey Plover *Pluvialis squatarola* [A141] • Lapwing *Vanellus vanellus* [A142] • Dunlin *Calidris alpina* [A149] • Black-tailed Godwit *Limosa limosa* [A156] • Bar-tailed Godwit *Limosa lapponica* [A157] • Curlew *Numenius arquata* [A160] • Wetland and Waterbirds [A999] (After NPWS 2013b)	11.3
Bannow Bay SAC (000697)	The conservation objectives of this site relate to maintaining or restoring the favourable conservation condition of the following qualifying interests; • Estuaries [1130] • Mudflats and sandflats not covered by seawater at low tide [1140] • Annual vegetation of drift lines [1210] • Perennial vegetation of stony banks [1220] • Salicornia and other annuals colonising mud and sand [1310] • Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] • Mediterranean salt meadows (*Juncetalia maritimi*) [1410] • Mediterranean and thermo-Atlantic *halophilous* scrubs (*Sarcocornetea fruticosi*) [1420] • Embryonic shifting dunes [2110] • Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120] • Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130] (After NPWS 2012a)	12.2
Bannow Bay SPA (004033)	The conservation objectives of this site relate to maintaining or restoring the favourable conservation condition of the following Special conservation interests; • Light-bellied Brent Goose *Branta bernicla hrota* [A046] • Shelduck *Tadorna tadorna* [A048] • Pintail *Anas acuta* [A054] • Oystercatcher *Haematopus ostralegus* [A130] • Golden Plover *Pluvialis apricaria* [A140] • Grey Plover *Pluvialis squatarola* [A141] • Lapwing *Vanellus vanellus* [A142] • Knot *Calidris canutus* [A143] • Dunlin *Calidris alpina* [A149] • Black-tailed Godwit *Limosa limosa* [A156] • Bar-tailed Godwit *Limosa lapponica* [A157] • Curlew *Numenius arquata* [A160]	12.7

Site Name & Code	Conservation Summary	Minimum Distance from Site (km)
	• Redshank *Tringa totanus* [A162] • Wetland and Waterbirds [A999] (After NPWS 2012b)	
River Nore SPA (004233)	The conservation objectives of this site relate to maintaining or restoring the favourable conservation condition of the following special conservation interests; • Kingfisher *Alcedo atthis* [A229] (After NPWS 2024a)	13.9
Hugginstown Fen SAC (000404)	The conservation objectives of this site relate to maintaining or restoring the favourable conservation condition of the following qualifying interests; • Alkaline fens [7230] (After NPWS 2019)	14.9

The Natura 2000 sites considered to be located within the Zone of Influence of the proposed development are River Barrow & River Nore SAC (002162) and Lower River Suir SAC (002137).

There is no hydrological connection between the development site and any other Natura 2000 sites in the wider hinterland area. There is no potential for likely significant effects on more distant Natura 2000 sites and following consideration no pathway was identified by which any such sites might be impacted upon. Therefore, the two sites that will be considered in further detail in this assessment are River Barrow & River Nore SAC (002162) and Lower River Suir SAC (002137).

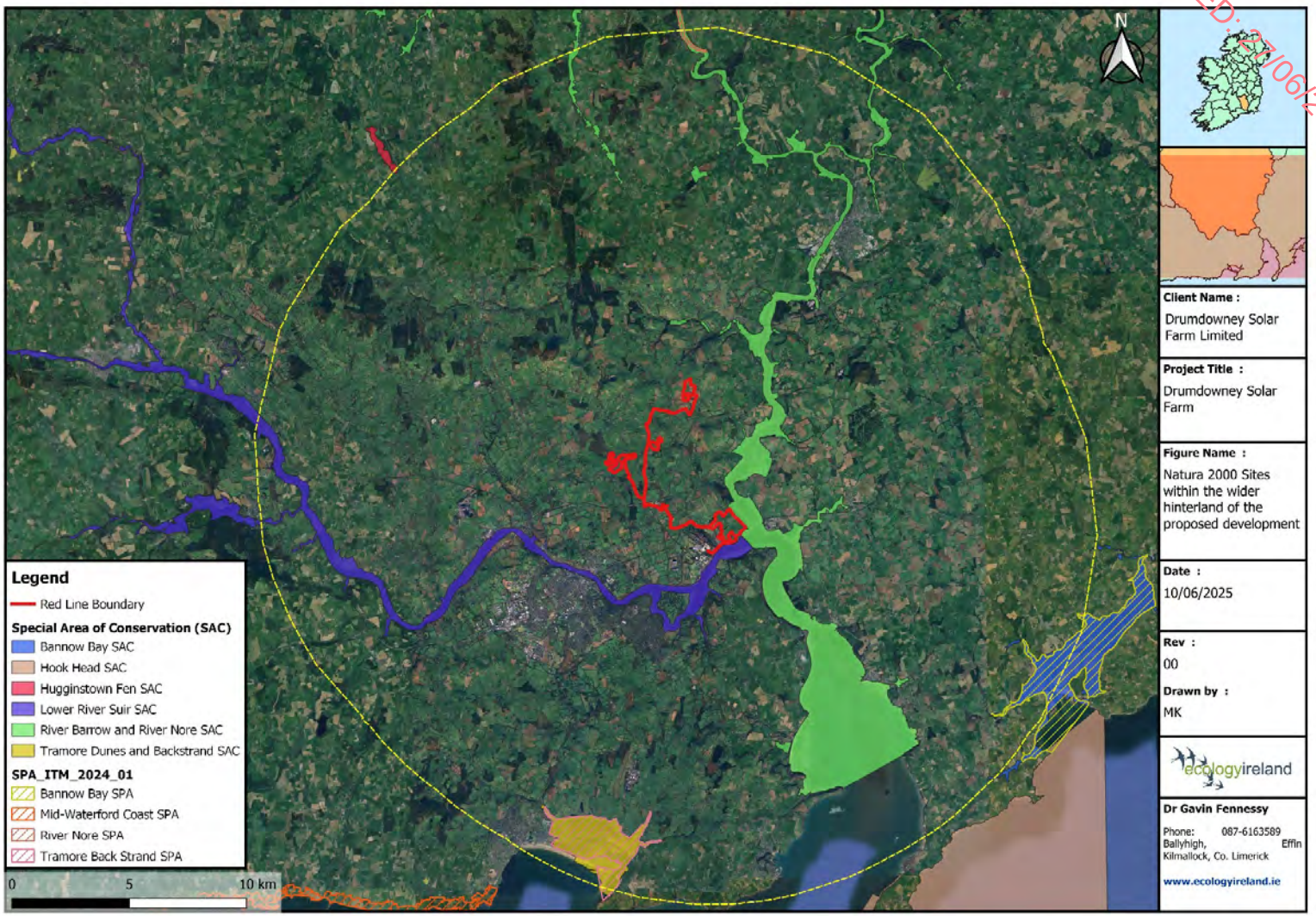

Figure 2-4 Natura 2000 sites located in the wider hinterland area.

Figure 2-5 European designated sites proximate to Parcel 4.

3 Stage 1: Assessment Criteria

3.1 Elements of the Project Likely to Impact on the Natura 2000 Sites

Consideration of the following potential impacts is assessed here in respect of the Natura 2000 sites identified as requiring further consideration in this screening assessment;

- Lower River Suir SAC
- River Barrow & River Nore SAC

Both sites are designated for a range of habitat and faunal interests. Many of the Qualifying interests are known to occur further upstream and away from the brackish water influence (e.g White-clawed Crayfish, *Austropotamobius pallipes*).

3.1.1 Direct Habitat Loss

The development site is not part of any designated site, nor does it require any resources from them; thereby ruling out any direct habitat loss at the conservation sites in question.

3.1.2 Indirect Habitat Loss or Deterioration

Indirect habitat loss or deterioration of designated sites within the surrounding area could occur from the effects of run-off or discharge into the aquatic environment through impacts such as increased siltation, nutrient release and/or contamination. This requires connectivity between the site and the designated site in question through watercourses and/or drainage ditches. As outlined in Section 3.1, there is a potential hydrological link, between the proposed development site and two designated sites: River Barrow & River Nore SAC and Lower River Suir SAC and therefore an impact-receptor-pathway exists between these designated sites and the proposed development site.

The main civil works for the solar farm project are described as follows:

- *Erection of PV arrays, prefabricated Inverter/Transformer station*s, *Ring Main Units and Storage Containers:* Piling of frame structures and mounting of panels. The inverters/ transformers and other units come to the site as prefabricated and ready to install;
- *Internal Access Track and Drain Deck Crossing*: The track which provides direct access to the solar arrays consists of compacted gravel. It allows, in particular, small vehicular movement during the operation of the PV plant. For its preparation, a thin layer of topsoil shall be removed before construction build-up is placed. The 'dry' deck crossing will be put in place to cross an existing site drain;
- *Cable trenches*: Narrow cable trenches to a depth of about 1.0 -1.5m will be excavated during construction, where required, but will not be visible after the construction is finished. Underground cabling will be typically confined where possible to the access track to avoid undue soil disturbance in accordance with best practice measures. At areas of the proposed interconnector route which traverse watercourses, Horizontal Direction Drilling (HDD) will be required;
- *Perimeter Fencing*: Secure perimeter fencing will be required as indicated on the planning drawings. This will be stock proof fencing (up to 2.4 m high) with support poles located at

approximately 2.5m centres. The footings for the security fencing will be precast or localised in-situ concrete. All final detail for the foundation elements will be developed with the contractor at construction stage. Typical plan details for this fencing and CCTV installations are provided as part of the planning application;

- *Substation and grid connection*: The proposed substation and grid connection will be constructed in parallel with solar farm. This infrastructure will be taken in charge by the ESB and constructed in accordance with ESB specifications and technical standards.

The construction phase of the proposed development will involve the stripping of topsoil to facilitate the laying of access tracks as well as minor excavation works to facilitate cable laying and inverter/transformer foundations. The construction of the on-site substation will be subject to a separate consent process but is also considered as part of this assessment. Earthworks as part of the construction of the substation and associated infrastructure also has the potential to result in run-off of sediment and other potential pollutants to the hydrologically connected designated sites.

Parcel 4 is located closest to the European designated sites and while there are no named watercourses within the area of this land parcel where construction will occur there is some potential for overland flow and/or groundwater mediated effects on the adjoining watercourses. The construction of the proposed solar farm will also require dry-deck crossings of land drains and a HDD crossing of the Luffany Stream that discharges to the Suir Estuary. Tributaries of the Blackwater (itself a tributary of the Suir) drain the eastern part of Parcel 3 and this land parcel has a number of land drains that may convey water towards the watercourse to the west of the site.

A minimum buffer of 5-10m from all land drains and 20m from natural watercourses was applied to these features when designing the layout of the above ground solar farm infrastructure.

The construction of the solar farm will include the installation of PV arrays, prefabricated inverter/transformer stations, storage containers, access track and bridge crossings, cable trenches, fencing, CCTV etc and all associated development works. There are 4 no. district field parcels of solar arrays associated with this solar farm. Construction of the solar farm within each parcel will take approximately 3-5 months with activities overlapping and construction resources shared on individual land parcels, as required. It is expected that the overall programme for construction of the solar farm will be 24 months, inclusive of electrical commissioning and any close out activities.

The substation and grid connection does not form part of the solar farm planning application however in the interests of completeness these are also considered in the CEMP. It is expected that the overall programme for construction of the solar farm and substation/grid connection will be 24 months. The construction traffic will be broadly spread over the construction programme.

The excavation and storage of soil has the potential to cause temporary siltation of watercourses in the event of prolonged heavy rain where excavated areas and spoil heaps are unprotected or sited in close proximity to watercourses. In the case of the proposed development, the earthworks are relatively minor and there will be no storage of spoil within 50m of any watercourse or drainage ditch.

Installation of the metal frames supporting the solar panel will cause minimal ground disturbance within the overall application site and these occupy a small proportion (typically <5%) of the footprint of the overall site.

Construction machinery and associated equipment will be the principal sources of pollutants such as oil, lubricants, fuel and hydrocarbons. The accidental release of fuel, oil spills or harmful chemicals, particularly close to drains and minor watercourses could result in adverse water quality impacts. Construction pollutants such as fuel or oil will be stored in secure bunded impermeable containers within the site compound, away from the watercourse and drainage ditches. Taking this into account along with the setback buffers from such features greatly reduces the likelihood of an accidental pollution event resulting in significant impacts to water quality.

In the absence of appropriate environmental controls there is some potential for run-off from the construction site to impact upon the quality or extent of a number of the qualifying habitats of River Barrow & River Nore SAC and Lower River Suir SAC. The recently updated Conservation Objectives of the River Barrow & River Nore SAC indicate that the QI habitats downstream of the application site, and therefore potentially affected by run-off from the site are Estuaries [1130], Mudflats and Sandflats not covered by seawater at low tide [1140] and potentially Reefs [1170]. In addition, several of the QI species of both SAC's could potentially be affected including Lamprey, *Lampetra* sp., Salmon, *Salmo salar*, Twaite Shad, *Allosa fallax* and Otter e.g. through changes in water quality or prey availability. There are areas of Atlantic Salt Meadow (Glauco-Puccinellietalia maritimae) a QI habitat of the Lower River Suir SAC upstream of Parcel 4 and the confluence with the Luffany Stream. However, there is a potential hydrological route from Parcel 3 through the Blackwater River which means that part of the site is upstream of this QI habitat.

It is worth noting that in the 'do-nothing' scenario, the development site (*i.e*. arable fields and pasture) would be subject to regular ploughing, re-seeding, fertiliser and weed spraying activities, which would represent a much higher and repeated risk of watercourse siltation/contamination than the relatively minor earthworks associated with the construction phase of the proposed development.

All other general/sanitary waste generated at the site during construction will be appropriately managed prior to removal off-site by licenced contractors and there will be no disposal of such waste to nearby watercourses or any designated site.

In the absence of adequate mitigation (*e.g*. standard environmental controls and implementation of buffer zones to watercourses) there is some likelihood of significant effects arising from run-off of contaminants from the site. The application site is large and located relatively close to both River Barrow & River Nore SAC and Lower River Suir SAC. In the absence of appropriate mitigation, the potential for indirect habitat loss or deterioration cannot be discounted at this stage.

<u>Disturbance/Displacement</u>

Activities associated with the construction of the proposed development could disturb and/or displace faunal species associated with designated conservation sites through noise and/or visual cues. Direct disturbance/displacement effects in relation to noise and/or visual cues on fauna associated with designated sites could be of relevance given that part of the proposed development site is located adjacent to the estuarine sections of the Lower River Suir SAC and the River Barrow & River Nore SAC. Both of these sites have Otter as a QI species. Otter are likely to be present also along the Luffany Stream and were photographed on trail camera on the watercourse west of Parcel 3. Works have the potential to cause localised disturbance to Otter – through noise and/or visual cues.

The construction related noise and traffic would see a temporary localised increase in the movement of plant and personnel on the lands within the application site. The construction of the solar arrays within each parcel is likely to take c. 3-5 months (per parcel) within an overall construction phase for the solar farm of c. 24 months. A perimeter fence will be constructed of stockproof fencing and will be up to 2.4 m in height.

The solar PV panels will be mounted on supporting structures, in the form of metal frames, which are typically anchored by driven or screw piles to a depth of up to 2m, causing minimal ground disturbance and occupying less than 1% of the land area. The angled racks will be anchored to the ground using one of the following methods:

- *Screw piles or rammed piles:* This is the preferred method of founding the racks, as it is the quickest to construct and most economical. This can be considered the default method and it is expected that the vast majority of the site will use screw or rammed piles as anchors;
- *Pre-drilled holes with backfilling/concrete:* In certain cases, geotechnical conditions such as the presence of rock close to the surface may require foundation holes to be pre-drilled prior to ramming the piles. These holes would then be backfilled with concrete or other aggregate. A pre-construction geotechnical assessment will confirm if this type of anchor is required. It is expected that this would only be deployed in localised pockets of land where rock was present, if at all;
- *Ballast foundations:* This foundation type can be used in localised circumstances where penetration of the ground surface is not possible. This method uses concrete anchors to counteract any lift forces generated by wind loading on the modules. Ballast foundations could be deployed in areas of the site in the event of rock near the surface, or where there is potential for sub-surface archaeology.

With the exception of a specific scenario where pre-drilled holes are necessary, there are no concrete works required in the installation process. The anchoring of panels will be followed by DC cabling, connections to inverters/transformers and a period of associated testing. The construction phase will be temporary in nature and as summarised in the Natura Impact Statement, the potential for disturbance / displacement of Otter in the estuarine sections of the adjoining SACs is not deemed to be significant. There is no known Otter holt in proximity to the development and given that the proposed construction activity will occur during the daylight hours there is no significant potential for construction related disturbance/displacement effects on Otter. The development site will not typically be lit at night. Site fencing will incorporate gaps/opes to facilitate commuting across the site by mammals, including Otter.

Ex-situ disturbance/displacement effects need to be considered in relation to highly mobile qualifying interest species that can occur outside of the designated site itself. There is potential that SCI species including Otter could utilise lands within the site for foraging purposes, albeit on an occasional basis. There are no EPA named watercourses flowing through any of the land parcels and no signs of Otter were recorded away from the riparian corridor. With the setbacks as designed from drains and watercourses it is unlikely that there will be any significant ex-situ disturbance/displacement effects on Otter, or any of the other faunal QI interests.

Operational Phase

Proposed Development Site

No significant effects are expected on designated sites during the operational phase of the proposed development. There will be no waste-water disposal associated with the proposed development as the facility will not be manned and does not require welfare facilities. Surface water run-off will be accommodated by soakaways at the site. The proposed solar farm is designed so as to minimise the effect on the original drainage and infiltration pattern of the site. Therefore, adverse impacts arising from a deterioration in water quality during the operation of the proposed solar farm is considered unlikely.

The lands under the panels may be grazed by sheep and not subject to ploughing or spreading of fertiliser. It is likely that the run-off of sediment and other potential pollutants from the site to drains and watercourses will be lower than currently experienced during the operational phase.

The solar farm will be unmanned, and maintenance requirements are expected to be very low. It should also be noted that the development will not be lit at night. Disturbance effects are therefore considered unlikely during the operation of the proposed solar farm. Solar farms are easily reversible, and the land can be restored, generally in better condition in respect of enhanced biodiversity. There will be no significant effects on designated sites during the decommissioning/restoration phase of the proposed development.

Taking the above into consideration, potential effects on the designated sites arising from the operation of the proposed development are considered neutral.

Decommissioning Phase

There is potential for similar impacts to occur during the decommissioning phase as in the construction phase. In the absence of appropriate environmental controls there is some potential for temporary localised disturbance and displacement of mobile QI species such as Otter and/or run-off of contaminants to the hydrologically connected designated sites. It is reasonable to predict that the scale and nature of the potential impacts arising from this phase is similar to that which has been described for the construction phase.

3.1.3 Likely Significant Effects: Conclusion

The development site is not part of the Natura 2000 sites under consideration here and does not require any resources from them – thereby ruling out any direct habitat loss impacts.

However, it is considered that construction/decommissioning phase elements of the project (in particular potential overland flow of construction stage silt/pollutants has the potential to impact on Natura 2000 sites (i.e., Lower River Suir SAC and River Barrow & River Nore SAC) within the project Zone of Influence (i.e., without the implementation of best practice measures or site-specific mitigation measures during the project construction phase). Similarly, without appropriate mitigation there is some potential for disturbance/displacement of faunal qualifying interest, Otter during construction and decommissioning phases of the proposed solar farm project.

3.2 Likely Impacts of the Project on the Natura 2000 Sites

As outlined in Section 3.1 above, it is deemed that construction/decommissioning phase elements of the project (in particular potential overland flow of construction stage silt/pollutants directly to or to watercourses hydrologically linked to the Lower River Suir SAC and the River Barrow & River Nore SAC have the potential to impact these Natura 2000 sites within the project Zone of Influence, without the implementation of best practice measures, a CEMP or site-specific mitigation measures during the project construction phase and at eventual decommissioning.

3.2.1 Size, Scale & Land-take

The development site is c. 189 hectares in area.

3.2.2 Distance from or Key Features of the Natura 2000 Sites

As described in Table 2-1 above.

3.2.3 Resource Requirements (water abstraction *etc.*)

Not applicable.

3.2.4 Excavation Requirements

The construction phase of the development will involve the stripping of a thin layer of topsoil, and it will be removed before construction build-up is placed.

The excavation and storage of soil has the potential to cause temporary siltation of watercourses in the event of prolonged heavy rain where excavated areas and spoil heaps are unprotected or sited in close proximity to watercourses. In the case of the proposed development, the earthworks are minor and there will be no storage of spoil within 50m of any watercourses. The construction phase will however require the construction of 7 dry-deck crossings and a HDD crossing of the Luffany Stream.

3.2.5 Emission (disposal to land, water or air)

No significant effects are likely on the conservation objectives of the Lower River Suir SAC or River Barrow and River Nore SAC as a result of air emissions during construction. This conclusion is supported by the temporary, localised nature of air emissions, the absence of sensitive terrestrial receptors within the SACs in close proximity and the lack of cumulative air quality pressures in the receiving environment.

It is considered that construction and decommissioning phase elements of the project (in particular potential overland flow of construction stage silt/pollutants to the watercourses hydrologically connected to and the estuaries that form part of the Lower River Suir SAC and the River Barrow and River Nore SAC and disturbance/displacement of Otter has the potential to impact Natura 2000 sites (i.e., Lower River Suir SAC and the River Barrow & River Nore SAC) within the project Zone of Influence. Such impacts cannot be discounted without adequate Construction and Environmental Management Plan (CEMP) commitments being implemented and/or site-specific mitigation measures being put in place during the project construction/decommissioning phase. Such mitigation cannot be considered as part of the Screening stage and therefore a Natura Impact Statement is required.

3.2.6 Transportation Requirements

There will be some localised increase in construction traffic during the construction phase (and to a lesser extent during decommissioning) however operational phase maintenance requirements are low. The facility will not require any day-to-day staffing and security will be remote and monitored via CCTV.

3.2.7 Duration of Operations

The construction and commissioning of the solar farm will take c. 24 months in total. The operational lifespan of the solar farm will be 40 years after which time the development will be decommissioned.

3.2.8 Cumulative and In-combination Effects

In order to fully assess the potential impact of the proposed development on the receiving environment including on Natura 2000 sites, the project must be assessed alone or in combination with existing activities and proposed plans for the region.

It is proposed that the solar farm will be served by an onsite 110kV GIS substation and loop-in infrastructure comprising underground 110kV cabling and 2 no. interface towers which will connect into the existing 110kV Great Island to Waterford overhead line. This infrastructure shall be the subject of a separate planning application to An Bord Pleanála. Notwithstanding the dual consent process, this EcIA considers both the solar farm development and the substation and grid connection development for the purposes of completing a robust assessment of the entire project.

In order to fully assess the potential impact of the proposed development on Natura 2000 sites, the project must be assessed alone or in combination with existing activities and proposed plans for the region. Myplan.ie and Kilkenny City and County Development Plan 2021-2027 were consulted in order to determine if there were any other plans or projects in the area which could result in cumulative impacts. A selection of these plans and projects are considered further in this respect in Table 3-1 below. Most of the planning permissions in the local area are associated with relatively minor works such as modifications to residential or farm buildings and construction of one-off houses.

The proposed development area is rural and agricultural land use is dominant. A number of the planning applications in the area relate to operations at or associated with Belview Port, electricity distribution from Great Island Power station and renewable energy projects. There is a live application before the local authority (25/60254) in relation to modifications to road access at Belview Port and this application is accompanied by a NIS. The field surveys recorded Otter activity at the port, along the Suir Estuary.

Potential cumulative effects in relation to solar farms include construction related surface-water run-off, in particular where qualifying interests associated with the SACs could be subject to cumulative impact through hydrological or water quality impacts such as increased siltation, nutrient release and contaminated run-off arising from other developments. This project has been considered on its own and in relation to the potential for any cumulative or in combination impacts arising from any combination of the project proceeding in the future.

The earthworks associated with the permitted solar farms are relatively minor and with the application of the environmental controls and recommended mitigation, the risk to watercourses is considered very low (lower than for seasonal ploughing for agricultural purposes); therefore, no cumulative impacts on watercourses or designated sites are expected as a result of this solar farm development and the nearby permitted and proposed developments.

No potential for significant cumulative/in-combination effects related to disturbance, displacement morbidity or mortality impacts on fauna species has been identified.

Taking the above into consideration, along with the proposed environmental management and controls integrated into the project design and for other projects in the area, no potentially negative cumulative and in-combination ecological effects have been identified.

Table 3-1 Selection of planning applications in the vicinity of the proposed works

Ref. Number	Distance from Subject Site	Status	Planning Authority	Description
ABP-321962	c. 450m	Live Application, Decision Due – 30/06/2025	An Bord Pleanála	Construction of an integrated plasterboard manufacturing facility and all associated works. Environmental Impact Assessment Report (EIAR) and Natura Impact Statement (NIS) submitted with application.
25/60233	c. 140m	Live Application, Decision Due – 24/06/2025	Kilkenny County Council	constructing 2 no. industrial warehouse blocks for bulk storage, with Block A housing 4 no. single storey storage units (floor area - 3,488.4m2) and Block B housing 4 no. single storey units (floor area - 8446.2m2), new weighbridge and cabin, new internal access roads, retaining walls and boundary fencing and all ancillary works
25/60205	c. 2km	Live Application, Decision Due – 12/06/2025	Kilkenny County Council	The proposed development will consist of 10 No. campervan parking bays, alterations to an existing derelict outbuilding to provide for campsite facilities including toilet/shower block, wastewater treatment system and ancillary site works.
25/60208	c. 3.5km	Live Application, Decision Due – 12/06/2025	Kilkenny County Council	for the renovation and extension of our existing administration offices together with a new security hut, altered entrance arrangement and all associated site works.
25/60177	c. 50m	Live Application, Decision Due – 29/05/2025	Kilkenny County Council	for the construction of a bulk store and associated site works. The store will be used to store port related products such as break bulk, bulk and unitised loads
25/60074	c. 480m	Live Application, Decision Due – 22/05/2025	Kilkenny County Council	for the construction of a new wastewater treatment system and a proposed change to the site boundary situated

Ref. Number	Distance from Subject Site	Status	Planning Authority	Description
24/60304	c. 3.8km	Granted – 10/04/2025	Waterford City & County Council	The Phase 1 development includes 9 blocks with a total gross floor area (GFA) of 60579sqm (64953sqm including undercroft and basement car parks (4374sqm)). The development involves construction of a podium which establishes new ground/ street formation level which varies from c.4.6mOD to 8.4mOD which connects to the Sustainable Transport Bridge (by WCCC) at the Central Plaza. Provision is made for pedestrian connection from Central Plaza to Dock Road via the approved pedestrian bridge (by WCCC). A new riverside promenade / cycleway (part of Greenway) is proposed between the Sustainable Transport Bridge and the Eastern Access to the site.
24/60308	c. 2.9km	Granted – 13/03/2025	Kilkenny County Council	for the proposed erection of 14 number semi-detached two-storey and basement [three-stories overall] dwellinghouses together with all associated site development works [including removal of existing concrete bases and reduction of levels to original contour levels] in lieu of 10 number houses [No 17-26] previously permitted under Planning Reference 16/872
ABP-318204	c. 1km	Granted – 15/01/2025	An Bord Pleanála	Grid stability service development and associated site works.
ABP-318103	c. 1km	Granted – 13/11/2024	An Bord Pleanála	Development of a new electricity circuit. A Natura Impact Statement (NIS) was submitted with the application.
23/60426	c. 1km	Granted – 16/09/2024	Kilkenny County Council	for a 7-year planning permission for 3 No Bulk Stores, a marshalling yard and site works including earthworks, road works, entrance, gates and fencing, concrete paving, water services, drainage works, site lighting and landscaping. The stores will be used to store Port related products such as bulk goods, break bulk and unitised products.

Ref. Number	Distance from Subject Site	Status	Planning Authority	Description
23/60578	c. 3km	Granted – 05/08/2024	Kilkenny County Council	for the demolition of two existing shed buildings and removal of the remaining floor slab of a previous dwelling, the construction of 16 No. two storey houses (12 No. 3-bedroom & 04 No. 02-bedroom), a new site entrance from Abbey Road, new boundary treatments, and all associated site & development works
24/60256	c. 750m	Granted – 23/07/2024	Kilkenny County Council	for the development of 2no. grain silos and associated site works
20240309	c. 1.4km	Granted – 12/06/2024	Wexford County Council	Permission for development consisting of construction of a Battery Energy Storage System (BESS)
ABP-318914	c. 1km	Granted – 05/06/2024	An Bord Pleanála	110kV substation and 110kV underground grid connection
23/60323	c. 1.6km	Granted – 08/04/2024	Kilkenny County Council	for the proposed erection of 4 number fully serviced 2 storey detached dwellings, 4 number detached single storey garages, 2 number proposed vehicular and pedestrian entrances, boundary treatments to include removal of existing stone wall to front of site to facilitate sightlines, landscaping, together with all associated site development works to include removal of adjoining section of farm building
20231294	c. 1.2km	Granted – 16/02/2024	Wexford County Council	Permission for development, consisting of: Construction of an electrical infrastructure installation and associated underground grid connection (UGC)

Ref. Number	Distance from Subject Site	Status	Planning Authority	Description
23/60536	c. 3.5km	Granted – 25/01/2024	Kilkenny County Council	for the demolition of the existing biofilter for odour abatement and the construction of a new biofilter, stack and all associated pipework and ducting
ABP-312631	c. 1.3km	Granted – 22/01/2024	An Bord Pleanála	Construction of two boreholes in milk processing plant. Natura Impact Statement submitted with the planning application. The Glanbia Ireland DAC facility has an Industrial Emissions Licence granted by the EPA
23/60504	c. 3.6km	Granted – 04/01/2024	Kilkenny County Council	for the provision of new effluent treatment system with associated percolation area including all site development works
23/60274	c. 690m	Granted – 02/11/2023	Kilkenny County Council	(1) New single storey warehouse, incorporating a 2 Storey office block; (2) Open sided covered goods in-take area from proposed warehouse to existing building; (3) New single storey storage building between proposed building and existing building; (4) Relocation of existing weigh-bridge and associated items; (5) Relocation of existing static water bladder tank; (6) Realignment of existing car parking area on site to include for additional spaces; (7) Realignment of internal site road, together with all associated site development works, all at Gorteens, Slieverue, Co. Kilkenny. This application is accompanied by a Natura Impact Statement (NIS).
ABP-314069	c. 3.6km	Granted – 27/10/2023	An Bord Pleanála	Construction of extension and all associated site works

Ref. Number	Distance from Subject Site	Status	Planning Authority	Description
23/60352	c. 3.9km	Granted – 25/09/2023	Kilkenny County Council	for a water storage tank, single storey pump house and all associated site works
22/318	c. 280m	Granted – 17/05/2023	Kilkenny County Council	for a laydown area for equipment and break bulk materials. The works will include earthworks, drainage, concrete paving, retaining walls and landscaping works. A Natura Impact Statement will accompany this application
22/549	c. 690m	Granted – 28/04/2023	Kilkenny County Council	for a single-storey extension to existing warehouse (BV2) to north of site, new storm water attenuation tank and the part realignment of existing concrete yard together with all associated site development works
23/29	c. 30m	Granted – 30/03/2023	Kilkenny County Council	for the construction of a slatted tank, cattle shed, alongside all associated site works
ABP-311746	c. 4.4km	Granted – 02/02/2023	An Bord Pleanála	Waterford City Public Infrastructure Project - Flood Defences West. Development of c.1.1km of flood protection measures.
22/480	c. 720m	Granted – 19/01/2023	Kilkenny County Council	for a Maintenance Building, roof mounted solar panels and associate site works at Belivew Port.

Ref. Number	Distance from Subject Site	Status	Planning Authority	Description
22/569	c. 360m	Granted – 12/01/2023	Kilkenny County Council	to construct 3No wood based, biomass storage bays an ash storage building and associated site works including road widening to an existing internal road and a new concrete yard area. A Natura Impact Statement will accompany the Application. Smartply Europe currently hold an Industrial Emission Licence issued by the EPA.
20221162	2.2km	Granted – 16/12/2022	Wexford County Council	Permission to amend the design of the approved development (Planning Reference 20170330) which comprises consent for a Solar PV Energy Development. Proposed amendments include; (1) Change of location and increase in number of client substations, (2) Increase in number of storage rooms, (3) Decrease in number and size of transformer containers, (4) Deer fencing to decrease in size, (5) Number of CCTV cameras to be reduced, (6) Slight alteration to the access tracks, (7) Change in height and number of module racks and pile driven poles, (8) Change in height and angle of solar panels, and (9) Change in lifetime of the permission from 5 years to 10 years with an increase operational lifetime from 25 to 35 years
20220628	1.7km	Granted – 6/07/2022	Wexford County Council	Permission for development which will consist of grid connection infrastructure to connect the approved Ballyedock Solar Farm (PA Ref:20170330) to the existing Great Island Substation comprising the laying of underground cables, overhead lines, associated infrastructure and Horizontal Directional Drilling. The proposed development will also include upgrades to the substation (previously consented under planning application reference 20170330) to align with the connection route to the national grid. A Natura Impact Statement has been prepared in respect of the application for planning permission.
22/452	c. 45m	Granted – 22/11/2022	Kilkenny County Council	for the construction of a Livestock Underpass beneath the public road between the crossroads and existing farmyard alongside all associated site works

Ref. Number	Distance from Subject Site	Status	Planning Authority	Description
22/513	c. 40m	Granted – 27/09/2022	Kilkenny County Council	for the change of use of land to extend the service station carpark to enable the installation of a modular substation and ancillary site development works; to facilitate 2 no. shared electric vehicle charging units and 4 no. charging bays within a partially reconfigured parking area
22/81	c. 40m	Granted – 04/04/2022	Kilkenny County Council	for development. The development will consist of the installation of 5250 Solar PV panels over the roof of existing industrial buildings and all associated site works and services
21/1030	c. 1km	Granted – 14/02/2022	Kilkenny County Council	for the handling and temporary storage of zinc and lead ore at an existing bulk store, and loading of the ore from the store onto ships from an existing Wharf.
21/989	c. 1.4km	Granted – 03/02/2022	Kilkenny County Council	the installation of a Combined Heat and Power (CHP) unit including a 7.55m high stack, stack access ladder and platform, improvements to the internal estate road and ancillary site works at the permitted cheese manufacturing plant, planning permission reference no. 19/668 (APB-306136-19). An Industrial Emissions Licence is required for the cheese manufacturing plant and the proposed development. A Natura Impact Statement will also be submitted with the application.
21/551	c. 3.2km	Granted – 08/11/2021	Kilkenny County Council	for the construction of a terrace of 5 No. two bedroom bungalows designed for the elderly, together with proposed boundary treatments, landscaping, car parking, drainage connections and all associated site development works
21/586	c. 320m	Granted – 31/08/2021	Kilkenny County Council	for a 7 year planning permission for a bulk store and associated site works. The store will be used to store port related products such as break bulk, bulk and unitised loads

Ref. Number	Distance from Subject Site	Status	Planning Authority	Description
ABP-308906	c. 1km	Granted – 23/06/2021	An Bord Pleanála	Proposed development will form part of the Greenlink Interconnector and will consist of the development of a new converter station, tail station, MV substation and 23km of high voltage direct current (JVDC) electricity cables, 420m of high voltage alternating current (HVAC) cables, 23.42km of fibre optic cable and all associated site works with an overall proposed development site area of 83.8ha.
20/845	c. 3.3km	Granted – 10/06/2021	Kilkenny County Council	for the following: a) change of use of the existing first floor area to residential use to provide 15 no. apartments, b) construct a new rooftop penthouse containing 8 no apartments (23 apartments in total) together with c) elevational modifications, and all associated site works
20/700	c. 320m	Granted – 05/03/2021	Kilkenny County Council	to develop a log yard and associated works. The log yard will extend the area available for stockpiling and handling of logs for use in SmartPly's oriented strand board mill which adjoins the site. A Natura Impact Statement will accompany the Application
20/453	c. 2.5km	Granted – 03/03/2021	Kilkenny County Council	the construction of 40 no. residential units

3.3 Likely Changes to the Natura 2000 Sites

As outlined in Section 3.1 above, it is deemed that construction phase elements of the project (in particular potential overland flow of construction stage silt/pollutants) to the watercourses hydrologically connected to and the estuaries that form part of the Lower River Suir SAC and the River Barrow and River Nore SAC and potential disturbance/displacement of Otter has the potential to impact Natura 2000 sites (i.e., the Lower River Suir SAC and the River Barrow and River Nore SAC) within the project Zone of Influence, without the implementation of best practice measures, a CEMP or site-specific mitigation measures during the project construction phase and during eventual decommissioning.

Table 3-2 presents a screening rational for QIs of both of the designated sites potentially affected by the proposed development. Table 3-3 presents the reasoning why there is no likelihood of significant effects in relation to many of the QIs of these designated sites.

3.3.1 Reduction of Habitat Area

There is the potential for indirect habitat loss or deterioration of Natura 2000 sites within the project ZoI from the effects of run-off or discharge into the aquatic environment through impacts such as increased siltation, nutrient release and/or contamination, particularly during the project construction phase.

3.3.2 Disturbance to Key Species

During construction (and decommissioning), disturbance associated with the movement of plant and personnel could potentially disturb or displace Otters in areas proximate to the active works.

3.3.3 Habitat or Species Fragmentation

Not applicable.

3.3.4 Reduction in Species Density

There is some potential for the proposed project to contribute towards changes in water quality of Natura 2000 sites within the project ZoI. This is related to the potential for run-off or discharge into the aquatic environment contributing to downstream impacts such as increased siltation, nutrient release and/or contamination, particularly during the project construction phase. In the event that the water quality/feeding resource in nearby areas of the estuaries was impacted this could lead to a reduction in the qualifying fauna species density in these areas (e.g. Otter, Salmon, *Salmo salar*). Similarly, if disturbance/displacement of Otters was to occur as a result of the development that could impact upon the local distribution and abundance of the species within the SACs in question.

3.3.5 Changes in Key Indicators of Conservation Value (water quality *etc*.)

There is some potential for the proposed project to contribute towards changes in water quality of Natura 2000 sites within the project ZoI. This is related to the potential for run-off or discharge into the aquatic environment contributing to downstream impacts such as increased siltation, nutrient release and/or contamination, particularly during the project construction phase.

3.4 Likely Impacts on the Natura 2000 Sites as a Whole

It is considered that in the absence of adequate mitigation that construction phase elements of the project (to the watercourses hydrologically connected to and the estuaries that form part of the Lower River Suir SAC and the River Barrow and River Nore SAC) and disturbance/displacement of Otter which is a qualifying

interest of both of the SACs in question has the potential to have significant effects on the Natura 2000 sites (i.e., Lower River Suir SAC and the River Barrow and River Nore SAC) within the project Zone of Influence. Such impacts cannot be discounted without adequate CEMP commitments being implemented and/or site-specific mitigation measures being put in place during the project construction phase. Likewise, it is reasonable to infer that in the absence of adequate environmental controls during the decommissioning phase that there could be similar effects on the local Natura 2000 sites.

3.4.1 Interference with the Key Relationships that Define the Structure and Function of the Natura 2000 Sites

Without the implementation of best practice measures, a CEMP or site-specific mitigation measures during the project construction phase (and again during decommissioning), it is considered that construction phase elements of the project may have the potential to contribute towards significant effects that may interfere with the structure and function of Natura 2000 sites within the project ZoI; Lower River Suir SAC and the River Barrow and River Nore SAC.

3.5 Indicators of Significance as a Result of the Identification of Effects Set Out Above

As outlined above, it is deemed that construction phase elements of the project (in particular potential overland flow of construction stage silt/pollutants) to the watercourses hydrologically connected to and the estuaries that form part of the Lower River Suir SAC and the River Barrow and River Nore SAC and potential disturbance/displacement of Otter has the potential to impact Natura 2000 sites (i.e., the Lower River Suir SAC and the River Barrow and River Nore SAC) within the project Zone of Influence, without the implementation of best practice measures, a CEMP or site-specific mitigation measures during the project construction phase. Likewise, it is reasonable to infer that in the absence of adequate environmental controls during the decommissioning phase that there could be similar effects on the local Natura 2000 sites.

3.5.1 Loss

There is the potential for indirect habitat loss or deterioration of Natura 2000 sites within the project ZoI from the effects of run-off or discharge into the aquatic environment through impacts such as increased siltation, nutrient release and/or contamination, particularly during the project construction/decommissioning phases.

3.5.2 Fragmentation

Not applicable.

3.5.3 Disruption

There is the potential for indirect habitat loss or disruption of Natura 2000 sites within the project ZoI from the effects of run-off or discharge into the aquatic environment through impacts such as increased siltation, nutrient release and/or contamination, particularly during the project construction/decommissioning phases.

3.5.4 Disturbance

The construction/decommissioning phase activity has the potential to displace Otters from areas within and proximate to the development site. This could involve disturbance of Otters within the designated sites or ex-situ disturbance of Otters elsewhere within the development site.

3.5.5 Change to Key Elements of the Site

As outlined in Section 3.1 above, it is deemed that construction phase elements of the project (in particular potential overland flow of construction stage silt/pollutants) to the watercourses hydrologically connected to and the estuaries that form part of the Lower River Suir SAC and the River Barrow and River Nore SAC and potential disturbance/displacement of Otter has the potential to impact Natura 2000 sites (i.e., the Lower River Suir SAC and the River Barrow and River Nore SAC) within the project Zone of Influence. Such impacts cannot be discounted without adequate CEMP commitments being implemented and/or site-specific mitigation measures being put in place during the project construction phase. Likewise, it is reasonable to infer that in the absence of adequate environmental controls during the decommissioning phase that there could be similar effects on the local Natura 2000 sites.

3.6 Elements of the Project Likely to Significantly Impact on the Natura 2000 Sites or where the Scale or Magnitude of Impacts are Unknown

The proposed development site is located in close proximity to the Natura 2000 sites Lower River Suir SAC and the River Barrow and River Nore SAC and there are potential hydrological connections via the watercourses (and drains) proximate to the development site as well as via overland flow and potential groundwater linkages. Significant effects during the project construction phase cannot be discounted without the implementation of best practice construction design measures and the implementation of a Construction & Environmental Management Plan (CEMP). Likewise, it is reasonable to infer that in the absence of adequate environmental controls during the decommissioning phase that there could be similar effects on the local Natura 2000 sites.

Therefore, it cannot be concluded, that the proposed project, individually or in combination with other plans or projects, will not have a significant effect on a Natura 2000 sites, without the consideration and analysis of further information. Therefore Stage 2 NIS (AA) is required.

A Natura Impact Statement (NIS) is presented in **Section 4**, to provide scientific examination of the project to enable the competent authority to undertake an AA. The NIS will examine potential effects to Natura 2000 sites screened in as part of this Screening for Appropriate Assessment; site Lower River Suir SAC and the River Barrow and River Nore SAC.

Table 3-2 Screened-In Qualifying Interests

SAC	Qualifying Interest (QI)	Screening Rationale
Lower River Suir SAC	Salmon (*Salmo salar*) [1106]	Estuarine habitat used during migration; vulnerable to sediment or pollutant input.
Lower River Suir SAC	Otter *(Lutra lutra*) [1355]	Uses estuarine margins; may be disturbed by construction activity. Present in the Luffany and minor watercourses adjacent to Parcel 3.
Lower River Suir SAC	Atlantic Salt Meadows [1330]	Downstream habitat to water flowing into the Blackwater and onto the Suir, potentially sensitive to runoff and eutrophication.
Lower River Suir SAC	Twaite Shad (*Alosa fallax fallax*) [1103]	Migrates through estuary in spring; vulnerable to turbidity or pollution.
River Barrow and River Nore SAC	Salmon (*Salmo salar*) [1106]	As above.
River Barrow and River Nore SAC	Otter (*Lutra lutra*) [1355]	As above.
River Barrow and River Nore SAC	Atlantic Salt Meadows [1330]	As above.
River Barrow and River Nore SAC	Twaite Shad (*Alosa fallax fallax*) [1103]	As above.
River Barrow and River Nore SAC	Sea Lamprey (*Petromyzon marinus*) [1095]	Estuarine sections used in migration/spawning.
River Barrow and River Nore SAC	River Lamprey (*Lampetra fluviatilis*) [1099]	May be present in estuarine reaches during life cycle.
River Barrow and River Nore SAC	Brook Lamprey (*Lampetra planeri*) [1096]	Occasional use of estuarine areas; precautionary inclusion.

Table 3-3 Screened-Out Qualifying Interests

Site	Qualifying Interest	Reason for Screening Out
Lower River Suir SAC [002137]	1029 *Margaritifera margaritifera* (Freshwater Pearl Mussel)	No suitable habitat or hydrological link.
Lower River Suir SAC [002137]	1092 *Austropotamobius pallipes* (White-clawed Crayfish)	No instream works; estuarine setting unsuitable.
Lower River Suir SAC [002137]	3260 Floating river vegetation	Estuarine section unsuitable; feature limited to upstream freshwater reaches.
Lower River Suir SAC [002137]	7220 Petrifying springs with tufa formation	No karst or spring hydrology in receiving environment.
Lower River Suir SAC [002137]	91A0 Old sessile oak woods	No semi-natural woodland habitat present or within ZOI.
Lower River Suir SAC [002137]	91E0 Alluvial forests	No qualifying alluvial woodland within zone of influence.
River Barrow and River Nore SAC [002162]	1029 *Margaritifera margaritifera* (Freshwater Pearl Mussel)	No freshwater substrate; project located near estuarine section.
River Barrow and River Nore SAC [002162]	1092 *Austropotamobius pallipes* (White-clawed Crayfish)	No direct works to instream habitat; estuarine section unsuitable.
River Barrow and River Nore SAC [002162]	7220 Petrifying springs with tufa formation	No spring-fed tufa features present or hydrologically connected.
River Barrow and River Nore SAC [002162]	91A0 Old sessile oak woods	No qualifying habitat present; habitat not hydrologically linked.
River Barrow and River Nore SAC [002162]	91E0 Alluvial forests	No qualifying riparian woodland present in study area.
River Barrow and River Nore SAC [002162]	4030 European dry heaths	No dry heath habitat within zone of influence.

Site	Qualifying Interest	Reason for Screening Out
River Barrow and River Nore SAC [002162]	6430 Hydrophilous tall herb fringe communities	No hydrophilous tall herb communities present or likely to be affected.
River Barrow and River Nore SAC [002162]	6985 *Vandenboschia speciosa* (Killarney Fern)	No suitable shaded, humid niche habitat present.
River Barrow and River Nore SAC [002162]	1016 *Vertigo moulinsiana*	No calcareous fen habitat present; unsuitable conditions.

4 Natura Impact Statement

This section of the report provides the necessary information to inform the AA process to be completed by the planning authority. This NIS provides the relevant scientific information to enable the competent authority in carrying out its AA to determine whether or not the proposed development would adversely affect the integrity of Natura 2000 sites.

The NIS assesses whether or not the proposed development would adversely affect the integrity of Natura 2000 sites within the project ZoI, for which effects could not be excluded during the Screening for AA (see Section 3 for details). The Natura 2000 sites are as follows:

- Lower River Suir SAC
- River Barrow and River Nore SAC

As outlined in Section 3, the proposed development site has potential hydrological connectivity with the Natura 2000 sites (site Lower River Suir SAC and the River Barrow and River Nore SAC). Parcel 4 of the proposed development site is located closely adjacent to these Natura 2000 sites. All of the application site is located within the subcatchment of these designated sites. Parcel 3 is adjacent to watercourses which flow into the Blackwater a tributary of the Suir. The proposed development requires dry-deck crossings of drains and a HDD crossing of the Luffany (upstream of the Suir Estuary). There is potential for impacts to occur through run-off of contaminants to the Natura 2000 sites and potential disturbance/displacement impacts on Otter, a qualifying interest species of both SACs. These likely effects were identified in the screening process as requiring further consideration and appropriate mitigation.

Table 4-1 summarises the qualifying and special conservation interests of these sites. The detailed Conservation Objectives of these sites are provided in Appendix 1 to this NIS. As summarised in Table 3-2 only certain QIs have the potential to be impacted upon by the proposed development. In relation to water-quality mediated impacts there is some potential for impact upon fish species, Atlantic Salt Meadows and Otter.

The mitigation and environmental control measures outlined in Section 4.2 have been designed to prevent any damaging run-off or pollution of either of the Natura 2000 sites located proximate to the development. Similarly, the mitigation also presents precautionary measures designed to minimise the potential disturbance of Otters that may be present in the vicinity of the application site.

Table 4-1 Details of the Natura 2000 sites considered in this NIS.

Site Name & Code	Conservation Summary	Minimum Distance from Site (km)
River Barrow and River Nore SAC (002162)	The conservation objectives of this site relate to maintaining or restoring the favourable conservation condition of the following qualifying interests; • Estuaries [1130] • Mudflats and sandflats not covered by seawater at low tide [1140] • Reefs [1170] • Salicornia and other annuals colonising mud and sand [1310] • Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] • Mediterranean salt meadows (*Juncetalia maritimi*) [1410] • Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260] • European dry heaths [4030] • Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430] • Petrifying springs with tufa formation (Cratoneurion) [7220] • Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0] • Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) [91E0] • Desmoulin's Whorl Snail *Vertigo moulinsiana* [1016] • Freshwater Pearl Mussel *Margaritifera margaritifera* [1029] • White-clawed Crayfish *Austropotamobius pallipes* [1092] • Sea Lamprey *Petromyzon marinus* [1095] • Brook Lamprey *Lampetra planeri* [1096] • River Lamprey *Lampetra fluviatilis* [1099] • Twaite Shad *Alosa fallax fallax* [1103] • Salmon *Salmo salar* 1106] • Otter *Lutra lutra* [1355] • Killarney Fern *Trichomanes speciosum* [1421] • Nore Freshwater Pearl Mussel, *Margaritifera durrovensis* (After NPWS 2025)	Directly bordering Parcel 4 to the East

Site Name & Code	Conservation Summary	Minimum Distance from Site (km)
Lower River Suir SAC (002137)	The conservation objectives of this site relate to maintaining or restoring the favourable conservation condition of the following qualifying interests; • Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] • Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260] • Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430] • Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0] • Alluvial forests with *Alnus glutinosa* and Fraxinus excelsior (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0] • *Taxus baccata* woods of the British Isles [91J0] • Freshwater Pearl Mussel *Margaritifera margaritifera* [1029] • White-clawed Crayfish *Austropotamobius pallipes* [1092] • Sea Lamprey *Petromyzon marinus* [1095] • Brook Lamprey *Lampetra planeri* [1096] • River Lamprey *Lampetra fluviatilis* [1099] • Twaite Shad *Alosa fallax fallax* [1103] • Salmon *Salmo salar* 1106] • Otter *Lutra lutra* [1355] (After NPWS 2017)	0.04

4.1 Impact Assessment

4.1.1 Characterising Impacts

The methodology for the assessment of impacts is derived from the Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites (EC, 2002). When describing changes/activities and impacts on ecosystem structure and function, the types of impacts that are commonly presented include the following:

- direct and indirect effects,
- short- and long-term effects,
- construction, operational and deconstruction / demolition effects, and
- isolated, interactive and cumulative effects.

Impacts that could potentially occur through the implementation of the project can be categorised under a number of impact categories as outlined in the EC 2002 document as follows:

- Loss/Reduction of habitat area,
- Disturbance to key species,
- Habitat or species fragmentation,
- Reduction in species density, and
- Changes in key indicators of conservation value such as decrease in water quality and quantity.

Meaning of 'Adversely Affect the Integrity of the Site'

The concept of the 'integrity of the site' is explained in the EU publication Managing Natura 2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC, as follows;

'It is clear from the context and from the purpose of the directive that the 'integrity of the site' relates to the site's conservation objectives. For example, it is possible that a plan or project will adversely affect the integrity of a site only in a visual sense or only habitat types or species other than those listed in Annex I or Annex II. In such cases, the effects do not amount to an adverse effect for purposes of Article 6(3), provided that the coherence of the network is not affected. On the other hand, the expression 'integrity of the site' shows that focus is here on the specific site. Thus, it is not allowed to destroy a site or part of it on the basis that the conservation status of the habitat types and species it hosts will anyway remain favourable within the European territory of the Member State.

As regards the connotation or meaning of 'integrity', this can be considered as a quality or condition of being whole or complete. In a dynamic ecological context, it can also be considered as having the sense of resilience and ability to evolve in ways that are favourable to conservation. The 'integrity of the site' has been usefully defined as 'the coherence of the site's ecological structure and function, across its whole area, or the habitats, complex of habitats and/or populations of species for which the site is or will be classified'

A site can be described as having a high degree of integrity where the inherent potential for meeting site conservation objectives is realised, the capacity for self-repair and self-renewal under dynamic conditions is maintained, and a minimum of external management support is required. When looking at the 'integrity of the site', it is therefore important to take into account a range of factors, including the possibility of effects manifesting themselves in the short, medium and long-term.

The integrity of the site involves its ecological functions. The decision as to whether it is adversely affected should focus on and be limited to the site's conservation objectives.

4.1.2 Potential Effects from the Proposed Development to Qualifying Habitats and Species of Natura 2000 Sites within the Project Zone of Influence

Potential effects associated with the proposed development to the Qualifying Habitats and Species of Natura 2000 Sites within the project Zone of Influence (site Lower River Suir SAC and the River Barrow and River Nore SAC) are as follows:

Construction phase elements of the project (in particular potential overland flow of construction stage silt/pollutants to watercourses hydrologically linked to the designated sites in question, or directly to these sites themselves) have the potential to impact Natura 2000 sites (i.e., Lower River Suir SAC and the River Barrow and River Nore SAC). Such effects can result in indirect habitat loss or deterioration of these Natura 2000 sites, as well as reduction in density of qualifying avian species. Likewise, it is reasonable to infer that in the absence of adequate environmental controls during the decommissioning phase that there could be similar effects on the local Natura 2000 sites.

Disturbance or displacement effects on Otter could occur, particularly during construction and to a lesser extent during the eventual decommissioning phase as a result of the movement and operation of plant and personnel. The construction activity will involve the movement of plant and personnel

and associated noise and visual stimuli which could potential effect the distribution and abundance of Otters using nearby parts of the designated sites, or ex situ disturbance in areas of the development site away from the SACs. Direct disturbance/displacement effects in relation to noise and/or visual cues on fauna associated with designated sites could be of relevance given that Parcel 4 is located closely adjacent to the two estuarine sections of these designated sites.

Ex-situ disturbance/displacement effects also need to be considered in relation to highly mobile qualifying interest species that can occur outside of the designated site itself. There is potential that Otters could utilise lands within the site for foraging purposes, albeit on an occasional basis, given that there is very limited attractive habitat for the species within the construction footprint. There is no evidence that the lands within the proposed development site are of high resource value for Otters.

Given that the development area appears to be unattractive for Otters and that no holts were discovered proximate to the development site, there is little concern in relation to potential disturbance or direct displacement of the species from the development site. Construction and decommissioning works are also temporary in nature and any areas with high-levels of activity are likely to be highly localised at any time. Construction works are also limited to the hours of daylight when Otters would not be expected to be active.

The construction related noise and traffic will see a temporary localised increase in the movement of plant and personnel on the lands within the application site. There is the potential for construction activity throughout the year and some potential for disturbance (visual and noise related etc.) to Otters present locally. Potential direct disturbance effects would of course be limited to areas of construction close to the designated sites (Parcel 4). However, these are currently intensively managed agricultural fields with regular movement of farm vehicles and livestock. The lands are screened from the River Barrow estuary by mature woodland and the Lower Suir Estuary is located well below the lands in Parcel 4 where the fields rise steeply away from the estuary.

The construction of the solar arrays within each parcel is likely to take c. 3-5 months (per parcel) within an overall construction phase for the solar farm of c. 24 months. A perimeter fence will be constructed of stockproof fencing and will be up to 2.4 m in height. The solar PV panels will be mounted on supporting structures, in the form of metal frames, which are typically anchored by driven or screw piles to a depth of up to 2m, causing minimal ground disturbance and occupying less than 1% of the land area. The angled racks will be anchored to the ground using one of the following methods:

- *Screw piles or rammed piles:* This is the preferred method of founding the racks, as it is the quickest to construct and most economical. This can be considered the default method and it is expected that the vast majority of the site will use screw or rammed piles as anchors;
- *Pre-drilled holes with backfilling/concrete:* In certain cases, geotechnical conditions such as the presence of rock close to the surface may require foundation holes to be pre-drilled prior to ramming the piles. These holes would then be backfilled with concrete or other aggregate. A pre-construction geotechnical assessment will confirm if this type of anchor is required. It is expected that this would only be deployed in localised pockets of land where rock was present, if at all;

- *Ballast foundations:* This foundation type can be used in localised circumstances where penetration of the ground surface is not possible. This method uses concrete anchors to counteract any lift forces generated by wind loading on the modules. Ballast foundations could be deployed in areas of the site in the event of rock near the surface, or where there is potential for sub-surface archaeology.

The construction phase will be temporary in nature and away from water, during daylight hours and highly localised within improved agricultural grassland so the potential for disturbance / displacement of Otters is not deemed to be significant. The CEMP details measures that will be implemented to ensure that the noise and visual disturbance of the wider receiving environment will be minimised. The development site will not be lit at night.

The following section details the mitigation and monitoring commitments which will be effective in ensuring that there are no adverse effects on the integrity of the Natura 2000 sites under consideration as a result of any phase of the project.

4.2 Best Practice Design and Mitigation Measures

The measures outlined below will be implemented to ensure that any impacts on the receiving environment will be avoided during the project's construction and operational phases.

Construction Phase

4.2.1 Construction & Environmental Management Plan (CEMP)

A detailed CEMP has been prepared for the proposed development (See Appendix 2). The CEMP contains commitments designed to mitigate issues related to the potential for run-off or contamination of watercourses and any associated risks to the hydrologically connected Natura 2000 sites. In addition, it captures the more general ecological and environmental commitments as a whole, including mitigation to minimise the potential disturbance to non-qualifying interests and non-special conservation interests.

An Ecological Clerk of Works (ECoW) will be appointed to ensure the full and proper implementation of all environmental controls and mitigation commitments throughout construction. An ECoW will also be appointed to oversee the eventual decommissioning of the solar farm. No significant effects are predicted on designated sites during the operational phase of the proposed development. Surface water run-off will be accommodated by the existing drainage regime at the site. The solar farm is designed so as to minimise the effect on the original drainage and infiltration pattern of the site.

The contractor will be required to incorporate all of the commitments in the CEMP into the Construction and Environmental Management Plan (CEMP) they prepare as part of their contractual obligations. The objectives of this document are as follows:

- To ensure that best construction management practices are applied to the site by the main contractor and that measures are in place during construction to reduce as much as possible the impact of the works on people, property and the environment.
- To ensure that waste generated during the demolition, construction will be managed and disposed of in a way that ensures the provisions of the Waste Management Acts 1996 – 2013 and associated Regulations are applied. The report sets out the methodology to ensure that waste reduction, re-use and recycling are maximised during the construction of the project.
- To detail how the proposed development will implement a comprehensive and integrated approach to protecting the watercourses and other sensitive receptors within the potential zone of influence.

Specific best practice measures to safeguard the receiving environment, the water quality of the watercourses present and consequently those Natura 2000 sites downstream of the proposed development site are included in the CEMP and are also presented below.

Storage/Use of Materials Plant & Equipment

- Materials, plant and equipment shall be stored in the proposed site compounds. The temporary construction compounds will incorporate these relevant measures, with suitable provision made for a geotextile base and support silt fencing on any downslope edges to watercourses/drains.
- A buffer of 5-10m to all watercourses including drains except for a small number of localised areas where a fence line or CCTV pole may marginally extend within that buffer will be established and clearly marked out prior to the commencement of construction activities where possible. The buffer will be maintained during the construction of the proposed cable interconnectors.
- Plant and equipment will be parked in areas remote from any sensitive locations.
- Re-fuelling of machinery, plant or equipment will be carried out in the site compounds.
- Hazardous liquid materials or materials with potential to generate runoff shall be stored in areas remote from any sensitive locations, including drains.
- All hazardous liquid materials shall be stored in a bunded area and spill containment measures will be in place.
- All oils, fuels and other hazardous liquid materials shall be clearly labelled and stored in an upright position in an enclosed bunded area within the proposed development site compound. The capacity of the bunded area shall conform with EPA Guidelines – hold 110% of the contents or 110% of the largest container whichever is greater.
- Fuel may be stored in the designated bunded area or in fuel bowsers located in the proposed compound locations. Fuel bowsers shall be double skinned and equipped with certificates of conformity or integrity tested, in good condition and have no signs of leaks or drip trays will be turned upside down if not in use to prevent the collection of rainwater.
- Waters collected in drip trays must be assessed prior to discharge. If classified as contaminated, they shall be disposed by a permitted waste contractor in accordance with current waste management legal and regulatory requirements.
- Plant and equipment to be used during works, will be in good working order, fit for purpose, regularly serviced/maintained and have no evidence of leaks or drips.
- No plant used shall cause a public nuisance due to fumes, noise, and leakage or by causing an obstruction.
- Re-fuelling of machinery, plant or equipment will be carried out in the site compound as per the appointed Construction Contractor re-fuelling controls.
- All persons working will receive work specific induction in relation to material storage arrangements and actions to be taken in the event of an accidental spillage.

- Daily environmental toolbox talks / briefing sessions will be conducted for all persons working to outline the relevant environmental control measures and to identify any environment risk areas/works.

Surface Water Mitigation During Construction

The following mitigation measures will be carried out by the Contractor during construction phase to prevent surface water runoff into sensitive drains or watercourses. The interconnector cable will cross streams / drains via 7 no. watercourse/drain deck crossings and 4 no. horizontal directional drill crossings (under the N25 and N29 public roads and the Luffany River).

A significant offset of >100m between the proposed solar arrays and the River Barrow has been incorporated into the design of the proposal to protect local water quality and that of downstream designated sites. Similarly, a buffer zone of a minimum of 5-10m from all drains and 20m from watercourses will be implemented except for a small number of localised areas where a fence line or CCTV pole may marginally extend within that buffer. The buffer will be established and clearly marked out prior to the commencement of construction activities where possible. The buffer will be maintained during the construction of the proposed cable interconnectors.

Any material or substance which could cause pollution, including fuels or silty water will be prevented from entering groundwater, surface water drains or nearby watercourses by the appropriate use of and temporary installation of silt fences, cut-off drains, silt traps and drainage to vegetated areas where appropriate. Stilling ponds will be used to minimise the risk of suspended solids, where necessary.

The temporary construction compounds will incorporate these relevant measures, with suitable provision made for a geotextile base and support silt fencing on any downslope edges to watercourses/drains. Stockpiles of soil will be stored well away from the drains on site and (if appropriate) ringed with silt fences. The contractor will carry out environmental awareness training as part of the site inductions for all staff.

Fuel pipes on plant, outlets at fuel tanks etc. will be regularly checked and maintained to ensure that no drips or leaks to ground occur. The following precautions will also be installed on fuel delivery pipes:

- Any flexible pipe, tap or valve must be fitted with a lock where it leaves the container and be locked when not in use;
- Flexible delivery pipes must be fitted with manually operated pumps or a valve at the delivery end that closes automatically when not in use;
- Warning notices including “No smoking” and “Close valves when not in use” shall also be displayed;
- Spill kits will be available within each plant/vehicle on site and also located close to identified pollution sources or sensitive receptors (fuel storage areas, etc.);

- Interceptor drip trays (or similar, e.g. plant nappies, – open metal drip trays are not acceptable) will be available in accordance with standard good practice across the construction industry;
- Interceptor drip trays will be positioned under any stationary mobile plant to prevent oil contamination of the ground surface or water. Plant and site vehicles are to be well maintained and any vehicles leaking fluids must be repaired or removed from site immediately. Any servicing operations shall take place over drip trays;
- Areas used to store fuel and oil on the site will be appropriately lined and bunded to prevent the downward percolation of contaminants to natural soils and groundwater;
- Fuel for construction vehicles will be stored on an impervious base within a bund able to contain at least 110% of the volume stored. Rainwater will not be allowed to accumulate within the bund and in any way compromise the required 110% volume capacity. No tanks or containers may be perforated or dismantled on site. A competent operator shall empty all contents and residues for safe disposal elsewhere;
- Suitable wheel wash facilities, complete with C/W silt traps will be put in place to ensure vehicles entering/existing the site do not carry/transport debris;
- Topsoil and vegetation must be stored separately from subsoil and shall be retained and reinstated on all areas of stripped ground as soon as possible to prevent erosion and leaching/loss of nutrients.

Mitigation of Dust during Construction

The main activities that may give rise to dust emissions during construction include the following:

- Excavation and removal of earthworks.
- Materials handling and storage.
- Movement of vehicles (particularly HGV's) and mobile plant.
- Suspended solids in surface water runoff.

The following mitigation measures will be carried out by the Contractor during construction phase to prevent dust entering the drains or nearby watercourses or the surrounding residential areas:

- Construction traffic carrying loose material will be covered to reduce dust generation. This measure will be combined with wheel washing at site access points. A water bowser will be provided for dust suppression on site if necessary and areas of concern can be 'dampened down' during periods of dry weather.
- If necessary, arrangements will be made for sweeping public roads in the vicinity of the site access using a standard road sweeper. The Site Manager will be responsible for determining if additional measures will be required.

- Speed limits on site (15km/h or less) to reduce dust generation and mobilisation. Furthermore, any areas that has the potential to give rise to fugitive dust must be regularly watered, as appropriate, during dry and/or windy conditions. Measures are to include the following:
- Truck spraying and hosing down will be carried out during dry periods and as necessary to control dust.
- A road sweeper operating during the soil-stripping and excavation stage as required.
- The design of the proposed solar farm has incorporated buffer zones around drains and nearby watercourses in order to protect local water quality and that of downstream designated sites. Crossing of drains/minor watercourses will be by way of clear span structures and under the supervision of the ECoW.
- Solar panel cleaning will take place annually or as required. Cleaning will most likely be undertaken using a lightweight tracked machine with a special cleaning attachment. Due to the Irish climate which is relatively mild with high rainfall, solar panel cleaning is required less than other climates such as hot and dusty conditions. However, we assume an annual cleaning cycle to ensure optimum solar farm performance. The panels will be cleaned with water only, and no chemical products will be used.
- All construction (and decommissioning) works will be carried out according to best practice with standard environmental controls in place to prevent any damaging run-off from the site (see CIRIA 2001, 2010 & 2015). The construction of the proposed development will be implemented in accordance with the Construction Environmental Management Plan (CEMP) for the proposed development.
- All other mitigation measures, biodiversity enhancement and monitoring commitments described in the EcIA will be fully implemented.

Ecological Mitigation

The following mitigation measures will be implemented as part of the proposed project in order to minimise the potential effects on the existing ecology as discussed above. These measures are to be read in conjunction with the detailed construction phase commitments presented in the CEMP that accompanies the planning application.

- An Ecological Clerk of Works (ECoW) will be appointed to ensure that the mitigation strategy is correctly implemented both during the construction phase, establishment of the landscaping measures and for the duration of the eventual decommissioning of the project.
- Construction works will be carried out according to best practice with standard environmental controls in place to prevent any damaging run-off from the site (see CIRIA 2010 Environmental Good Practice on Site. CIRIA, UK; and CIRIA 2001 Control of water pollution from construction sites: guidance for consultants and contractors. CIRIA C532. London 2001.)

- Any silty water generated on site will be settled out as much as possible through drainage mitigation measures (silt traps, silt fences, cut off drains, etc.) and channelled into vegetated areas at least 50 metres from watercourses, to allow the settlement of solids.

- A phased approach will be taken when constructing the substation and access tracks for the site, as per the outlined construction programme. This will include a focused gap between the soil stripping of the substation and access tracks, as part of a precautionary approach.

- As a precautionary measure, the soil stripping and construction of the site access tracks will be carried out outside of periods of wet weather. Scheduling of works will avoid insofar as practicable the wetter months of the year. In addition, appropriate run-off control will be installed and maintained for the duration of the construction phase. It will help minimise the risk of run-off from the site by limiting the earthworks undertaken in the wetter months of the year.

- In advance of the stream crossing works required for the underground interconnector cabling, a staked silt fence shall be installed at a distance of 2-3m from the channel on both banks. The approaching track excavations will be stopped at this distance back from the channel, therefore retaining a vegetated buffer strip between the access track approach and the channel until such time as the dry deck is lifted into place.

- Silt fencing shall be retained on the downslope between the dry deck plinth and the channel until such time as the access track has bedded in and the swales (with check dams in-site) have revegetated.

- The swales alongside the access track approaching the stream crossing deck shall have temporary and permanent gravel check-dams installed to slow velocity and attenuate flow prior to reaching the channel.

- Dust can be created from movement of construction traffic and from general construction activities and can be carried by prevailing winds impacting upon the local area. The air quality management objectives are: Protection of air quality; Use all reasonable and practicable measures to minimise airborne dust and greenhouse gas emissions to minimise impacts on land, flora/fauna, water and air quality; Track and report; Minimise impacts on adjacent residents, land owners and community.

- Construction traffic carrying loose material will be covered to reduce dust generation. This measure will be combined with wheel washing at site access points. A water bowser will be provided for dust suppression on site if necessary and areas of concern can be ‘dampened down’ during periods of dry weather.

- If necessary, arrangements will be made for sweeping public roads in the vicinity of the site access using a standard road sweeper. The Site Manager will be responsible for determining if additional measures will be required.

- The design of the proposed solar farm has incorporated buffer zones around drains within the site and from adjacent watercourses in order to protect local water quality and that of downstream designed sites. Crossing of drains will be by way of clear span structures and under the supervision of the ECoW.

- Solar panel cleaning will take place annually or as required. Cleaning will most likely be undertaken using a lightweight tracked machine with a special cleaning attachment. Due to the Irish climate which is relatively mild with high rainfall, solar panel cleaning is required less than other climates such as hot and dusty conditions. However, we assume an annual cleaning cycle to ensure optimum solar farm performance. The panels will be cleaned with water only, and no chemical products will be used.
- All construction (and decommissioning) works will be carried out according to best practice with standard environmental controls in place to prevent any damaging run-off from the site (see CIRIA 2001, 2010 & 2015). The construction of the proposed development will be implemented in accordance with the Construction Environmental Management Plan (CEMP) for the proposed development.
- All other mitigation, biodiversity enhancement and monitoring commitments described in the EcIA will be fully implemented.

Responsibilities of the Site Manager/ECoW

The Site Manager/Environmental Clerk of Works will be responsible for the pollution prevention programme presented in the planning phase CEMP (Appendix 2) and will ensure that routine checks of key construction design measures are carried out to ensure compliance. A record of these checks will be maintained throughout the duration of the project.

The prepared EcIA also includes a suite of identified mitigation measures to in order to minimise potential effects on the existing ecology. Some overlap exists in respect of the above referenced measures.

- Detailed mitigation to minimise the risk of run-off or pollution of drains or adjacent watercourses during construction is provided in the CEMP and Construction Method Statement for Electrical Infrastructure which accompany this application. This includes the following commitments:

    a. A buffer of 5-10m from the closest drain will be established and clearly marked out prior to the commencement of construction activities where possible. The buffer will be maintained with the exception of localised areas where access, crossing or cable trenching is required.
    b. Silt fencing will be installed within the works area for the proposed interconnector cables. The silt fence will provide protection from sediment and potential site water runoff.
    c. The silt fencing will be checked twice daily during construction and once per day thereafter to ensure that it is working satisfactorily until such time as the re-instated ground/material has been fully established.
    d. If dewatering is required as part of the proposed works e.g., in trenches for underground cabling or in wet areas, water must be treated prior to discharge. The Contractor shall employ best practice settling systems to ensure maximum removal

of suspended solids prior to discharge of any surface water or groundwater from excavations to receiving waterbodies. This may include treatment via settlement tanks. There will be no direct pumping of water from the works to any watercourses or drains at any time.

e. An emergency-operating plan will be established to deal with incidents or accidents during construction that may give rise to pollution within any nearby watercourses or drains. This will include means of containment in the event of accidental spillage of hydrocarbons or other pollutants (spill kits etc.).

f. The contractor will ensure that good housekeeping is always maintained and that all site personnel are made aware of the importance of the nearby estuary/aquatic environments and the requirement to avoid pollution of all types.

- Construction works will be carried out according to the CEMP which will incorporate all of the planning phase commitments along with standard environmental controls to prevent any damaging run-off from the site (see CIRIA 2001, 2010 & 2015).

- A suitably qualified Environmental/Ecological Clerk of Works (ECoW) will be appointed to oversee the implementation of environmental mitigation throughout the construction phase.

- As a precautionary measure, the soil stripping and construction of the site access tracks will be carried out outside of periods of wet weather. Scheduling of works will avoid insofar as practicable the wetter months of the year unless otherwise agreed with the planning authority. In addition, appropriate run-off control will be installed and maintained for the duration of the construction phase. It will help minimise the risk of run-off from the site by limiting the earthworks undertaken during wetter periods of the year.

- Prior to the commencement of construction (or vegetation removal) in areas within 200m of an EPA named watercourse the area will be surveyed to record evidence of Otter activity. In the event that a holt is present, no work will be carried out within 200m of the holt until a derogation licence has been sought and granted to permit works according to the recommended protocol and licence conditions.

- The design of the proposed solar farm has incorporated buffer zones around drains and watercourses in order to protect local water quality and that of downstream designed sites. Crossing of drains/minor watercourses will be by way of clear span structures, with the exception of the HDD crossing of the Luffany. All of these watercourse crossing works will be carried out under the supervision of the ECoW.

Mitigation Measures for Habitats and Flora

- No removal of habitats or movement of construction machinery will occur outside of the development works area/footprint during the construction phase, where the works area/footprint will be clearly marked for associated site staff.

- The landscaping plan for the proposed development will be fully implemented.

- A pre-construction survey of the site and along the interconnector routes will be carried out to record any Third Schedule Invasive Plant Species that may be present. If any are located within the works footprint and Invasive Species Management Plan will be prepared and implemented under the supervision of the ECoW. This process will be repeated ahead of the decommissioning phase of the project.

    a. The survey will be repeated ahead of the decommissioning phase and any recommended actions in relation to control or eradication of invasive plant species will be fully implemented.

Mitigation Measures for Fauna

- Pre-construction (and decommissioning) surveys for Badger, Otter and roosting bats shall be carried out prior to the commencement of any works.

    - Prior to the commencement of construction (or vegetation removal) in areas within 200m of an EPA named watercourse the area will be surveyed to record evidence of Otter activity. In the event that a holt is present, no work will be carried out within 200m of the holt until a derogation licence has been sought and granted to permit works according to the recommended protocol and licence conditions.

    - Any trees required to be removed (whether within hedgerow or the scrub/woodland) will be subject to ground-level inspection to record any trees with moderate or higher bat roost potential (Collins, 2016). Any trees with moderate/higher potential will be subject to more detailed assessment, including climbing and direct inspection of potential roost features. In the event that any roosting bats are discovered -the tree will not be removed until such time as a derogation licence is obtained. All recommendations and licence conditions will be implemented under the supervision of the ECoW. As a secondary mitigation, all trees/shrubs that are felled will be left 'sit' for a minimum of 24 hours before being cut/logged or mulched.

    - A pre-works survey will be carried out to assess the activity at the known Badger sett on site and to record any new activity (or setts) that may be present. No construction/decommissioning traffic will be permitted within 50m of an active sett without the advice of a suitably qualified ecologist and in consultation with the National Parks and Wildlife Service. The ecologist will advise on the need for any further consultation or licensing ahead of the commencement of construction. Badger activity will be monitored throughout the construction phase and the ECoW will have 'Stop Works' authority.

- In the event that protected fauna are found actively using the site for breeding/roosting (*e.g.* bird nest, bat roosting) during the construction phase, works will cease immediately and the area will be cordoned off until advice is sought from a suitably qualified/experienced ecologist.

- There will be no removal of woody vegetation during the bird breeding season (1st March to August 31st inclusive).
- All excavations/trenches will be covered at night, or a suitable means of escape provided for nocturnal mammals such as Badger and Otter.
- A tree survey shall be performed to identify any trees in dangerous states prior to works commencing. Any trees requiring intervention will be inspected for roosting bats and nesting birds and the ECoW will ensure that any risks to breeding or resting birds and mammals are minimised.
- Security fencing shall have a 200mm gap between the bottom of the fence and the ground, or alternatively mammal gates will be provided at regular intervals (every 150m at a minimum) at the base of the fence to allow free movement of mammals through the solar farm site.
- A total of 50 woodcrete (or recycled plastic) bat boxes will be erected at the site to improve the roosting potential of the site for bats. The boxes will be erected under the supervision of a suitably qualified ecologist. The boxes will be checked and maintained annually by a suitably qualified (and licensed ecologist) and replaced as necessary over the lifetime of the project.
- Two Barn Owl nest boxes will be erected at locations chosen by a suitably qualified ecologist. The boxes will be erected under the supervision of the ecologist. The boxes will be checked and maintained annually by a suitably qualified (and licensed ecologist) and replaced as necessary over the lifetime of the project.

Decommissioning & Restoration Phase Mitigation

At the time of decommissioning and restoration, the Applicant will ensure that any related activities in support of same are undertaken with such due care and diligence in order to reduce or eliminate risk to the environment. The Applicant will lead the decommissioning and restoration process;

- The Applicant will ensure adequate internal and external resources are available to manage and undertake all decommissioning activities required and be required to submit for agreement with the planning authority a Decommissioning and Restoration Plan;
- The date for decommissioning will be well known in advance of the activation of the Decommissioning and Restoration Plan;
- Pre-works walkovers will be carried out by a suitably qualified ecologist to identify any ecological constraints on site and to provide appropriate advice ahead of the mobilisation of the decommissioning contractors.
- All potential negative environmental effects from decommissioning of the project will be mitigated through established measures. These measures include, but are not limited to:
    - The use of erosion and sediment control measures;
    - Maintenance of all existing buffers (hedgerows / treeline, drainage ditches etc.);

- Timing of decommissioning works to ensure that they do not interfere with wildlife breeding / nesting times; and
- Measures which will rapidly establish a vegetative cover on any disturbed areas.

- All stored fluids or solid materials, be they chemicals, greases or oils shall be returned to suppliers where appropriate. Alternatively, they will be disposed of off-site to licensed waste facilities;
- Disposal off-site shall mean that licensed removal contractors, licensed removal equipment and licensed reception facilities are utilised where required during decommissioning;
- Disposal off-site shall mean that a full record and log will be maintained of all plant, equipment, finished or raw materials and fluids removed off-site;
- Not all structures will be removed from site. For example, if infrastructure forms parts of the substation or grid connection then ownership of this belongs to ESB Networks and may be retained for future long-term use as part of the national electricity distribution system. In addition, the landowner may choose to retain access tracks within the solar farm for improved access with the farm holding. It should be noted that any structures or land uses which are proposed to be retained will be advised to Kilkenny County Council in advance of final decommissioning and restoration.
- All contractors engaged in the Decommissioning and Restoration Plan shall be fully licensed, experienced and approved to undertake the activities for which they are engaged; and
- On completion of decommissioning, a Closure Validation Audit Report will be completed and issued to Kilkenny County Council to demonstrate that the site is suitable for use and its condition would not pose a future risk to public health or the environment. This report will be issued to the Council and the site will only be confirmed as fully decommissioned on the Councils confirmation that it is satisfied with the findings from this report.
- After ensuring the solar panels are disconnected from the electrical network, the panels may be individually removed from their frame. The panels can be reused depending on their age and condition. If they are not fit for reuse, they will be disposed of to a suitably licenced waste facility. Storage containers will be available should the panels be reused or disposal containers if they are to be transported to a waste facility.
    - The panels will be mounted on a steel frame system. These can be reused, so they will be stored and taken off site. The mounting system is connected to the ground via a small driven pile system. These driven steel piles will be removed with a rig. These will not be reused so they will be taken off site for recycling.
- The 110kV substation and associated 110kV underground grid connection cabling and transition masts will become the property of ESB Networks once the project is energised and will therefore remain on-site following the decommissioning of the solar farm as per the connection agreement with ESB Networks. This infrastructure will have a future long term use as part of the national electricity transmission system.
- The electrical cabling will be disconnected. The cables and accompanying ducting will then be removed via digger. The cables will be pulled from the ducts and recycled appropriately. The ducting will also be sent to the relevant waste facility.
- Depending on the condition of the inverter and transformer station, they will either be refurbished and reused, or dissembled and recycled. The inverter and transformers will be

disconnected from all electrical systems. A crane will then transfer the stations onto a flatbed lorry to be removed from site. The remaining concrete pad foundations, or supporting blocks, will be broken up and removed from site for appropriate recycling. The land will then but filled and re-seeded for full reinstatement.

- Site Security Equipment includes the perimeter fencing and CCTV system. These will be dismantled and removed once all other equipment has been removed from site. The security fence will be removed and depending on its condition, transported for recycling or reuse. The holes from the fencing will be refilled. The CCTV system will be disconnected, and the poles removed from the ground. Similarly, the holes will be refilled and the land reinstated.
- Additional site access tracks constructed as part of the solar farm may add value to the site and as such their removal will be subject to landowner agreement. Should the landowner request that the access tracks be removed, the stone build-up of the road will be broken- up, removed and appropriately recycled. The area will then be covered with a layer of topsoil to allow for the reinstatement of the land.

The site decommissioning and restoration plan will be executed in line with the environmental conditions of the Planning Permission. In advance of final decommissioning and restoration the Applicant will consult with Kilkenny County Council to agree any additional requirements. Following the decommissioning of the site the agricultural land will be restored to its original state. Should the access tracks be removed, the areas will be covered with topsoil and planted with a grass seed mixture. The vegetation will be monitored by the Applicant to ensure the grass areas are growing sufficiently. If there are any the areas showing poor growth, these will be re-ploughed and re-seeded. All pre-existing drains will be retained in their original state throughout the lifetime of the solar farm. Should any existing drains or ditches become damaged during the decommissioning process, these will be repaired. Please refer to the Construction Environmental Management Plan for further details on site drainage. The land will be reinstated to its original conditions as per the agreement with the landowner.

4.2.2 Wastewater/Foul Effluent Discharge

There will no wastewater requirements associated with the proposed solar farm. Welfare facilities may be provided at the substation that is subject to a separate consent process. There is no requirement for potable water or wastewater treatment facilities as part of the constructed solar farm as it will be an unmanned facility. Any wastewater during construction, or associated with facilities provided at the substation will be collected and disposed off-site in accordance with the principles contained in the Environmental Protection Act (Duty of Care) Regulations 1991.

4.3 NIS Summary and Conclusion

4.3.1 Integrity Of The Site

From the *Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC* (EC, 2002), the meaning of integrity is described as follows:

'*The integrity of a site involves its ecological functions. The decision as to whether it is adversely affected should focus on and be limited to the site's conservation objectives*'.

The concept of the 'integrity of the site' is also explained in the EU publication Managing Natura 2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC (EC, 2000), as follows:

'It is clear from the context and from the purpose of the directive that the 'integrity of the site' relates to the site's conservation objectives. For example, it is possible that a plan or project will adversely affect the integrity of a site only in a visual sense or only habitat types or species other than those listed in Annex I or Annex II. In such cases, the effects do not amount to an adverse effect for purposes of Article 6(3), provided that the coherence of the network is not affected. On the other hand, the expression 'integrity of the site' shows that focus is here on the specific site. Thus, it is not allowed to destroy a site or part of it on the basis that the conservation status of the habitat types and species it hosts will anyway remain favourable within the European territory of the Member State.

4.3.2 Integrity of the Natura 2000 Sites within the Project Zone of Influence

Potential for any significant adverse effects will be resolved through the implementation of the mitigation commitments contained in the CEMP.

From the information gathered and the predictions made about the changes that are likely to result from the construction, operational and decommissioning stages of the project and the mitigation commitments proposed to avoid impacts on the two Natura 2000 sites within the zone of influence of the project, an Integrity of Site Checklist for Natura 2000 sites considered in this Natura Impact Statement is presented in Table 4.2 below.

Table 4-1: Integrity of Site Checklist for Natura 2000 Sites within the Project Zone of Influence

Conservation Objectives		
Does the project have the potential to:	Yes or No	Comment
Cause delays in progress towards achieving the conservation objectives of the site?	No	There will be no significant direct impacts to the QIs of the Natura 2000 sites located within the project ZoI and considered in this NIS. Potential indirect effects to Natura 2000 sites e.g. via overland flow and/or contamination of drains and watercourses hydrologically linked to Lower River Suir SAC and the River Barrow and River Nore SAC have been considered in the above assessment. Works practices and design measures have been proposed in the accompanying CEMP to address potential impacts which could be caused by uncontrolled run-off and/or sources of disturbance for Otters. The proposed development will therefore not cause delays in achieving the conservation objectives of Natura 2000 sites within project ZoI.

Conservation Objectives		
Does the project have the potential to:	**Yes or No**	**Comment**
Interrupt progress towards achieving the conservation objectives of the site?	No	The proposed development will not interrupt the achievement the site's Conservation Objectives or those factors that help maintain the favourable conditions of the site or interfere with the distribution and density of key indicator species. There will be no significant direct impacts to the QIs of the Natura 2000 sites located within the project ZoI and considered in this NIS. Potential indirect effects to Natura 2000 sites e.g. via overland flow and/or contamination of drains and watercourses hydrologically linked to Lower River Suir SAC and the River Barrow and River Nore SAC have been considered in the above assessment. Works practices and design measures have been proposed in the accompanying CEMP to address potential impacts which could be caused by uncontrolled run-off and/or sources of disturbance for Otters. The proposed development will therefore not interrupt progress towards achieving the conservation objectives of the Natura 2000 sites, disrupt the factors that maintain favourable conditions with these sites, or interfere with the balance, distribution of density of key species that are the indicators of the favourable condition of these Natura 2000 sites.
Disrupt those factors that help to maintain the favourable conditions of the site?	No	
Interfere with the balance, distribution and density of key species that are the indicators of the favourable condition of the site?	No	
Other Objectives: Does the project have the potential to:	Yes or No	Comment
Cause changes to the vital defining aspects (e.g. nutrient balance) that determine how the site functions as a habitat or ecosystem?	No	There will be no significant direct impacts to the QIs of the Natura 2000 sites located within the project ZoI and considered in this NIS. Potential indirect effects to Natura 2000 sites e.g. via overland flow and/or contamination of drains and watercourses hydrologically linked to Lower River Suir SAC and the River Barrow and River Nore SAC have been considered in the above assessment. Works practices and design measures have been proposed in the accompanying CEMP to address potential impacts which could be caused by uncontrolled run-off and/or sources of
Change the dynamics of the relationships (between, for example, soil and water or plants and animals) that define the structure and/or function of the	No	

Conservation Objectives		
Does the project have the potential to:	Yes or No	Comment
site?		disturbance for Otters. The proposed development will not cause changes to the vital defining aspects (that determine how the site functions as a habitat or ecosystem or change the dynamics of the relationships that define the structure and/or function of the site.
Interfere with predicted or expected natural changes to the site (such as water dynamics or chemical composition)?	No	The proposed development will not interfere with predicted or expected natural changes to the Natura 2000 sites under consideration.
Reduce the area of key habitats?	No	The proposed development will not result in the loss, reduction or change of key features associated with Natura 2000 sites. The proposed development is located within an area of intensive agriculture and the development footprint is not within any designated conservation sites, nor does it require any resources from these sites; thereby ruling out any direct habitat loss at the conservation sites in question. Indirect habitat loss or deterioration of designated sites within the surrounding area could occur from the effects of run-off or discharge into the aquatic environment through impacts such as increased siltation, nutrient release and/or contamination. However, works practices and design measures have been committed to in the accompanying CEMP to address all potential impacts to these watercourses and by extension effects to the hydrologically connected Natura 2000 sites.
Reduce the population of key species?	No	
Change the balance between key species?	No	
Reduce diversity of the site?	No	
Result in disturbance that could affect population size or density or the balance between key species?	No	The proposed development will not result in disturbance that will affect population size or densities of Qualifying features associated with the Natura 2000 sites within the project ZoI. The construction works are temporary in nature and will be concentrated outside the wettest months of the year. While Otters occur locally, they are strongly associated with the riparian corridor. Therefore, significant ex-situ disturbance impacts

Conservation Objectives		
Does the project have the potential to:	Yes or No	Comment
		are deemed highly unlikely. Much of the application site is partly or wholly screened from view from the intertidal areas of importance for Otters. Even in areas closest and most visible to the intertidal habitats there is limited potential for significant disturbance due to the nature and scale of the construction effort required. The mitigation measures ensure that the soil-stripping and access road construction will be carried out outside of the wetter periods of year and that appropriate surface water run-off controls will be in place ahead of the soil-stripping and access track construction phase, further minimising the potential for any significant disturbance effects.
Result in fragmentation?	No	There will be no fragmentation of Natura 2000 sites within the project ZoI as a result of the development.
Result in loss or reduction of key features (e.g., tree cover, tidal exposure, annual flooding, etc.)?	No	The proposed development will not result in the loss or reduction of key features of Natura 2000 Sites.

4.4 Conclusion

The AA Screening (see **Section 3**) found that it could not be excluded, on the basis of objective scientific information that the proposed works, individually or in combination with other plans or projects, would have a significant effect on a Natura 2000 site. Therefore, a NIS (presented in **Section 4**) was required to ascertain whether the proposed works would have an adverse effect on the integrity of the Natura 2000 sites.

Best practice measures and mitigation measures (as outlined within **Section 4.2** and the accompanying CEMP (reproduced in Appendix 2) have been identified to ensure that potential pollutant sources are not released from the proposed development to the receiving environment and that the potential for disturbance and displacement effects on Otters is minimised such that there is no risk of adverse effects on these Qualifying Features of Natura 2000 sites within this project's ZoI.

It has been objectively concluded that the proposed development will not adversely affect the integrity of Natura 2000 sites, and there is no reasonable scientific doubt in relation to this conclusion.

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Appendix 1

Conservation Objectives of

Lower River Suir SAC

River Barrow & River Nore SAC

ISSN 2009-4086

National Parks and Wildlife Service

Conservation Objectives Series

Lower River Suir SAC 002137

An Roinn Ealaíon, Oidhreachta,
Gnóthaí Réigiúnacha, Tuaithe agus Gaeltachta

Department of Arts, Heritage,
Regional, Rural and Gaeltacht Affairs

National Parks and Wildlife Service,
Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs,

7 Ely Place, Dublin 2, Ireland.

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Introduction

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

A site-specific conservation objective aims to define favourable conservation condition for a particular habitat or species at that site.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, are stable or increasing, and
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- the conservation status of its typical species is favourable.

The favourable conservation status of a species is achieved when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

Notes/Guidelines:

1. The targets given in these conservation objectives are based on best available information at the time of writing. As more information becomes available, targets for attributes may change. These will be updated periodically, as necessary.
2. An appropriate assessment based on these conservation objectives will remain valid even if the targets are subsequently updated, providing they were the most recent objectives available when the assessment was carried out. It is essential that the date and version are included when objectives are cited.
3. Assessments cannot consider an attribute in isolation from the others listed for that habitat or species, or for other habitats and species listed for that site. A plan or project with an apparently small impact on one attribute may have a significant impact on another.
4. Please note that the maps included in this document do not necessarily show the entire extent of the habitats and species for which the site is listed. This should be borne in mind when appropriate assessments are being carried out.
5. When using these objectives, it is essential that the relevant backing/supporting documents are consulted, particularly where instructed in the targets or notes for a particular attribute.

Qualifying Interests

**** indicates a priority habitat under the Habitats Directive***

002137	Lower River Suir SAC
1029	Freshwater Pearl Mussel *Margaritifera margaritifera*
1092	White-clawed Crayfish *Austropotamobius pallipes*
1095	Sea Lamprey *Petromyzon marinus*
1096	Brook Lamprey *Lampetra planeri*
1099	River Lamprey *Lampetra fluviatilis*
1103	Twaite Shad *Alosa fallax fallax*
1106	Salmon *Salmo salar*
1330	Atlantic salt meadows (Glauco-Puccinellietalia maritimae)
1355	Otter *Lutra lutra*
1410	Mediterranean salt meadows (Juncetalia maritimi)
3260	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels
91A0	Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles
91E0	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)*
91J0	*Taxus baccata* woods of the British Isles*

Please note that this SAC is adjacent to River Barrow and River Nore SAC (002162). See map 2. The conservation objectives for this site should be used in conjunction with those for the adjacent site as appropriate.

Supporting documents, NPWS reports and publications are available for download from: www.npws.ie/Publications

NPWS Documents

Year :	1998
Title :	Conservation management of the white-clawed crayfish, *Austropotamobius pallipes*
Author :	Reynolds, J.D.
Series :	Irish Wildlife Manual No. 1
Year :	2006
Title :	Otter survey of Ireland 2004/2005
Author :	Bailey, M.; Rochford, J.
Series :	Irish Wildlife Manual No. 23
Year :	2006
Title :	Initiation of a monitoring program for the freshwater pearl mussel, *Margaritifera margaritifera*, in the Clodiagh River (Suir)
Author :	Ross, E.
Series :	Unpublished report to NPWS
Year :	2007
Title :	A survey of juvenile lamprey populations in the Corrib and Suir catchments
Author :	O'Connor, W.
Series :	Irish Wildlife Manual No. 26
Year :	2007
Title :	Supporting documentation for the Habitats Directive Conservation Status Assessment - backing documents. Article 17 forms and supporting maps
Author :	NPWS
Series :	Unpublished report to NPWS
Year :	2008
Title :	National survey of native woodlands 2003-2008
Author :	Perrin, P.M.; Martin, J.; Barron, S.; O'Neill, F.H.; McNutt, K.E.; Delaney, A.
Series :	Unpublished report to NPWS
Year :	2009
Title :	Saltmarsh monitoring project 2007-2008
Author :	McCorry, M.; Ryle, T.
Series :	Unpublished report to NPWS
Year :	2009
Title :	NS II freshwater pearl mussel sub-basin management plans: monitoring of the freshwater pearl mussel in the Clodiagh
Author :	Ross, E.
Series :	Unpublished report to NPWS
Year :	2009
Title :	NS II freshwater pearl mussel sub-basin management plans: fisheries survey. Stage 1 report
Author :	Paul Johnston Associates
Series :	Unpublished report to NPWS
Year :	2009
Title :	NS II freshwater pearl mussel sub-basin management plans: report on biological monitoring of surface water quality in Clodiagh (Waterford) catchment
Author :	Morgan, G.
Series :	Unpublished report to NPWS

Year :	2010
Title :	A provisional inventory of ancient and long-established woodland in Ireland
Author :	Perrin, P.M.; Daly, O.H.
Series :	Irish Wildlife Manual No. 46
Year :	2010
Title :	A technical manual for monitoring white-clawed crayfish (*Austropotamobius pallipes*) in Irish lakes
Author :	Reynolds, J., O'Connor, W., O'Keeffe, C.; Lynn, D.
Series :	Irish Wildlife Manual No.45
Year :	2010
Title :	Second draft Clodiagh freshwater pearl mussel sub-basin management plan (2009-2015). March 2010
Author :	NPWS
Series :	Unpublished document to the Department of Environment, Heritage and Local Government
Year :	2010
Title :	NS2 freshwater pearl mussel sub-basin management plans. Phytobenthos monitoring of the Clodiagh catchment, Co. Waterford (SERBD). June and July
Author :	Ní Chatháin, B.
Series :	Unpublished report to NPWS
Year :	2012
Title :	Lower River Shannon SAC (site code: 2165) Conservation objectives supporting document- Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation V1
Author :	NPWS
Series :	Conservation objectives supporting document
Year :	2013
Title :	National otter survey of Ireland 2010/12
Author :	Reid, N.; Hayden, B.; Lundy, M.G.; Pietravalle, S.; McDonald, R.A.; Montgomery, W.I.
Series :	Irish Wildlife Manual No. 76
Year :	2013
Title :	Irish semi-natural grasslands survey 2007-2012
Author :	O'Neill, F.H.; Martin, J.R.; Devaney, F.M.; Perrin, P.M.
Series :	Irish Wildlife Manual No. 78
Year :	2013
Title :	Results of monitoring survey of old sessile oak woods and alluvial forests
Author :	O'Neill, F.H.; Barron, S.J.
Series :	Irish Wildlife Manual No. 71
Year :	2013
Title :	Results of a monitoring survey of yew woodland
Author :	Cross, J.; Lynn, D.
Series :	Irish Wlidlife Manual No. 72
Year :	2013
Title :	The status of EU protected habitats and species in Ireland. Volume 3. Species assessments
Author :	NPWS
Series :	Conservation assessments

Year :	2016
Title :	Ireland Red List No. 10: Vascular Plants
Author :	Wyse Jackson, M.; FitzPatrick, Ú.; Cole, E.; Jebb, M.; McFerran, D.; Sheehy Skeffington, M.; Wright, M.
Series :	Ireland Red Lists series, NPWS
Year :	2017
Title :	Lower River Suir SAC (site code: 2137) Conservation objectives supporting document- coastal habitats V1
Author :	NPWS
Series :	Conservation objectives supporting document
Year :	2017
Title :	Survey and condition assessment of the freshwater pearl mussel, *Margaritifera margaritifera* (L.), in the Clodiagh River (Suir, Portlaw)
Author :	Ross, E.; Moorkens, E.; Killeen, I.
Series :	Unpublished report to NPWS

Other References

Year :	1898
Title :	Contributions towards a Cybele Hibernica. Second Edition
Author :	Colgan, N.; Scully, R.W.
Series :	Edward Ponsonby, Dublin
Year :	1982
Title :	Otter survey of Ireland
Author :	Chapman, P.J.; Chapman, L.L.
Series :	Unpublished report to Vincent Wildlife Trust
Year :	1988
Title :	The reproductive biology of freshwater mussels in Ireland, with observations on their distribution and demography
Author :	Ross, E.D.
Series :	Unpublished Ph.D. Thesis, National University of Ireland, Galway
Year :	1991
Title :	The spatial organization of otters (*Lutra lutra*) in Shetland
Author :	Kruuk, H.; Moorhouse, A.
Series :	Journal of Zoology, 224: 41-57
Year :	1992
Title :	Status of the freshwater pearl mussels *Margaritifera margaritifera* and *M. m. durrovensis* in the Nore, Barrow and Suir River tributaries, south-east Ireland
Author :	Moorkens, E.A.; Costello, M.J.; Speight, M.C.D.
Series :	Irish Naturalists' Journal, 24(3): 127-131
Year :	1996
Title :	Studies on the biology and ecology of *Margaritifera* in Ireland
Author :	Moorkens, E.
Series :	Unpublished Ph.D. thesis, University of Dublin, Trinity College.
Year :	1999
Title :	Diet of otters (*Lutra lutra*) on Inishmore, Aran Islands, west coast of Ireland
Author :	Kingston, S.; O'Connell, M.; Fairley, J.S.
Series :	Biology and Environment: Proceedings of the Royal Irish Academy, 99B: 173-182

Year :	2001
Title :	Aquatic plants in Britain and Ireland
Author :	Preston, C.D.; Croft, J.M.
Series :	Harley Books, Colchester
Year :	2002
Title :	Reversing the habitat fragmentation of British woodlands
Author :	Peterken, G.
Series :	WWF-UK, London
Year :	2002
Title :	A survey of the white-clawed crayfish (*Austropotamobius pallipes*) Lereboullet and of water quality in two catchments of eastern Ireland
Author :	Demers, A.; Reynolds, J.D.
Series :	Bulletin Francais de la Peche et de la Pisciculture, 367: 729-740
Year :	2003
Title :	Monitoring the river, sea and brook lamprey, *Lampetra fluviatilis*, *L. planeri* and *Petromyzon marinus*
Author :	Harvey, J.; Cowx, I.
Series :	Conserving Natura 2000 Rivers Monitoring Series No. 5. English Nature, Peterborough
Year :	2003
Title :	Ecology of watercourses characterised by Ranunculion fluitantis and Callitricho-Batrachion Vegetation
Author :	Hatton-Ellis, T.W.; Grieve, N.
Series :	Conserving Natura 2000 Rivers Ecology Series No. 11. English Nature, Peterborough
Year :	2003
Title :	Ecology of the allis and twaite shad
Author :	Maitland, P.S.; Hatton-Ellis, T.W.
Series :	Conserving Natura 2000 Rivers Ecology Series No. 3. English Nature, Peterborough
Year :	2003
Title :	Pondweeds of Great Britain and Ireland
Author :	Preston, C.D.
Series :	BSBI Handbook, No. 8, London
Year :	2003
Title :	Identifying lamprey. A field key for sea, river and brook lamprey
Author :	Gardiner, R.
Series :	Conserving Natura 2000 rivers, Conservation techniques No. 4. English Nature, Peterborough
Year :	2006
Title :	Otters - ecology, behaviour and conservation
Author :	Kruuk, H.
Series :	Oxford University Press
Year :	2006
Title :	The status of host fish populations and fish species richness in European freshwater pearl mussel (*Margaritifera margaritifera*) streams
Author :	Geist, J.; Porkka, M.; Kuehn, R.
Series :	Aquatic Conservation: Marine and Freshwater Ecosystems, 16: 251-266
Year :	2007
Title :	Evolutionary history of lamprey paired species *Lampetra fluviatilis* L. and *Lampetra planeri* Bloch as inferred from mitochondrial DNA variation
Author :	Espanhol, R.; Almeida, P.R.; Alves, M.J.
Series :	Molecular Ecology, 16: 1909-1924

Year :	2008
Title :	Poor water quality constrains the distribution and movements of twaite shad (*Alosa fallax fallax*, Lacepede, 1803) in the watershed of river Scheldt
Author :	Maas, J.; Stevens, M.; Breine, J.
Series :	Hydrobiologia, 602: 129-143
Year :	2008
Title :	Flora of County Waterford
Author :	Green, P.
Series :	The National Botanic Gardens of Ireland, Dublin
Year :	2010
Title :	Otter tracking study of Roaringwater Bay
Author :	De Jongh, A.; O'Neill, L.
Series :	Unpublished draft report to NPWS
Year :	2010
Title :	Addressing the conservation and rehabilitation of *Margaritifera margaritifera* populations in the Republic of Ireland within the framework of the habitats and species directive
Author :	Moorkens, E.
Series :	Journal of Conchology, 40: 339
Year :	2011
Title :	Comparison of field- and GIS-based assessments of barriers to Atlantic salmon migration: a case study in the Nore Catchment, Republic of Ireland
Author :	Gargan, P.G.; Roche, W.K.; Keane, S.; King, J.J.; Cullagh, A.; Mills, P.; O'Keeffe, J.
Series :	Journal of Applied Ichthyology, 27 (Suppl. 3): 66-72
Year :	2012
Title :	Rare and threatened bryophytes of Ireland
Author :	Lockhart, N.; Hodgetts, N.; Holyoak, D.
Series :	National Museums Northern Ireland
Year :	2013
Title :	Aspects of brook lamprey (*Lampetra planeri* Bloch) spawning in Irish waters
Author :	Rooney, S.M.; O'Gorman, N.M.; Green, F.; King, J.J.
Series :	Biology and Environment: Proceedings of the Royal Irish Academy, 113B(1): 13-25
Year :	2013
Title :	Management strategies for the protection of high status water bodies
Author :	Ní Chatháin, B.; Moorkens, E.; Irvine, K.
Series :	Strive Report Series No. 99. EPA, Wexford
Year :	2013
Title :	Interpretation manual of European Union habitats- Eur 28
Author :	European Commission- DG Environment
Series :	European Commission
Year :	2014
Title :	Assessing near-bed velocity in a recruiting population of the endangered freshwater pearl mussel (*Margaritifera margaritifera*) in Ireland
Author :	Moorkens, E.; Killeen, I.
Series :	Aquatic Conservation: Marine and Freshwater Ecosystems, 24(6): 853-862

Year :	2015
Title :	Water quality in Ireland 2010-2012
Author :	Bradley, C.; Byrne, C.; Craig, M.; Free, G.; Gallagher, T.; Kennedy, B.; Little, R.; Lucey, J.; Mannix, A.; McCreesh, P.; McDermott, G.; McGarrigle, M.; Ní Longphuirt, S.; O'Boyle, S.; Plant, C.; Tierney, D.; Trodd, W.; Webster, P.; Wilkes, R.; Wynne, C.
Series :	EPA, Wexford
Year :	2015
Title :	Behaviour of sea lamprey (*Petromyzon marinus* L.) at man-made obstacles during upriver spawning migration: use of telemetry to access efficacy of weir modifications for improved passage
Author :	Rooney, S.M.; Wightman, G.D.; O Conchuir, R.; King, J.J.
Series :	Biology and Environment: Proceedings of the Royal Irish Academy, 115B: 1-12
Year :	2015
Title :	River engineering works and lamprey ammocoetes; impacts, recovery, mitigation
Author :	King, J.J.; Wightman, G.D.; Hanna, G.; Gilligan, N.
Series :	Water and Environment Journal, 29: 482-488
Year :	2016
Title :	A narrative for conserving freshwater and wetland habitats in England
Author :	Mainstone, C.; Hall, R.; Diack, I.
Series :	Natural England Research Reports Number 064
Year :	2016
Title :	The Status of Irish Salmon Stocks in 2015 with Precautionary Catch Advice for 2016
Author :	SSCS (Standing Scientific Committee on Salmon)
Series :	Independent Scientific Report to Inland Fisheries Ireland
Year :	Undated
Title :	WFD111 (2a) Coarse resolution rapid-assessment methodology to assess obstacles to fish migration: Field manual level A assessment
Author :	SNIFFER (Scotland and Northern Ireland Forum for Environmental Research)
Series :	SNIFFER WFD111

Spatial data sources

Year :	Revision 2010
Title :	Saltmarsh Monitoring Project 2007-2008. Version 1
GIS Operations :	QIs selected; clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	1330, 1410 (map 3)
Year :	Revision 2010
Title :	National Survey of Native Woodlands 2003-2008. Version 1
GIS Operations :	QIs selected; clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	91A0, 91E0 (maps 4 and 5)
Year :	Revision 2012
Title :	Margaritifera Sensitive Areas data
GIS Operations :	Relevant catchment boundaries identified. Expert opinion used as necessary to resolve any issues arising
Used For :	1029 (map 6)
Year :	2016
Title :	NPWS rare and threatened species database
GIS Operations :	Dataset created from spatial references in database records. Expert opinion used as necessary to resolve any issues arising
Used For :	1029, 1092 (maps 6 and 7)
Year :	2010
Title :	EPA WFD Waterbodies data
GIS Operations :	Creation of 20m buffer to river and stream centreline data. Dataset combined with derived OSi data for 1355 SSCO. Overlapping regions investigated and resolved; resulting dataset clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	1355 (no map)
Year :	2005
Title :	OSi Discovery series vector data
GIS Operations :	Creation of 80m buffer on the marine side of high water mark (HWM); creation of 10m buffer on terrestrial side of HWM; combination of 80m and 10m HWM buffer datasets. Datasets combined with derived EPA WFD Waterbodies data for 1355 SSCO. Overlapping regions investigated and resolved; resulting dataset clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	1355 (no map)

1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae)

To restore the favourable conservation condition of Atlantic salt meadows (Glauco-Puccinellietalia maritimae) in Lower River Suir SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For the sub-site (Little Island) and potential areas mapped: 33.43ha. See map 3	Based on data from the Saltmarsh Monitoring Project (SMP) (McCorry and Ryle, 2009). The sub-site Little Island (SMP site ID: SMP0052) that supports Atlantic Salt Meadows (ASM) was mapped during the SMP (4.11ha) and additional areas of potential ASM habitat (29.32ha) were identified from an examination of aerial photographs, giving a total estimated area of 33.43ha within Lower River Suir SAC. NB further unsurveyed areas may be present within the SAC. See the Lower River Suir SAC conservation objectives supporting document for coastal habitats for further details
Habitat distribution	Occurrence	No decline or change in habitat distribution, subject to natural processes. See map 3 for known and potential distribution	Based on data from McCorry and Ryle (2009). Saltmarsh occurs on the River Suir estuary downstream of Waterford City in old flood meadows where the embankment is absent, or has been breached, and along the tidal stretches of some of the in-flowing channels below Little Island. NB further unsurveyed areas may be present within the SAC. See the coastal habitats supporting document for further details
Physical structure: sediment supply	Presence/absence of physical barriers	Maintain natural circulation of sediments and organic matter, without any physical obstructions	Based on data from McCorry and Ryle (2009). See the coastal habitats supporting document for further details
Physical structure: creeks and pans	Occurrence	Maintain creek and pan structure, subject to natural processes, including erosion and succession	Based on data from McCorry and Ryle (2009). Little Island saltmarsh contains a well-developed topography and large, deep creeks are present. See the coastal habitats supporting document for further details
Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime	Based on data from McCorry and Ryle (2009). Much of the shoreline along the Lower River Suir channel has been modified by embankments, infilling and drainage. See the coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	Based on data from McCorry and Ryle (2009). There are several saltmarsh communities present and zonation is moderately well-developed in the sub-site surveyed. The ASM transitions to grassland and freshwater habitats. This is typical of an estuary type saltmarsh with a significant freshwater influence. See the coastal habitats supporting document for further details
Vegetation structure: sward height	Centimetres	Maintain structural variation within sward	Based on data from McCorry and Ryle (2009). As the sub-site is not grazed, the sward height is lush and rank in places. However, the overall sward structure is still quite variable. See the coastal habitats supporting document for further details
Vegetation structure: vegetation cover	Percentage cover at a representative number of monitoring stops	Maintain more than 90% of the area outside of creeks vegetated	Based on data from McCorry and Ryle (2009). See the coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative number of monitoring stops	Maintain range of sub-communities with typical species listed in McCorry and Ryle (2009)	See the coastal habitats supporting document for further details

Vegetation composition: negative indicator species - *Spartina anglica*	Hectares	No significant expansion of common cordgrass (*Spartina anglica*), with an annual spread of less than 1% where it is known to occur	Based on data from McCorry and Ryle (2009). Common cordgrass (*Spartina anglica*) is present in the SAC, but swards are not a significant feature. See the coastal habitats supporting document for further details

1410 Mediterranean salt meadows (Juncetalia maritimi)

To restore the favourable conservation condition of Mediterranean salt meadows (Juncetalia maritimi) in Lower River Suir SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession	Mediterranean Salt Meadows (MSM) habitat was not recorded in Lower River Suir SAC during the Saltmarsh Monitoring Project (SMP) (McCorry and Ryle, 2009). Thus the total area of the qualifying habitat in the SAC is unknown. An NPWS survey in the 1990s noted stands of sea rush (*Juncus maritimus*), indicative of MSM, on the saltmarsh at Grantstown (NPWS internal files), but the habitat was not recorded in the Little Island sub-site during the SMP in 2007 (McCorry and Ryle, 2009). NB unsurveyed areas may be present within the SAC. See the Lower River Suir SAC conservation objectives supporting document for coastal habitats for further details
Habitat distribution	Occurrence	No decline or change in habitat distribution, subject to natural processes	See note on area above. NB unsurveyed areas may be present within the SAC. See the coastal habitats supporting document for further details
Physical structure: sediment supply	Presence/absence of physical barriers	Maintain natural circulation of sediments and organic matter, without any physical obstructions	Attribute and target based on data from McCorry and Ryle (2009). See the coastal habitats supporting document for further details
Physical structure: creeks and pans	Occurrence	Maintain creek and pan structure, subject to natural processes, including erosion and succession	Attribute and target based on data from McCorry and Ryle (2009). See the coastal habitats supporting document for further details
Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime	Attribute and target based on data from McCorry and Ryle (2009). Mediterranean salt meadow habitat is found high up in the saltmarsh but requires occasional tidal inundation. See the coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	Attribute and target based on data from McCorry and Ryle (2009). See the coastal habitats supporting document for further details
Vegetation structure: sward height	Centimetres	Maintain structural variation in the sward	Attribute and target based on data from McCorry and Ryle (2009). See the coastal habitats supporting document for further details
Vegetation structure: vegetation cover	Percentage cover at a representative number of monitoring stops	Maintain more than 90% of the area outside of creeks vegetated	Attribute and target based on data from McCorry and Ryle (2009). See the coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative number of monitoring stops	Maintain range of sub-communities with characteristic species listed in McCorry and Ryle (2009)	See the coastal habitats supporting document for further details
Vegetation composition: negative indicator species - *Spartina anglica*	Hectares	No significant expansion of common cordgrass (*Spartina anglica*), with an annual spread of less than 1% where it is already known to occur	Attribute and target based on data from McCorry and Ryle (2009). See the coastal habitats supporting document for further details

3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation

To maintain the favourable conservation condition of Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation in Lower River Suir SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Kilometres	Area stable or increasing, subject to natural processes	The description of habitat 3260 covers upland rivers with bryophytes and macroalgae to lowland depositing rivers with pondweeds and starworts. The selection of Lower River Suir SAC used this broad interpretation. Conservation objectives for habitat 3260 concentrate on the high conservation value sub-types, however, little is known of the habitat's distribution or its sub-types in Lower River Suir SAC. There is a large number of lowland and tidal rivers in the SAC, as well as faster-flowing tributaries. Note: rooted macrophytes should be absent or trace (<5% cover) in freshwater pearl mussel (*Margaritifera margaritifera*) habitat. The freshwater pearl mussel (1029) conservation objective takes precedence over this objective for habitat 3260 in the Clodiagh River (Portlaw) within this SAC, because the mussel requires environmental conditions close to natural background levels
Habitat distribution	Occurrence	No decline, subject to natural processes	Further study is needed of Irish sub-types and their conservation value to interpret the broad description of habitat 3260 (European Commission, 2013). As noted above, little is known about the distribution of the habitat and its sub-types in Lower River Suir SAC. The uncommon, protected opposite-leaved pondweed (*Groenlandia densa*) was recorded in the SAC from floodplain ditches of the Suir near Carrick-on-Suir and Clonmel, as well as the Clodiagh near Portlaw (Colgan and Scully, 1898; NPWS internal files). See NPWS (2012) for information on the requirements of opposite-leaved pondweed. There are no known records for rare or threatened bryophytes from the rivers in the SAC (Lockhart et al., 2012). The rivers in the SAC are mainly lowland, depositing and tidal, and are likely dominated by marginal and submerged higher plants. Some fast-flowing rivers also occur that should, naturally, be dominated by macroalgae and bryophytes, with limited submerged or emergent higher plants
Hydrological regime: river flow	Metres per second	Maintain appropriate hydrological regimes	High conservation value sub-types are associated with natural hydrology. A natural flow regime is required for both plant communities and channel geomorphology to be in favourable condition, exhibiting typical dynamics for the river type (Hatton-Ellis and Grieve, 2003). For many sub-types, high flows are required to maintain the substratum necessary for the characteristic species. Flow variation can be particularly important, with high and flood flows being critical to the hydromorphology. Other aspects of hydrology, such as tidal regime, are important for certain sub-types of the habitat. The rivers in the SAC vary from naturally flashy, through depositing to tidal reaches
Hydrological regime: groundwater discharge	Metres per second	Maintain appropriate hydrological regime	Even small groundwater contributions can significantly alter hydrochemistry, particularly where there is basic bedrock and/or subsoils. Freshwater seepages can be very important in tidal reaches

Hydrological regime: tidal influence	Daily water level fluctuations - metres	Maintain natural tidal regime	Opposite-leaved pondweed (*Groenlandia densa*) is typical of the tidal reaches of large Irish rivers, e.g. Suir, Slaney, Shannon and Blackwater (see Preston and Croft, 2001; Preston, 2003). This species is listed as Near Threatened (Wyse Jackson et al., 2016) and is protected on the Flora (Protection) Order, 2015 (Statutory Instrument No. 356 of 2015). Both the disturbance and substratum associated with the tidal regime may be important drivers
Substratum composition: particle size range	Millimetres	Maintain appropriate substratum particle size range, quantity and quality, subject to natural processes	Many of the high conservation value sub-types are dominated by coarse substrata, and it is likely that bedrock, boulders, cobbles and coarse gravels were naturally abundant in many tributaries in this SAC, particularly where the freshwater pearl mussel (*Margaritifera margaritifera*) occurred. Fine substrata are naturally abundant in depositing and tidal reaches. The size and distribution of particles are largely determined by the river flow. The chemical composition (particularly minerals and nutrients) of the substratum is also important. The quality of finer sediment particles is a notable driver of rooted plant communities. Note: increased fine sediment is contributing to the unfavourable status of the freshwater pearl mussel in the Clodiagh. See the freshwater pearl mussel (1029) conservation objective
Water quality	Various	Maintain appropriate water quality to support the natural structure and functioning of the habitat	The specific targets may vary among sub-types. Depositing and tidal stretches of rivers may, naturally, be more nutrient-rich and, therefore Water Framework Directive (WFD) good status may suffice in terms of nutrient and oxygenation standards, and EQRs (Ecological Quality Ratios) for macroinvertebrates and phytobenthos. Faster-flowing tributaries that are naturally dominated by bryophytes and macroalgae typically require WFD high status. High status targets apply to freshwater pearl mussel (*Margaritifera margaritifera*) habitat in the Clodiagh (see The European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009 - S.I. No. 296 of 2009). See also The European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. No. 272 of 2009), Environmental Protection Agency (EPA) river water quality reports (e.g. Bradley et al., 2015) and Ní Chatháin et al. (2013)
Typical species	Occurrence	Maintain typical species in good condition, including appropriate distribution and abundance	The sub-types of this habitat are poorly understood and their typical species have not yet been fully defined. The typical species may include higher plants, bryophytes, macroalgae and microalgae, and invertebrates. As noted above, the protected vascular plant species opposite-leaved pondweed (*Groenlandia densa*) is associated with rivers and floodplains in the SAC. The banks of the Suir, particularly its tidal stretches, support a notable population of the rare *Rumex crispus* subsp. *uliginosus* (Green, 2008)
Floodplain connectivity	Hectares	Maintain floodplain connectivity necessary to support the typical species and vegetation composition of the habitat	River connectivity with the floodplain is important for the functioning of this habitat. Channels with a naturally functioning floodplain are better able to maintain habitat and water quality (Hatton-Ellis and Grieve, 2003). Floodplain connectivity is particularly important in terms of sediment sorting and nutrient deposition. High conservation value rivers are intimately connected to floodplain habitats and function as important wildlife corridors, connecting otherwise isolated or fragmented habitats in the wider countryside (Hatton-Ellis and Grieve, 2003; Mainstone et al., 2016). Alluvial woodland (91E0) is an important feature of rivers in Lower River Suir SAC (see the conservation objective for 91E0)

Fringing habitats	Hectares	Maintain marginal fringing habitats that support the typical species and vegetation composition of the habitat	Riparian habitats (including those along lake shores), particularly natural/semi-natural woodlands and wetlands, are an integral part of the structure and functioning of river systems, even where they do not form part of a natural floodplain. Fringing habitats can contribute to the aquatic food web (e.g. allochthonous matter such as leaf fall), provide habitat (refuge and resources) for certain life-stages of fish, birds and aquatic invertebrates, assist in the settlement of fine suspended material, protect banks from erosion and contribute to nutrient cycling. Shade may also be important in suppressing algal growth in enriched rivers and moderating temperatures. Equally, fringing habitats are dependent on rivers/lakes, particularly their water levels, and support wetland communities and species of conservation concern. See Mainstone et al. (2016). Alluvial and riparian woodland is important for the rivers in Lower River Suir SAC

6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels

To maintain the favourable conservation condition of Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels in Lower River Suir SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels habitat has not been mapped in detail for Lower River Suir SAC and thus the total area of the qualifying habitat in the SAC is unknown. The lowland type communities of the habitat are considered to occur in association with the various areas of alluvial forest (91E0) within the SAC, notably at Fiddown, below Carrick-on-Suir and at Tibberaghny Marshes. This habitat type would also be expected to occur in association with other woodland types in fringe areas along the river and with areas of open marsh or wet grassland within the SAC (NPWS internal files)
Habitat distribution	Occurrence	No decline, subject to natural processes	See notes on area above
Hydrological regime: Flooding depth/height of water table	Metres	Maintain appropriate hydrological regime	This habitat requires winter inundation, which results in deposition of naturally nutrient-rich sediment
Vegetation composition: positive indicator species	Number of species at a representative number of monitoring stops	At least three positive indicator species present	Attribute and target based on O'Neill et al. (2013), where the list of positive indicator species is also presented
Vegetation composition: positive indicator species	Percentage cover at a representative number of monitoring stops	Cover of positive indicator species at least 40%	Attribute and target based on O'Neill et al. (2013), where the list of positive indicator species is also presented
Vegetation composition: non-native species	Percentage cover at a representative number of monitoring stops	Cover of non-native species not more than 1%	Attribute and target based on O'Neill et al. (2013). The spread of Japanese knotweed (*Fallopia japonica*) is noted as a threat at Tibberaghny (NPWS internal files)
Vegetation composition: negative indicator species	Percentage at a representative number of monitoring stops	Cover of negative indicator species not more than 33%	Attribute and target based on O'Neill et al. (2013), where the list of negative indicator species is also presented
Vegetation composition: scrub, bracken and heath	Percentage at a representative number of monitoring stops	Cover of scrub, bracken (*Pteridium aquilinum*) and heath not more than 5%	Attribute and target based on O'Neill et al. (2013)
Vegetation structure: height	Height (centimetres) at a representative number of monitoring stops	Herb height at least 50cm	Attribute and target based on O'Neill et al. (2013)
Physical structure: bare soil	Percentage at a representative number of monitoring stops	Cover of bare soil not more than 10%	Attribute and target based on O'Neill et al. (2013)
Physical structure: grazing and disturbance	Square metres in local vicinity of a representative number of monitoring stops	Area of the habitat showing signs of serious grazing or disturbance less than 20m²	Attribute and target based on O'Neill et al. (2013)

91A0 Old sessile oak woods with Ilex and Blechnum in the British Isles

To restore the favourable conservation condition of Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles in Lower River Suir SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, at least 29.3ha for sites surveyed. See map 4	Old sessile oak woods with *Ilex* and *Blechnum* were surveyed in Lower River Suir SAC by Perrin et al. (2008) as part of the National Survey of Native Woodlands (NSNW) at Lyranearla (NSNW site code: 1834) and Inchinsqullib Wood (NSNW site code: 1898). The area of old oak woodlands in the surveyed sites within the SAC is estimated to be 29.3ha. It is important to note that further unsurveyed areas are present within the SAC, including at Portlaw Wood within the Curraghmore Estate and other small pockets within the SAC (NPWS internal files). Map 4 shows the old oak woodlands surveyed by Perrin et al. (2008)
Habitat distribution	Occurrence	No decline. Surveyed locations shown on map 4	Distribution shown based on Perrin et al. (2008). NB further unsurveyed areas are present within this SAC
Woodland size	Hectares	Area stable or increasing. Where topographically possible, "large" woods at least 25ha in size and “small” woods at least 3ha in size	The target areas for individual woodlands aim to reduce habitat fragmentation and benefit those species requiring ‘deep’ woodland conditions (Peterken, 2002). In some cases, topographical constraints may restrict expansion
Woodland structure: cover and height	Percentage and metres	Diverse structure with a relatively closed canopy containing mature trees; subcanopy layer with semi-mature trees and shrubs; and well-developed herb layer	Described in Perrin et al. (2008) and NPWS internal files
Woodland structure: community diversity and extent	Hectares	Maintain diversity and extent of community types	Described in Perrin et al. (2008) and NPWS internal files
Woodland structure: natural regeneration	Seedling: sapling: pole ratio	Seedlings, saplings and pole age-classes occur in adequate proportions to ensure survival of woodland canopy	Oak (*Quercus petraea*) generally regenerates poorly. In suitable sites, ash (*Fraxinus excelsior*) can regenerate in large numbers although few seedlings reach pole size
Woodland structure: dead wood	m^3 per hectare; number per hectare	At least $30m^3$/ha of fallen timber greater than 10cm diameter; 30 snags/ha; both categories should include stems greater than 40cm diameter	Dead wood is a valuable resource and an integral part of a healthy, functioning woodland ecosystem
Woodland structure: veteran trees	Number per hectare	No decline	Mature and veteran trees are important habitats for bryophytes, lichens, saproxylic organisms and some bird species. Their retention is important to ensure continuity of habitats/niches and propagule sources
Woodland structure: indicators of local distinctiveness	Occurrence	No decline	Includes ancient or long-established woodlands (see Perrin and Daly, 2010), archaeological and geological features as well as red-listed and other rare or localised species. The rare lichen tree lungwort (*Lobaria pulmonaria*), an indicator of ancient woodlands, is found in Portlaw Wood (NPWS internal files)
Vegetation composition: native tree cover	Percentage	No decline. Native tree cover not less than 95%	Species reported in Perrin et al. (2008) and NPWS internal files

Vegetation composition: typical species	Occurrence	A variety of typical native species present, depending on woodland type, including oak (*Quercus petraea*) and birch (*Betula pubescens*)	Species reported in Perrin et al. (2008) and NPWS internal files
Vegetation composition: negative indicator species	Occurrence	Negative indicator species, particularly non-native invasive species, absent or under control	Rhododendron (*Rhododendron ponticum*) infestation at Portlaw Wood is noted as being serious, as well as the occurrence of beech (*Fagus sylvatica*), sycamore (*Acer pseudoplatanus*), and silver fir (*Abies alba*) in the woodland (NPWS internal files). Beech was reported from Lyrandarla (NSNW site code: 1834) by Perrin et al. (2008)

91E0 Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)

To restore the favourable conservation condition of Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)* in Lower River Suir SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, at least 32.9ha for sites surveyed. See map 5	Alluvial forest was surveyed in Lower River Suir SAC by Perrin et al. (2008) as part of the National Survey of Native Woodlands (NSNW) at Fiddown (NSNW site code: 0022), Mountbolton (NSNW site code: 1823) and Ballycanvan Big (NSNW site code: 1839). Fiddown (0022) was also included in a national monitoring survey (O'Neill and Barron, 2013). The area of alluvial woodlands in the surveyed sites within the SAC is estimated to be 32.9ha. It is important to note that further unsurveyed areas of alluvial forest are present within the SAC, for example at islands below Carrick-on-Suir, at Shanbally (Coillte LIFE project site), Tibberaghny Marshes, along the lower stretches of the more westerly of the Suir tributaries and along both banks of the Suir as far east as the Dawn River (NPWS internal files). Map 5 shows the alluvial woodlands surveyed by Perrin et al. (2008)
Habitat distribution	Occurrence	No decline. Surveyed locations shown on map 5	Distribution shown based on Perrin et al. (2008). NB further unsurveyed areas are present within the SAC
Woodland size	Hectares	Area stable or increasing. Where topographically possible, "large" woods at least 25ha in size and “small” woods at least 3ha in size	The target areas for individual woodlands aim to reduce habitat fragmentation and benefit those species requiring ‘deep’ woodland conditions (Peterken, 2002). In some cases, topographical constraints may restrict expansion
Woodland structure: cover and height	Percentage and metres	Diverse structure with a relatively closed canopy containing mature trees; subcanopy layer with semi-mature trees and shrubs; and well-developed herb layer	Described in Perrin et al. (2008) and NPWS internal files
Woodland structure: community diversity and extent	Hectares	Maintain diversity and extent of community types	Described in Perrin et al. (2008) and NPWS internal files
Woodland structure: natural regeneration	Seedling:sapling:pole ratio	Seedlings, saplings and pole age-classes occur in adequate proportions to ensure survival of woodland canopy	Alder (*Alnus glutinosa*) and oak (*Quercus* spp.) tend to regenerate poorly. Ash (*Fraxinus excelsior*) often regenerates in large numbers although few seedlings reach pole size
Hydrological regime: flooding depth/height of water table	Metres	Appropriate hydrological regime necessary for maintenance of alluvial vegetation	Periodic flooding is essential to maintain alluvial woodlands along river floodplains, but not for woodland around springs/seepage areas
Woodland structure: dead wood	m^3 per hectare; number per hectare	At least $30m^3$/ha of fallen timber greater than 10cm diameter; 30 snags/ha; both categories should include stems greater than 40cm diameter (greater than 20cm diameter in the case of alder (*Alnus glutinosa*))	Dead wood is a valuable resource and an integral part of a healthy, functioning woodland ecosystem
Woodland structure: veteran trees	Number per hectare	No decline	Mature and veteran trees are important habitats for bryophytes, lichens, saproxylic organisms and some bird species. Their retention is important to ensure continuity of habitats/niches and propagule sources

Woodland structure: indicators of local distinctiveness	Occurrence	No decline	Includes ancient or long-established woodlands, archaeological and geological features as well as red-listed and other rare or localised species. Perrin and Daly (2010) identify the site Ballycanvan Big (NSNW site code: 1839) as being "possible ancient woodland"
Vegetation composition: native tree cover	Percentage	No decline. Native tree cover not less than 95%	Species reported in Perrin et al. (2008) and NPWS internal files
Vegetation composition: typical species	Occurrence	A variety of typical native species present, depending on woodland type, including alder (*Alnus glutinosa*), willows (*Salix* spp.), oak (*Quercus* spp.), ash (*Fraxinus excelsior*) and birch (*Betula pubescens*)	Species reported in Perrin et al. (2008) and NPWS internal files
Vegetation composition: negative indicator species	Occurrence	Negative indicator species, particularly non-native invasive species, absent or under control	Norway spruce (*Picea abies*) and sycamore (*Acer pseudoplatanus*) occur at Shanbally (NPWS internal files). Spread of Japanese knotweed (*Fallopia japonica*) is a problem at Tibberaghny (NPWS internal files). Cherry laurel (*Prunus laurocerasus*) and rhododendron (*Rhododendron ponticum*) have been reported as occurring in part of Ballycanvan Big (NSNW site code: 1839) by Perrin et al. (2008), but not within the alluvial woodland

91J0 Taxus baccata woods of the British Isles

To restore the favourable conservation condition of *Taxus baccata* woods of the British Isles* in Lower River Suir SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	*Taxus baccata* woods of the British Isles habitat has not been mapped in detail for Lower River Suir SAC and thus the total area of the qualifying habitat is unknown. Yew (*Taxus baccata*) woodland is known to occur at Cahir Park in an area of c.500m by 50m. Cahir Park was included in a national monitoring survey of yew woodland (Cross and Lynn, 2013). NB further unsurveyed areas may be present within the SAC
Habitat distribution	Occurrence	No decline	A narrow stand of yew woodland occurs along the steep western flank of a limestone knoll at Cahir Park within Lower River Suir SAC. See Cross and Lynn (2013) for further details. NB further unsurveyed areas may be present within the SAC
Woodland size	Hectares	Area stable or increasing	Yew (*Taxus baccata*) has been planted on deeper soil on top of the knoll at Cahir Park. If the transplants survive, the area of yew woodland will be considerably expanded. See Cross and Lynn (2013) for further details
Woodland structure: cover and height	Percentage and metres	Diverse structure with a relatively closed canopy containing mature trees; subcanopy layer with semi-mature trees and shrubs; and herb and bryophyte layer	See Perrin et al. (2008) and Cross and Lynn (2013) for further details
Woodland structure: community diversity and extent	Hectares	Maintain diversity and extent of community types	See Perrin et al. (2008) and Cross and Lynn (2013) for further details
Woodland structure: natural regeneration	Seedling:sapling:pole ratio	Seedlings, saplings and pole age-classes occur in adequate proportions to ensure survival of woodland canopy	Yew (*Taxus baccata*) regenerates poorly under its own canopy but can regenerate under a canopy of other species or in the open if the competition from the field layer is not too strong
Woodland structure: dead wood	m^3 per hectare; number per hectare	At least $30m^3$/ha of fallen timber greater than 10cm diameter; 30 snags/ha; both categories should include stems greater than 40cm diameter	Dead wood is a valuable resource and an integral part of a healthy, functioning woodland ecosystem
Woodland structure: veteran trees	Number per hectare	No decline	Mature and veteran trees are important habitats for bryophytes, lichens, saproxylic organisms and some bird species. Their retention is important to ensure continuity of habitats/niches and propagule sources
Woodland structure: indicators of local disctinctiveness	Occurrence	No decline	Includes ancient or long-established woodlands (see Perrin and Daly, 2010), archaeological and geological features as well as red-data and other rare or localised species
Vegetation composition: native tree cover	Percentage	No decline. Native tree cover not less than 95%	See Perrin et al. (2008) and Cross and Lynn (2013) for further details
Vegetation composition: typical species	Occurrence	A variety of typical native species present, including yew (*Taxus baccata*) and ash (*Fraxinus excelsior*)	See Perrin et al. (2008) and Cross and Lynn (2013) for further details

Vegetation composition: negative indicator species	Occurrence	Negative indicator species, particularly non-native invasive species, absent or under control	The most common invasive species in this woodland type is beech (*Fagus sylvatica*), although there is evidence to suggest that it actually facilitates regeneration of yew (*Taxus baccata*). Numerous exotic species, including cherry laurel (*Prunus laurocerasus*) in particular, have been reported from Cahir Park (Cross and Lynn, 2013)

1029 Freshwater Pearl Mussel *Margaritifera margaritifera*

To restore the favourable conservation condition of Freshwater Pearl Mussel in Lower River Suir SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Kilometres	Restore distribution to 10.4km. See map 6	The conservation objective applies to the Clodiagh freshwater pearl mussel (*Margaritifera margaritifera*) population, which is listed on The European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009. (S.I. 296 of 2009). Full baseline distribution and abundance mapping was conducted in 2006 (Ross, 2006). Mussel habitat is widespread in the Clodiagh, with mussels almost continually present in low numbers from downstream of Clonea to above Portlaw (Ross, 2006). Mussels were nowhere abundant; maximum density was 3 per square metre (Ross, 2006). The habitat is significantly below carrying-capacity. The distribution in the Clodiagh has contracted since the 1990s (Ross, 2006). The target is for the species to be sufficiently widespread to maintain itself on a long-term basis as a viable component of the Clodiagh system. See NPWS (2010) for further information
Population size	Number of adult mussels	Restore population to at least 10,000 adult mussels	Ross (2006) counted 1,206 mussels and estimated a total population of 2,412, concluding that, given the large areas of physically suitable habitat, a much larger population was previously present and a major population decline had occurred. Ross (2009) measured an 18.5% decline in mussel numbers between 2006 and 2009 at transect 1, indicating continued losses. Ross et al. (2017) recorded 'rapid and alarming' declines of 56-94% between 2006 and 2016 at five monitoring locations (67% decline overall). Moorkens (2010) estimated the population to be less than 10,000. The target of 10,000 is considered appropriate for a functional, self-sustaining population. NPWS (2013), in producing a national population estimate, assumed the Clodiagh population had declined at a rate of 3% per year. The target is for the species to be sufficiently abundant to maintain itself on a long-term basis as a viable component of the Clodiagh system
Population structure: recruitment	Percentage per size class	Restore to at least 20% of each population no more than 65mm in length; and at least 5% of each population no more than 30mm in length	Mussels ≤65mm are 'young mussels' and found buried in the substratum or beneath adult mussels. Mussels ≤30mm are 'juvenile mussels' and always buried in the substratum. See the European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009. The Clodiagh failed both targets in 2006, 2009 and 2016 (Ross, 2006, 2009; NPWS, 2010; Ross et al., 2017). Ross (2006) found no juveniles, ≤65mm extremely uncommon, smallest individual was 45.4mm and 97% was >80mm. In 2009, the smallest mussel was 78mm and (based on Ross, 1988) 15-20 years old (Ross, 2009). The smallest of 21 mussels measured in 1986 was 48.6mm (Ross, 1988). NPWS (2010) concluded there had been no successful recruitment from 1986 to 2009. The Clodiagh population is considered to be unsustainable owing to lack of survival of juvenile and adult mussels. The target is for sufficient juvenile recruitment to allow the species to maintain itself on a long-term basis as a viable component of the Clodiagh system

Population structure: adult mortality	Percentage	No more than 5% decline from previous number of live adults counted; dead shells less than 1% of the adult population and scattered in distribution	5% is considered the cut-off between the combined errors associated with natural fluctuations and sampling methods and evidence of true population decline. 1% of dead shells is considered to be indicative of natural losses. The Clodiagh failed both targets in 2009 (Ross, 2009; NPWS, 2010) and, as noted above, a major population decline has occurred (Ross, 2006; Ross et al., 2017), and is presumed to be on-going. In 2009, 1 transect and 1 delimited count were counted: T1 numbers had fallen from 27 in 2006 to 22, representing a 18.5% decline, while numbers were the same in C2. Seven dead shells were found among 23 live mussels at one location, indicating high mortality in parts of the Clodiagh. In 2016, 67 mussels were counted at five monitoring sites that had 205 mussels in 2006 (Ross et al., 2017). The target is for sufficient survival of adults to allow the species to maintain itself on a long-term basis as a viable component of the Clodiagh system
Suitable habitat: extent	Kilometres	Restore suitable habitat in more than 8.8km in the Clodiagh system and any additional stretches necessary for salmonid spawning	Mussel habitat in the Clodiagh is known to occur from Clonea to Portlaw, and is sparsely occupied from c.630m downstream of Clonea to c.1.8km above Portlaw (Ross, 2006). Mussels were recorded at Portlaw as recently as the 1990s and downstream of Portlaw in the early 20th century. It is possible that some mussel habitat occurs upstream or downstream of the mapped stretches, but few mussels are likely to be found (Ross, 2006). The mussel habitat has been severely impacted for a significant period by sedimentation, other hydromorphological changes, organic pollution and eutrophication (NPWS, 2010). The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Clodiagh system
Suitable habitat: condition	Kilometres	Restore condition of suitable habitat	The species' habitat is a combination of the area of 1) habitat adult and juvenile mussels can occupy; 2) spawning and nursery habitats host fish can occupy. Fish nursery and mussel habitat typically overlap. Fish spawning habitat is generally adjacent to mussel habitat, but may lie upstream of the generalised mussel distribution. Only spawning areas that regularly contribute juvenile fish to adult mussel habitat should be considered. Availability of mussel and fish habitat is determined by flow and substratum conditions. It is highly sensitive to hydromorphological changes, sedimentation and enrichment. Pressures throughout the catchment contribute to such impacts. Mussel habitat is widespread in the Clodiagh but in unfavourable condition owing to sedimentation, other hydro-morphological changes and nutrient enrichment. The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Clodiagh system

Water quality: macroinvertebrate and phytobenthos (diatoms)	Ecological quality ratio (EQR)	Restore water quality - macroinvertebrates: EQR greater than 0.90 (Q4-5 or Q5); phytobenthos: EQR greater than 0.93	The EQRs correspond to high ecological status for these two Water Framework Directive biological quality elements. They represent high water quality with very low nutrient concentrations (oligotrophic conditions). In 2009, the habitat in the Clodiagh system failed the macroinvertebrate target, but passed the phytobenthos target (Morgan, 2009; Ní Chatháin, 2010; NPWS, 2010). Q values in the mussel habitat were Q3-Q4 (Morgan, 2009). There has been a gradual decline in quality at several main-channel sites since the late 1970s (Morgan, 2009). Sewage discharge at Clonea is impacting water quality downstream of Clonea Bridge (Ross, 2006; Morgan, 2009; Ní Chatháin, 2010; NPWS, 2010). See also The European Communities Environmental Objectives (Surface Waters) Regulations 2009. The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Clodiagh system
Substratum quality: filamentous algae (macroalgae); macrophytes (rooted higher plants)	Percentage	Restore substratum quality - filamentous algae: absent or trace (less than 5%); macrophytes: absent or trace (less than 5%)	The Clodiagh failed the macrophyte target, but marginally passed the macroalgal target in 2009 (NPWS, 2010). Patches of abundant *Ranunculus* were recorded by all surveyors, with up to 40% cover in places (Morgan, 2009; Ross, 2009; Ní Chatháin, 2010; NPWS, 2010). Ross (2006) also recorded widespread and, in places, abundant (up to 80%) *Ranunculus*. Algae were generally absent in 2009, however up to 10% *Cladophora* cover was recorded downstream of Clonea Bridge (Ní Chatháin, 2010; NPWS, 2010), where sewage fungus had previously been recorded (Ross, 2006). Algae were also sparse in 2006 and 2016 (Ross, 2006; Ross et al., 2017). Tree shade may be supressing plant growth over much of the mussel habitat (Ross et al., 2017). The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Clodiagh system
Substratum quality: sediment	Occurrence	Restore substratum quality - stable cobble and gravel substrate with very little fine material; no artificially elevated levels of fine sediment	The Clodiagh failed the target for the Sub-basin Management Plan in 2009 and 2016, with strong silt plumes recorded in mussel habitat (Ross, 2009; NPWS, 2010; Ross et al., 2017). Ross et al. (2017) recorded extremely heavy silt plumes at every site, even in fast riffles. Ross (2006) recorded significant siltation of the mussel habitat and observed river bank erosion and collapse, and livestock entry to the river. Silt in the Clodiagh is providing a rooting medium for macrophytes. Sufficient survival of juvenile and adult mussels is being prevented by the poor condition of the river substratum. The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Clodiagh system
Substratum quality: oxygen availability	Redox potential	Restore to no more than 20% decline from water column to 5cm depth in substrate	Differences in redox potential between the water column and the substrate correlate with differences in oxygen levels. Juvenile mussels require full oxygenation while buried in gravel. In suitable habitat, there should be very little loss of redox potential between the water column and underlying gravels. Average redox was very poor, 23-28% at four sites monitored in 2016, only three of the 40 measurements was <20% (Ross et al., 2017). The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Clodiagh system

Hydrological regime: flow variability	Metres per second	Maintain appropriate hydrological regime	The availability of suitable freshwater pearl mussel habitat is largely determined by flow (catchment geology being the other key factor). To restore the habitat for the species, flow variability over the annual cycle must be such that: 1) high flows can wash fine sediments from the substratum; 2) high flows are not artificially increased so as to cause excessive scour of mussel habitat; 3) low flows do not exacerbate the deposition of fine sediment or growth of algae/macrophytes and 4) low flows do not cause stress to mussels in terms of exposure, water temperatures, food availability or aspects of the reproductive cycle; see Moorkens and Killeen (2014). Groundwater inflow to the substratum contributes to water-cycling. The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of Clodiagh system
Host fish	Number	Maintain sufficient juvenile salmonids to host glochidial larvae	Salmonid fish are host to the larval stage of the freshwater pearl mussel and essential to completion of the life cycle. 0+ and 1+ fish are typically used, both because of habitat overlaps and the development of immunity with age in fish. Fish presence is sufficient, as higher fish density and biomass is indicative of enriched conditions in mussel rivers. Geist et al. (2006) found that higher densities of host fish coincided with eutrophication, poor substrate quality for mussels and a lack of mussel recruitment, while significantly lower host fish density and biomass were associated with high juvenile mussel numbers. Fish movements must be such that 0+ fish remain in the mussel habitat until their 1+ summer. No fish stocking should occur within the mussel habitat, nor any works that may change the salmonid balance or residency time. No glochidia were found on young Clodiagh fish in May 2009, although six trout and 38 salmon were caught (Johnston, 2009; NPWS, 2010)
Fringing habitat: area and condition	Hectares	Restore the area and condition of fringing habitats necessary to support the population	Riparian habitats, including those along lake fringes, particularly natural/semi-natural woodlands and wetlands, even where they do not form part of a natural floodplain, are an integral part of the structure and functioning of river systems. Fringing habitats aid in the settlement of fine suspended matter, protect banks from erosion, contribute to nutrient cycling and to the aquatic food web (e.g. allochthonous matter such as leaf fall) and provide habitat for life-stages of fish, birds and aquatic invertebrates. Shade may also be important in suppressing algal and macrophyte growth in enriched rivers (e.g. along parts of the Clodiagh) and moderating temperatures. Equally, fringing habitats are dependent on rivers/lakes, particularly their water levels, and support wetland communities and species of conservation concern. The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Clodiagh system

1092 White-clawed Crayfish *Austropotamobius pallipes*

To maintain the favourable conservation condition of White-clawed Crayfish in Lower River Suir SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Occurrence	No reduction from baseline. See map 7	White-clawed crayfish (*Austropotamobius pallipes*) occurs extensively on the River Suir and on many of its tributaries. On the River Suir main channel, the species has been recorded on almost the entire length of non-tidal river from the most upstream point at Cabragh, near Thurles, to downstream of Kilsheelan. It is also present on the following tributaries: Anner and Clashawley, Clodiagh and Owenbeg, Multeen, Tar, Nier, and Clodiagh Lower
Population structure: recruitment	Occurrence of juveniles and females with eggs	Juveniles and/or females with eggs in all occupied tributaries	See Reynolds et al. (2010) for further details
Negative indicator species	Occurrence	No alien crayfish species	Alien crayfish species are identified as a major direct threat to this species and as a disease vector. Ireland is currently free of non-native invasive crayfish species. See Reynolds (1998) for further details
Disease	Occurrence	No instances of disease	Disease is identified as a major threat and crayfish plague has occurred in Ireland even in the absence of alien vectors. Disease can, in some circumstances, be introduced through contaminated equipment and water in the absence of vector species. See Reynolds (1998) for further details
Water quality	EPA Q value	At least Q3-4 at all sites sampled by EPA	Target taken from Demers and Reynolds (2002). Q values based on triennial water quality surveys carried out by the Environmental Protection Agency (EPA)
Habitat quality: heterogeneity	Occurrence of positive habitat features	No reduction in habitat heterogeneity or habitat quality	Crayfish need high habitat heterogeneity. Larger crayfish must have stones to hide under, or an earthen bank in which to burrow. Hatchlings shelter in vegetation, gravel and among fine tree roots. Smaller crayfish are typically found among weed and debris in shallow water. Larger juveniles in particular may also be found among cobbles and detritus, such as leaf litter. These conditions must be available on the whole length of occupied habitat

1095 Sea Lamprey *Petromyzon marinus*

To restore the favourable conservation condition of Sea Lamprey in Lower River Suir SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: extent of anadromy	Percentage of river accessible	Greater than 75% of main stem length of rivers accessible from estuary	Artificial barriers can block or cause difficulties to lampreys' upstream migration, thereby limiting the species to lower stretches and restricting access to spawning areas (Gargan et al., 2011; Rooney et al., 2015). Float-over surveys by Inland Fisheries Ireland (IFI) point to little success of sea lamprey adults in passing the weirs in Clonmel in Lower River Suir SAC. Modifications to these weirs would facilitate upstream passage of sea lamprey. IFI has embarked on a programme of detailed survey of major barriers in SAC catchments, in the context of sea lamprey passage, using the SNIFFER (Scotland and Northern Ireland Forum for Environmental Research) WFDIII methodology
Population structure of juveniles	Number of age/size groups	At least three age/size groups present	Attribute and target based on data from Harvey and Cowx (2003) and O'Connor (2007). A catchment-wide larval lamprey survey was completed by IFI in 2016. The data are currently being analysed
Juvenile density in fine sediment	Juveniles/m²	Juvenile density at least 1/m²	Juveniles burrow in areas of fine sediment in still water. Attribute and target based on data from Harvey and Cowx (2003). A catchment-wide larval lamprey survey was completed by IFI in 2016. The data are currently being analysed
Extent and distribution of spawning habitat	m² and occurrence	No decline in extent and distribution of spawning beds	Attribute and target based on spawning bed mapping by IFI. Lampreys spawn in clean gravels. Substantial areas of suitable spawning habitat are available from Cahir to Carrick-on-Suir, but access to areas upstream of Clonmel is problematic
Availability of juvenile habitat	Number of positive sites in 3rd order channels (and greater), downstream of spawning areas	More than 50% of sample sites positive	Silting habitat is essential for larval lamprey and they can be severely impacted by sediment removal. Recovery can be rapid and newly-created habitat can be rapidly colonised (King et al., 2015). However, it is vital that such sedimenting habitats are retained

1096 Brook Lamprey *Lampetra planeri*

To restore the favourable conservation condition of Brook Lamprey in Lower River Suir SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Percentage of river accessible	Access to all water courses down to first order streams	Artificial barriers can block or cause difficulties to lampreys' migration both up- and downstream, thereby possibly limiting species to specific stretches, restricting access to spawning areas and creating genetically isolated populations (Espanhol et al., 2007)
Population structure of juveniles	Number of age/size groups	At least three age/size groups of brook/river lamprey present	Attribute and target based on data from Harvey and Cowx (2003) and O'Connor (2007). It is impossible to distinguish between brook and river lamprey juveniles in the field (Gardiner, 2003), hence they are considered together in this target
Juvenile density in fine sediment	Juveniles/m²	Mean catchment juvenile density of brook/river lamprey at least 2/m²	Juveniles burrow in areas of fine sediment in still water. Attribute and target based on data from Harvey and Cowx (2003) who state 10/m² in optimal conditions and more than 2/m² on a catchment basis. A catchment-wide larval lamprey survey was completed by Inland Fisheries Ireland (IFI) in 2016. The data are currently being analysed
Extent and distribution of spawning habitat	m² and occurrence	No decline in extent and distribution of spawning beds	Attribute and target based on spawning bed mapping by IFI. Brook lampreys spawn in clean gravels where they excavate shallow nests and can spawn communally (Rooney et al., 2013)
Availability of juvenile habitat	Number of positive sites in 2nd order channels (and greater), downstream of spawning areas	More than 50% of sample sites positive	Silting habitat is essential for larval lamprey and they can be severely impacted by sediment removal. Recovery can be rapid and newly-created habitat can be rapidly colonised (King et al., 2015). However, it is vital that such sedimenting habitats are retained

1099 River Lamprey *Lampetra fluviatilis*

To restore the favourable conservation condition of River Lamprey in Lower River Suir SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Percentage of river accessible	Access to all water courses down to first order streams	Artificial barriers can block river lampreys' migration both up- and downstream, thereby limiting species to specific stretches, restricting access to spawning areas and creating genetically isolated populations (Espanhol et al., 2007)
Population structure of juveniles	Number of age/size groups	At least three age/size groups of river/brook lamprey present	Attribute and target based on data from Harvey and Cowx (2003) and O'Connor (2007). It is impossible to distinguish between river and brook lamprey juveniles in the field (Gardiner, 2003), hence they are considered together in this target
Juvenile density in fine sediment	Juveniles/m²	Mean catchment juvenile density of brook/river lamprey at least 2/m²	Juveniles burrow in areas of fine sediment in still water. Attribute and target based on data from Harvey and Cowx (2003) who state 10/m² in optimal conditions and more than 2/m² on a catchment basis. A catchment-wide larval lamprey survey was completed by Inland Fisheries Ireland (IFI) in 2016. The data are currently being analysed
Extent and distribution of spawning habitat	m² and occurrence	No decline in extent and distribution of spawning beds	Attribute and target based on spawning bed mapping by Inland Fisheries Ireland (IFI). River lampreys spawn in clean gravels where thay excavate shallow nests and can spawn communally in numbers (Rooney et al., 2013)
Availability of juvenile habitat	Number of positive sites in 2nd order channels (and greater), downstream of spawning areas	More than 50% of sample sites positive	Silting habitat is essential for larval lamprey and they can be severely impacted by sediment removal. Recovery can be rapid and newly-created habitat can be rapidly colonised (King et al., 2015). However, it is vital that such sedimenting habitats are retained

1103 Twaite Shad *Alosa fallax fallax*

To restore the favourable conservation condition of Twaite Shad in Lower River Suir SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: extent of anadromy	Percentage of river accessible	Greater than 75% of main stem length of rivers accessible from estuary	In some catchments, artificial barriers block twaite shads' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas
Population structure: age classes	Number of age classes	More than one age class present	
Extent and distribution of spawning habitat	m² and occurrence	No decline in extent and distribution of spawning habitats	
Water quality: oxygen levels	Milligrams per litre	No lower than 5mg/l	Attribute and target based on Maas et al. (2008)
Spawning habitat quality: Filamentous algae; macrophytes; sediment	Occurrence	Maintain stable gravel substrate with very little fine material, free of filamentous algal (macroalgae) growth and macrophyte (rooted higher plants) growth	See Maitland and Hatton-Ellis (2003) for further information

1106 Salmon *Salmo salar*

To restore the favourable conservation condition of Atlantic Salmon in Lower River Suir SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: extent of anadromy	Percentage of river accessible	100% of river channels down to second order accessible from estuary	Artificial barriers block salmons' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas
Adult spawning fish	Number	Conservation limit (CL) for each system consistently exceeded	A conservation limit (CL) is defined by the North Atlantic Salmon Conservation Organisation (NASCO) as "the spawning stock level that produces long-term average maximum sustainable yield as derived from the adult to adult stock and recruitment relationship". The target is based on the Standing Scientific Committee on Salmon (SSCS) annual model output of CL attainment levels. See SSCS (2016). Attainment of CL estimates are derived from direct counts of adults (rod catch, fish counter) or indirectly by fry abundance counts. The Suir is currently below CL, meeting 79% of CL
Salmon fry abundance	Number of fry/5 minutes electrofishing	Maintain or exceed 0+ fry mean catchment-wide abundance threshold value. Currently set at 17 salmon fry/5 minutes sampling	The target is the threshold value for rivers currently exceeding their conservation limit (CL). The average electrofishing value for the Suir in 2016 was 10.2 salmon fry, which is below the 17 fry target
Out-migrating smolt abundance	Number	No significant decline	Smolt abundance can be negatively affected by a number of impacts such as estuarine pollution, predation and sea lice (*Lepeophtheirus salmonis*)
Number and distribution of redds	Number and occurrence	No decline in number and distribution of spawning redds due to anthropogenic causes	Salmon spawn in clean gravels. Artificial barriers are generally not currently preventing salmon from accessing suitable spawning habitat in Lower River Suir SAC
Water quality	EPA Q value	At least Q4 at all sites sampled by EPA	Q values based on triennial water quality surveys carried out by the Environmental Protection Agency (EPA)

1355 Otter *Lutra lutra*

To maintain the favourable conservation condition of Otter in Lower River Suir SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Percentage positive survey sites	No significant decline	Measure based on standard otter survey technique. Favourable Conservation Status (FCS) target based on 1980/81 survey findings, is 88% in SACs. Current range is estimated at 93.6% (Reid et al. 2013)
Extent of terrestrial habitat	Hectares	No significant decline. Area mapped and calculated as 116.17ha above high water mark (HWM) and 726.61ha along river banks	No field survey. Areas mapped to include 10m terrestrial buffer along shoreline (above HWM and along river banks) identified as critical for otters (NPWS, 2007)
Extent of marine habitat	Hectares	No significant decline. Area mapped and calculated as 712.27ha	No field survey. Area mapped based on evidence that otters tend to forage within 80m of the shoreline (HWM) (Kruuk, 2006; NPWS, 2007)
Extent of freshwater (river) habitat	Kilometres	No significant decline. Length mapped and calculated as 382.31km	No field survey. River length calculated on the basis that otters will utilise freshwater habitats from estuary to headwaters (Chapman and Chapman, 1982)
Couching sites and holts	Number	No significant decline	Otters need lying up areas throughout their territory where they are secure from disturbance (Kruuk and Moorhouse, 1991; Kruuk, 2006)
Fish biomass available	Kilograms	No significant decline	Broad diet that varies locally and seasonally, but dominated by fish, in particular salmonids, eels and sticklebacks in freshwater (Bailey and Rochford, 2006; Reid et al., 2013) and wrasse and rockling in coastal waters (Kingston et al., 1999)
Barriers to connectivity	Number	No significant increase	Otters will regularly commute across stretches of open water up to 500m e.g. between the mainland and an island; between two islands; across an estuary (De Jongh and O'Neill, 2010). It is important that such commuting routes are not obstructed

Legend

Lower River Suir SAC 002137

An Roinn Ealaíon, Oidhreachta, Gnóthaí Réigiúnacha, Tuaithe agus Gaeltachta

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MAP 1:
LOWER RIVER SUIR SAC
CONSERVATION OBJECTIVES
SAC DESIGNATION

Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE: SAC 002137; version 3.
CO. WATERFORD, CO. LIMERICK, CO.TIPPERARY, CO. KILKENNY

0 3 6 9 12 15 km

N

Map Version 1
Date: Oct 2016

Legend

- Lower River Suir SAC 002137
- River Barrow and River Nore SAC 002162
- OSi Discovery Series County Boundary

An Roinn Ealaíon, Oidhreachta, Gnóthaí Réigiúnacha, Tuaithe agus Gaeltachta

Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs

MAP 2:
LOWER RIVER SUIR SAC
CONSERVATION OBJECTIVES
ADJOINING DESIGNATION

Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE:
SAC 002137; version 3. SAC 002162; version 3.01
CO. WATERFORD, CO. LIMERICK, CO.TIPPERARY, CO. KILKENNY

0 6 12 18 24 30 km

N

Map Version 1
Date: Oct 2016

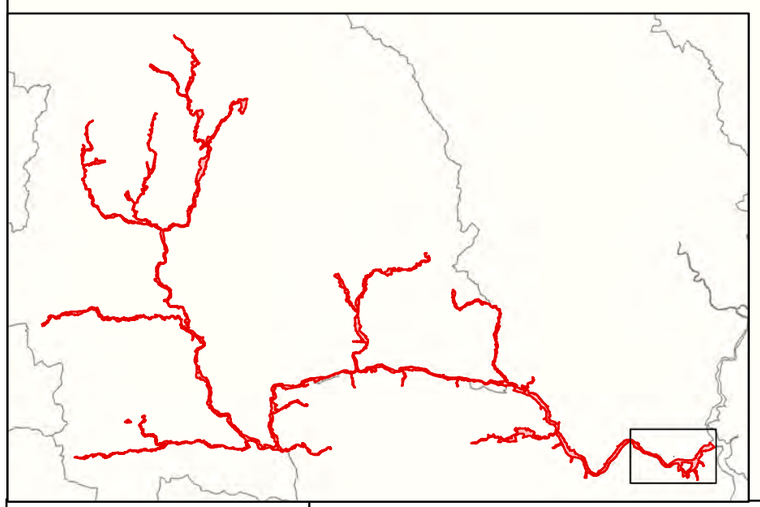
Legend

- Lower River Suir SAC 002137
- Saltmarsh Monitoring Project Survey Area

Annex I Saltmarsh Habitats

- 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- Potential 1330 Potential Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- OSi Discovery Series County Boundary

SMP Site Code: SMP0052



An Roinn Ealaíon, Oidhreachta, Gnóthaí Réigiúnacha, Tuaithe agus Gaeltachta

Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs

MAP 3:
LOWER RIVER SUIR SAC
CONSERVATION OBJECTIVES
SALTMARSH HABITATS

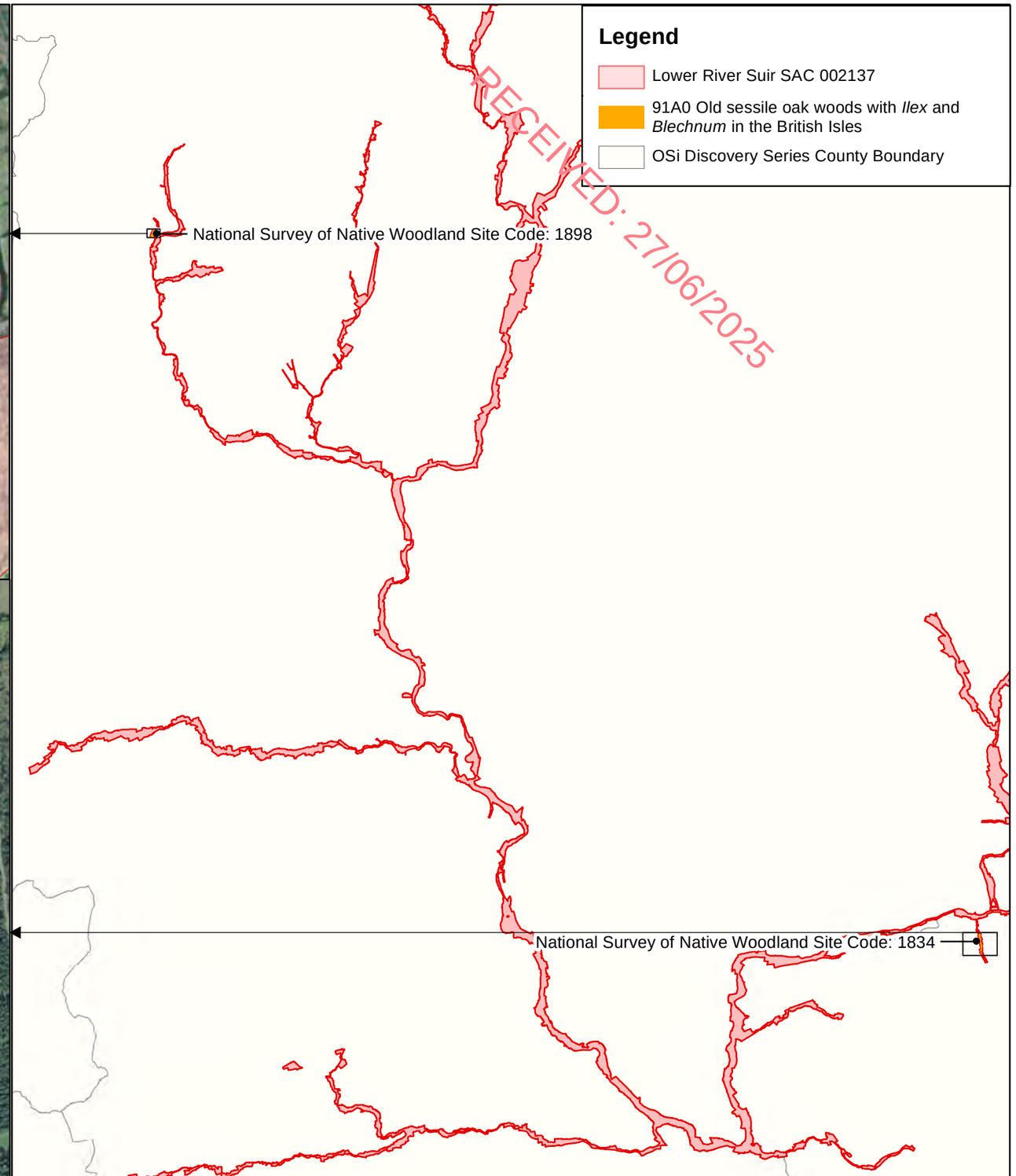
Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE:
SAC 002137; version 3.
CO. WATERFORD, CO. LIMERICK, CO.TIPPERARY, CO. KILKENNY

0 0.3 0.6 0.9 1.2 1.5 km

N

Map Version 1
Date: Oct 2016



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Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs

MAP 4:
LOWER RIVER SUIR SAC
CONSERVATION OBJECTIVES
OLD SESSILE OAK WOODLAND

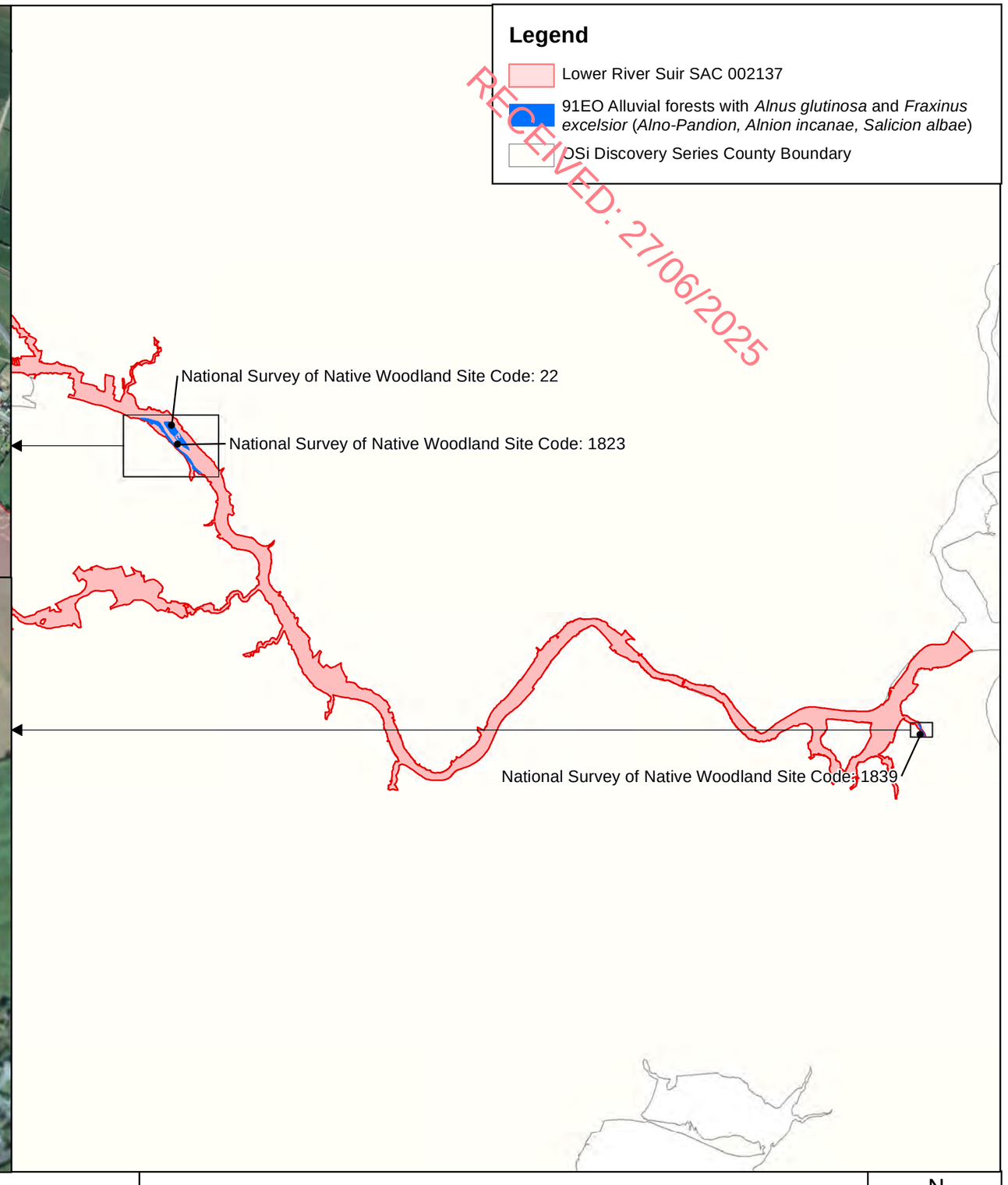
Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE:
SAC 002137; version 3.
CO. WATERFORD, CO. LIMERICK, CO.TIPPERARY, CO. KILKENNY

0 0.035 0.07 0.105 0.14 0.175 km

N

Map Version 1
Date: Oct 2016



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MAP 5:
LOWER RIVER SUIR SAC
CONSERVATION OBJECTIVES
ALLUVIAL WOODLAND

Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE: SAC 002137; version 3.
CO. WATERFORD, CO. LIMERICK, CO.TIPPERARY, CO. KILKENNY

0 0.15 0.3 0.45 0.6 0.75 km

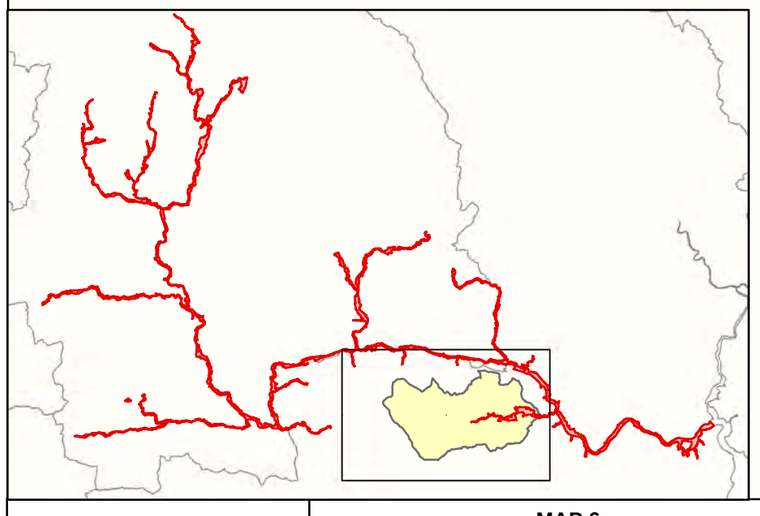
N

Map Version 1
Date: Oct 2016

Legend

- Lower River Suir SAC 002137
- 1029 Freshwater Pearl Mussel *Margaritifera margaritifera* Suitable habitat length
- 1029 Freshwater Pearl Mussel *Margaritifera margaritifera* Distribution target
- 1029 Freshwater Pearl Mussel *Margaritifera margaritifera* Catchment
- OSi Discovery Series County Boundary

Clodiagh Catchment



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MAP 6:
LOWER RIVER SUIR SAC
CONSERVATION OBJECTIVES
FRESHWATER PEARL MUSSEL -
MARGARITIFERA MARGARITIFERA

Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE:
SAC 002137; version 3.
CO. WATERFORD, CO. LIMERICK, CO.TIPPERARY, CO. KILKENNY

0 0.8 1.6 2.4 3.2 4 km

N

Map Version 1
Date: Oct 2016

Legend

- Lower River Suir SAC 002137
- 1092 White-clawed Crayfish *Austropotamobius pallipes*
- OSi Discovery Series County Boundary

An Roinn Ealaíon, Oidhreachta, Gnóthaí Réigiúnacha, Tuaithe agus Gaeltachta

Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs

MAP 7:
LOWER RIVER SUIR SAC
CONSERVATION OBJECTIVES
WHITE-CLAWED CRAYFISH

Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE:
SAC 002137; version 3.
CO. WATERFORD, CO. LIMERICK, CO.TIPPERARY, CO. KILKENNY

0 3 6 9 12 15 km

N

Map Version 1
Date: Oct 2016

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National Parks and Wildlife Service

Conservation Objectives Series

River Barrow and River Nore SAC 002162

National Parks and Wildlife Service,
Department of Housing, Local Government and Heritage,

90 King Street North, Dublin 7, D07 N7CV, Ireland.

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Series Editors: Maria Long and Colin Heaslip
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Introduction

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

A site-specific conservation objective aims to define favourable conservation condition for a particular habitat or species at that site.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, are stable or increasing, and
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- the conservation status of its typical species is favourable.

The favourable conservation status of a species is achieved when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

Notes/Guidelines:

1. The targets given in these conservation objectives are based on best available information at the time of writing. As more information becomes available, targets for attributes may change. These will be updated periodically, as necessary.
2. An appropriate assessment based on these conservation objectives will remain valid even if the targets are subsequently updated, providing they were the most recent objectives available when the assessment was carried out. It is essential that the date and version are included when objectives are cited.
3. Assessments cannot consider an attribute in isolation from the others listed for that habitat or species, or for other habitats and species listed for that site. A plan or project with an apparently small impact on one attribute may have a significant impact on another.
4. Please note that the maps included in this document do not necessarily show the entire extent of the habitats and species for which the site is listed. This should be borne in mind when appropriate assessments are being carried out.
5. When using these objectives, it is essential that the relevant backing/supporting documents are consulted, particularly where instructed in the targets or notes for a particular attribute.

Qualifying Interests

**** indicates a priority habitat under the Habitats Directive***

002162	River Barrow and River Nore SAC
1016	Desmoulin's Whorl Snail *Vertigo moulinsiana*
1029	Freshwater Pearl Mussel *Margaritifera margaritifera*
1092	White-clawed Crayfish *Austropotamobius pallipes*
1095	Sea Lamprey *Petromyzon marinus*
1096	Brook Lamprey *Lampetra planeri*
1099	River Lamprey *Lampetra fluviatilis*
1103	Twaite Shad *Alosa fallax fallax*
1106	Salmon *Salmo salar*
1130	Estuaries
1140	Mudflats and sandflats not covered by seawater at low tide
1170	Reefs
1310	*Salicornia* and other annuals colonising mud and sand
1330	Atlantic salt meadows (Glauco-Puccinellietalia maritimae)
1355	Otter *Lutra lutra*
1410	Mediterranean salt meadows (Juncetalia maritimi)
1421	Killarney Fern *Trichomanes speciosum*
3260	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation
4030	European dry heaths
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels
7220	Petrifying springs with tufa formation (Cratoneurion)*
91A0	Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles
91E0	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)*

Please note that this SAC is adjoins Lower River Suir SAC (002137), Blackstairs Mountains SAC (000770), Slieve Bloom Mountains SAC (000412) and overlaps with River Nore SPA (004233) and Slieve Bloom Mountains SPA (004160). See map 1a. The conservation objectives for this site should be used in conjunction with those for overlapping and adjoining site(s) as appropriate. IMPORTANT: This 'Version 2' document includes 1 additional QI (1170), 3 updates to existing QIs (1029/1130/1140) and 1 QI removal (1990). The conservation objectives for other pre-existing QIs have generally not been updated.

Supporting documents, relevant reports & publications

Supporting documents, NPWS reports and publications are available for download from: www.npws.ie/Publications

NPWS Documents

Year :	1995
Title :	Mapping of proposed SAC rivers for *Margaritifera margaritifera*. A report for the National Parks and Wildlife Service on work carried out from August to October 1995 (in two volumes). Volume 1
Author :	Moorkens, E.
Series :	Unpublished report to NPWS
Year :	1998
Title :	Conservation management of the white-clawed crayfish, *Austropotamobius pallipes*
Author :	Reynolds, J.D.
Series :	Irish Wildlife Manuals, No. 1
Year :	2006
Title :	The distribution of Lamprey in the River Barrow SAC
Author :	King, J.J.
Series :	Irish Wildlife Manual No. 21
Year :	2006
Title :	Otter survey of Ireland 2004/2005
Author :	Bailey, M.; Rochford, J.
Series :	Irish Wildlife Manuals, No. 23
Year :	2006
Title :	Initiation of a monitoring program for the freshwater pearl mussel, *Margaritifera margaritifera* (L.) in the Mountain River (Barrow)
Author :	Ross, E.
Series :	Unpublished report to National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin
Year :	2007
Title :	A survey of juvenile lamprey populations in the Corrib and Suir catchments
Author :	O'Connor, W.
Series :	Irish Wildlife Manuals, No. 26
Year :	2008
Title :	All Ireland Species Action Plan - Killarney Fern
Author :	NPWS ; EHS-NI
Series :	Species Action Plan
Year :	2008
Title :	National survey of native woodlands 2003-2008
Author :	Perrin, P.M.; Martin, J.; Barron, S.; O'Neill, F.H.; McNutt, K.E.; Delaney, A.
Series :	Unpublished report to NPWS
Year :	2009
Title :	NS II Freshwater Pearl Mussel Sub-basin Management Plan: Fisheries Survey. Stage 1 Report
Author :	Johnston and Associates, P.
Series :	Unpublished Report to the National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin

Year :	2009
Title :	NS II Freshwater Pearl Mussel Sub-basin Management Plans: Monitoring of the Freshwater Pearl Mussel in the Ballymurphy
Author :	Moorkens, E.A.
Series :	Department of the Environment, Heritage and Local Government, Dublin
Year :	2009
Title :	NS II Freshwater Pearl Mussel Sub-basin Management Plans: Monitoring of the Freshwater Pearl Mussel in the Mountain
Author :	Moorkens, E.A.
Series :	Department of the Environment, Heritage and Local Government, Dublin
Year :	2009
Title :	NS II Freshwater Pearl Mussel Sub-basin Management Plans: Monitoring of the Freshwater Pearl Mussel in the Nore
Author :	Moorkens, E.A.
Series :	Department of the Environment, Heritage and Local Government, Dublin
Year :	2010
Title :	A provisional inventory of ancient and long-established woodland in Ireland
Author :	Perrin, P.M.; Daly, O.H.
Series :	Irish Wildlife Manuals, No. 46
Year :	2010
Title :	Irish semi-natural grasslands survey. Annual report No.3: Counties Donegal, Dublin, Kildare and Sligo
Author :	O'Neill, F.H.; Martin, J.R.; Devaney, F.M.; McNutt, K.E.; Perrin, P.M.; Delaney, A.
Series :	Unpublished report to NPWS
Year :	2010
Title :	Second Draft Nore Freshwater Pearl Mussel Sub-basin Management Plan (2009-2015)
Author :	DEHLG
Series :	Unpublished Report to NPWS
Year :	2010
Title :	Second Draft Ballymurphy Freshwater Pearl Mussel Sub-basin Management Plan (2009-2015)
Author :	DEHLG
Series :	National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland
Year :	2010
Title :	Second Draft Mountain Freshwater Pearl Mussel Sub-basin Management Plan (2009-2015)
Author :	DEHLG
Series :	National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland
Year :	2011
Title :	River Barrow and River Nore SAC (002162): Conservation objectives supporting document - coastal habitats [Version 1]
Author :	NPWS
Series :	Conservation objectives supporting document
Year :	2011
Title :	River Barrow and River Nore SAC (002162): Conservation objectives supporting document - marine habitats [Version 1]
Author :	NPWS
Series :	Conservation objectives supporting document

Year :	2011
Title :	River Barrow and River Nore SAC (002162): Conservation objectives supporting document - woodland habitats [Version 1]
Author :	NPWS
Series :	Conservation objectives supporting document
Year :	2012
Title :	Monitoring Populations of the Freshwater Pearl Mussel *Margaritifera margaritifera* - A condition assessment survey of the freshwater pearl mussel in the Nore River, Counties Laois and Kilkenny. Spring 2012
Author :	Moorkens, E.A.
Series :	Department of Arts, Heritage and the Gaeltacht, Dublin
Year :	2014
Title :	Report on assisted breeding of the Nore pearl mussel
Author :	Moorkens, E.A.
Series :	Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland
Year :	2016
Title :	Population genetic analyses of the endangered freshwater pearl mussel (*Margaritifera margaritifera*) in Ireland
Author :	Feind, S.; Kuehn, R.; Geist, J.; Moorkens, E.A.; Killeen, I.J.
Series :	Unpublished report for the National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.
Year :	2017
Title :	Survey and Condition Assessment of the population of the freshwater mussel *Margaritifera margaritifera* in the Mountain River, County Carlow
Author :	Moorkens, E.
Series :	Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland
Year :	2017
Title :	Survey and Condition Assessment of the population of the freshwater mussel *Margaritifera margaritifera* in the Nore River, County Laois
Author :	Moorkens, E.
Series :	Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland
Year :	2018
Title :	Electrofishing survey to identify fish hosts for the freshwater pearl mussel Margaritifera margaritifera in 12 populations in the Republic of Ireland. 2017 Survey
Author :	Johnston, P.M.; Moorkens, E.A.
Series :	Unpublished Report to the National Parks and Wildlife Service, DCHG, Dublin.
Year :	2020
Title :	Monitoring Populations of the Freshwater Pearl Mussel, Margaritifera margaritifera, Stage 3 and Stage 4 Survey
Author :	Moorkens, E.A. & Killeen, I.J.
Series :	Irish Wildlife Manuals No. 122
Year :	2020
Title :	2019 Survey and Condition Assessment of the population of the freshwater mussel *Margaritifera margaritifera* in the Nore River, County Laois
Author :	Moorkens, E.A.
Series :	Department of Culture, Heritage and the Gaeltacht, Ireland
Year :	2023
Title :	2022 Survey and Condition Assessment of the population of the freshwater mussel *Margaritifera margaritifera* in the Ballymurphy River, County Carlow
Author :	Wetland Surveys Ireland
Series :	Department of Housing, Local Government and Heritage, Dublin

Year :	2025
Title :	River Barrow and River Nore SAC (site code 2162). Conservation objectives supporting document - marine habitats [Version 2].
Author :	NPWS
Series :	Conservation objectives supporting document

Other References

Year :	1982
Title :	Otter survey of Ireland
Author :	Chapman, P.J.; Chapman, L.L.
Series :	Unpublished report to Vincent Wildlife Trust
Year :	1991
Title :	The spatial organization of otters (*Lutra lutra*) in Shetland
Author :	Kruuk, H.; Moorhouse, A.
Series :	Journal of Zoology, 224: 41-57
Year :	1991
Title :	The freshwater pearl mussels *Margaritifera margaritifera* in the South East of Ireland
Author :	Moorkens, E.A.
Series :	MSc Thesis, University of Dublin, Trinity College
Year :	1994
Title :	Imminent extinction of the Nore freshwater pearl mussel (Margaritifera durrovensis) Phillips: a species unique to Ireland
Author :	Moorkens, E.A.; Costello, M.J.
Series :	Aquatic Conservation: Marine and Freshwater Ecosystems 4,363-365
Year :	1996
Title :	Studies on the biology and ecology of *Margaritifera* in Ireland
Author :	Moorkens, E.
Series :	Unpublished Ph.D. thesis, University of Dublin, Trinity College
Year :	1999
Title :	Diet of otters (*Lutra lutra*) on Inishmore, Aran Islands, west coast of Ireland
Author :	Kingston, S.; O'Connell, M.; Fairley, J.S.
Series :	Biology and Environment: Proceedings of the Royal Irish Academy, 99B: 173-182
Year :	2000
Title :	A survey of broadleaf woodlands in 3 SACs: Barrow-Nore, River Unshin & Lough Forbes
Author :	Browne, A.; Dunne, F.; Roche, N.
Series :	Unpublished Report to NPWS
Year :	2002
Title :	Reversing the habitat fragmentation of British woodlands
Author :	Peterken, G.
Series :	WWF-UK, London
Year :	2002
Title :	A survey of the white-clawed crayfish, *Austropotamobius pallipes* (Lereboullet), and of water quality in two catchments of eastern Ireland
Author :	Demers, A.; Reynolds, J.D.
Series :	Bulletin Francais de la Peche et de la Pisciculture, 367: 729-740

Year :	2003
Title :	Monitoring the river, brook and sea lamprey, *Lampetra fluviatilis*, *L. planeri* and *Petromyzon marinus*
Author :	Harvey, J.; Cowx, I.
Series :	Conserving Natura 2000 Rivers Monitoring Series No. 5. English Nature, Peterborough
Year :	2003
Title :	Ecology of watercourses characterised by Ranunculion fluitantis and Callitricho-Batrachion vegetation
Author :	Hatton-Ellis, T.W.; Grieve, N.
Series :	Conserving Natura 2000 Rivers Ecology Series No. 11. English Nature, Peterborough
Year :	2003
Title :	Ecology of the allis and twaite shad
Author :	Maitland, P.S.; Hatton-Ellis, T.W.
Series :	Conserving Natura 2000 Rivers Ecology Series No. 3. English Nature, Peterborough
Year :	2004
Title :	Pilot Project for Monitoring Populations of the Freshwater Pearl Mussel. Baseline survey of the Nore River SAC, Counties Laois and Kilkenny
Author :	Moorkens, E.
Series :	Unpublished Report to NPWS
Year :	2004
Title :	A survey of freshwater pearl mussels in the south eastern river basin district
Author :	Moorkens, E.A.; Killeen, I.; Kurz, I.
Series :	Unpublished report for the Heritage Council
Year :	2005
Title :	The ecology and conservation of the gametophyte generation of the Killarney Fern (Trichomanes speciosum Willd.) in Ireland
Author :	Kingston, N.; Hayes, C.
Series :	Biology and Environment: Proceedings of the Royal Irish Academy 105B(2): 71-79
Year :	2006
Title :	Otters - ecology, behaviour and conservation
Author :	Kruuk, H.
Series :	Oxford University Press
Year :	2006
Title :	The status of host fish populations and fish species richness in European freshwater pearl mussel (*Margaritifera margaritifera*) streams
Author :	Geist, J.; Porkka, M.; Kuehn, R.
Series :	Aquatic Conservation: Marine and Freshwater Ecosystems, 16: 251-266
Year :	2007
Title :	Assessment of fish passage and the ecological impact of migration barriers on the River Nore catchment
Author :	Sullivan, A.
Series :	Nore Suir Rivers Trust & OPW
Year :	2008
Title :	A survey of mudflats and sandflats in Ireland. An intertidal soft sediment survey of Waterford Estuary
Author :	Aquatic Services Unit
Series :	Unpublished Report to Marine Institute & NPWS

Year :	2008
Title :	Benthic Biotope classification of subtidal sedimentary habitats in the Lower River Suir candidate Special Area of Conservation and the River Nore and River Barrow candidate Special Area of Conservation
Author :	ARMS
Series :	Unpublished Report to NPWS
Year :	2008
Title :	Poor water quality constrains the distribution and movements of twaite shad (*Alosa fallax fallax*, Lacepede, 1803) in the watershed of river Scheldt
Author :	Maas, J.; Stevens, M.; Breine, J.
Series :	Hydrobiologia, 602: 129-143
Year :	2008
Title :	Assessment of the Risk of Barriers to Fish Migration in the Nore Catchment, Southern Regional Fisheries Board
Author :	CFB; Compass Informatics
Series :	Unpublished Report to CFB
Year :	2009
Title :	The European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009. [S.I. 296 of 2009]
Author :	Government of Ireland
Series :	Irish Statute Book
Year :	2010
Title :	Report of the standing scientific committee to the DCENR. The status of Irish salmon stocks in 2010 and precautionary catch advice for 2011
Author :	SSC
Series :	Unpublished Report to DCENR
Year :	2010
Title :	Site investigations for Sabellaria alveolata (Honey-comb worm) biogenic reefs in Ireland
Author :	NPWS
Series :	Unpublished Report to NPWS
Year :	2010
Title :	Addressing the conservation and rehabilitation of *Margaritifera margaritifera* populations in the Republic of Ireland within the framework of the habitats and species directive
Author :	Moorkens, E.
Series :	Journal of Conchology, 40: 339
Year :	2014
Title :	Assessing near-bed velocity in a recruiting population of the endangered freshwater pearl mussel (*Margaritifera margaritifera*) in Ireland
Author :	Moorkens, E.; Killeen, I.
Series :	Aquatic Conservation: Marine and Freshwater Ecosystems, 24(6): 853-862
Year :	2017
Title :	Water quality – Guidance standard on monitoring freshwater pearl mussels (*Margaritifera margaritifera*) populations and their environment
Author :	NSAI
Series :	I.E. EN 16859:2017
Year :	2018
Title :	Genetic structure of Irish freshwater pearl mussels (*Margaritifera margaritifera* and *Margaritifera durrovensis*): Validity of subspecies, roles of host fish, and conservation implications
Author :	Geist, J.; Moorkens, E.; Killeen, I.; Feind, S.; Stoeckle, B.C.; O Connor, Á.; Kuehn, R.
Series :	Aquatic Conservation: Marine and Freshwater Ecosystems, 28: 923-933

Year :	2019
Title :	The European Communities Environmental Objectives (Surface Waters) (Amendment) Regulations 2019. [S.I. No. 77 of 2019]
Author :	Government of Ireland
Series :	Irish Statute Book

Spatial data sources

Year :	Revision 2025
Title :	Margaritifera Sensitive Areas data
GIS Operations :	Relevant catchment boundaries identified. Expert opinion used as necessary to resolve any issues arising
Used For :	1029
Year :	2010
Title :	EPA transitional waterbody data
GIS Operations :	Clipped to SAC boundary
Used For :	1130 (map 2)
Year :	Interpolated 2011 and 2025
Title :	Intertidal and subtidal surveys 2008, 2010 and 2024
GIS Operations :	Polygon feature classes from marine community types base data sub-divided based on interpolation of marine survey data
Used For :	Marine community types, 1140, 1170 (maps 3, 4 and 4a)
Year :	2005
Title :	OSi Discovery series vector data
GIS Operations :	High water mark (HWM) and low water mark (LWM) polyline feature classes converted into polygon feature classes and combined; Saltmarsh and Sand Dune datasets erased out if applicable
Used For :	Marine community types base data (map 4a)
Year :	Revision 2010
Title :	Saltmarsh Monitoring Project 2007-2008. Version 1
GIS Operations :	QIs selected; clipped to SAC boundary; overlapping regions with Sand Dune data investigated and resolved with expert opinion used
Used For :	1310, 1330, 1410 (map 5)
Year :	Derived 2011
Title :	Internal NPWS files
GIS Operations :	Dataset created from spatial reference contained in files
Used For :	7220 (map 6)
Year :	Revision 2010
Title :	National Survey of Native Woodlands 2003-2008. Version 1
GIS Operations :	QIs selected; clipped to SAC boundary
Used For :	91A0, 91E0 (map 6)
Year :	2011 and 2025
Title :	NPWS rare and threatened species database
GIS Operations :	Dataset created from spatial references in database records
Used For :	1016, 1092, 1421, 1029 (maps 7 and 8)
Year :	2005
Title :	OSi Discovery series vector data
GIS Operations :	Creation of an 80m buffer on the marine side of the high water mark (HWM); creation of a 10m buffer on the terrestrial side of the HWM; combination of 80m and 10m HWM buffer datasets; creation of a 10m buffer on the landward side of the river banks data; creation of a 20m buffer applied to river centerline and stream data; combination of 10m river banks and 20m river and stream centerline buffer datasets; combined river and stream buffer dataset clipped to HWM; combination of HWM buffer dataset with river and stream buffer dataset; overlapping regions investigated and resolved; resulting dataset clipped to SAC boundary
Used For :	1355 (no map)

1130 Estuaries

To maintain the favourable conservation condition of Estuaries in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	The permanent habitat area is stable or increasing, subject to natural processes. See map 2	Habitat area was estimated using OSI data and the defined Transitional Water Body area under the Water Framework Directive as 3856ha. See marine supporting document for further details
Community distribution	Hectares	Conserve the following community types in a natural condition: Muddy estuarine community complex; Sand to muddy fine sand community complex; Fine sand with *Fabulina fabula* community; Sheltered to moderately exposed intertidal reef community complex. See map 4a	The likely area of sediment community types was derived from a combination of intertidal and subtidal surveys undertaken in 2008, 2009, 2010 and 2024. See marine supporting document for further details
Community structure: extent	Hectares and distribution	Conserve the extent of *Sabellaria alveolata* reef community, subject to natural processes. See map 4a	Based on site-specific surveys undertaken in 2010 and 2024 (NPWS internal files), most of the suitable habitat was colonised overlying the rocky substrate. See the marine supporting document for further details
Community structure: quality	Honeycomb reef structure	Conserve the high quality of the *Sabellaria alveolata* reef community, subject to natural processes. See map 4a	Based on site-specific surveys in 2010 and 2024 (NPWS internal files), there was a high percentage of clearly defined and intact honeycomb reef structures. See the marine supporting document for further details

1140 Mudflats and sandflats not covered by seawater at low tide

To maintain the Favourable conservation condition of the Mudflats and sandflats not covered by seawater at low tide in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	The permanent habitat area is stable or increasing, subject to natural processes. See map 3	Habitat area was estimated using OSI data as 926ha. See marine supporting document for further details
Community distribution	Hectares	Conserve the following community types in a natural condition: Muddy estuarine community complex; Sand to muddy fine sand community complex. See map 4a	The likely area of sediment communities was derived from a combination of intertidal and subtidal surveys undertaken in 2008 (ARMS, 2008; ASU, 2008). See marine supporting document for further details

1170 Reefs

To maintain the Favourable conservation condition of Reefs in River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	The permanent area is stable or increasing, subject to natural processes. See map 4	Habitat area estimated as 17.20ha based on information from site-specific survey in February 2024 (NPWS internal files) and orthophotography. See the River Barrow and River Nore SAC conservation objectives supporting document for marine habitats and species for further details
Distribution	Occurrence	The distribution of reefs is stable or increasing, subject to natural processes. See map 4	Based on information from a site-specific survey in February 2024 and orthophotography. Map 4a shows the mapped geological features, which are used as indicators of the distribution of the reefs habitat. See the marine supporting document for further details
Community extent	Hectares	Conserve the following community type in a natural condition: Sheltered to moderately exposed intertidal reef community complex in a natural condition, subject to natural processes. See map 4a	Based on a site-specific survey undertaken in February 2024. See the marine supporting document for further details
Community structure: extent	Hectares and distribution	Conserve the extent of *Sabellaria alveolata* reef community, subject to natural processes. See map 4a	Based on site-specific surveys undertaken in 2010 and 2024 (NPWS internal files), most of the suitable habitat was colonised overlying the rocky substrate. See the marine supporting document for further details
Community structure: quality	Honeycomb reef structure	Conserve the high quality of the *Sabellaria alveolata* reef community, subject to natural processes. See map 4a	Based on site-specific surveys in 2010 and 2024 (NPWS internal files), there was a high percentage of clearly defined and intact honeycomb reef structures. See the marine supporting document for further details

1310 *Salicornia* and other annuals colonising mud and sand

To maintain the favourable conservation condition of *Salicornia* and other annuals colonizing mud and sand in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For the one sub-site mapped: Ringville - 0.03ha. See map 5	Based on data from the Saltmarsh Monitoring Project (McCorry and Ryle, 2009). The Ringville sub-site was mapped and no additional areas of potential Salicornia mudflat were identified from an examination of aerial photographs, giving a total estimated area of 0.03ha. NB futher unsurveyed areas maybe present within the site. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 5	See coastal habitats supporting document for further details
Physical structure: sediment supply	Presence/absence of physical barriers	Maintain or where necessary restore natural circulation of sediments and organic matter, without any physical obstructions	See coastal habitats supporting document for further details
Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime	See coastal habitats supporting document for further details
Physical structure: creeks and pans	Occurrence	Maintain/restore creek and pan structure, subject to natural processes, including erosion and succession	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain range of saltmarsh habitat zonations including transitional zones, subject to natural processes including erosion and succession. See map 5	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: vegetation height	Centimetres	Maintain structural variation within sward	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: vegetation cover	Percentage cover at a representative sample of monitoring stops	Maintain more than 90% of area outside creeks vegetated.	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain range of sub-communities with typical species listed in Saltmarsh Monitoring Project (McCorry & Ryle, 2009).	See coastal habitats supporting document for further details
Vegetation structure: negative indicator species: *Spartina anglica*	Hectares	No significant expansion of *Spartina*. No new sites for this species and an annual spread of less than 1% where it is already known to occur	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details

1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae)

To restore the Favourable conservation condition of Atlantic salt meadows in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-sites mapped: Dunbrody Abbey - 1.25ha, Killowen - 2.59ha, Rochestown - 17.50ha, Ringville - 6.70ha. See map 5	Based on data from the Saltmarsh Monitoring Project (McCorry and Ryle, 2009). Four sub-sites were mapped and additional areas of potential saltmarsh were identified from an examination of aerial photographs, giving a total estimated area of Atlantic salt meadow of 35.07ha. NB futher unsurveyed areas maybe present within the site. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 5	See coastal habitats supporting document for further details
Physical structure: sediment supply	Presence/absence of physical barriers	Maintain/restore natural circulation of sediments and organic matter, without any physical obstructions	See coastal habitats supporting document for further details
Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime	See coastal habitats supporting document for further details
Physical structure: creeks and pans	Occurrence	Maintain/restore creek and pan structure, subject to natural processes, including erosion and succession	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain range of saltmarsh habitat zonations including transitional zones, subject to natural processes including erosion and succession. See map 5	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: vegetation height	Centimetres	Maintain structural variation within sward	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: vegetation cover	Percentage cover at a representative sample of monitoring stops	Maintain more than 90% of area outside creeks vegetated	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain range of sub-communities with typical species listed in Saltmarsh Monitoring Project (McCorry & Ryle, 2009)	See coastal habitats supporting document for further details
Vegetation structure: negative indicator species: *Spartina anglica*	Hectares	No significant expansion of *Spartina*. No new sites for this species and an annual spread of less than 1% where it is already known to occur	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details

1410 Mediterranean salt meadows (Juncetalia maritimi)

To restore the favourable conservation condition of Mediterranean salt meadows in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-sites mapped: Dunbrody Abbey - 0.08ha, Rochestown - 0.04ha, Ringville - 6.70ha. See map 5	Based on data from the Saltmarsh Monitoring Project (McCorry and Ryle, 2009). Three sub-sites were mapped and no additional areas of potential saltmarsh were identified from an examination of aerial photoraphs, giving a total estimated area of Mediterranean salt meadow of 6.82ha. NB further unsurveyed areas maybe present within the site. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 5	See coastal habitats supporting document for further details
Physical structure: sediment supply	Presence/absence of physical barriers	Maintain or where necessary restore natural circulation of sediments and organic matter, without any physical obstructions	See coastal habitats supporting document for further details
Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime	See coastal habitats supporting document for further details
Physical structure: creeks and pans	Occurrence	Maintain/restore creek and pan structure, subject to natural processes, including erosion and succession	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain range of saltmarsh habitat zonations including transitional zones, subject to natural processes including erosion and succession. See map 5	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: vegetation height	Centimetres	Maintain structural variation within sward	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: vegetation cover	Percentage cover at a representative sample of monitoring stops	Maintain more than 90% of area outside creeks vegetated.	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain range of sub-communities with typical species listed in Saltmarsh Monitoring Project (McCorry & Ryle, 2009)	See coastal habitats supporting document for further details
Vegetation structure: negative indicator species: *Spartina anglica*	Hectares	No significant expansion of *Spartina*. No new sites for this species and an annual spread of less than 1% where it is already known to occur	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details

3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation

To maintain the Favourable conservation condition of Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat distribution	Occurrence	No decline, subject to natural processes	The full distribution of this habitat and its sub-types in this site is currently unknown. The basis of the selection of the SAC for the habitat is the presence of an excellent example of the vegetation community (nutrient-rich type) associated with extensive tufa deposits on the river bed in the Kings tributary of the Nore (Heuff, 1987). Other examples of this or other sub-types may be present within the SAC
Habitat area	Kilometres	Area stable or increasing, subject to natural processes	The full extent of this habitat in this site is currently unknown. See above
Hydrological regime: river flow	Metres per second	Maintain appropriate hydrological regimes	Due to regular disturbance (through variations in flow), river macrophytes rarely reach a climax condition but frequently occur as transient communities. A natural (relatively unmodified) flow regime is required for both plant communities and channel geomorphology to be in favourable condition, exhibiting typical dynamics for the river type (Hatton-Ellis and Grieve, 2003). For most of the sub-types of this habitat, high flows are required to maintain the substratum (see below) necessary fo
Hydrological regime: groundwater discharge	Metres per second	The groundwater flow to the habitat should be permanent and sufficient to maintain tufa formation	This attribute refers to sub-types with tufa formations. Groundwater discharges to this habitat throughout the year
Substratum composition: particle size range	Millimetres	The substratum should be dominated by large particles and free from fine sediments	The tufaceous sub-types develop on relatively stable substrata such as bedrock, boulders and cobbles, where tufa can deposit and accumulate. Tufa deposition is believed to be biologically mediated, by algae and bryophytes. The substratum must remain free of fine sediments such as clay, silt and fine sand, which would adversely affect the growth of algae and mosses
Water chemistry: minerals	Milligrammes per litre	The groundwater and surface water should have sufficient concentrations of minerals to allow deposition and persistence of tufa deposits	The tufaceous sub-types require mineral- (typically calcium-) rich groundwaters to allow deposition of tufa. Surface water must also be sufficiently base-rich to prevent chemical erosion. Alkalinity and/or total hardness data may also be relevant
Water quality: suspended sediment	Milligrammes per litre	The concentration of suspended solids in the water column should be sufficiently low to prevent excessive deposition of fine sediments	See substratum composition above. Turbidity data may also be relevant
Water quality: nutrients	Milligrammes per litre	The concentration of nutrients in the water column should be sufficiently low to prevent changes in species composition or habitat condition	Phosphorus (MRP) is typically the limiting nutrient, however increased nitrogen (NO3-) negatively impacts upon the N-fixing blue-green algal communities that frequently contribute to tufa deposition. Nutrient enrichment of the habitat typically leads to increased filamentous-green-algal biomass, and consequent changes in other algae, bryophyte and macrophyte species composition and abundance. Water quality should reach a minimum of Water Framework Directive good status, in terms of n

Vegetation composition: typical species	Occurrence	Typical species of the relevant habitat sub-type should be present and in good condition	The sub-types of this habitat are poorly understood and their typical species have not yet been defined. Typical species and appropriate targets may emerge to be site-specific. The typical species of the tufaceous sub-type in the Kings tributary of the Nore are identified in Heuff (1987). The typical species may include higher plants, bryophytes, macroalgae and microalgae
Floodplain connectivity	Area	The area of active floodplain at and upstream of the habitat should be maintained	River connectivity with the floodplain is essential for the functioning of this habitat. The site of the tufaceous sub-type in the King's River is within an area of floodplain, with further large floodplains upstream. Floodplains regulatefine sediment deposition within the channel. See substratum composition above

4030 European dry heaths

To maintain the favourable conservation condition of European dry heaths in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat distribution	Occurrence	No decline from current habitat distribution, subject to natural processes	Spatial extent currently unmapped but indicated as occurring on the steep, free-draining, river valley sides especially the Barrow and tributaries in the foothills of the Blackstairs Mountains (based on NPWS NHA Survey - 1997/98 Site Notes; Natura 2000 Form Explanatory Notes - May 2006; The above NHA survey was prior to the extensions to the SAC that included river habitat and estuary at Ballyhack which may have incorporated additional dry heath habitat)
Habitat area	Hectares	Area stable or increasing, subject to natural processes. Habitat area is not known but estimated as less than 400ha of the area of the SAC, occurring in dispersed locations	Based on NPWS NHA Survey Site Notes (1997/98); Natura 2000 Form Explanatory Notes - May 2006
Physical structure: free-draining, acid, low nutrient soil; rock outcrops	Occurrence	No significant change in soil nutrient status, subject to natural processes. No increase or decrease in area of natural rock outcrop	Based on NPWS NHA Survey Site Notes - 1997/98; Natura 2000 Form Explanatory Notes - May 2006
Vegetation structure: sub-shrub indicator species	Percentage cover	Cover of characteristic sub-shrub indicator species at least 25%: gorse (*Ulex europaeus*) and where rocky outcrops occur bilberry (*Vaccinium myrtillus)* and woodrush (*Luzula sylvatica*). Some rock outcrops support English stonecrop (*Sedum anglicum*), sheep's bit (*Jasione montana*) and wild madder (*Rubia peregrina*) as well as important moss and lichen assemblages	Dry heath in this SAC occurs on free-draining nutrient poor soils and is often characterised by gorse and open acid grassland areas. A characteristic coastal dry heath of the southeast also occurs. Several rare plants occur including two species listed in the Red Data Book (Curtis and McGough, 1988). The species occurring on the site are listed in NPWS NHA Survey Site Notes - 1997/98. A brief overview of the principal characteristics of the dry heath habitat of this SAC is given in t
Vegetation structure: senescent gorse	Percentage cover	Cover of senescent gorse less than 50%	Based on NPWS NHA Survey Site Notes and Natura 2000 Form Explanatory Notes - May 2006 and on a modified version of the dry heath condition assessment methodology of Perrin et al. (2010)
Vegetation structure: browsing	Percentage cover	Long shoots of bilberry with signs of browsing collectively less than 33%	Based on NPWS NHA Survey Site Notes and Natura 2000 Form Explanatory Notes - May 2006 and on a modified version of the dry heath condition assessment methodology of Perrin et al. (2010)
Vegetation structure: native trees and shrubs	Percentage cover	Cover of scattered native trees and shrub less than 20%	Based on NPWS NHA Survey Site Notes - 1997/98; Natura 2000 Form Explanatory Notes - May 2006 and on a modified version of the dry heath habitat condition assessment methodology of Perrin et al. (2010). From the NHA survey notes the main threats appear to be reclamation or invasion by scrub woodland
Vegetation composition: positive indicator species	Number	Number of positive indicator species at least 2 e.g. gorse and associated dry heath/ acid grassland flora	Dry heath in this SAC occurs on free-draining nutrient poor soils and is characterised by gorse and acid grassland areas. It corresponds to Annex I sub-type "heaths rich in gorse (*Ulex*) of the Atlantic margins" (European Commission, 2007). Based on NPWS NHA Survey Site Notes -1997/98; Natura 2000 Form Explanatory Notes - May 2006 and a modified version of the dry heath habitat condition assessment methodology of Perrin et al. (2010)

Vegetation structure: positive indicator species	Percentage cover	Cover of positive indicator species at least 60%. This should include plant species characterisitic of dry heath in this SAC including gorse, bilberry and associated acid grassland flora	Dry heath in this SAC is characterised by gorse and acid grassland areas and locally bilberry and woodrush. Based on NPWS NHA Survey Site Notes and Natura 2000 Form Explanatory Notes - May 2006 and a modified version of the dry heath habitat condition assessment methodology of Perrin et al. (2010)
Vegetation composition: bryophyte and non-crustose lichen species	Number	Number of bryophyte or non-crustose lichen species present at least 2	Based on NPWS NHA Survey Site Notes and Natura 2000 Form Explanatory Notes - May 2006 and on a modified version of the dry heath habitat condition assessment methodology of Perrin et al. 2010
Vegetation composition: bracken (*Pteridium aquilinum*)	Percentage cover	Cover of bracken less than 10% - however see 'Notes'	Based on NPWS NHA Survey Site Notes and Natura 2000 Form Explanatory Notes - May 2006 and on a modified version of the dry heath habitat condition assessment methodology of Perrin et al. (2010). Bracken appears to be quite dense in places and before any management action is considered its rate of spread needs to be established as well as its threat, if any, to other dry heath species and its potential value to important fauna (e.g. Twite)
Vegetation structure: weedy negative indicator species	Percentage cover	Cover of agricultural weed species (negative indicator species) less than 1%	Based on NPWS NHA Survey Site Notes and Natura 2000 Form Explanatory Notes - May 2006 and on a modified version of the dry heath habitat condition assessment methodology of Perrin et al. (2010)
Vegetation composition: non-native species	Percentage cover	Cover of non-native species less than 1%.	Based on NPWS NHA Survey Site Notes and Natura 2000 Form Explanatory Notes - May 2006 and on a modified version of the dry heath habitat condition assessment methodology of Perrin et al. (2010)
Vegetation composition: rare/scarce heath species	Location, area and number	No decline in distribution or population sizes of rare, threatened or scarce species, including Greater Broomrape (*Orobanche rapum-genistae)* and the legally protected clustered clover (*Trifolium glomeratum*)	Broomrape is dependent on gorse at this site as it is parasitic on gorse roots. It is recorded as occurring on steep slopes above New Ross. A small area of excellent dry coastal heath at Ballyhack is interspersed with patches rock and of dry lowland grassland and has a high species diversity. Notably there is an excellent range of Clover (*Trifolium*) species including the legally protected clustered clover, a species known only from one other site in Ireland. Also *T*
Vegetation structure: disturbed bare ground	Percentage cover	Cover of disturbed bare ground less than 10% (but if peat soil less than 5%)	Based on NPWS NHA Survey Site Notes and Natura 2000 Form Explanatory Notes - May 2006 and on a modified verison of the dry heath habitat condition assessment methodology of Perrin et al. (2010)
Vegetation structure: burning	Occurrence	No signs of burning within sensitive areas	Perrin et al. (2010) defines sensitive areas

6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels

To maintain the favourable conservation condition of Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat distribution	Occurrence	No decline, subject to natural processes	Distribution of this habitat in this site is currently unknown. Considered to occur in association with some riverside woodlands, unmanaged river islands and in narrow bands along the floodplain of slow-flowing stretches of river (Natura 2000 Form Explanatory Notes)
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Extent of this habitat in this site is currently unknown. See above
Hydrological regime: flooding depth/height of water table	Metres	Maintain appropriate hydrological regimes	This habitat requires winter inundation, which results in deposition of naturally nutrient-rich sediment
Vegetation structure:sward height	Centimetres	30-70% of sward is between 40 and 150cm in height	Bare ground, due to natural indundation processes, may often be present. Attribute and target based on the Irish Semi-natural Grassland Survey (O'Neill et al., 2010)
Vegetation composition: broadleaf herb: grass ratio	Percentage	Broadleaf herb component of vegetation between 40 and 90%	Attribute and target based on O'Neill et al. (2010)
Vegetation composition: typical species	Number	At least 5 positive indicator species present	List of positive indicator species identified by O'Neill et al. (2010)
Vegetation composition: negative indicator species	Occurrence	Negative indicator species, particularly non-native invasive species, absent or under control- NB Indian balsam (*Impatiens glandulifera*), monkeyflower (*Mimulus guttatus*), Japanese knotweed (*Fallopia japonica*) and giant hogweed (*Heracleum mantegazzianum*)	Species listed as being present in the site (Natura 2000 Form Explanatory Notes)

7220 Petrifying springs with tufa formation (Cratoneurion)*

To maintain the Favourable conservation condition of Petrifying springs with tufa formation (*Cratoneurion*) in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Square metres	Area stable or increasing, subject to natural processes	Extent of this habitat in this site is currently unknown. An area ("Tens of square metres") has been described at one location (Natura 2000 Form Explanatory Notes; internal NPWS files), see below
Habitat distribution	Occurrence	No decline. See map 6 for recorded location	Full distribution of this habitat in this site is currently unknown. It has been described in woodlands at Dysart, between Thomastown and Inistioge (Natura 2000 Form Explanatory Notes; internal NPWS files). NB futher areas are likely to occur within the site
Hydrological regime: height of water table; water flow	Metres; metres per second	Maintain appropriate hydrological regimes	Current hydrological regimes are unknown. Petrifying springs rely on permanent irrigation, usually from upwelling groundwater sources or seepage sources
Water quality	Water chemistry measures	Maintain oligotrophic and calcareous conditions	Water chemistry is currently unknown. Water supply to petrifying springs is characteristically oligotrophic and calcareous
Vegetation composition: typical species	Occurrence	Maintain typical species	The bryophytes *Cratoneuron commutatum* and *Eucladium verticillatum* are diagnostic of this habitat. Both are found at the location described above. Natura 2000 Form Explanatory Notes and internal NPWS files also list other typical species

91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles

To restore the favourable conservation condition of Old oak woodland with Ilex and Blechnum in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, at least 85.08ha for sub-sites surveyed: see map 6	Minimum area, based on 13 sites surveyed by Perrin et al. (2008) - site codes 14, 20, 49, 73, 125, 508, 509, 510, 514, 515, 518, 519, 521, and other sources. NB further unsurveyed areas maybe present within the site
Habitat distribution	Occurrence	No decline. Surveyed locations shown on map 6	Distribution based on Perrin et al. (2008). NB further unsurveyed areas maybe present within the site
Woodland size	Hectares	Area stable of increasing. Where topographically possible, "large" woods at least 25ha in size and "small" woods at least 3ha in size	The sizes of at least some of the existing woodlands need to be increased in order to reduce habitat fragmentation and benefit those species requiring 'deep' woodland conditions (Peterken, 2002). Topographical and land ownership constraints may restrict expansion
Woodland structure: cover and height	Percentage and metres	Diverse structure with a relatively closed canopy containing mature trees; subcanopy layer with semi-mature trees and shrubs; and well-developed herb layer	Described in Perrin et al. (2008); Browne et al. (2000). See woodland habitats supporting document for further details
Woodland structure: community diversity and extent	Hectares	Maintain diversity and extent of community types	Described in Perrin et al. (2008); Browne et al. (2000). See woodland habitats supporting document for further details
Woodland structure: natural regeneration	Seedling:sapling:pole ratio	Seedlings, saplings and pole age-classes occur in adequate proportions to ensure survival of woodland canopy	Oak regenerates poorly. In suitable sites ash can regenerate in large numbers although few seedlings reach pole size
Woodland structure: dead wood	m^3 per hectare; number per hectare	At least $30m^3$/ha of fallen timber greater than 10cm diameter; 30 snags/ha; both categories should include stems greater than 40cm diameter	Dead wood is a valuable resource and an integral part of a healthy, functioning woodland ecosystem.
Woodland structure: veteran trees	Number per hectare	No decline	Mature and veteran trees are important habitats for bryophytes, lichens, saproxylic organisms and some bird species. Their retention is important to ensure continuity of habitats/niches and propagule sources
Woodland structure: indicators of local disctinctiveness	Occurrence	No decline	Includes ancient or long-established woodlands, archaeological and geological features as well as red-listed and other rare or localised species. Perrin and Daly (2010) list sites 14, 20, 73, 125, 508, 509, 510, 514, 515, 518, 521 as potential ancient/long established woodlands
Vegetation composition: native tree cover	Percentage	No decline. Native tree cover not less than 95%	Species reported in Perrin et al. (2008); Browne et al. (2000)
Vegetation composition: typical species	Occurrence	A variety of typical native species present, depending on woodland type, including oak (*Quercus petraea*) and birch (*Betula pubescens*)	Species reported in Perrin et al. (2008); Browne et al. (2000)
Vegetation composition: negative indicator species	Occurrence	Negative indicator species, particularly non-native invasive species, absent or under control	The following are the most common invasive species in this woodland type: beech (*Fagus sylvatica*), rhododendron (*Rhododendron ponticum*), cherry laurel (*Prunus laurocerasus*)

91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)*

To restore the Favourable conservation condition of Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, at least 181.54ha for sites surveyed: see map 6	Minimum area, based on 16 sites surveyed by Perrin et al. (2008) - site codes 10, 15, 17, 126, 127, 262, 282, 287, 511, 516, 517, 518, 520, 608, 1021; Coillte LIFE project and other sources. NB further unsurveyed areas maybe present within the SAC
Habitat distribution	Occurrence	No decline. Surveyed locations shown on map 6	Distribution based on Perrin et al. (2008). NB further unsurveyed areas maybe present within the site
Woodland size	Hectares	Area stable of increasing. Where topographically possible, "large" woods at least 25ha in size and "small" woods at least 3ha in size	The sizes of at least some of the existing woodlands need to be increased in order to reduce habitat fragmentation and benefit those species requiring 'deep' woodland conditions (Peterken, 2002). Topographical and land ownership constraints may restrict expansion
Woodland structure: cover and height	Percentage and metres	Diverse structure with a relatively closed canopy containing mature trees; subcanopy layer with semi-mature trees and shrubs; and well-developed herb layer	Described in Perrin et al. (2008); Browne et al. (2000). See woodland habitats supporting document for further details
Woodland structure: community diversity and extent	Hectares	Maintain diversity and extent of community types	Described in Perrin et al. (2008); Browne et al. (2000). See woodland habitats supporting document for further details
Woodland structure: natural regeneration	Seedling:sapling:pole ratio	Seedlings, saplings and pole age-classes occur in adequate proportions to ensure survival of woodland canopy	Alder and oak regenerate poorly. Ash often regenerates in large numbers although few seedlings reach pole size
Hydrological regime: flooding depth/height of water table	Metres	Appropriate hydrological regime necessary for maintenance of alluvial vegetation	Periodic flooding is essential to maintain alluvial woodlands along river flood plains but not for woodland around springs/seepage areas
Woodland structure: dead wood	m^3 per hectare; number per hectare	At least $30m^3$/ha of fallen timber greater than 10cm diameter; 30 snags/ha; both categories should include stems greater than 40cm diameter (greater than 20cm diameter in the case of alder)	Dead wood is a valuable resource and an integral part of a healthy, functioning woodland ecosystem
Woodland structure: veteran trees	Number per hectare	No decline	Mature and veteran trees are important habitats for bryophytes, lichens, saproxylic organisms and some bird species. Their retention is important to ensure continuity of habitats/niches and propagule sources
Woodland structure: indicators of local disctinctiveness	Occurrence	No decline	Includes ancient or long-established woodlands, archaeological and geological features as well as red-listed and other rare or localised species. Perrin and Daly (2010) list sites 10, 15, 17, 127, 282, 516, 517, 518, 608 as potential ancient/long established woodlands
Vegetation composition: native tree cover	Percentage	No decline. Native tree cover not less than 95%	Species reported in Perrin et al. (2008); Browne et al. (2000)

Vegetation composition: typical species	Occurrence	A variety of typical native species present, depending on woodland type, including ash (*Fraxinus excelsior*) alder (*Alnus glutinosa*), willows (*Salix* spp) and locally, oak (*Quercus robur*)	Species reported in Perrin et al. (2008); Browne et al. (2000)
Vegetation composition: negative indicator species	Occurrence	Negative indicator species, particularly non-native invasive species, absent or under control	The following are the most common invasive species in this woodland type: sycamore (*Acer pseudoplatanus*), beech (*Fagus sylvatica*), rhododendron (*Rhododendron ponticum*), cherry laurel (*Prunus laurocerasus*), dogwood (*Cornus sericea*), Himalayan honeysuckle (*Leycesteria formosa*) and Himalayan balsam (*Impatiens grandiflora*)

1016 Desmoulin's Whorl Snail *Vertigo moulinsiana*

To maintain the Favourable conservation condition of Desmoulin's whorl snail in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: occupied sites	Number	No decline. Two known sites: Borris Bridge, Co. Carlow S711503; Boston Bridge, Kilnaseer S338774, Co. Laois. See map 7	Data from NPWS rare and threatened species database
Population size: adults	Number per positive sample	At least 5 adults snails in at least 50% of samples	Attribute and target from Moorkens and Killeen (2011)
Population density	Percentage positive samples	Adult snails present in at least 60% of samples per site	Attribute and target from Moorkens and Killeen (2011)
Area of occupancy	Hectares	Minimum of 1ha of suitable habitat per site	Attribute and target from Moorkens and Killeen (2011)
Habitat quality: vegetation	Percentage of samples with suitable vegetation	90% of samples in habitat classes I and II as defined in Moorkens & Killeen (2011)	Attribute and target from Moorkens and Killeen (2011)
Habitat quality: soil moisture levels	Percentage of samples with appropriate soil moisture levels	90% of samples in moisture class 3-4 as defined in Moorkens & Killeen (2011)	Attribute and target from Moorkens and Killeen (2011)

1029 Freshwater Pearl Mussel *Margaritifera margaritifera*

To restore the Favourable conservation condition of the Freshwater pearl mussel (*Margaritifera margaritifera*) in River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: Ballymurphy	Kilometres	Restore distribution at 3.91km. See map 8	The conservation objective applies to the Ballymurphy, Mountain and Nore freshwater pearl mussel populations, which are listed on the European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009 (Statutory Instrument No. 296 of 2009). The target is for the species to be sufficiently widespread to maintain itself on a long-term basis as a viable component of the Ballymurphy, Mountain and Nore systems (see further information below and, for all attributes, Moorkens and Killeen, 2020). The Ballymurphy population is confined to the Ballymurphy (or Ballyroughan Little) River, a tributary of the Barrow River. The population is distributed from above Earl's Bridge down to the bridge at Clashganna. Given the severe decline since 2004 and the scattered distribution it is highly likely the species range has contracted. See DEHLG (2010) and Wetland Surveys Ireland (2023) for further information
Distribution: Mountain	Kilometres	Restore distribution at 9.45km. See map 8	The conservation objective applies to the Ballymurphy, Mountain and Nore freshwater pearl mussel populations, which are listed on the European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009 (Statutory Instrument No. 296 of 2009). The target is for the species to be sufficiently widespread to maintain itself on a long-term basis as a viable component of the Ballymurphy, Mountain and Nore systems (see further information below and, for all attributes, Moorkens and Killeen, 2020). The Mountain population is confined to the Mountain River, a tributary of the Barrow River. The population is distributed from just upstream of its confluence with the Kiledmond River down to where the Mountain joins the main channel of the Barrow River. The best habitat for the species is upstream of Borris. Given the continuing decline in mussel numbers it is highly likely that there has been an upstream contraction. See DEHLG (2010) for further information
Distribution: Nore	Kilometres	Restore distribution at 21.13km. See map 8	The conservation objective applies to the Ballymurphy, Mountain and Nore freshwater pearl mussel populations, which are listed on the European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009 (Statutory Instrument No. 296 of 2009). The target is for the species to be sufficiently widespread to maintain itself on a long-term basis as a viable component of the Ballymurphy, Mountain and Nore systems (see further information below and, for all attributes, Moorkens and Killeen, 2020). The Nore population stretches from Poorman's Bridge to Lismaine Bridge, with most of the population found between Poorman's Bridge and the just upstream of the bridge at Ballyragget (Moorkens, 1996). However, given the severe decline upstream of New Bridge, it is more likely that the range has contracted (Moorkens, 2016). See DEHLG (2010) for further information

Population size: Ballymurphy	Number of adult mussels	Restore Ballymurphy population to at least 1,000 adult mussels	Mussels were first recorded from the Ballymurphy by Moorkens (1991) and were found to be common (301-1,500 per 100m). A detailed survey in 2004 counted a total of 183 adult mussels (Moorkens, Killeen and Kurz, 2004). The population estimate in 2009 was less than 300 mussels (DEHLG, 2010). In 2022, the population within a section was recounted and the total number of mussels recorded was 14 adults, 89% less than that recorded in 2009 (Wetland Surveys Ireland, 2023). The population in 2024 was estimated to be 30 adult mussels. The target is for the species to be sufficiently abundant to maintain itself on a long-term basis as a viable component of the Ballymurphy system
Population size: Mountain	Number of adult mussels	Restore Mountain population to at least 4,000 adult mussels	A 3km stretch of the Mountain from the ford adjacent to the ruins of Kiltennell Church downstream to the bridge near Brook Lodge was estimated in 1995 as having a population of 4,000 adult mussels (Moorkens, 1995). Ross (2006) estimated that the population in the entire Mountain system was 1,898 adult mussels. In 2009, the Mountain population was estimated as 740 - 1,000 adult mussels (DEHLG, 2010). The 2016 survey revealed that the adult population had declined by at least 50% since 2009. The continual decline in numbers and no evidence of recruitment together with the 2016 monitoring results suggests that the population in the Mountain is unlikely to exceed 200 individual mussels in 2024. The target is for the species to be sufficiently abundant to maintain itself on a long-term basis as a viable component of the Mountain system
Population size: Nore	Number of adult mussels	Restore Nore population to at least 5,000 adult mussels	Genetic research has placed the Nore population (formerly *Margaritifera durrovensis*, Species code 1990) within the *Margaritifera margaritifera* taxon (Feind et al., 2016; Geist et al., 2018). Surveys carried out since 2010 show that the number of individuals has declined dramatically (Moorkens, 2012, 2014, 2017 and 2020). The total counts from all post-2014 surveys estimate the freshwater pearl mussel population in the Nore at 100 individuals, unless some of the short term captive bred individuals released in 2014 have survived (Moorkens, 2017 and 2020). The target is for the species to be sufficiently abundant to maintain itself on a long-term basis as a viable component of the Nore system
Population structure: recruitment	Percentage per size class	Restore to at least 20% of population no more than 65mm in length; and at least 5% of population no more than 30mm in length	Mussels of no more than 65mm are 'young mussels' and may be found buried in the substratum and/or beneath adult mussels. Mussels of no more than 30mm are 'juvenile mussels' and are always buried in the substratum. See the European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009 and I.S. EN 16859:2017. A profile created from 362 dead shells collected from the Ballymurphy in 2004 had no mussels ≤70mm in length (Moorkens et al., 2004). No mussels ≤65mm were found in the Mountain River in either 2009 or 2016 (DEHLG, 2010; Moorkens, 2017). The species is known not to have reproduced successfully in the River Nore since 1970 (Moorkens and Costello, 1994; Moorkens, 2004, 2012, 2017, 2020). These three populations are unsustainable owing to lack of survival of juvenile mussels. The target is for sufficient juvenile recruitment to allow the species to maintain itself on a long-term basis as a viable component of the Ballymurphy, Mountain and Nore systems

Population structure: adult mortality. Ballymurphy	Percentage	No more than 5% decline from previous number of live adults counted; dead shells less than 1% of the adult population and scattered in distribution	5% is considered the cut-off between the combined errors associated with natural fluctuations and sampling methods and evidence of true population decline. 1% of the population as dead shells is considered to be indicative of natural losses. The target is for sufficient survival of adults to allow the species to maintain itself on a long-term basis as a viable component of the Ballymurphy, Mountain and Nore systems. The Ballymurphy failed the live adult target in 2009, with a c.15% loss in surveyed sections of the main population area compared to the 2004 survey. The number of living mussels had declined by a further 91% in 2022 to just 10 individuals based on repeated counts of 100m of approximately the same section of river (Wetland Survey Ireland, 2023). The Ballymurphy failed the target for dead shells in 2009 with hundreds of dead shells on the river bed (DEHLG, 2010) and again in 2022 when a further 44 dead shells were recorded
Population structure: adult mortality. Mountain	Percentage	No more than 5% decline from previous number of live adults counted; dead shells less than 1% of the adult population and scattered in distribution	5% is considered the cut-off between the combined errors associated with natural fluctuations and sampling methods and evidence of true population decline. 1% of the population as dead shells is considered to be indicative of natural losses. The target is for sufficient survival of adults to allow the species to maintain itself on a long-term basis as a viable component of the Ballymurphy, Mountain and Nore systems. The Mountain failed the live adult target as the population declined by up to 61% in stretches of the Mountain between 2006 and 2009 (DEHLG, 2010), and by >50% between 2009 and 2016 (Moorkens, 2017) based on repeated counts of a 100m section. The Mountain failed the target for dead shells in 2009 (DEHLG, 2010) but passed in 2016 (Moorkens, 2017)
Population structure: adult mortality. Nore	Percentage	No more than 5% decline from previous number of live adults counted; dead shells less than 1% of the adult population and scattered in distribution	5% is considered the cut-off between the combined errors associated with natural fluctuations and sampling methods and evidence of true population decline. 1% of the population as dead shells is considered to be indicative of natural losses. The target is for sufficient survival of adults to allow the species to maintain itself on a long-term basis as a viable component of the Ballymurphy, Mountain and Nore systems. The Nore failed the live adult target as the population declined by between 23% and 67% in stretches between 2004 and 2009 (Moorkens, 2009). No discernible decline in number was observed in 2011 or 2016, however no live mussel was observed in the 2019 (Moorkens, 2012, 2017 and 2020). The Nore failed the target for dead shells in 2009 (DEHLG, 2010) but it was unknown if the dead shells observed belonged to mussels that recently died or to mussels that died several years earlier because, as the Nore River water is highly calcareous, the dead shells do not erode quickly
Suitable habitat: extent	Kilometres	Restore suitable habitat in more than 3.91km in the Ballymurphy, 5.3km in the Mountain and 16.72km in the Nore system (see map 8) and any additional stretches necessary for salmonid spawning	The habitat for the species is currently unsuitable for the survival of adult mussels or the recruitment of juveniles (DEHLG, 2010; Moorkens, 2009, 2012, 2017, 2020; Wetland Survey Ireland, 2023). Mussel habitat in the Ballymurphy, Mountain and Nore Rivers is impacted from catchment-wide intensification of agriculture and forestry, with multiple severe pressures that result in negative cumulative effects on hydromorphology, sedimentation and nutrient enrichment. While, the Mountain River was found to have extensive areas of physically good juvenile habitat, it is intermittently compromised by siltation to the extent that juveniles are killed and adults are stressed (Moorkens, 2017). The target is for the species' habitat to be sufficiently widespread to allow the species to maintain itself on a long-term basis as a viable component of the Ballymurphy, Mountain and Nore systems

Suitable habitat: condition	Kilometres	Restore condition of suitable habitat	The species' habitat is a combination of the area of 1) habitat adult and juvenile mussels can occupy; 2) spawning and nursery habitats host fish can occupy. Fish nursery and mussel habitat typically overlap. Fish spawning habitat is generally adjacent to mussel habitat, but may lie upstream of the generalised mussel distribution. Only spawning areas that regularly contribute juvenile fish to adult mussel habitat should be considered. Mussel and fish habitat availability is determined by flow and substratum conditions, and is sensitive to hydromorphological, sedimentation and enrichment pressures from throughout the catchment. The target is based on the stretches of river identified as having habitat for the species however further habitat characterisation and condition mapping is recommended. The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Ballymurphy, Mountain and Nore systems
Water quality: macroinvertebrates and phytobenthos (diatoms)	Ecological quality ratio (EQR)	Restore water quality- macroinvertebrates: EQR greater than 0.90 (Q4-5 or Q5); phytobenthos: EQR greater than 0.93	These EQR correspond to high ecological status for these two Water Framework Directive biological quality elements. They represent high water quality with low nutrient concentrations (oligotrophic conditions). Reaching these targets does not, however, guarantee achieving the targets for the other attributes. See also The European Communities Environmental Objectives (Surface Waters) (Amendment) Regulations 2019, DEHLG, 2010 and EPA sources for further information. The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Ballymurphy, Mountain and Nore systems
Substratum quality: filamentous algae (macroalgae); macrophytes (rooted higher plants)	Percentage	Restore substratum quality- filamentous algae: absent or trace (less than 5%); macrophytes: absent or trace (less than 5%)	The habitat in the Ballymurphy River passed the macroalgae standard during 2009 sampling for the sub-basin management plans (DEHLG, 2010) but failed both macroalgae and macrophyte standards in 2022 (Wetlands Survey Ireland, 2023). The habitat in the Mountain River passed the macroalgae standard but failed the macrophyte standard in both 2009 and 2016 (DEHLG, 2010; Moorkens, 2017). Macrophyte cover was up to 70% in the Mountain during the 2017 assessment. The habitat in the Nore River passed the macroalgae standard but failed the macrophyte standard in 2012, 2016 and 2019 (Moorkens, 2012, 2017 and 2020); macrophytes occurred in 56% of quadrats and with up to 100% cover in the open centre of the channel. High abundance of macroalgae was recorded during 2009 sampling (DEHLG, 2010). The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Ballymurphy, Mountain and Nore systems

Substratum quality: sediment	Occurrence	Restore substratum quality- stable cobble and gravel substrate with very little fine material; no artificially elevated levels of fine sediment	The habitat for the species in the Ballymurphy, Mountain and Nore systems is currently unsuitable for the recruitment of juveniles owing to sedimentation of the substratum and significant cover of silt. In many locations, it is also unsuitable for the survival of adult mussels. Significant sedimentation has been recorded during all recent mussel monitoring surveys in the Ballymurphy, Mountain, and Nore systems (Moorkens et al., 2004; Ross, 2006; DEHLG, 2010; Moorkens, 2004, 2012, 2017, 2020; Wetlands Survey Ireland, 2023). In the Mountain, 48% of the quadrats contained habitat suitable for juvenile mussels but while the physical habitat is still present the habitat is intermittently impacted by sedimentation preventing survival of juvenile mussels (Moorkens, 2017). The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Ballymurphy, Mountain and Nore systems
Substratum quality: oxygen availability	Redox potential	Restore to no more than 20% decline from water column to 5cm depth in substrate	Differences in redox potential between the water column and the substrate correlate with differences in oxygen levels. Juvenile mussels require full oxygenation while buried in gravel. In suitable habitat, there should be very little loss of redox potential between the water column and underlying gravels. See I.S. EN 16859:2017. The redox potential loss at 5cm depth in the Ballymurphy in 2009 was 31.75% (DEHLG, 2010); the Mountain in 2009 was 40% and 17-28% in 2016 (DEHLG, 2010; Moorkens 2017); and the Nore in 2009 was 58-64%, in 2011 was 24-34%, in 2016 was 16-22% and in 2019 was 11-31% (DEHLG, 2010; Moorkens, 2012, 2017, 2019). The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Ballymurphy, Mountain and Nore systems
Hydrological regime: flow variability	Metres per second	Restore appropriate hydrological regime	The availability of suitable freshwater pearl mussel habitat is largely determined by flow (catchment geology is the other key factor). In order to restore the habitat for the species, flow variability over the annual cycle must be such that: 1) high flows can wash fine sediments from the substratum; 2) high flows are not artificially increased so as to cause excessive scour of mussel habitat; 3) low flows do not exacerbate the deposition of fine sediments or growth of algae/macrophytes and 4) low flows do not cause stress to mussels in terms of exposure, water temperatures, food availability or aspects of the reproductive cycle. Groundwater inflow to a river contributes to water-cycling. See Moorkens and Killeen (2014) and I.S. EN 16859:2017 for further information. The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of Ballymurphy, Mountain and Nore systems

Host fish	Number	Maintain sufficient juvenile salmonids to host glochidial larvae	Salmonid fish are host to the larval stage of the freshwater pearl mussel and thus, they are essential to completion of the life cycle. 0+ and 1+ fish are typically used, both because of habitat overlaps and the development of immunity with age in fish. Fish presence is considered sufficient, as higher densities and biomass is indicative of enriched conditions in mussel rivers. Geist et al. (2006) found that higher densities of host fish coincided with eutrophication, poor substrate quality and a lack of pearl mussel recruitment, while significantly lower densities and biomass of host fish were associated with high juvenile mussel numbers. Fish movements must be such that 0+ fish remain in the mussel habitat until their 1+ summer. No fish stocking should occur within the mussel habitat, nor any works that may change the salmonid balance or residency time. Encystment on trout was recorded in the Mountain and Nore Rivers, but on neither salmonid in the Ballymurphy system
Fringing habitat: area and condition	Hectares	Restore the area and condition of fringing habitats necessary to support the population	Semi-natural and natural riparian habitats, even where they do not form part of a natural floodplain, are an integral part of the structure and functioning of river systems. Open wetlands, such as wet heath and blanket bog, are particularly critical to the hydrological regime of mussel rivers. Fringing habitats assist in the settlement of fine suspended material, protect banks from erosion and contribute to nutrient cycling, as well as contributing to the aquatic food web (e.g. allochthonous matter from poor fens and flushes) and providing habitat (refuge and resources) for life-stages of fish, birds and aquatic invertebrates. Equally, fringing habitats are dependent on rivers/lakes, particularly their water levels, and support wetland communities and species of conservation concern. The target is for sufficient habitat in favourable condition to allow the species to maintain itself on a long-term basis as a viable component of the Ballymurphy, Mountain and Nore systems

1092 White-clawed Crayfish *Austropotamobius pallipes*

To maintain the Favourable conservation condition of White-clawed crayfish in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Occurrence	No reduction from baseline. See map 7	The crayfish is present almost throughout this SAC. The records extend as far downstream as Thomastown on the Nore and Graiguenamanagh on the Barrow
Population structure: recruitment	Percentage occurrence of juveniles and females with eggs	Juveniles and/or females with eggs in at least 50% of positive samples	See Reynolds et al. (2010) for further details
Negative indicator species	Occurrence	No alien crayfish species	Alien crayfish species are identified as major direct threat to this species and as disease vector. See Reynolds (1998) for further details
Disease	Occurrence	No instances of disease	Disease is identified as major threat and has occurred in Ireland even in the absence of alien vectors. See Reynolds (1998) for further details
Water quality	EPA Q value	At least Q3-4 at all sites sampled by EPA	Target taken from Demers and Reynolds (2002). Q values based on triennial water quality surveys carried out by the Environmental Protection Agency (EPA)
Habitat quality: heterogeneity	Occurrence of positive habitat features	No decline in heterogeneity or habitat quality	Crayfish need high habitat heterogeneity. Larger crayfish must have stones to hide under, or an earthen bank in which to burrow. Hatchlings shelter in vegetation, gravel and among fine tree-roots. Smaller crayfish are typically found among weed and debris in shallow water. Larger juveniles in particular may also be found among cobbles and detritus such as leaf litter. These conditions must be available on the whole length of occupied habitat

1095 Sea Lamprey *Petromyzon marinus*

To restore the Favourable conservation condition of Sea lamprey in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: extent of anadromy	% of river accessible	Greater than 75% of main stem length of rivers accessible from estuary	Artificial barriers can block or cause difficulties to lampreys' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information on artificial barriers
Population structure of juveniles	Number of age/size groups	At least three age/size groups present	Attribute and target based on data from Harvey and Cowx (2003) and O'Connor, (2007). King (2007) provides survey information for the Barrow
Juvenile density in fine sediment	Juveniles/m²	Juvenile density at least 1/m²	Juveniles burrow in areas of fine sediment in still water. Attribute and target based on data from Harvey and Cowx (2003)
Extent and distribution of spawning habitat	m² and occurrence	No decline in extent and distribution of spawning beds	Attribute and target based on spawning bed mapping by Inland Fisheries Ireland (IFI). Lampreys spawn in clean gravels. Artificial barriers are currently preventing lamprey from accessing suitable spawning habitat. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information
Availability of juvenile habitat	Number of positive sites in 3rd order channels (and greater), downstream of spawning areas	More than 50% of sample sites positive	Artificial barriers are currently preventing juvenile lampreys from accessing the full extent of suitable habitat. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information

1096 Brook Lamprey *Lampetra planeri*

To restore the favourable conservation condition of Brook lamprey in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	% of river accessible	Access to all watercourses down to first order streams	Artificial barriers can block lampreys' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information on artificial barriers
Population structure of juveniles	Number of age/size groups	At least three age/size groups of brook/river lamprey present	Attribute and target based on data from Harvey and Cowx (2003). King (2007) provides survey information for the Barrow. It is impossible to distinguish between brook and river lamprey juveniles in the field, hence they are considered together in this target
Juvenile density in fine sediment	Juveniles/m²	Mean catchment juvenile density of brook/river lamprey at least 2/m²	Juveniles burrow in areas of fine sediment in still water. Attribute and target based on data from Harvey and Cowx (2003) who state 10/m² in optimal conditions and more than 2/m² on a catchment basis
Extent and distribution of spawning habitat	m² and occurrence	No decline in extent and distribution of spawning beds	Attribute and target based on spawning bed mapping by Inland Fisheries Ireland (IFI). Lampreys spawn in clean gravels. Artificial barriers are currently preventing lamprey from accessing suitable spawning habitat. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information
Availability of juvenile habitat	Number of positive sites in 2nd order channels (and greater), downstream of spawning areas	More than 50% of sample sites positive	Artificial barriers are currently preventing juvenile lampreys from accessing the full extent of suitable habitat. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information

1099 River Lamprey *Lampetra fluviatilis*

To restore the Favourable conservation condition of River lamprey in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: extent of anadromy	% of river accessible	Greater than 75% of main stem and major tributaries down to second order accessible from estuary	Artificial barriers can block lampreys' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information on artificial barriers
Population structure of juveniles	Number of age/size groups	At least three age/size groups of river/brook lamprey present	Attribute and target based on data from Harvey and Cowx (2003). King (2007) provides survey information for the Barrow. It is impossible to distinguish between brook and river lamprey juveniles in the field, hence they are considered together in this target
Juvenile density in fine sediment	Juveniles/m²	Mean catchment juvenile density of brook/river lamprey at least 2/m²	Juveniles burrow in areas of fine sediment in still water. Attribute and target based on data from Harvey and Cowx (2003) who state 10/m² in optimal conditions and more than 2/m² on a catchment basis
Extent and distribution of spawning habitat	m² and occurrence	No decline in extent and distribution of spawning beds	Attribute and target based on spawning bed mapping by Inland Fisheries Ireland (IFI). Lampreys spawn in clean gravels. Artificial barriers are currently preventing lamprey from accessing suitable spawning habitat. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information
Availability of juvenile habitat	Number of positive sites in 2nd order channels (and greater), downstream of spawning areas	More than 50% of sample sites positive	Artificial barriers are currently preventing juvenile lampreys from accessing the full extent of suitable habitat. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information

1103 Twaite Shad *Alosa fallax fallax*

To restore the favourable conservation condition of Twaite shad in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: extent of anadromy	% of river accessible	Greater than 75% of main stem length of rivers accessible from estuary	In some catchments, artificial barriers block twaite shads' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas
Population structure: age classes	Number of age classes	More than one age class present	Regular breeding has been confirmed in the River Barrow in recent years, but not in the Nore
Extent and distribution of spawning habitat	m² and occurrence	No decline in extent and distribution of spawning habitats	
Water quality: oxygen levels	Milligrammes per litre	No lower than 5mg/l	Attribute and target based on Maas, Stevens and Briene (2008)
Spawning habitat quality: Filamentous algae; macrophytes; sediment	Occurrence	Maintain stable gravel substrate with very little fine material, free of filamentous algal (macroalgae) growth and macrophyte (rooted higher plants) growth	See Maitland and Hatton-Ellis (2003) for further information

1106 Salmon *Salmo salar*

To restore the favourable conservation condition of Salmon in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: extent of anadromy	% of river accessible	100% of river channels down to second order accessible from estuary	Artificial barriers block salmons' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas. See Sullivan (2007) and CFB and Compass Informatics (2008) for further information on artificial barriers
Adult spawning fish	Number	Conservation limit (CL) for each system consistently exceeded	A conservation limit is defined by the North Atlantic Salmon Conservation Organisation (NASCO) as "the spawning stock level that produces long-term average maximum sustainable yield as derived from the adult to adult stock and recruitment relationship". The target is based on the Standing Scientific Committee of the National Salmon Commission's annual model output of CL attainment levels. See SSC (2010). Stock estimates are either derived from direct counts of adults (rod catch, fish counter) or
Salmon fry abundance	Number of fry/5 minutes electrofishing	Maintain or exceed 0+ fry mean catchment-wide abundance threshold value. Currently set at 17 salmon fry/5 min sampling	Target is threshold value for rivers currently exceeding their conservation limit (CL)
Out-migrating smolt abundance	Number	No significant decline	Smolt abundance can be negatively affected by a number of impacts such as estuarine pollution, predation and sea lice (*Lepeophtheirus salmonis*)
Number and distribution of redds	Number and occurrence	No decline in number and distribution of spawning redds due to anthropogenic causes	Salmon spawn in clean gravels. Artificial barriers are currently preventing salmon from accessing suitable spawning habitat
Water quality	EPA Q value	At least Q4 at all sites sampled by EPA	Q values based on triennial water quality surveys carried out by the Environmental Protection Agency (EPA)

1355 Otter *Lutra lutra*

To restore the favourable conservation condition of Otter in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Percentage positive survey sites	No significant decline	Measure based on standard otter survey technique. FCS target, based on 1980/81 survey findings, is 88% in SACs. Current range in south-east estimated at 73% (Bailey and Rochford, 2006)
Extent of terrestrial habitat	Hectares	No significant decline. Area mapped and calculated as 122.8ha above high water mark (HWM); 1136.0ha along river banks / around ponds	No field survey. Areas mapped to include 10m terrestrial buffer along shoreline (above HWM and along river banks) identified as critical for otters (NPWS, 2007)
Extent of marine habitat	Hectares	No significant decline. Area mapped and calculated as 857.7ha	No field survey. Area mapped based on evidence that otters tend to forage within 80m of the shoreline (HWM) (NPWS, 2007; Kruuk, 2006)
Extent of freshwater (river) habitat	Kilometres	No significant decline. Length mapped and calculated as 616.6km	No field survey. River length calculated on the basis that otters will utilise freshwater habitats from estuary to headwaters (Chapman and Chapman, 1982)
Extent of freshwater (lake) habitat	Hectares	No significant decline. Area mapped and calculated as 2.6ha	No field survey. Area mapped based on evidence that otters tend to forage within 80m of the shoreline (NPWS, 2007)
Couching sites and holts	Number	No significant decline	Otters need lying up areas throughout their territory where they are secure from disturbance (Kruuk, 2006; Kruuk and Moorhouse, 1991)
Fish biomass available	Kilograms	No significant decline	Broad diet that varies locally and seasonally, but dominated by fish, in particular salmonids, eels and sticklebacks in freshwater (Bailey and Rochford, 2006) and wrasse and rockling in coastal waters (Kingston et al., 1999)

1421 Killarney Fern *Trichomanes speciosum*

To maintain the Favourable conservation condition of Killarney Fern in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Location	No decline. Three locations known, with three colonies of gametophyte and one sporophyte colony. See map 7	Data from NPWS rare and threatened species database
Population size	Number	Maintain at least three colonies of gametophyte, and at least one sporophyte colony of over 35 fronds	Data from NPWS rare and threatened species database
Population structure: juvenile fronds	Occurrence	At least one of the locations to have a population structure comprising sporophyte, unfurling fronds, 'juvenile' sporophyte and gametophyte generations	Juvenile' sporophytes, which appear as small entire fronds, are known from this site. However, it is unknown whether they are due to apogamous growth or sexual reproduction. Based on Kingston and Hayes (2005) and Ni Dhuill (pers. Comm.)
Habitat extent	m²	No loss of suitable habitat, such as shaded rock crevices, caves or gullies in or near to, known colonies. No loss of woodland canopy at or near to known locations	Based on Kingston and Hayes (2005) and Ni Dhuill (pers. Comm.)
Hydrological conditions: visible water	Occurrence	Maintain hydrological conditions at the locations so that all colonies are in dripping or damp seeping habitats, and water is visible at all locations	Based on Kingston and Hayes (2005) and Ni Dhuill (pers. Comm.)
Hydrological conditions: humidity	Number of dessicated fronds	No increase. Presence of dessicated sporophyte fronds or gametophyte mats indicates conditions are unsuitable	Based on Kingston and Hayes (2005) and Ni Dhuill (pers. Comm.)
Light levels: shading	Percentage	No changes due to anthropogenic impacts	Based on Kingston and Hayes (2005) and Ni Dhuill (pers. Comm.)
Invasive species	Occurrence	Absent or under control	NPWS and EHS-NI (2008) provides further details

Banagher
Kilcormac
Birr
Shinrone
Borris in Ossory
Rathdowney
Borrisoleigh
Urlingford
Holycross
Killenaule
Cashel
Mountmellick
Portarlington
Monasterevin
Portlaoise
Mountrath
Stradbally
Abbeyleix
Durrow
Ballyragget
Freshford
Kilkenny
Callan
Milltown
Newbridge
Kildare
Kilcullen
Dunlavin
Athy
Baltinglass
Castledermot
Carlow
Castlecomer
Tullow
Leighlinbridge
Bagenalstown
Borris
Dungarvan
Graiguenamanagh
Thomastown
Clonroche
New Ross
Newbawn
Wellingtonbridge
Carrick
Waterford
Tramore
N62
N52
N80
N77
N78
N75
N76
N10
N81
N24
N29
M7
M8
M9
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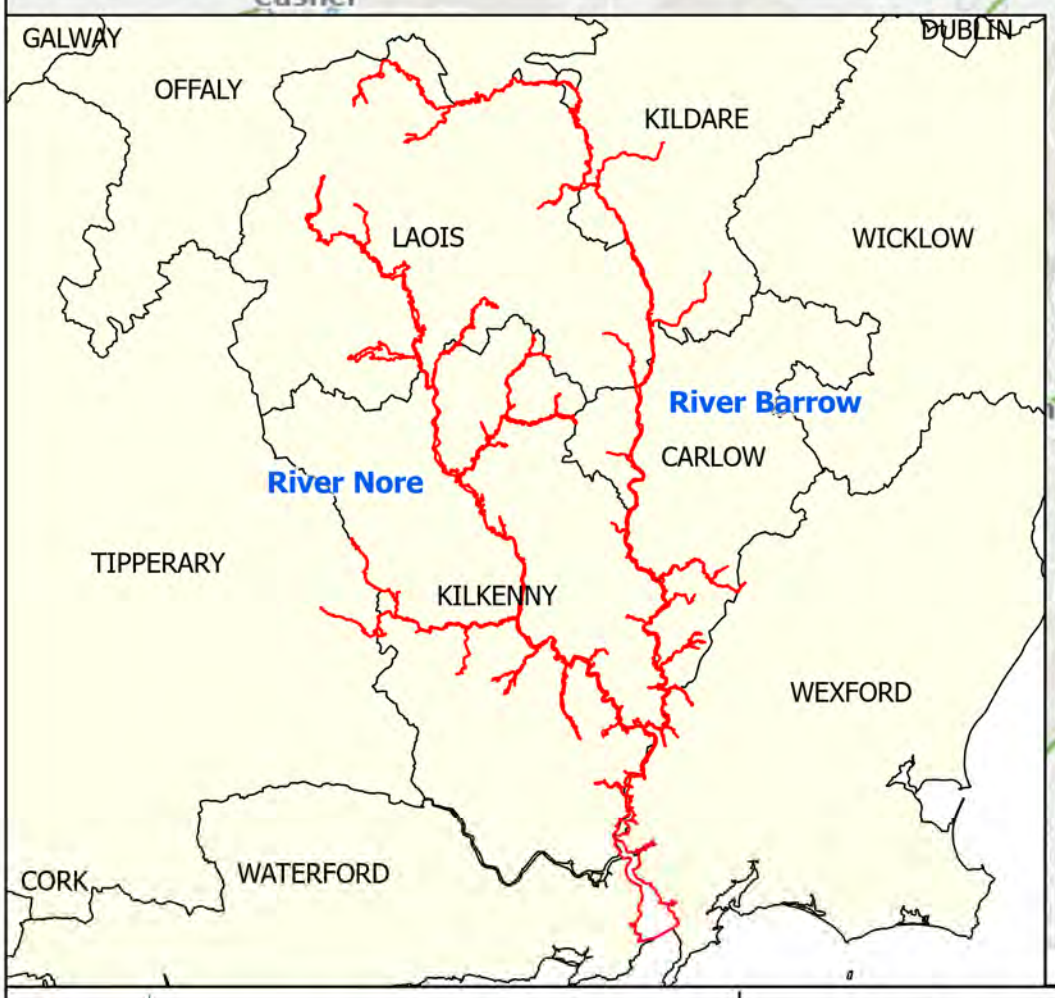

River Barrow and River Nore SAC 002162

NPWS
An tSeirbhís Páirceanna Náisiúnta agus Fiadhúlra
National Parks and Wildlife Service

SITE CODE: 002162
SAC; Version 3.04;
CO. CARLOW, CO. KILDARE, CO. KILKENNY, CO. LAOIS, CO. OFFALY, CO. TIPPERARY, CO. WATERFORD, CO. WEXFORD

The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision.
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Níl sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le chead ón Rialtas (Ceadunas Uimh. EN 0059208)

N

MAP 1: RIVER BARROW AND RIVER NORE SAC
CONSERVATION OBJECTIVES
SAC DESIGNATION

0 7 14 km

Map Version 2
Date: May 2025

Map to be read in conjunction with the NPWS Conservation Objectives Document.

Slieve Bloom Mountains SAC

Slieve Bloom Mountains SPA

River Nore SPA

River Nore SPA

Blackstairs Mountains SAC

Lower River Suir SAC

Banagher
Kilcormac
Birr
Shinrone
Borris in Ossory
Mountmellick
Portarlington
Monasterevin
Newbridge
Kildare
Kilcullen
Dunlavin
Portlaoise
Stradbally
Mountrath
Athy
Baltinglass
Abbeyleix
Castledermot
Rathdowney
Durrow
Carlow
Tullow
Castlecomer
Ballyragget
Borrisoleigh
Urlingford
Freshford
Leighlinbridge
Bagenalstown
Holycross
Kilkenny
Borris
Dungarvan
Killenaule
Callan
Graiguenamanagh
Thomastown
Cashel
Fethard
Clonroche
New Ross
Caher
Cloonmel
Carrick-on-Suir
Ardfinnan
Newbawn
Wellingtonbridge
Carrick
Waterford
Tramore

N62 N52 N80 N7 M9 N77 N78 N81 N75 M8 N76 N10 N74 N24 N25 N29

Legend

- River Barrow and River Nore SAC 002162
- Lower River Suir SAC 002137
- Slieve Bloom Mountains SAC 000412
- Blackstairs Mountains SAC 000770
- River Nore SPA 004233
- Slieve Bloom Mountains SPA 004160

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N

Map Version 1
Date: May 2025

MAP 1a: RIVER BARROW AND RIVER NORE SAC CONSERVATION OBJECTIVES OVERLAPPING AND ADJACENT SITES

0 7 14 km

Map to be read in conjunction with the NPWS Conservation Objectives Document.

Legend

- SAC 002162
- 1130 Estuaries
- OSi Discovery Series County Boundary

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MAP 2: RIVER BARROW AND RIVER NORE CONSERVATION OBJECTIVES ESTUARIES

Map to be read in conjunction with the NPWS Conservation Objectives Document.

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CO. KILKENNY; version 1.1, CO. LAOIS; version 1.07,
CO. OFFALY; version 1.01, CO. TIPPERARY; version 1.01,
CO. WATERFORD; version 1.01, CO. WEXFORD; version 1.01

0 1 2 3 4 5 km

N

Map Version 1
Date: April 2011

Legend

- SAC 002162
- 1140 Mudflats and sandflats not covered by sea water at low tide
- OSi Discovery Series County Boundary

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MAP 3:
RIVER BARROW AND RIVER NORE CONSERVATION OBJECTIVES TIDAL MUDFLATS AND SANDFLATS

Map to be read in conjunction with the NPWS Conservation Objectives Document.

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0 1 2 3 km

N

Map Version 1
Date: April 2011

Legend

- 1170 Reefs
- River Barrow and River Nore SAC 002162
- OSi Discovery Series County Boundary

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N

Map Version 1
Date: March 2025

MAP 4: RIVER BARROW AND RIVER NORE SAC CONSERVATION OBJECTIVES REEFS

0 0.5 1 km

Map to be read in conjunction with the NPWS Conservation Objectives Document.

Legend

River Barrow and River Nore SAC 002162

OSi Discovery Series County Boundary

Community Types

Fine sand with *Fabulina fabula* community

Muddy estuarine community complex

Sand to Muddy fine sand community complex

Sheltered to moderately exposed intertidal reef community complex/*Sabellaria alveolata* reef

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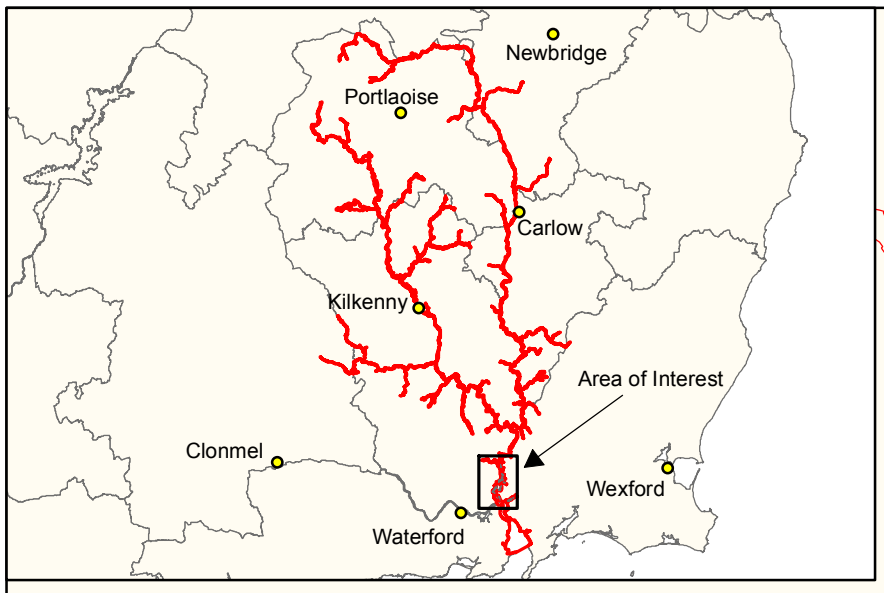
Map Version 2
Date: March 2025

MAP 4a: RIVER BARROW AND RIVER NORE SAC
CONSERVATION OBJECTIVES
MARINE COMMUNITY TYPES

0 1.5 3 km

Map to be read in conjunction with the NPWS Conservation Objectives Document.



SMP0049

SMP0050

SMP0051

SMP0048

Legend

- SAC 002162
- OSi Discovery Series County Boundary

Saltmarsh Habitats

- 1310 *Salicornia* and other annuals colonising mud and sand
- 1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae)
- 1330 / 1410 Atlantic salt meadows (Glauco-Puccinellietalia maritimae) / Mediterranean salt meadows (Juncetalia maritimi)
- 1410 Mediterranean salt meadows (Juncetalia maritimi)
- Potential 1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae)

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MAP 5:
RIVER BARROW AND RIVER NORE CONSERVATION OBJECTIVES SALTMARSH HABITATS

Map to be read in conjunction with the NPWS Conservation Objectives Document.

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0 0.25 0.5 0.75 1 km

N

Map Version 1
Date: April 2011

Newbridge
Portlaoise
Carlow
Kilkenny

262
608
282
1021
287
10
127
15
17
49
73
14
516
517
518
519
126
520
515
125
521
20
514
510
508
509
511

Legend

- SAC 002162
- OSi Discovery Series County Boundary
- 7220 *Petrifying springs with tufa formation (Cratoneurion)

Woodland Habitats

- 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles
- 91E0 *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-padion, Alnion incanae, Salicion albae)
- 91A0 / 91E0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles / *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-padion, Alnion incanae, Salicion albae)
- WD1 (Mixed) broadleaved woodland
- WN2 / WD1 Oak-ash-hazel woodland / (Mixed) broadleaved woodland
- WN2 / WN6 Oak-ash-hazel woodland / Wet willow-alder-ash woodland

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MAP 6:
RIVER BARROW AND RIVER NORE CONSERVATION OBJECTIVES OLD OAK WOODLANDS, ALLUVIAL FORESTS & PETRIFYING SPRINGS

Map to be read in conjunction with the NPWS Conservation Objectives Document.

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0 2 4 6 8 10 km

N

Map Version 1
Date: April 2011

Legend

- 1016 Desmoulin's Whorl Snail - *Vertigo moulinsiana*
- 1092 White-Clawed Crayfish - *Austropotamobius pallipes*
- 1421 Killarney Fern - *Trichomanes speciosum*
- River Barrow and River Nore SAC 002162
- OSi Discovery Series County Boundary

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Map Version 2
Date: May 2025

MAP 7: RIVER BARROW AND RIVER NORE SAC CONSERVATION OBJECTIVES DESMOULIN'S WHORL SNAIL, WHITE-CLAWED CRAY FISH & KILLARNEY FERN

0 5 10 km

Map to be read in conjunction with the NPWS Conservation Objectives Document.

Nore

Mountain

Ballymurphy

Legend

- 1029 - Freshwater Pearl Mussel - *Margaritifera margaritifera* Suitable habitat target
- 1029 - Freshwater Pearl Mussel - *Margaritifera margaritifera* Distribution target
- 1029 - Freshwater Pearl Mussel - *Margaritifera margaritifera* Catchments
- River Barrow and River Nore SAC 002162
- OSi Discovery Series County Boundary

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Map Version 1
Date: May 2025

MAP 8: RIVER BARROW AND RIVER NORE SAC CONSERVATION OBJECTIVES FRESHWATER PEARL MUSSEL

0 3 6 km

Map to be read in conjunction with the NPWS Conservation Objectives Document.

Appendix 2

Construction & Environmental Management Plan

Drumdowney Solar Farm Limited

Construction and Environmental Management Plan

PV Solar Farm

Atateemore or Blackneys, Ballyhobuck, Ballyrahan, Carriganurra, Charlestown, Davidstown, Drumdowney Lower, Drumdowney Upper, Gorteens, Grogan, Kilmurry, Nicholastown, Rathpatrick, Scartnamoe, Tinvaucoosh and Treanaree in County Kilkenny

June 2025

Document Control Sheet

Client			Drumdowney Solar Farm Limited	
Project Title			Drumdowney Solar Farm	
Document Title			Construction and Environmental Management Plan	
Document No.			RPT_Drumdowney_CEMP	
Document Comprises	DCS	TOC	Text	Appendices
	1	1	1	1
Prepared By	AS		Checked By	RC

Rev.	Issue Date
A	23/05/2025
B	18/06/2025
C	25/06/2025

June 2025

Table of Contents

1. Introduction

1.1 Context

This Construction and Environmental Management Plan (CEMP) is prepared to support a planning application for the development of a ground mounted solar farm by Drumdowney Solar Farm Limited in the townlands of Ataeemore or Blackneys, Ballyhobuck, Ballyrahan, Carriganurra, Charlestown, Davidstown, Drumdowney Lower, Drumdowney Upper, Gorteens, Grogan, Kilmurry, Nicholastown, Rathpatrick, Scartnamoe, Tinvaucoosh and Treanaree in County Kilkenny. The solar farm will connect to the Great Island to Waterford overhead line by means of a proposed substation, associated underground cable and 2 no. proposed interface towers. The grid connection for the solar farm, including the substation, will be the subject of a separate 'Strategic Infrastructure Development' (SID) application to An Bord Pleanála. Notwithstanding this dual consent process, this report considers the full combined development for the purposes of completing a robust assessment of the entire project. It should be read in conjunction with the 'Drumdowney Solar Farm Electrical Infrastructure - Construction Methodology by Drumdowney Solar Farm Limited' (Appendix A).

The purpose of this CEMP is to ensure that all potential construction phase environmental impacts will be addressed in accordance with current legislative requirements and best practice guidelines. It will assist in the control of environmental risks that may arise during construction to ensure that these works do not result in an environmental incident, environmental damage or undue nuisance to the local environment.

The key objectives of this CEMP are to:

- Provide a method of documenting compliance with the Environmental Commitments / Environmental Management / Best Practice Guidelines;
- Ensure compliance with current legislation;
- Effectively minimise any potential adverse environmental effects during construction, including how site-specific method statements will be developed to avoid and minimise construction effects on the environment; and,
- Communicate key environmental obligations that apply to all contractor organisations, their sub-contractors and employees while carrying out any form of construction activity.

This CEMP will be used by the appointed contractor to prepare an updated final CEMP prior to the commencement of any onsite works. If required by the conditions of the grant of planning permission, the updated plan will be approved by the Planning Authority in advance of any works commencing onsite. The approved plan will be implemented for the duration of the construction works to protect the receiving environment from potential impacts arising during the construction works.

1.2 Site Location

The subject site extends across seventeen townlands covering a site area of 189 hectares, inclusive of underground cabling connections on public roads and private lands. The lands are located circa 4.5km northeast of Waterford city. The application site includes four distinct solar farm land parcels (and one addition parcel for the proposed substation) as identified in Figure 1. The subject lands comprise a mix of arable and pasture agricultural farmlands consisting of small to medium sized fields contained by mature tree-lined and well-maintained hedgerow boundaries. Parcel 4 of the solar farm is located northeast of Port of Waterford, with the local area well served by the strategic road network which includes the N25 and N29 in addition to local roads.

Figure 1 – Site Context

1.3 Development Description

Solar Panels

The working title for the project is Drumdowney Solar Farm. The civil works for the panels themselves use a simple, ground-mounted system that avoids undue ground disturbance and works with the existing site topography. The PV panels will sit on angled racks comprised of galvanized steel arranged in portrait or landscape configuration depending on the final system deployed[1]. It is envisaged that these will be screw or driven-piled following geotechnical assessment[2]. The panels will be positioned on the rack at a minimum height of 0.8 m above the ground and rise to a maximum height of up to 3.25 m. The PV panels will be orientated to the south in order to capture maximum solar energy. The panels will be positioned at a tilt angle between 10-25 degrees from the horizontal having regard to natural site topographical and orientation conditions to ensure the best solar absorption. The panels will be stationary with no movable parts. Low voltage direct current cabling will connect the panels to the inverter/transformer stations across the site.

Inverters / Transformers / Ring Main Units

A total of 27 no. inverter/transformer stations are incorporated into the layout to convert direct current generated by the PV panels into alternating current which can be subsequently used by the electricity network. These units are manufactured offsite and delivered installation ready. These will have a maximum floor area of approximately 29.8 m2. There will also be 3 no. Ring Main Units. These units are similar to kiosks and will have an area of approximately 2.4m2. The design also includes 5 no. equipment containers, also 29.8m2 in area, to store spare parts.

Interconnector Cabling

The solar farm comprises four distinct field parcels, which will be connected by means of 5 no. 33kV underground interconnector cables. These will be contained in solar farm access tracks, within private lands and within the L3429, L7523, L7563, L7469, L7466, L3406, L3407, L3414, L3415, L7483, N25 and N29 public roads. The specification for these cable routes is set out in the submitted drawings and Drumdowney Solar Farm Electrical Infrastructure - Construction Methodology. As detailed, the route of underground cabling will include 4 no. horizontal directional drill crossings under the N25 and N29 public roads and the Luffany River.

Access

A compacted gravel access track up to 4.5 metres wide will provide internal access to the solar arrays and associated infrastructure. This will extend to approximately 4,903 linear metres of new track across the land parcels, with 1,384 linear metres of refurbished track also utilised. Stripped soil arising from the construction of these access tracks will be sustainably reused across the site as part of landscaping, filling in the verges of access tracks and grass reinstatement in the areas of temporary construction compounds. As noted above, the access track will require 7 no. drain crossings within Parcel 1, Parcel

1 Refer to technical drawings DWNY-SD-DR-04 for panel and array system options. Final technical specification to be agreed with Kilkenny County Council prior to construction. The final design will be subject to standard micro-siting arising from site survey work.

2 The exact nature of the foundations will be determined at detailed design stage. Other alternative foundations arrangements include ballasting systems and piles. Final foundation type will be confirmed with Kilkenny County Council prior to construction.

3 and Parcel 4 through a 'dry' construction deck crossing, the construction of which requires no instream/drain works.

It is proposed to access the proposed solar farm during the construction phase via 5 no. existing entrances for Parcel 1 (L3429), Parcel 2 (L7469), Parcel 3 (L7466) and Parcel 5 (L34142 which will be subject to upgrade works. Separate construction access via either the Port of Waterford or the L4783 are proposed for Parcel 4. These are also existing entrances. Two options are considered in the planning application for construction access to Parcel 4. The Port of Waterford and Suir Shipping have provided agreements in principle to use their lands for accessing Parcel 4 during construction (Access 4b). However, until such time as those agreement are formalised, the Applicant has also considered the scenario where the L4783 is used for construction access (Access 4a). It should be noted that the L4783 is the only option considered for the operational phase of the solar farm.

Other Infrastructure

A perimeter fence up to 2.4 m in height will be erected to provide security and restrict unauthorised entry. This fence will be stock proof in nature, sympathetic to the agricultural character of the site. The footings for the fence will either be pre-moulded or localised in-situ concrete, to be determined once a contractor is appointed. The installed fencing will incorporate mammal friendly access, with a maximum 200 mm gap retained at the bottom between the fence and the ground, as per the submitted technical plans.

The proposed development will be an unmanned facility; however, the facility will be monitored 24 hours a day remotely by the Applicant's operation system and the Engineer Procurement and Construction provider. The site will be subject to routine inspections. The CCTV will be orientated towards this infrastructure rather than any third-party lands. There is no requirement for potable water or wastewater treatment facilities as part of the constructed solar farm[3].

The proposed layout includes 5 no. weather monitoring stations. These are centrally located within the solar farm and will reach a maximum height of 5 metres. These stations measure ambient temperatures, wind speeds and direction, direct and diffuse irradiance etc. as part of standard operational monitoring of the solar farm.

Landscaping & Biodiversity

A total of 285 linear metres of hedgerow will be permanently removed throughout the site alongside 191 square meters of scrub/woodland to facilitate site entrance, access tracks and underground cabling. This will be offset by 2,718 linear metres of new hedgerow planting (Type 2), as well as the bolstering of an additional 22,470 linear metres where necessary, to fill any gaps in existing hedgerows. Ecology on the site will be further fostered to deliver significant biodiversity gains to the receiving environment through the establishment of focused ecological biodiversity areas and species rich grasslands.

The solar farm will contribute directly to a carbon dioxide emission reduction of 41,647tonnes per annum or the equivalent of approximately 1,665,917 tonnes of CO2 over the 40 year lifetime of the project.

Substation and Grid Connection

The proposed 110kV GIS substation, interface towers and grid connection will be subject to a Strategic Infrastructure Development (SID) application to An Bord Pleanála in accordance with section 182A of

3 There is a requirement for potable water for the substation, the application for which will be made to An Bord Pleanala.

the Planning and Development Act 2000. For completeness purposes, this infrastructure is considered in the various technical reports informing the solar farm planning application to Kilkenny County Council.

Substation

The 110kV substation compound will consist of a two storey GIS substation building, IPP Control Room buildings, High Voltage (HV) electrical equipment and associated infrastructure including palisade fences and concrete post and rail fences. The installation of HV electrical equipment will include a transformer with associated equipment along with:

- Lightning Masts (LM);
- Back-Up Diesel Generator;
- Harmonic filters if required by EirGrid;
- Capacitor Bank if required by EirGrid;
- Fire/Blast Wall;
- Telecoms Pole;
- 110kV underground cable which will connect into the existing 110kV Great Island to Waterford overhead line via 2 no. new Interface Towers.

The substation compound has a total area of 5,335m2. Earthworks will be undergone so the compound is level.

Further information on the substation and grid connection are described in detail in the 'Drumdowney Solar Farm Electrical Infrastructure - Construction Methodology'.

Grid Connection

The substation will connect into the national grid via a 'loop-in / loop-out' underground 110kV cable grid connection which will connect into the existing Great Island to Waterford overhead line. Two new interface towers are required to achieve this. The interface towers are approximately 15 metres apart, therefore the similar length of the existing Great Island to Waterford line will need to be decommissioned. The proposed substation will connect into each interface tower via an underground 110kV cable. This cable is comprised of 3 no. power ducts, 2 no. telecom ducts and 1 no. earth continuity duct. The cables to each interface tower are 68 and 83 metres in length.

1.5 Summary Construction Works

The main civil works for the solar farm project are:

- *Erection of PV arrays, prefabricated Inverter/Transformer station*s, *Ring Main Units and Storage Containers:* Piling of frame structures and mounting of panels. The inverters/ transformers and other units come to the site as prefabricated and ready to install;

- *Internal Access Track and Drain Deck Crossing*: The track which provides direct access to the solar arrays consists of compacted gravel. It allows, in particular, small vehicular movement during the operation of the PV plant. For its preparation, a thin layer of topsoil shall be removed before construction build-up is placed. The 'dry' deck crossing will be put in place to cross an existing site drain;

- *Cable trenches*: Narrow cable trenches to a depth of about 1.0 -1.5m will be excavated during construction, where required, but will not be visible after the construction is finished. Underground cabling will be typically confined where possible to the access track to avoid undue soil disturbance in accordance with best practice measures. At areas of the proposed

interconnector route which traverse watercourses, Horizontal Direction Drilling (HDD) will be required;

- *Perimeter Fencing*: Secure perimeter fencing will be required as indicated on the planning drawings. This will be stock proof fencing (up to 2.4 m high) with support poles located at approximately 2.5m centres. The footings for the security fencing will be precast or localised in-situ concrete. All final detail for the foundation elements will be developed with the contractor at construction stage. Typical plan details for this fencing and CCTV installations are provided as part of the planning application;
- *Substation and grid connection*: The proposed substation and grid connection will be constructed in parallel with solar farm. This infrastructure will be taken in charge by the ESB and constructed in accordance with ESB specifications and technical standards.

2. Construction Programme

2.1 Construction Timeline

A typical construction timeline is outlined in Figure 2.

The construction of the solar farm will include the installation of PV arrays, prefabricated inverter/transformer stations, storage containers, access track and bridge crossings, cable trenches, fencing, CCTV etc and all associated development works. There are 4 no. district field parcels of solar arrays associated with this solar farm. Construction of the solar farm within each parcel will take approximately 3-5 months with activities overlapping and construction resources shared on individual land parcels, as required. It is expected that the overall programme for construction of the solar farm will be 24 months, inclusive of electrical commissioning and any close out activities.

The substation and grid connection does not form part of the solar farm planning application however in the interests of completeness these are also considered in this CEMP. It is expected that the overall programme for construction of the solar farm and substation/grid connection will be 24 months. The construction traffic will be broadly spread over the construction programme. It is hoped that the solar farm can be energised by 2028 in order to contribute to Irelands 2030 climate and renewable energy electricity targets.

Estimated Construction Programme & Vehicle Numbers

	Construction Programme (Months)																							
Week	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Substation Construction																								
Enabling Works	250	250	250																					
Civil Works				20	20	20	20	20	20	20														
Electrical Works											20	20	15	10	5									
Grid Connection Construction																								
Civil and Electrical Works													137	138	138	138								
Substation Electrical Commissioning																								
Pre-commissioning																								
ESB Commissioning																								
Solar Farm Construction																								
Solar Farm Site Set Up & Installation							323	440	235	287	99	99	99	202	112	112	301	301	298	22	22	4	96	71
Solar Farm Electrical Commissioning																								
Electrical Commissioning																					100	100	80	
Close Out																							80	80
Estimated Vehicles Per Month	250	250	250	20	20	20	342.9	459.6	255.4	307.4	119.2	119.2	251.2	349.6	255.5	250.5	300.6	300.6	298	22.05	122.1	104.2	256.1	151
Estimated Vehicles Per Week	62.5	62.5	62.5	5	5	5	85.72	114.9	63.84	76.84	29.81	29.81	62.81	87.4	63.86	62.61	75.15	75.15	74.49	5.513	30.51	26.05	64.02	37.7
Estimated Vehicles Per Day (5.5 days)	11	11	11	1	1	1	16	21	12	14	5	5	11	16	12	11	14	14	14	1	6	5	12	7
Peak Daily Vehicles	21																							
Peak Hourly Vehicles	2.625																							
Average Daily Vehicles	10																							
Average Hourly Vehicles	1																							

Figure 2 – Indicative Construction Programme

3. Sequence of Solar Farm Construction Activities

The following sections set out the sequence of construction related activities associated with the proposed solar farm. The substation and grid connection will be subject to a separate application to An Bord Pleanála under Section 182A of the Planning and Development Act 2000, as amended. Details on the construction methodology for this development are set out in the 'Electrical Infrastructure - Construction Methodology' report contained in Appendix A.

Site Set Up

This activity will typically take between 4-12 weeks within each land parcel. The initial set up works will involve constructing a 4.5 metre wide compacted gravel access track, and the establishment of temporary construction compounds. The construction of the access track will require the removal of a strip of topsoil, with the outer edges being re-filled following the laying of the gravel. The dry construction deck crossing will be constructed as per the submitted methodology with no in-drain works. Temporary matting will be used for construction compounds to ensure no significant disturbance of soil layers. The location of the construction compounds is identified in Figure 3, as well as on the submitted site layout plan drawings.

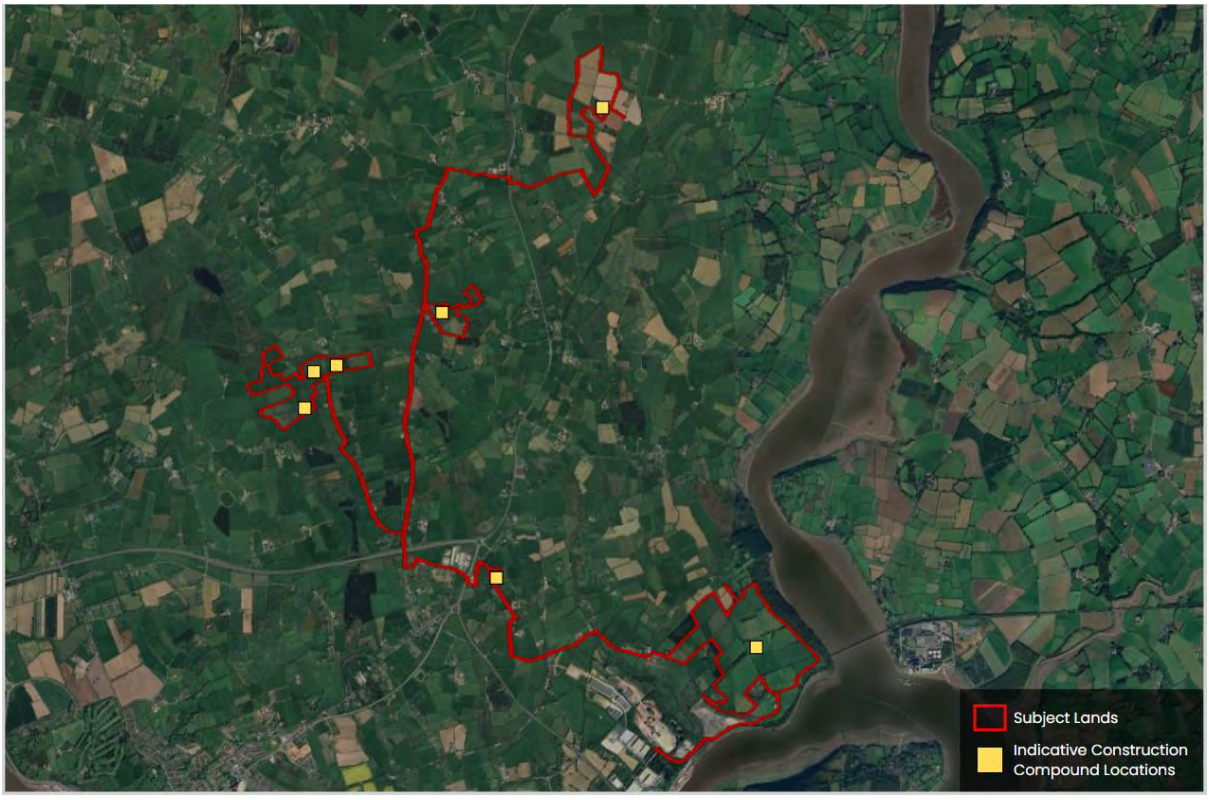


Figure 3 – Proposed Location of Temporary Site Compounds

The perimeter fence will be constructed of stockproof fencing and will be up to 2.4 m in height, with mammal access facilitated by way of a maximum 200 mm gap between the erected fence and ground. The access gates will be designed in accordance with standard guidelines for the provision of mammal access (e.g., NRA 2008). The perimeter fence will be set back approximately 5 m from the centreline of the surrounding ditch/hedgerow and a minimum of 5-10 metres from identified drains of ecological importance. All landscape planting will be as per the submitted landscape plans.

Installation of Solar PV Panels

This activity will typically take between 10-13 months. The solar PV panels will be mounted on supporting structures, in the form of metal frames, which are typically anchored by driven or screw piles to a depth of up to 2m, causing minimal ground disturbance and occupying less than 1% of the land area. The angled racks will be anchored to the ground using one of the following methods:

- *Screw piles or rammed piles:* This is the preferred method of founding the racks, as it is the quickest to construct and most economical. This can be considered the default method and it is expected that the vast majority of the site will use screw or rammed piles as anchors;
- *Pre-drilled holes with backfilling/concrete:* In certain cases, geotechnical conditions such as the presence of rock close to the surface may require foundation holes to be pre-drilled prior to ramming the piles. These holes would then be backfilled with concrete or other aggregate. A pre-construction geotechnical assessment will confirm if this type of anchor is required. It is expected that this would only be deployed in localised pockets of land where rock was present, if at all;
- *Ballast foundations:* This foundation type can be used in localised circumstances where penetration of the ground surface is not possible. This method uses concrete anchors to counteract any lift forces generated by wind loading on the modules. Ballast foundations could be deployed in areas of the site in the event of rock near the surface, or where there is potential for sub-surface archaeology.

With the exception of a specific scenario where pre-drilled holes are necessary, there are no concrete works required in the installation process. The anchoring of panels will be followed by DC cabling, connections to inverters/transformers and a period of associated testing.

AC Cable Trenches and Civil Works

The AC or interconnector cable trenching will take place over an extended period given that sections of same are located in public roads. The excavation, installation, and reinstatement process typically take an average of 1 day to complete 100m section depending on the cable configuration. The overall programme assumes interconnector cabling in public roads will take approximately 19 no. weeks. Sections of the proposed interconnector route which involve the undercrossing of the N25, the N29 and the crossing of a watercourse between the L7483 and L3415. These crossings will require the use of a Horizontal Direction Drill (HDD).

Transformer/Inverters Stations & Spare Parts Containers

The 27 no. inverters/transformer stations, 3 no. Ring Main Units and 5 no. spare parts containers will be manufactured offsite and delivered installation ready. Subject to final specification, these units will either be mounted on blocks or laid on pad foundations of shallow depth.

Reinstatement of Excavated Materials/ Landscaping

This task will take place at periodic intervals and will involve the reinstatement of all the excavated materials and associated landscaping works. The reinstatement will include the placement of topsoil as required, for example:

- Areas of disturbed ground;
- Exposed substrata areas as a result of the construction works;
- Adjacent access tracks;

- The construction compound and other temporary works areas and redundant features which are not required as part of the permanent works.

Pre-commissioning/Commissioning

The pre-commissioning survey work will be completed following the constriction of the solar farm and will comprise the inspection of all electrical equipment, earthing and bus wiring. All relevant site tests will be completed, including conductivity, resistance, timing and other mechanical operational checks. Follow on commissioning tests will then be completed ahead of energization of the substation.

4. Site Compound

Temporary site compounds shall be provided as shown in the example in Figure 4. It will include the following facilities at a minimum:

- Adequate canteen space to allow for all workers during the peak period;
- Office space with lighting, heating and internet facilities;
- A diesel generator to provide sufficient capacity for all facilities;
- Toilets and adequate welfare facilities for construction staff in accordance with the relevant statutory Health & Welfare guidelines;
- Parking space for both light and heavy vehicles;
- Waste storage area.

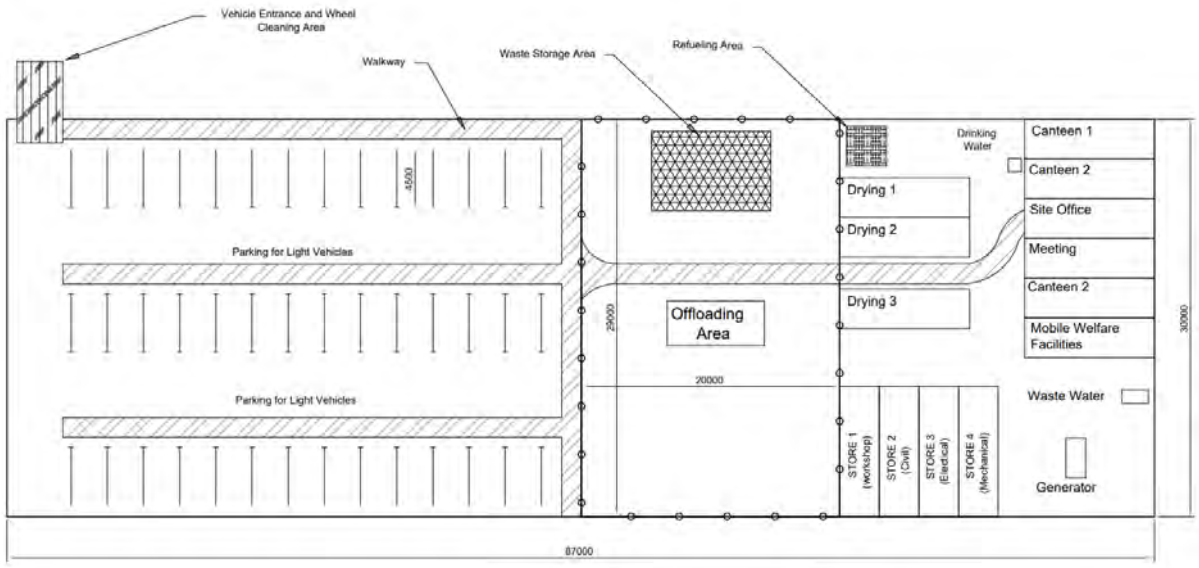


Figure 4 – Indicative Typical Site Compound Layout (refer to drawing DRMDY-SD-DR-07)

The final configuration of the construction compounds will be tailored to the site and will be agreed with the Planning Authority prior to commencement of development. The location of these temporary facilities has been considered as part of the design of the proposal, the layout of which will include a geotextile base and silt fencing as part of environmental controls. On completion of the construction stage the compound areas will be returned to grassland, it is not intended to incorporate these into the solar array area.

All relevant statutory welfare facilities will be provided as part of the temporary construction compound, including canteen facilities and drinking water supply, toilet, wash up and locker facilities, first aid facilities and offices for site engineers and contractors.

Portable toilet and wash facilities will be provided from a licenced sanitation supplier bound by Environmental Protection and Health & Safety legislation. Toilets will be serviced on a weekly basis or where necessary, according to type. A record of servicing will be kept by the operator. Wastewater effluent will be collected and disposed off-site in accordance with the principles contained in the Environmental Protection Act (Duty of Care) Regulations 1991.

Washing and changing areas will be located adjacent toilet facilities and a supply of clean warm and cold water maintained where reasonably practicable. Soap and other means of cleaning and towels or other suitable means of drying will be provided and replenished as part of servicing arrangements by the licenced sanitation supplier. All waste water will be collected and removed from the site. Sufficient ventilation and support lighting will be provided.

A supply of drinking water will be stored and made readily available. Rest facilities will provide shelter from wind and rain. These will have adequate numbers of tables and seating, a means for heating water for drinks and for warming up food will be provided. Rest areas will not to be used to store plant, equipment or materials.

Figure 5 - Sample Welfare/ Sanitation Facilities and Servicing

5. Traffic Management

5.1 Delivery Route

The delivery route options were assessed by CSEA Engineering Advisors in the Site Access Study that accompanies this application. The methodology for the access study included: a desk top study of historic records for the site; a site walkthrough with visual inspection; a site drive-through with a GPS enabled dashboard camera; swept path analysis; and a detailed review of horizontal and vertical geometry in relation to the vehicles proposed for construction stage.

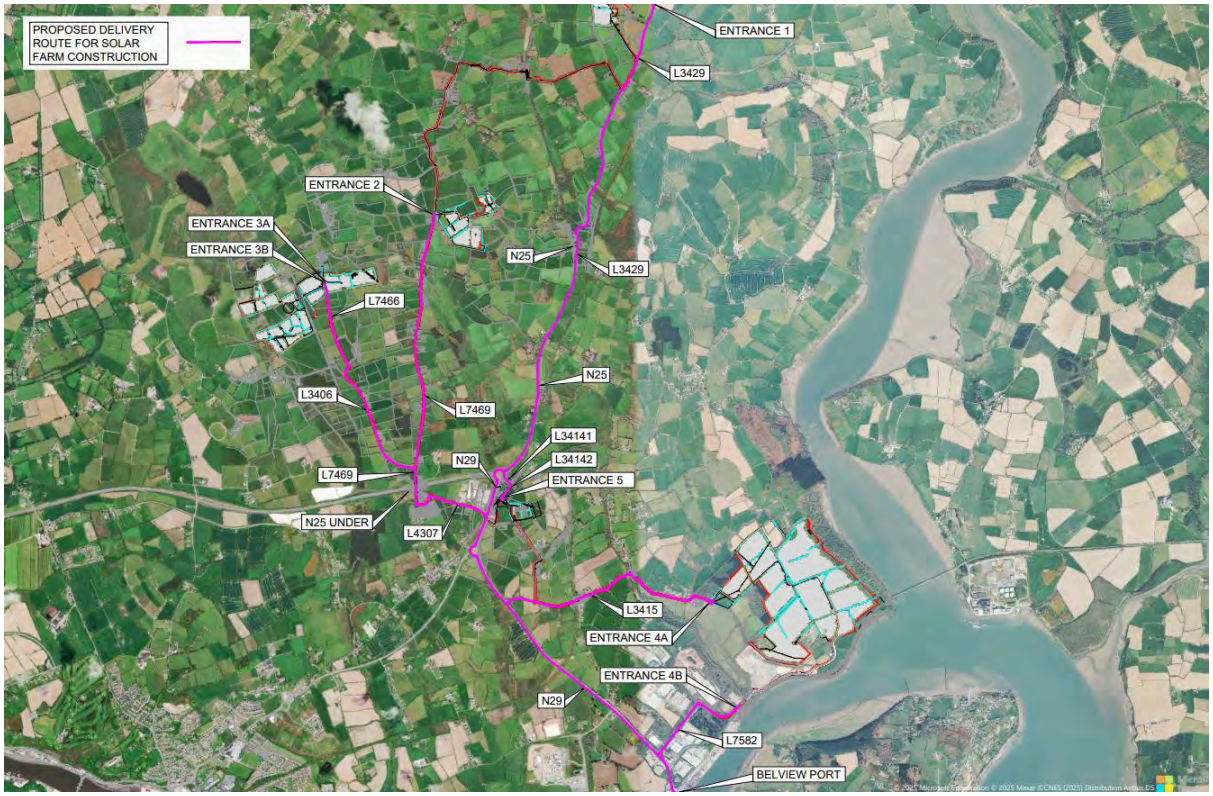
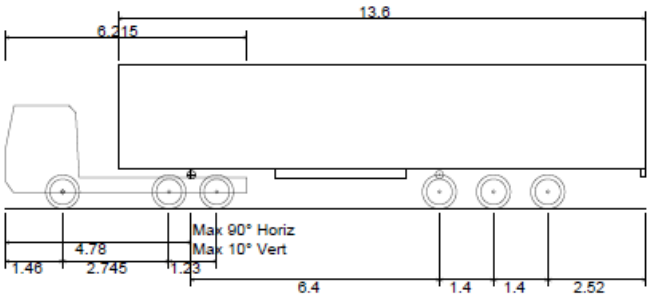


Figure 6 - Proposed Delivery Route (commencing at Belview Port)

A key benefit of the subject solar farm location is its proximity to Belview Port, greatly reducing travel times for deliveries to site during the construction phase. The identified delivery route commences at the Belview Port and follows along the N29. The route will branch off of the N29 onto the local roads L3415 or L7582 in order to access Parcel 4. The delivery route north to service the other three parcels will continue on the N29 from the Slieverue Roundabout before branching into two routes where the L3407 meets the N29. One route will follow the L3407 northward to the L3406. One route will follow the L3406 and L7466 to Entrances 3a and 3b, while the other will follow the L7469 to Entrance 2. At the Luffany Roundabout, one section of the delivery route will exit onto the L34141 and continue onto the L34142 in order to access Entrance 5. Another section of the delivery route will continue northward from the Luffany Roundabout along the N25 and L3429 to access Entrance 1. The map above shows the proposed delivery route to the solar farm site.

Appendix A of the Site Access Report shows a detailed suite of delivery route drawings. The analysis undertaken in the Site Access Study shows that this route poses no challenge to articulated vehicles. There were no locations on any of the routes surveyed where the gradient exceeded 14% (maximum

gradient permitted in the guidance documents) and no significant crests nor dips in the existing alignment were found. The existing horizontal geometry was also found to be generally adequate.



Articulated Vehicle with Twin Steered Tractor	
Overall Length	16.500m
Overall Width	2.550m
Overall Body Height	3.691m
Min Body Ground Clearance	0.426m
Max Track Width	2.500m
Lock to lock time	6.00s
Kerb to Kerb Turning Radius	6.987m

Figure 6a – HGV Specification of the Delivery Vehicles

5.2 Site Entrances

It is proposed to access the proposed solar farm during the construction phase via 5 no. existing entrances for Parcel 1 (L3429), Parcel 2 (L7469), Parcel 3 (L7466) and Parcel 5 (L34142 which will be subject to upgrade works. Separate construction access via either the Port of Waterford or the L4783 are proposed for Parcel 4. These are also existing entrances. Two options are considered in the planning application for construction access to Parcel 4. The Port of Waterford and Suir Shipping have provided agreements in principle to use their lands for accessing Parcel 4 during construction (Access 4b). However, until such time as those agreement are formalised, the Applicant has also considered the scenario where the L4783 is used for construction access (Access 4a). It should be noted that the L4783 is the only option considered for the operational phase of the solar farm

A swept-path analysis has confirmed that HGVs can safely access and egress the site during the construction phase. Please refer to the technical drawings by CSEA Engineering Advisors.

As detailed elsewhere in this document, all site delivery activities will be informed by suitably devised safe systems working arrangements, including intermittent delivery sequencing to mitigate any build-up in traffic congestion and the use of traffic/speed controls on approach including warning signs and flagmen, to be agreed with the Council prior to development as part of the final Construction and Environmental Management Plan, complete with Traffic Management Plan.

5.3 Traffic Considerations

The solar panels and ancillary components are relatively small and are transported in pallets before being assembled on site. The panels comprise of high transmission, low iron, tempered glass and each panel weighs approximately 30 kilograms. The final panels are yet to be chosen but the typical area is between 1.6 and 2 m^2. A 40-foot high cube container can carry approximately 720 panels, weighing almost 23 tonnes.

Ancillary components such as switchgear and inverter panels will be housed in units and easily transported to site using medium articulated trucks also during the construction phase.

Traffic Volumes

The construction stage of the development (both the solar farm and the substation and grid connection) is anticipated to take approximately 24 months. Materials will be delivered by Heavy Goods Vehicles (HGV) and it is anticipated this will equate to peak daily number of vehicles at 21 no. and the peak hourly traffic volume at 2.6 no. trips. The average daily number of vehicles is 10 no. and the average hourly traffic volume is 1 no. This includes movements for the delivery of all panels and mounting frames and cables, ducting, fencing plus additional movements for the transportation of machinery, building material, access track aggregates and waste management processes.

Onsite construction staffing numbers will vary over the construction period reaching a peak of 180 workers during the construction stage This traffic will be spread across the entire development site (including the length of the grid connection which will be finalised in the SID application to An Bord Pleanála). Staff will access the development using light vehicles (cars/mini-buses), and car parking facilities will be available to ensure that traffic flows on the local road network in the vicinity will not be impeded. Car-pooling for staff will be encouraged for the duration of the project.

Traffic Access

Access and egress to the site will be controlled by the project manager. Access to the subject site will be taken via the identified entrances, with final arrangements to be discussed and agreed with Kilkenny County Council. On site vehicle tracks will be used to access the inverter/transformer stations and on-site substation which will consist of compacted gravel. These tracks will be principally used during the construction phase with occasional access for routine maintenance during the operational period.

All suppliers undertaking deliveries to the site will be informed of the delivery arrangements and restrictions. The number of construction staff on site will vary over the construction period depending on the activity that is taking place. The majority of staff are expected to share vehicles when travelling to and from the site, or travel in crew buses. Staff vehicles will also follow this designated local route, to gain access to the site.

Traffic Overview

In relation to construction traffic, the volumes are modest given the large development site and associated road network. It should also be noted that the construction phase will be temporary in nature and will be undertaken in accordance with a detailed traffic management plan to be agreed with Kilkenny County Council and An Garda Siochana. This traffic management plan will include advance signage in accordance with Chapter 8 of the Traffic Signs Manual, use of appropriate delivery routes, phasing of site traffic to minimise interference with school runs and the like and be designed, implemented and certified by traffic management professionals in line with current regulations. In line with the TII Standard, a Construction Management Plan is provided with the application documents. Pending planning approval, this Construction Management Plan will be developed further by construction contractors at detailed design stage in consultation with the Kilkenny County Council to ensure construction stage traffic is managed appropriately and with limited local impact.

5.4 Management Measures

Road Signage and Cleaning

Appropriate warning signs adopted from Chapter 8 'Temporary Traffic Measures and Signs for Roadworks' – Road Signs Manual will be erected to advise motorists and others of works affecting the public roads. Mitigation measures will also be put in place to ensure that public roadways are kept free of mud, dust and debris at all times. Such measure will be described in the final construction management plan provided by the contractor prior to construction.

Figure 7 – Sample Road Signage

Delivery Co-ordination

Deliveries of bulk materials such as hardcore, concrete and solar panels will be managed and co-ordinated to minimise disruption to local traffic and activities. In particular these will be scheduled to avoid activities which would attract significant traffic.

Construction Personnel

Standard working hours for construction will be Monday to Friday 08:00 to 18:00 and Saturday 08:00 to 13:00, with no works on Sundays or Bank Holidays except in exceptional circumstances or in the event of an emergency. Construction traffic will not pass through any local towns or villages. All site personnel will be required to wear project notification labelling on high visibility vests and head protection so that they can be easily identified by all workers on-site.

Access Control

A staff presence will be maintained at the site entrance during working hours. One of the functions will be to log all incoming vehicles and personnel and ensure no unauthorised access is permitted.

As an unmanned facility, the proposal will actively give rise to a reduced number of vehicular movements to/from the site once operational, improving the carrying capacity of the road network locally. As such, prospective traffic impacts arising from the development will largely be limited to the short 24-month construction stage. Further to this, a detailed Traffic Management Plan will be prepared at the pre-commencement stage that will facilitate the safe operation of the existing entrance during the construction stage to address and mitigate any concerns arising.

'Stop/Go' Traffic Management System

Where road widths permit, it is proposed to implement a 'Stop/Go' type traffic management system which will allow for one side of the road to be open to traffic at all times at a minimum width of 2.5m.

This would allow for underground cable construction works to continue one side of the road. Temporary traffic signals will be implemented to allow road users safely pass through the works area by directing them onto the open side of the road.

Facilitation of Continued Local Access

Provision of local access to residences along the active works area will be maintained with minimal disruption. This will be coordinated through signposted detour routes, with advance notice given to residents of anticipated works along with dates and further details. Access and egress of residences adjoining the works area of the UGC will be facilitated. The length of closure (as defined on site by signage/cones etc) is intended to be kept to the minimum length practicable for the works to be undertaken where homes are adjacent, and to avoid access restrictions to local residences being in place for multiple working days.

Minimising the closure period of junctions with other local roads will dictate maximum length of any one closure (unless otherwise specified by Kilkenny County Council) to avoid excessive disruption to the local area.

6. Health & Safety

6.1 General

As required by the Safety Health and Welfare at Work (Construction) Regulations 2001-2006, a Project Supervisor Design Process (PSDP) will be appointed by the developer to co-ordinate the design effort and to address and minimise construction risks during the design period. Notification of this appointment will be sent to the HSA by means of their Approved Form 1 (AF1). As design advances and before tender stage, a Preliminary Health and Safety Plan will be drawn up by the PSDP and reviewed by the project team.

This will then be issued with the tender package(s) and ultimately will be passed on to the appointed Project Supervisor Construction Stage (PSCS) to be developed into a full project Health and Safety Plan. Notification of this appointment and the commencement date of construction will sent be to the HSA by means of their Approved Form 2 (AF2).

The construction areas will be delineated and will be under the control of the PSCS who will co-ordinate and supervise all safety aspects of the project. A Safety File will be compiled and maintained on site for the duration of the project and this and the implementation of the Plan will be subject to regular audits.

The main contractor will engage the services of a safety consultant to prepare a site specific health & safety plan, carry out safety risk assessments, notify the HSA of commencement, and carry out audits of the site. All personnel and their subcontractors who will be working on or attending site will attend and comply with a Site Safety Induction Course to be provided by the Site Safety Officer.

All contractors will be requested to provide a sound working environment for all employees involved in the design, construction and operation of the proposed solar farm. This shall take into account all applicable national laws, guidelines and standards.

The Contractors must ensure that the following HSE objectives are met:

- Zero accidents and injuries with respect to all involved workers;
- Zero harm to workers, the public and the environment.

Each Contractor shall prepare and implement the Health, Safety and Environmental (HSE) Plan and associated working instructions and procedures that will govern the contractor's actions at all times. The HSE Plan will cover the following aspects:

- Project Policy Statement;
- Roles and Responsibilities;
- Site regulation, including, for example, housekeeping, barricades, excavations, tools and equipment, electrical work, ladders and scaffolds, etc;
- Risk Management and Hazard Identification;
- HSE training;
- HSE management of subcontractors;
- Work Permit system;
- Personnel Protective Equipment (PPE);
- Inspection and auditing;

- HSE meetings;
- Incident Investigation and Reporting;
- Site security;
- Medical care and first aid.

Furthermore, the Contractors shall develop and implement an emergency response plan outlining all necessary measures and communication procedures in case of emergency situations. The preparation and application of the HSE Plan shall be audited independently throughout the construction period.

7. Construction & Demolition Waste Management Plan

7.1 Waste Management General

The Contractor shall be responsible for developing the Waste Management Plan related to its construction activities. The Plan shall apply to all works carried out by the Contractor and any subcontractors under their control. In preparing the plan, the Contractor shall take into account any measures set out any planning consent document, the relevant legislation, and industry best practice.

The Contractor shall comply with the objectives of the regional waste management plan and establish a system for the management of wastes in accordance with the waste management hierarchy:

- Prevention;
- Minimisation;
- Reuse;
- Recycling and;
- Disposal.

Generally, the waste management goal will be achieved as follows:

- Giving preference to the purchase of materials with minimum packaging;
- Storing materials in designated areas and separate from wastes to minimise damage;
- Returning packaging to the producer where possible;
- Reusing rock/soil on-site during the construction of the project;
- Reusing and recycling materials on site during construction where practicable;
- Recycling other recyclable materials through appropriately permitted / licences contractors and facilities;
- Disposing of only non-recyclable wastes to licensed landfills.

7.2 Wastes Arising & Management

Construction works will be carried out according to best practice with standard environmental controls (see CIRIA 2010). Furthermore, all wastes generated during construction works will be transported off the site by licensed contractors following appropriate classification/segregation. These subcontractors will be identified nearer the commencement of construction. The Site Manager will ensure that the permits / authorisations held by each specialist subcontractor used have the necessary permits in place for each waste type being managed. Kilkenny County Council Environment Section will be consulted to confirm all permits are in order.

During construction, waste containers will be provided and rotated as soon as they are filled. A number of skips (20m^3 typical) will be kept in a secure area adjacent the site compound. Waste will be sorted and disposed of as per waste type to a nearby recycling / treatment facilities.

Excavated material (soil and stone — EWC Code 17 05 04) will be re-used in full on site; it is not expected to be taken off site for recovery. Any excavated material stockpiled on site during construction will be stored in such a manner as to ensure no silt or run-off from these stockpiles enters any watercourse or drain.

In order to prevent any damaging run-off from the site, that there will be no stockpiling of soil within 50 m of a watercourse and silt fence/screens are utilised where deemed necessary. This is a standard working practice. The landscape work is to be implemented in tandem with the main building works where possible, further reducing run off to any watercourse located in the vicinity of the site.

As the site is a green field site, it is unlikely that unsuitable material will be discovered during excavation, however if discovered, it will be stored separately and will be carted off site to designated dumping areas, by licenced contractors. This will be done in accordance with the "Waste Management Acts 1996-2008." All excavations will be undertaken in accordance with Building Regulations and Health and Safety standards.

The waste arising likely to be generated during the construction phase are:

- EWC 17 02 01 - Wood
- EWC 17 02 03 - Plastic
- EWC 17 04 05 - Iron & Steel
- EWC 15 01 01 - Paper & Cardboard packaging
- EWC 15 01 06 - Mixed Waste

In relation to foul waste arising from temporary toilet and canteen facilities the contractor will provide temporary storage facilities in the form of a prefabricated tank. The waste from the site toilet facilities will be removed from the site on a regular basis.

Waste generated will be for the duration of the construction period only and there will be no requirement for either potable water or waste water treatment once the solar farm is operational.

7.3 Documentation of Waste

The Contractor shall develop a Waste Documentation System within the overall documentation system for the works. The documentation to be maintained in relation to wastes includes the following (where applicable):

- The names of the agent(s) and the transporter(s) of the wastes;
- The name(s) of the person(s) responsible for the ultimate recovery or disposal of the wastes;
- The ultimate destination(s) of the wastes;
- Written confirmation of the acceptance and recovery or disposal of any hazardous waste
- consignments;
- The tonnages and European Waste Catalogue (EWC) Code for the waste materials;
- All other statutory recording requirements.

7.4 Hazardous Material

It is not anticipated that there will be any need for hazardous waste on-site, however if required, the management of hazardous waste will comply with current legislation:

- The Waste Management Acts (WMA) 1996 to 2005;
- Waste Management Regulations 1998.

Hazardous waste which may be produced or encountered on site includes:

- Soils contaminated with waste oils or fuels;
- Waste oils and fuels.

8. Environmental Management

8.1 Summary Approach

There are a number of potential sources of pollution from the solar farm construction works, which may impact upon both terrestrial and aquatic ecosystems:

- Silt run-off from exposed ground, e.g., temporary material stockpiles (aggregate and excavated/overburden soil), tracks and haul routes, and recently reinstated areas (road verges etc.);
- Plant washing and vehicle wheel wash areas;
- Fuel storage/refuelling areas;
- Dust emissions from traffic and excavation/construction areas; and
- Sewage and waste water from construction compound building amenities.

Good construction practice and appropriate management and monitoring are therefore essential for prevention of potential pollution from any of these sources.

The following points (not exhaustive) indicate general pollution prevention measures in accordance with those highlighted within the guidelines referenced in this document and application reports. Pollution prevention measures relating to specific tasks are also detailed in the respective sections of this document.

Any material or substance which could cause pollution, including fuels or silty water will be prevented from entering groundwater, surface water drains or watercourses by the appropriate use of and temporary installation of silt fences, cut-off drains, silt traps and drainage to vegetated areas where appropriate. Stilling ponds will be used to minimise the risk of suspended solids, where necessary.

In order to prevent any potential of watercourse pollution the array design ensures a 5-10m to all drains except for small number of localised areas where a fence line or CCTV pole may marginally extend within that buffer. The landscape work is to be implemented in tandem with the main building works where possible, further reducing run off to any drains onsite.

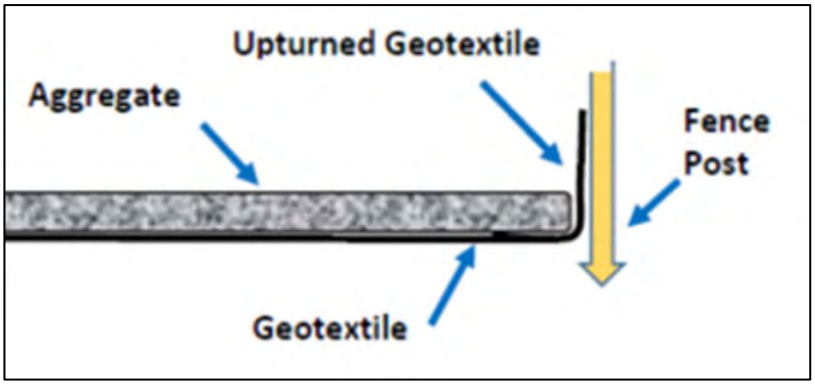


Figure 8 – Geotextile Base Detail for Temporary Compound (note - temporary matting may be used instead)

The temporary construction compound will incorporate these relevant measures, with suitable provision made for a geotextile base and support silt fencing on any downslope edges to watercourses/drains. Stockpiles of soil should be stored well away from the drains on site and (if appropriate) ringed with silt

fences. The contractor will carry out environmental awareness training as part of the site inductions for all staff.

Fuel pipes on plant, outlets at fuel tanks etc. will be regularly checked and maintained to ensure that no drips or leaks to ground occur. The following precautions will also be installed on fuel delivery pipes:

- Any flexible pipe, tap or valve must be fitted with a lock where it leaves the container and be locked when not in use;
- Flexible delivery pipes must be fitted with manually operated pumps or a valve at the delivery end that closes automatically when not in use;
- Warning notices including “No smoking” and “Close valves when not in use” shall also be displayed;
- Spill kits will be available within each plant/vehicle on site and also located close to identified pollution sources or sensitive receptors (fuel storage areas, etc.);
- Interceptor drip trays (or similar, e.g. plant nappies, – open metal drip trays are not acceptable) will be available in accordance with standard good practice across the construction industry;
- Interceptor drip trays will be positioned under any stationary mobile plant to prevent oil contamination of the ground surface or water. Plant and site vehicles are to be well maintained and any vehicles leaking fluids must be repaired or removed from site immediately. Any servicing operations shall take place over drip trays;
- Areas used to store fuel and oil on the site will be appropriately lined and bunded to prevent the downward percolation of contaminants to natural soils and groundwater;
- Fuel for construction vehicles will be stored on an impervious base within a bund able to contain at least 110% of the volume stored. Rainwater will not be allowed to accumulate within the bund and in any way compromise the required 110% volume capacity. No tanks or containers may be perforated or dismantled on site. A competent operator shall empty all contents and residues for safe disposal elsewhere;
- Suitable wheel wash facilities, complete with C/W silt traps will be put in place to ensure vehicles entering/existing the site do not carry/transport debris;
- It is of paramount importance to minimise disturbance to flora and fauna whilst carrying out the construction works, and to ensure that disturbed habitats will regenerate quickly after completion of the works;
- Topsoil and vegetation must be stored separately from subsoil and shall be retained and reinstated on all areas of stripped ground as soon as possible to prevent erosion and leaching/loss of nutrients.
- Daily environmental toolbox talks / briefing sessions will be conducted for all persons working to outline the relevant environmental control measures and to identify any environment risk areas/works.

8.2 Ecological Protection Measures

An Appropriate Assessment (AA) Screening and Natura Impact Statement (NIS) accompany the planning application. The NIS identifies mitigation measures to be implemented to ensure that any impacts on the receiving environment will be avoided during the project’s construction phase. There is

some overlap in areas with recommended mitigation, which has been included for consistency of approach.

Storage/Use of Materials Plant & Equipment

- Materials, plant and equipment shall be stored in the proposed site compounds. The temporary construction compounds will incorporate these relevant measures, with suitable provision made for a geotextile base and support silt fencing on any downslope edges to watercourses/drains.
- A buffer of 5-10m to all watercourses including drains except for a small number of localised areas where a fence line or CCTV pole may marginally extend within that buffer will be established and clearly marked out prior to the commencement of construction activities where possible. The buffer will be maintained during the construction of the proposed cable interconnectors.
- Plant and equipment will be parked in areas remote from any sensitive locations.
- Re-fuelling of machinery, plant or equipment will be carried out in the site compounds.
- Hazardous liquid materials or materials with potential to generate runoff shall be stored in areas remote from any sensitive locations, including drains.
- All hazardous liquid materials shall be stored in a bunded area and spill containment measures will be in place.
- All oils, fuels and other hazardous liquid materials shall be clearly labelled and stored in an upright position in an enclosed bunded area within the proposed development site compound. The capacity of the bunded area shall conform with EPA Guidelines – hold 110% of the contents or 110% of the largest container whichever is greater.
- Fuel may be stored in the designated bunded area or in fuel bowsers located in the proposed compound locations. Fuel bowsers shall be double skinned and equipped with certificates of conformity or integrity tested, in good condition and have no signs of leaks or drip trays will be turned upside down if not in use to prevent the collection of rainwater.
- Waters collected in drip trays must be assessed prior to discharge. If classified as contaminated, they shall be disposed by a permitted waste contractor in accordance with current waste management legal and regulatory requirements.
- Plant and equipment to be used during works, will be in good working order, fit for purpose, regularly serviced/maintained and have no evidence of leaks or drips.
- No plant used shall cause a public nuisance due to fumes, noise, and leakage or by causing an obstruction.
- Re-fuelling of machinery, plant or equipment will be carried out in the site compound as per the appointed Construction Contractor re-fuelling controls.
- All persons working will receive work specific induction in relation to material storage arrangements and actions to be taken in the event of an accidental spillage.
- Daily environmental toolbox talks / briefing sessions will be conducted for all persons working to outline the relevant environmental control measures and to identify any environment risk areas/works.

Surface Water Mitigation During Construction

The following mitigation measures will be carried out by the Contractor during construction phase to prevent surface water runoff into sensitive drains or watercourses. The interconnector cable will cross streams / drains via 7 no. watercourse/drain deck crossings and 4 no. horizontal directional drill crossings (under the N25 and N29 public roads and the Luffany River).

While there are no watercourses within the application site, there are indirect hydrological links through existing agricultural drains between the subject site and the River Barrow & River Nore and Lower River Suir Special Areas of Conservations (SACs) which are located adjacent to Parcel 4. A significant offset of >100m between the proposed solar arrays and the River Barrow has been incorporated into the design of the proposal to protect local water quality and that of downstream designated sites. Similarly, a buffer zone of 5-10m from all watercourses including drains will be implemented except for a small number of localised areas where a fence line or CCTV pole may marginally extend within that buffer. The buffer will be established and clearly marked out prior to the commencement of construction activities where possible. The buffer will be maintained during the construction of the proposed cable interconnectors.

Any material or substance which could cause pollution, including fuels or silty water will be prevented from entering groundwater, surface water drains or nearby watercourses by the appropriate use of and temporary installation of silt fences, cut-off drains, silt traps and drainage to vegetated areas where appropriate. Stilling ponds will be used to minimise the risk of suspended solids, where necessary.

The temporary construction compounds will incorporate these relevant measures, with suitable provision made for a geotextile base and support silt fencing on any downslope edges to watercourses/drains. Stockpiles of soil will be stored well away from the drains on site and (if appropriate) ringed with silt fences. The contractor will carry out environmental awareness training as part of the site inductions for all staff.

Fuel pipes on plant, outlets at fuel tanks etc. will be regularly checked and maintained to ensure that no drips or leaks to ground occur. The following precautions will also be installed on fuel delivery pipes:

- Any flexible pipe, tap or valve must be fitted with a lock where it leaves the container and be locked when not in use;
- Flexible delivery pipes must be fitted with manually operated pumps or a valve at the delivery end that closes automatically when not in use;
- Warning notices including “No smoking” and “Close valves when not in use” shall also be displayed;
- Spill kits will be available within each plant/vehicle on site and also located close to identified pollution sources or sensitive receptors (fuel storage areas, etc.);
- Interceptor drip trays (or similar, e.g. plant nappies, – open metal drip trays are not acceptable) will be available in accordance with standard good practice across the construction industry;
- Interceptor drip trays will be positioned under any stationary mobile plant to prevent oil contamination of the ground surface or water. Plant and site vehicles are to be well maintained and any vehicles leaking fluids must be repaired or removed from site immediately. Any servicing operations shall take place over drip trays;
- Areas used to store fuel and oil on the site will be appropriately lined and bunded to prevent the downward percolation of contaminants to natural soils and groundwater;

- Fuel for construction vehicles will be stored on an impervious base within a bund able to contain at least 110% of the volume stored. Rainwater will not be allowed to accumulate within the bund and in any way compromise the required 110% volume capacity. No tanks or containers may be perforated or dismantled on site. A competent operator shall empty all contents and residues for safe disposal elsewhere;
- Suitable wheel wash facilities, complete with C/W silt traps will be put in place to ensure vehicles entering/existing the site do not carry/transport debris;
- Topsoil and vegetation must be stored separately from subsoil and shall be retained and reinstated on all areas of stripped ground as soon as possible to prevent erosion and leaching/loss of nutrients.

Mitigation of Dust during Construction

The main activities that may give rise to dust emissions during construction include the following:

- Excavation and removal of earthworks.
- Materials handling and storage.
- Movement of vehicles (particularly HGV's) and mobile plant.
- Suspended solids in surface water runoff.

The following mitigation measures will be carried out by the Contractor during construction phase to prevent dust entering the drains or nearby watercourses or the surrounding residential areas:

- Construction traffic carrying loose material will be covered to reduce dust generation. This measure will be combined with wheel washing at site access points. A water bowser will be provided for dust suppression on site if necessary and areas of concern can be 'dampened down' during periods of dry weather.
- If necessary, arrangements will be made for sweeping public roads in the vicinity of the site access using a standard road sweeper. The Site Manager will be responsible for determining if additional measures will be required.
- Speed limits on site (15km/h or less) to reduce dust generation and mobilisation. Furthermore, any areas that has the potential to give rise to fugitive dust must be regularly watered, as appropriate, during dry and/or windy conditions. Measures are to include the following:
    - Truck spraying and hosing down will be carried out during dry periods and as necessary to control dust.
    - A road sweeper operating during the soil-stripping and excavation stage as required.
- The design of the proposed solar farm has incorporated buffer zones around drains and nearby watercourses in order to protect local water quality and that of downstream designated sites. Crossing of drains/minor watercourses will be by way of clear span structures and under the supervision of the ECoW.
- Solar panel cleaning will take place annually or as required. Cleaning will most likely be undertaken using a lightweight tracked machine with a special cleaning attachment. Due to the Irish climate which is relatively mild with high rainfall, solar panel cleaning

is required less than other climates such as hot and dusty conditions. However, we assume an annual cleaning cycle to ensure optimum solar farm performance. The panels will be cleaned with water only, and no chemical products will be used.

- All construction (and decommissioning) works will be carried out according to best practice with standard environmental controls in place to prevent any damaging run-off from the site (see CIRIA 2001, 2010 & 2015). The construction of the proposed development will be implemented in accordance with the Construction Environmental Management Plan (CEMP) for the proposed development.
- All other mitigation measures, biodiversity enhancement and monitoring commitments described in the EcIA will be fully implemented.

Ecological Mitigation

The following mitigation measures will be implemented as part of the proposed project in order to minimise the potential effects on the existing ecology as discussed above. These measures are to be read in conjunction with the detailed construction phase commitments presented in the CEMP that accompanies the planning application.

- An Ecological Clerk of Works (ECoW) will be appointed to ensure that the mitigation strategy is correctly implemented both during the construction phase, establishment of the landscaping measures and for the duration of the eventual decommissioning of the project.
- Construction works will be carried out according to best practice with standard environmental controls in place to prevent any damaging run-off from the site (see CIRIA 2010 *Environmental Good Practice on Site*. *CIRIA, UK*; and CIRIA 2001 *Control of water pollution from construction sites: guidance for consultants and contractors. CIRIA C532. London 2001*.)
- Any silty water generated on site will be settled out as much as possible through drainage mitigation measures (silt traps, silt fences, cut off drains, etc.) and channelled into vegetated areas at least 50 metres from watercourses, to allow the settlement of solids.
- A phased approach will be taken when constructing the substation and access tracks for the site, as per the outlined construction programme. This will include a focused gap between the soil stripping of the substation and access tracks, as part of a precautionary approach.
- As a precautionary measure, the soil stripping and construction of the site access tracks will be carried out outside of periods of wet weather. Scheduling of works will avoid insofar as practicable the wetter months of the year. In addition, appropriate run-off control will be installed and maintained for the duration of the construction phase. It will help minimise the risk of run-off from the site by limiting the earthworks undertaken in the wetter months of the year.
- In advance of the stream crossing works required for the underground interconnector cabling, a staked silt fence shall be installed at a distance of 2-3m from the channel on both banks. The approaching track excavations will be stopped at this distance back from the channel, therefore retaining a vegetated buffer strip between the access track approach and the channel until such time as the dry deck is lifted into place.
- Silt fencing shall be retained on the downslope between the dry deck plinth and the channel until such time as the access track has bedded in and the swales (with check dams in-site) have revegetated.

- The swales alongside the access track approaching the stream crossing deck shall have temporary and permanent gravel check-dams installed to slow velocity and attenuate flow prior to reaching the channel.
- Dust can be created from movement of construction traffic and from general construction activities and can be carried by prevailing winds impacting upon the local area. The air quality management objectives are: Protection of air quality; Use all reasonable and practicable measures to minimise airborne dust and greenhouse gas emissions to minimise impacts on land, flora/fauna, water and air quality; Track and report; Minimise impacts on adjacent residents, land owners and community.
    - Construction traffic carrying loose material will be covered to reduce dust generation. This measure will be combined with wheel washing at site access points. A water bowser will be provided for dust suppression on site if necessary and areas of concern can be 'dampened down' during periods of dry weather.
    - If necessary, arrangements will be made for sweeping public roads in the vicinity of the site access using a standard road sweeper. The Site Manager will be responsible for determining if additional measures will be required.
- The design of the proposed solar farm has incorporated buffer zones around drains within the site and from adjacent watercourses in order to protect local water quality and that of downstream designed sites. Crossing of drains will be by way of clear span structures and under the supervision of the ECoW.
- Solar panel cleaning will take place annually or as required. Cleaning will most likely be undertaken using a lightweight tracked machine with a special cleaning attachment. Due to the Irish climate which is relatively mild with high rainfall, solar panel cleaning is required less than other climates such as hot and dusty conditions. However, we assume an annual cleaning cycle to ensure optimum solar farm performance. The panels will be cleaned with water only, and no chemical products will be used.
- All construction (and decommissioning) works will be carried out according to best practice with standard environmental controls in place to prevent any damaging run-off from the site (see CIRIA 2001, 2010 & 2015). The construction of the proposed development will be implemented in accordance with the Construction Environmental Management Plan (CEMP) for the proposed development.
- All other mitigation, biodiversity enhancement and monitoring commitments described in the EcIA will be fully implemented.

Roles and Responsibilities of CEMP

The Site Manager/Environmental Clerk of Works will be responsible for the pollution prevention programme presented in the planning phase CEMP (Appendix 2) and will ensure that routine checks of key construction design measures are carried out to ensure compliance. A record of these checks will be maintained throughout the duration of the project.

The prepared EcIA also includes a suite of identified mitigation measures to in order to minimise potential effects on the existing ecology. Some overlap exists in respect of the above referenced measures.

- Detailed mitigation to minimise the risk of run-off or pollution of drains or adjacent watercourses during construction is provided in the CEMP and Construction Method Statement for Electrical Infrastructure which accompany this application. This includes the following commitments:

    a. A buffer of 5-10 m from the closest drain will be established and clearly marked out prior to the commencement of construction activities where possible. The buffer will be maintained with the exception of localised areas where access, crossing or cable trenching is required.
    b. Silt fencing will be installed within the works area for the proposed interconnector cables. The silt fence will provide protection from sediment and potential site water runoff.
    c. The silt fencing will be checked twice daily during construction and once per day thereafter to ensure that it is working satisfactorily until such time as the re-instated ground/material has been fully established.
    d. If dewatering is required as part of the proposed works e.g., in trenches for underground cabling or in wet areas, water must be treated prior to discharge. The Contractor shall employ best practice settling systems to ensure maximum removal of suspended solids prior to discharge of any surface water or groundwater from excavations to receiving waterbodies. This may include treatment via settlement tanks. There will be no direct pumping of water from the works to any watercourses or drains at any time.
    e. An emergency-operating plan will be established to deal with incidents or accidents during construction that may give rise to pollution within any nearby watercourses or drains. This will include means of containment in the event of accidental spillage of hydrocarbons or other pollutants (spill kits etc.).
    f. The contractor will ensure that good housekeeping is always maintained and that all site personnel are made aware of the importance of the nearby estuary/aquatic environments and the requirement to avoid pollution of all types.

- Construction works will be carried out according to the CEMP which will incorporate all of the planning phase commitments along with standard environmental controls to prevent any damaging run-off from the site (see CIRIA 2001, 2010 & 2015).

- A suitably qualified Environmental/Ecological Clerk of Works (ECoW) will be appointed to oversee the implementation of environmental mitigation throughout the construction phase.

Habitats and Flora

- No removal of habitats or movement of construction machinery will occur outside of the development works area/footprint during the construction phase, where the works area/footprint will be clearly marked for associated site staff.

- Construction works will be carried out according to best practice with standard environmental controls in place to prevent any damaging run-off from the site (see CIRIA 2001, 2010 & 2015).

- The landscaping commitments in the Biodiversity Management Plan for the proposed development will be implemented. Only native tree, shrub and meadow/wildflower species suited to the locality will be used in the final landscaping plan.

- A pre-construction survey will be undertaken to identify and map the occurrence and extent of any Third Schedule Invasive Plant species within or adjacent to the works footprint. If such species are found to occur at this time an Invasive Species Management Plan (ISMP) to control invasive species shall be developed following best practice guidance (e.g. after NRA 2010 and Fennell *et al*. 2018) with the advice of a suitably qualified ecologist. The ISMP should be

finalised in consultation with and based on advice provided by the appointed specialist contractor, who will continue to review and, if necessary, update the Management Plan, in order to ensure that current relevant guidelines and regulations are followed at the time when the management of these species is implemented.

Fauna

- Pre-construction (and decommissioning) surveys for Badger, Otter and roosting bats shall be carried out prior to the commencement of any works.
    - Prior to the commencement of construction (or vegetation removal) in areas within 200m of an EPA named watercourse the area will be surveyed to record evidence of Otter activity. In the event that a holt is present, no work will be carried out within 200m of the holt until a derogation licence has been sought and granted to permit works according to the recommended protocol and licence conditions.
    - Any trees required to be removed (whether within hedgerow or the scrub/woodland) will be subject to ground-level inspection to record any trees with moderate or higher bat roost potential (Collins, 2016). Any trees with moderate/higher potential will be subject to more detailed assessment, including climbing and direct inspection of potential roost features. In the event that any roosting bats are discovered -the tree will not be removed until such time as a derogation licence is obtained. All recommendations and licence conditions will be implemented under the supervision of the ECoW. As a secondary mitigation, all trees/shrubs that are felled will be left 'sit' for a minimum of 24 hours before being cut/logged or mulched.
    - A pre-works survey will be carried out to assess the activity at the known Badger sett on site and to record any new activity (or setts) that may be present. No construction/decommissioning traffic will be permitted within 50m of an active sett without the advice of a suitably qualified ecologist and in consultation with the National Parks and Wildlife Service. The ecologist will advise on the need for any further consultation or licensing ahead of the commencement of construction. Badger activity will be monitored throughout the construction phase and the ECoW will have 'Stop Works' authority.
- As In the event that protected fauna are found actively using the site for breeding/roosting (*e.g.* bird nest, bat roosting) during the construction phase, works will cease immediately and the area will be cordoned off until advice is sought from a suitably qualified/experienced ecologist.
- There will be no removal of woody vegetation during the bird breeding season (1st March to August 31st inclusive).
- All excavations/trenches will be covered at night, or a suitable means of escape provided for nocturnal mammals such as Badger and Otter.
- A tree survey shall be performed to identify any trees in dangerous states prior to works commencing. Any trees requiring intervention will be inspected for roosting bats and nesting birds and the ECoW will ensure that any risks to breeding or resting birds and mammals are minimised.
- Security fencing shall have a 200mm gap between the bottom of the fence and the ground, or alternatively mammal gates will be provided at regular intervals (every 150m at a minimum) at the base of the fence to allow free movement of mammals through the solar farm site.

- A total of 50 woodcrete (or recycled plastic) bat boxes will be erected at the site to improve the roosting potential of the site for bats. The boxes will be erected under the supervision of a suitably qualified ecologist. The boxes will be checked and maintained annually by a suitably qualified (and licensed ecologist) and replaced as necessary over the lifetime of the project.

- Two Barn Owl nest boxes will be erected at locations chosen by a suitably qualified ecologist. The boxes will be erected under the supervision of the ecologist. The boxes will be checked and maintained annually by a suitably qualified (and licensed ecologist) and replaced as necessary over the lifetime of the project.

Decommissioning and Restoration Phase Mitigation

At the time of decommissioning and restoration, the Applicant will ensure that any related activities in support of same are undertaken with such due care and diligence in order to reduce or eliminate risk to the environment. The Applicant will lead the decommissioning and restoration process;

- The Applicant will ensure adequate internal and external resources are available to manage and undertake all decommissioning activities required and be required to submit for agreement with the planning authority a Decommissioning and Restoration Plan;

- The date for decommissioning will be well known in advance of the activation of the Decommissioning and Restoration Plan;

- Pre-works walkovers will be carried out by a suitably qualified ecologist to identify any ecological constraints on site and to provide appropriate advice ahead of the mobilisation of the decommissioning contractors.

- All potential negative environmental effects from decommissioning of the project will be mitigated through established measures. These measures include, but are not limited to:

    - The use of erosion and sediment control measures;

    - Maintenance of all existing buffers (hedgerows / treeline, drainage ditches etc.);

    - Timing of decommissioning works to ensure that they do not interfere with wildlife breeding / nesting times; and

    - Measures which will rapidly establish a vegetative cover on any disturbed areas.

- All stored fluids or solid materials, be they chemicals, greases or oils shall be returned to suppliers where appropriate. Alternatively, they will be disposed of off-site to licensed waste facilities;

- Disposal off-site shall mean that licensed removal contractors, licensed removal equipment and licensed reception facilities are utilised where required during decommissioning;

- Disposal off-site shall mean that a full record and log will be maintained of all plant, equipment, finished or raw materials and fluids removed off-site;

- Not all structures will be removed from site. For example, if infrastructure forms parts of the substation or grid connection then ownership of this belongs to ESB Networks and may be retained for future long-term use as part of the national electricity distribution system. In addition, the landowner may choose to retain access tracks within the solar farm for improved access with the farm holding. It should be noted that any structures or land uses which are

proposed to be retained will be advised to Kilkenny County Council in advance of final decommissioning and restoration.

- All contractors engaged in the Decommissioning and Restoration Plan shall be fully licensed, experienced and approved to undertake the activities for which they are engaged; and

- On completion of decommissioning, a Closure Validation Audit Report will be completed and issued to Kilkenny County Council to demonstrate that the site is suitable for use and its condition would not pose a future risk to public health or the environment. This report will be issued to the Council and the site will only be confirmed as fully decommissioned on the Councils confirmation that it is satisfied with the findings from this report.

- After ensuring the solar panels are disconnected from the electrical network, the panels may be individually removed from their frame. The panels can be reused depending on their age and condition. If they are not fit for reuse, they will be disposed of to a suitably licenced waste facility. Storage containers will be available should the panels be reused or disposal containers if they are to be transported to a waste facility.

    - The panels will be mounted on a steel frame system. These can be reused, so they will be stored and taken off site. The mounting system is connected to the ground via a small driven pile system. These driven steel piles will be removed with a rig. These will not be reused so they will be taken off site for recycling.

- The 110kV substation and associated 110kV underground grid connection cabling and transition masts will become the property of ESB Networks once the project is energised and will therefore remain on-site following the decommissioning of the solar farm as per the connection agreement with ESB Networks. This infrastructure will have a future long term use as part of the national electricity transmission system.

- The electrical cabling will be disconnected. The cables and accompanying ducting will then be removed via digger. The cables will be pulled from the ducts and recycled appropriately. The ducting will also be sent to the relevant waste facility.

- Depending on the condition of the inverter and transformer station, they will either be refurbished and reused, or dissembled and recycled. The inverter and transformers will be disconnected from all electrical systems. A crane will then transfer the stations onto a flatbed lorry to be removed from site. The remaining concrete pad foundations, or supporting blocks, will be broken up and removed from site for appropriate recycling. The land will then but filled and re-seeded for full reinstatement.

- Site Security Equipment includes the perimeter fencing and CCTV system. These will be dismantled and removed once all other equipment has been removed from site. The security fence will be removed and depending on its condition, transported for recycling or reuse. The holes from the fencing will be refilled. The CCTV system will be disconnected, and the poles removed from the ground. Similarly, the holes will be refilled and the land reinstated.

- Additional site access tracks constructed as part of the solar farm may add value to the site and as such their removal will be subject to landowner agreement. Should the landowner request that the access tracks be removed, the stone build-up of the road will be broken- up, removed and appropriately recycled. The area will then be covered with a layer of topsoil to allow for the reinstatement of the land.

The site decommissioning and restoration plan will be executed in line with the environmental conditions of the Planning Permission. In advance of final decommissioning and restoration the Applicant will

consult with Kilkenny County Council to agree any additional requirements. Following the decommissioning of the site the agricultural land will be restored to its original state. Should the access tracks be removed, the areas will be covered with topsoil and planted with a grass seed mixture. The vegetation will be monitored by the Applicant to ensure the grass areas are growing sufficiently. If there are any the areas showing poor growth, these will be re-ploughed and re-seeded. All pre-existing drains will be retained in their original state throughout the lifetime of the solar farm. Should any existing drains or ditches become damaged during the decommissioning process, these will be repaired. Please refer to the Construction Environmental Management Plan for further details on site drainage. The land will be reinstated to its original conditions as per the agreement with the landowner.

8.3 Soil Structure Protection

To minimise damage to the soil structure within the solar farm site, construction activities will be confined to periods of suitable weather, with the use of appropriate machinery for such circumstances.

Equipment will be delivered to site by heavy goods vehicles and offloaded in packs by tracked machines or low ground pressure machines, which reduces the risk of compaction. The constructed access tracks which extend to all areas of the site will be the principal means to navigate the site for construction purposes. A delivery sequence of lower pressure vehicles will be devised which minimises repeated journeys over the pasture to reduce rutting and damage to the pasture and soil structure. Temporary ground-protecting access matting will be used in the area of the construction compound, as necessary.

On completion of the works, the pasture will be restored using light farming machines and prepared appropriately for seeding to encourage early growth, restoration of the soil structure and natural creation of meadow grass.

These processes will be supplemented in full by a suite of agreed measures to prevent against silt-laden run off as well as standard good practice site management procedures including routine deployment of wheel washing.

Figure 9 – Typical Low Ground Pressure Screw Pile Vehicle

8.4 Material Excavation and re-use on site

The access track for the inverter/ transformer stations will require the preparation of a heavy-duty track made of compacted layers of material. To this effect, the soil will be stripped to a depth of about 200mm in order to remove the soft top soil and replaced by a layer of coarse gravel/ suitable substrate. This will be undertaken in accordance with agreed practices, with a disaggregated temporary storage area for the appropriate management of same will be set out within the construction compound.

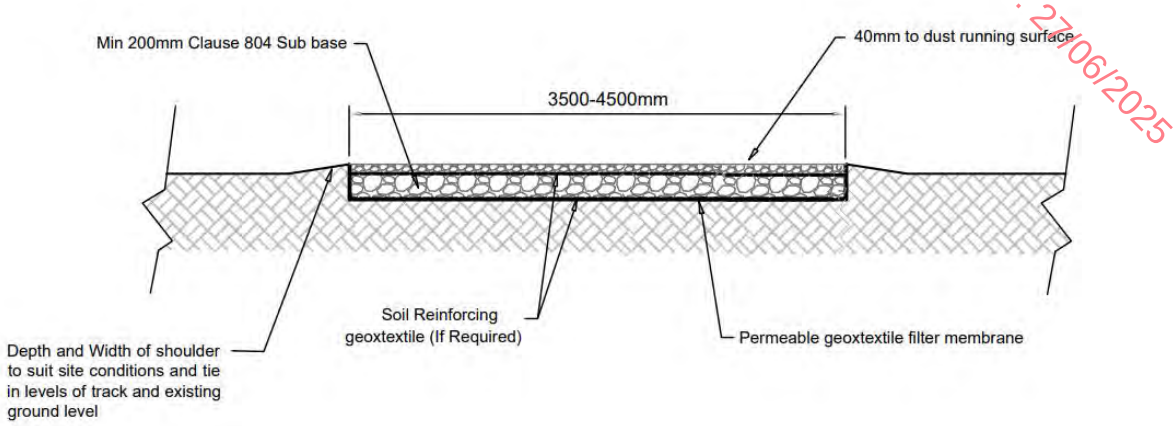


Figure 10 – Typical Access Track Detail

The soil stripping works to facilitate the track excavations will extend to c. 7,078 m3 of soil removal. All of this will be reused on site. The excavated material will be used directly as local fill in focused areas and to fill-in the verges of the internal track once the installation process is complete in accordance with proposed landscaping mitigation measures, with the residual re-tilled in the areas of hedgerow removal and the temporary construction compounds (if needed) to allow for full and active reinstatement for agricultural use.

8.5 Construction of Access Tracks

There will be a requirement to import aggregate for the construction of the access track in the development site. This will be kept to a minimum. The quantity will be determined accurately at construction stage and will largely depend on existing ground conditions. Typical construction details are as per Figure 10.

8.6 Dry Construction Deck

The dry construction drain deck crossing will be constructed as per the submitted methodology, refer to Section 9.1 of the of the Site Access Report by CSEA Engineering Advisors). As per the specification below, the construction of these decks do not require any works in the stream channel itself, rather pre-cast bearing slabs are brought to site on which a reinforced concrete deck is placed bridging the drain below.

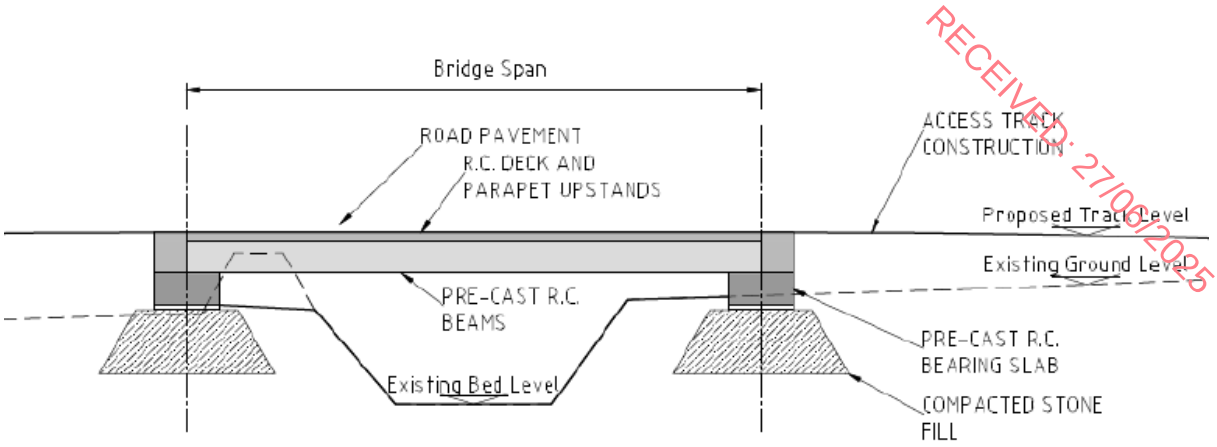


Figure 11 – Cross Section of Typical Agricultural Deck

Further to any grant of planning permission, and as per formal process, engagement will take place with the Office of Public Works in respect of approvals under Section 50 of the Arterial Drainage Act. All requirements of the OPW will be subsumed into the final construction method statement which will be submitted to Kilkenny County Council as part of the final contractor prepared CEMP.

8.7 On-Site Surface water generation and drainage

The proposed development is designed so as to minimise effect on the original drainage and infiltration pattern of the site. The only surfaces where infiltration may be materially impeded are the inverter/transformers and spare parts storage container which extend to a cumulative area of approximately 953.6m^2 of the total site area. The drainage strategy for the project is detailed in the submitted plans by IE Consulting.

Any existing drainage or ditch network shall be cleaned during construction and maintained on an annual basis by the site owner as per contractual obligation. It will therefore be ensured that the site drainage will constantly be optimal.

It should be noted, that although PV panels may appear as a roof-like structure they do not prevent water from reaching the ground. The grass and original pasture quickly return to its original state as shown in figure below. In fact, grass growth management does not differ from a normal pasture and will allow for sheep grazing. Any soil compaction that may occur during frame and panel installation will be chisel ploughed post construction to ensure there is no formation of rivulets.

Figure 12 – No effect on grass management or drainage requirement

8.8 Treatment of Silt Laden Runoff

Construction works will be carried out according to best practice with standard environmental controls in place to prevent any damaging run-off from the site (see CIRIA 2010 *Environmental Good Practice on Site. CIRIA, UK;* and CIRIA 2001 *Control of water pollution from construction sites: guidance for consultants and contractors. CIRIA C532. London 2001.*)

Any silty water generated on site will be settled out as much as possible through drainage mitigation measures (silt traps, silt fences, cut off drains, etc.) and channelled into vegetated areas at least 50 metres from watercourses, to allow the settlement of solids.

A phased approach will be taken when constructing the substation and access tracks for the site, as per the outlined construction programme. This will include a focused gap between the soil stripping of the substation and access tracks, as part of a precautionary approach.

Specific details will be provided by the contractor on development of the detailed Construction Management Plan at construction stage. As noted in Section 5, these will be agreed in full with the Council's Environmental Department prior to construction.

8.9 Project Connection Works

As outlined, it is proposed to connect the different land parcels by means of an underground cable run on private lands. The specification for these cable routes is set out in the submitted drawings by Drumdowney Solar Farm Limited and associated 'Drumdowney Electrical Infrastructure Construction Methodology'.

The following standard trenching methodology will be implemented:

- Prior to construction the Contractor and the appointed Site Manager will prepare a detailed Method Statement for each section of the cabling based on the detailed design of same. The

Method Statements will take into account any mitigation measures where required, or any planning conditions set out by Kilkenny County Council;

- All works will be subject to a road opening licence from Kilkenny County Council;
- A detailed traffic management plan will be prepared by the appointed contractor and agreed with Kilkenny County Council at construction stage, outlining how traffic will be managed during the course of the works on the public road. Where road closures and diversions are required to facilitate the works, these will be agreed with Kilkenny County Council and An Garda Siochana and the appropriate road closure licenses will be applied for.
- Traffic management measures will be implemented as per the preceding point;
- All existing underground services shall be identified on site prior to the commencement of construction works. Exact locations will be determined via slit trenches as mentioned in Section 3;
- Excavated material will be temporarily stockpiled onsite for re-use during reinstatement. Stockpiles will be restricted to less than 2m in height. Stockpiles will be in suitably safe locations and all stockpiling locations will be subject to approval by the Site Manager;
- Excavated material shall be employed to backfill the trench where appropriate and any surplus material will be transported off site and disposed of at a fully authorised soil recovery site;
- Any earthen (sod) banks to be excavated will be carefully opened with the surface sods being stored separately and maintained for use during reinstatement;
- Where required, grass will be reinstated by either seeding or by replacing with grass turves.
- The trench will be excavated in 100m sections. The trench will be dug to a 1220mm depth and varying width depending on the cable installation. Following this the trench sections will be trim and smoothed;
- The trench will be laid with a bedding layer for the ducts. This layer will be compacted in accordance with the design specifications;
- The ducts will be lowered into the trench and laid in a trefoil formation. Spacers will be used where appropriate to ensure the ducts are centred within the trench section;
- The ducts will then be carefully covered with the bedding layer and compacted to the required standards, as per the detailed design. The layer with be levelled to the appropriate height. Care will be taken to not damage or displace the ducts;
- A backfill will be placed on top the of the bedding layer and compacted as per the detailed design specifications.
- At the required level a yellow warning tape will be laid in accordance with the ESB Code 2955092;
- The ducts will then be cleaned and tested by pulling through a brush and mandrel. Following this a 12mm draw rope will be installed in each duct. The ducts will then be sealed using end seals, each fitted with rope attachment eyes to allow for cable installation;
- All the above works should be witnessed by ESBN Clerk of Works as required;

- Public road trenching will be reinstated in line with Kilkenny County Council requirements and as per the Guidelines for Managing Openings in Public Roads (Purple Book – April 2017);
- Cable lubricant will be applied to jacket (outer sheath) of the cables. This reduces friction between the cable and the rollers and also prevents the cable from snagging;
- The specialised winch will monitor the tension on the cables being pulled, ensuring the cables do not exceed their tensile limit;
- Works will only be conducted in normal working hours of Monday to Friday 08:00 to 18:00 and Saturday 08:00 to 13:00, with no works on Sundays or Bank Holidays except in exceptional circumstances or in the event of an emergency;
- The excavation, installation and reinstatement process typically take an average of 1 day to complete a 100m section; and
- Following the installation of ducting, pulling the cable will take approximately 1 no. day between each joint bay, with the jointing of cables taking approximately 2 no. days.

A Horizontal Direction Drill (HDD) will be required for the railway line and M9 Motorway crossing associated with the proposed interconnector route. Confirmation from CIE setting out its agreement in principle to the HDD under the railway line for planning purposes is included in Appendix B of the Drumdowney Electrical Infrastructure Construction Methodology'. The proposed drilling methodology is as follows:

- A works area of approximately 40m2 will be fenced on both sides creating an easement/wayleave.
- The drilling rig and fluid handling units located on one side of the crossing will be stored on double bunded 0.5mm PVC bunds which will contain any accidental fluid spills and storm water run-off.
- Entry and exit pits (1m x 1m x 2m) will be excavated; the excavated material will be temporarily stored within the works area and used for reinstatement or disposed of to a licensed facility.
- A 1m x 1m x 2m steel box will be placed in each pit. This box will capture any drilling fluid returns from the borehole.
- The drill bit will be set up by a surveyor, and the driller will push the drill string into the ground and will steer the bore path under the stream.
- A surveyor will monitor drilling works to ensure that the modelled stresses and collapse pressures are not exceeded.
- The drilled cuttings will be flushed back by drilling fluid to the steel box in the entry pit.
- Once the first pilot hole has been completed a hole-opener or back reamer will be fitted in the exit pit and will pull a drill pipe back through the bore to the entry side.
- When all bore holes have been completed, a towing assembly will be set up on the drill and this will pull the ducting into the bore.
- The steel boxes will be removed, and the drilling fluid disposed of to a licensed facility.
- The ducts will be cleaned and proven and their installed location surveyed.
- The entry and exit pits will be reinstated as per the landowners' requirements.

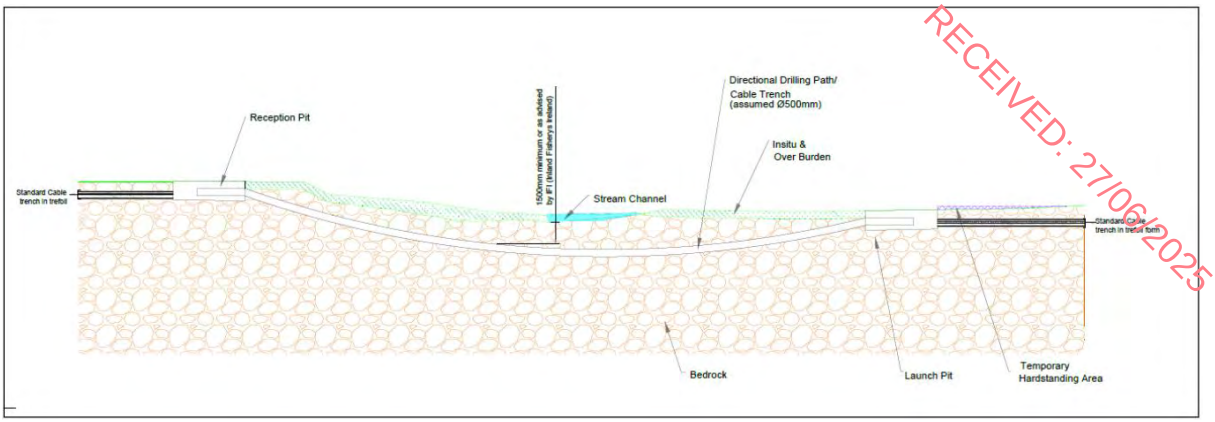


Figure 13 – Typical Horizontal Directional Drill (stream example)

8.10 Noise Management

It is expected that construction hours of operation will be between 08:00 and 18:00 Monday to Friday, and 08:00 and 13:00 on Saturday. No construction activities will occur outside these hours unless agreed in writing with Kilkenny County Council. All plant will be required to conform to the construction noise code of practice BS 5225 and will be properly maintained by contractors.

Potential noise impact will be controlled in accordance with all relevant British Standards Codes of practices such as: BS 5228-1: 1997 “Noise Control on Construction and Open Sites -Part 1”; BS 5228:2009 and AI:2014 “Code of practice for noise and vibration control on construction and open sites”. The applicant is happy to accept a condition limiting construction phase noise to 70dB for construction as per BS5228.

8.11 Air Quality

Dust can be created from movement of construction traffic and from general construction activities and can be carried by prevailing winds impacting upon the local area.

The air quality management objectives are:

- Protection of air quality;
- Use all reasonable and practicable measures to minimise airborne dust and greenhouse gas emissions to minimise impacts on land, flora/fauna, water and air quality;
- Track and report;
- Minimise impacts on adjacent residents, land owners and community.

Construction traffic carrying loose material will be covered to reduce dust generation. This measure will be combined with wheel washing at site access points. A water bowser will be provided for dust suppression on site if necessary and areas of concern can be ‘dampened down’ during periods of dry weather.

If necessary, arrangements will be made for sweeping public roads in the vicinity of the site access using a standard road sweeper. The Site Manager will be responsible for determining if additional measures will be required.

8.12 Adjoining Lands

The layout of the proposed solar farm includes a number of focused design measures such as development buffers, landscaping screening etc to mitigate against any potential for impact on adjoining

residential properties or land uses. The construction phase will be advanced in accordance with best practice measures to ensure there are no undue impacts on agricultural or other activities. Prior to the commencement of construction, local residents will be contacted with key information and the brief of the appointed contractor will include community liaison to record and address any queries arising.

8.13 Archaeology

An Archaeological, Architectural and Cultural Heritage Impact Assessment undertaken for the project includes a suite of construction management measures devised as part of a considered mitigation strategy. Identified measures, including the capacity for preservation in situ by design, and any actions arising from associated findings will be integrated into the final Construction Environmental Management Plan. The proposed layout of the development has been adjusted during the pre-planning design process to take account of findings from an extensive archaeological site inspection undertaken early in the design phase of the project.

The report recommends a pre-commencement (post planning consent) programme of archaeological and geophysical survey in areas where sub-surface excavation works are required, to be followed by programme of pre-development archaeological testing where warranted by geophysical findings. Other areas will be subject to a programme of archaeological monitoring by a suitably qualified archaeologist. Refer to Section 5 of the archaeological report submitted with this application for the proposed archaeological mitigation measures.

8.14 Reinstatement of Excavated Material after Construction Stage

Reinstatement of all excavated materials will occur as close to the site of excavation as possible. Materials will be reinstated on site in restoration and landscaping works.

Where practical, reinstatement and restoration will be carried out during the construction phase, or as soon as is practical after the completion of the works themselves. Early reinstatement and restoration is required to minimise visual impact and temporary storage/stockpiling of soils and to promote vegetation and habitat restoration as early as possible.

Reinstatement involves placement of topsoil as required:

- On any areas of disturbed ground;
- To exposed substrata areas as a result of the construction works;
- Adjacent access tracks;
- To construction compounds and other temporary works areas.

The Contractor is required to provide appropriate plant for undertaking reinstatement, restoration and landscaping works such that no unnecessary disturbance of the ground surface occurs.

The Contractor’s plans and method statements will provide details on the timing and predicted extent of any necessary reinstatement, including the design and working methods for reinstatement and restoration of all of these elements.

8.15 HDD Frack-Out Contingency Plan

Frack-out is the condition whereby drilling fluid (mud) is released through sub-surface geology (e.g. fractured bedrock, gravels, karst) reaching the surface environment. Drilling muds consist of largely a bentonite clay-water mix and are non-toxic, but if frack-out occurs under or near a watercourse the resulting suspended solids concentrations can have highly adverse impacts on instream habitats,

plants, invertebrates and fish. Frack-outs most commonly occur near the drilling entry and exit points, but can occur anywhere along the bore.

This contingency plan covers three steps in order of preference to avoid adverse impacts, i.e., prevention, response/containment and clean up.

The objectives are to:

- Minimise potential for frack-out;
- Provide mechanisms for detection of frack-out;
- Protect watercourses and riparian vegetation;
- Ensure a readily mobilised “minimum-impact” response plan is in place;
- Ensure all appropriate incident reporting and follow up are carried out.

Prevention

- Ground investigation works will be carried out well in advance of the drilling operation. These will involve GPR for location of underground services / utilities, plus seismic and core tests to determine sub-surface geology to ensure the bore is set within suitable sub-strata.
- Drilling pressure will be closely monitored in order to ensure: (a) they do not exceed those required to penetrate the site-specific formation, and (b) rapid detection of any drop in fluid pressure which usually signals fluid loss as a result of frack-out.
- Entry and exit pits must be protected using silt fencing and staked strawbales and/or sand bags that act as booms to any drilling mud release.
- Any obvious drains or flow paths between the entry/exit points and the river must also be fitted in advance of works with robust silt control measures, e.g., silt traps and sandbags/staked strawbales.
- A stockpile of silt control materials will be on site and ready for emergency mobilisation at all times, e.g., additional strawbales, sandbags, silt fencing, stakes and a tank for storing any escaped fluid

Water containing silt, mud, bentonite or any other materials shall not be allowed to flow into surface water or drains.

Containment

Any loss of drilling fluid pressure or lack of returns at the drill entrance signals a potential frack-out which will immediately trigger the following:

- Directional drilling will cease immediately;
- Drill bore-stem will be pulled back to relieve pressure on the frack-out location;
- The site supervisor will evaluate the situation, locate the frack-out location and immediately inform the Site Environmental Manager (SEM) and ECoW;
- If the frack-out is minor and fluid has not reached the surface environment and/or not threatening sensitive receptors, a leak-stopping compound can be introduced to the bore to block the frack-out;

- If the frack-out has reached the terrestrial surface, any bentonite contaminated material will be surrounded with booms / berms and removed by hand or vacuum truck and disposed of according to local authority requirements;
- If the frack-out reaches the aquatic environment, every action possible must be undertaken to control and remove the source of the drilling mud contamination within or associated with the bore before notifying Inland Fisheries Ireland (IFI) hotline and Limerick office (see numbers below).
- The SEM and ECoW must record the location, timing and approximate volume of fluid release to water for incident reporting and consultations with IFI.

Clean-up

- All materials and rubbish-construction debris must be removed from site or securely locked on-site at the end of each workday;
- Entry and exit sump pits must be filled and returned to natural grade at the end of works, with all construction and mitigation materials removed, e.g., strawbales, sandbags, silt fences etc.

Incident Reporting

- IFI must be notified immediately if pollution of a drain or watercourse has occurred;
- The SEM will be responsible for preparing an incident report and shall undertake all necessary measures and monitoring as set out by IFI following their notification and conditions.

11. Operational Site Management and Maintenance

Once construction of the solar farm is complete, an operations and maintenance plan will be put in place. This will be agreed with the Planning Authority in advance of implementation. The plan will include for a habitat management plan to monitor the ecological enhancements to ensure they are implemented appropriately and in line with proposals in this planning application.

Once the solar farm is operational, significant maintenance work will not be required. The solar farm will be an unmanned facility which will be remotely monitored by way of CCTV. The solar panels and associated equipment will be monitored remotely by an online system which will show electricity generation, operational statistics and any minor faults in realtime.

Standard maintenance requirements such as occasional panel replacement or maintenance to an inverter will be logged by the online web-based system and a maintenance team will be promptly sent to undertake any works if required. The solar farm will be constructed to provide uninterrupted service insofar as possible for commercial reasons.

Solar panel cleaning will take place annually or as required. Cleaning will most likely be undertaken using a lightweight tracked machine with a special cleaning attachment. Due to the Irish climate which is relatively mild with high rainfall, solar panel cleaning is required less than other climates such as hot and dusty conditions. However, we assume an annual cleaning cycle to ensure optimum solar farm performance. The panels will be cleaned with water only, and no chemical products will be used.

Figure 14 – Solar farm cleaning equipment

Landscaping for mitigation and screening will be maintained as per the Landscape and Visual Impact Assessment and Landscape Mitigation Plan submitted with the planning application. This will ensure that the solar farm is appropriately screened from receptors where required. Internally, there will be light landscape maintenance in order to maintain the natural biodiversity of the site. Wildgrass and wildflower meadows will be cultivated and internal hedgerows will be lightly trimmed once a year. Insofar as possible, vegetation will be allowed to grow without interference to ensure that the natural biodiversity of the site is retained or improved from its previous agricultural use. No weed killers or chemicals will be used within the solar farm site under any circumstances.

The grass and vegetation between the rows of panels will be mowed using a small standard agricultural vehicle for such purposes. Mowing will only take place where necessary to allow access between the panel rows and to ensure grass does not grow to a height which may affect electricity generation.

Overall, it is expected that there will be 2 – 4 vehicle visits per month to the solar farm for technical maintenance, cleaning and landscaping purposes. Vehicles used in these visits will be vans or standard agricultural vehicles.

12. Implementation and Monitoring of CEMP

12.1 Roles and Responsibilities

The implementation of the CEMP will be the responsibility of the Site Supervisor / Construction Manager. A management structure to include an organisational chart encompassing all staff with delegated duties for environmental work will be included in the final CEMP. The Site Supervisor / Construction Manager will be supported by a Site Environmental Manager, with contracted expertise from project ecologists and hydrologists, who will visit the site routinely and report to the Site Environmental Manager.

12.2 Environmental Awareness and Training

All staff members will undergo 'environmental induction' prior to commencement of work on site. This will include encompass the following measures:

- Review of Environmental Management Site Plans and discussion of the key environmental risks and constraints, including processes for site risk assessment / reporting.
- An outline of the CEMP structure.
- Review / discussion of any applicable works method statements.
- Review / understanding of roles and responsibilities of staff, including contractors, in relation to environmental management; and
- Understanding / compliance with all environmental incident reporting and management procedures.

During the construction phase, internal communication on environmental matters will be coordinated by the Site Supervisor / Construction Manager to include regular progress meetings, which will cover the following:

- Training undertaken;
- Progress reports;
- Inspections, audits and non-conformance;
- Complaints received;
- Visits by external bodies and the outcome or feedback from such visits; and,
- Objective / target achievement, including reporting on environmental performance.

12.3 Site Inspections and Environmental Auditing

Routine inspections of construction activities will be conducted on a daily and weekly basis by the Site Environmental Manager to ensure all controls to prevent environmental impact, relevant to the construction activities taking place at the time, are in place.

Environmental inspections will ensure that the works are undertaken in compliance with this Construction & Environmental Management Plan and any consent conditions.

Environmental audits will be conducted during the construction phase of the project. In contrast to monitoring and inspection activities, audits are designed to shed light on the underlying causes of non-compliance, and not merely detect the non-compliance itself. In addition, audits are the main means by

which system and performance improvement opportunities may be identified. Environmental audits will be carried out by contractor staff or alternatively by external personnel acting on their behalf. It is important that an impartial and objective approach is adopted. Environmental audits will be conducted at planned intervals to determine whether the CEMP is being properly implemented and maintained. The results of environmental audits will be provided to project management personnel.

12.4 Community Liasion

A site representative will be appointed as a liaison officer with the local community for the duration of the construction phase. This individual will be tasked with information dissemination for the construction phase of the project and will act as the dedicated point of contract on all queries and complaints.

Appendix A: Electrical Infrastructure - Construction Methodology by Drumdowney Solar Farm Limited

Drumdowney Solar Farm Electrical Infrastructure - Construction Methodology

DRUMDOWNEY SOLAR FARM LIMITED

JUNE 2025

Local Authority: Kilkenny County Council

Prepared By	Reviewed By
TERRA SOLAR	H&MV ENGINEERING

1 Contents

List of Figures

Appendices

Revision	Date	Author	Checked	Notes
01	12/05/2025	RH	ND/MMC	Draft Issue
02	16/06/2025	RH	ND/MMC	Issue for Planning

1 Introduction

1.1 Overview

The purpose of this document is to set out the construction techniques and methodologies which will be implemented during the construction of the electrical infrastructure proposed as part of the Drumdowney Solar Farm in County Kilkenny.

A summary of the electrical infrastructure associated with the solar farm is provided below:

Substation and Grid Connection

The substation will be a 110kV GIS electricity substation with 33kV customer compound. The substation will consist of the EirGrid and Independent Power Producers (IPP) control room buildings, a transformer, security fencing, security lighting, drainage infrastructure, temporary construction compound and high voltage electrical equipment. The substation will include a 'loop-in / loop-out' underground 110kV cable grid connection which will connect into the existing 110kV Great Island - Waterford overhead transmission line via 2 no. new Interface Towers.

Underground Cable Electrical Interconnectors

There are 5 no. separate parcels of land within the proposed solar farm. Inverter/transformer stations located in each parcel will be connected to the proposed substation via 33kV underground AC electrical interconnections (hereafter referred to as 33kV UGC Interconnectors). These are to be placed on private lands and within the public road network, with 5 no. separate Interconnectors. The number of ducts and cables, and therefore the trench width, will vary depending on the section of the 33kV UGC Interconnector.

This document is intended as an aid to understand the construction methods and timelines of the project and should be read in conjunction with all other specialist reports pertaining to the project. This document will be updated prior to the commencement of any construction activities by the electrical infrastructure construction contractor. The final Construction Method Statement will be agreed with the Planning Authority in advance of commencement of construction.

1.2 Planning Context

Drumdowney Solar Farm will be subject to a planning application to Kilkenny County Council. The proposed development will consist of ground mounted panels on frames, inverter/transformer stations and all ancillary development works. The solar farm planning application includes the 33kV UGC Interconnectors as described in this report.

The proposed substation, interface towers and grid connection will be subject to a Strategic Infrastructure Development (SID) application to An Bord Pleanála in accordance with section 182A of the Planning and Development Act 2000. For completeness purposes, this infrastructure is considered in this report as well as other technical reports informing the solar farm planning application to Kilkenny County Council.

This report will be updated to reflect the final substation and grid connection details in support of its future SID application to An Bord Pleanála.

1.3 Structure of Report

The structure of the remainder of this report is as follows:

- Section 2: provides a description of the proposed electrical infrastructure works;
- Section 3: provides information on the preliminary site investigations to be undertaken;
- Section 4: provides details of the substation construction methodology;
- Section 5: provides details of the grid connection construction methodology;
- Section 6: provides details of the underground cable construction methodologies for 33kV Interconnectors;
- Section 7: provides details on the Emergency Response Plan;
- Section 8: provides information on relevant best practice design and construction mitigation; and
- Section 9: provides a summary of the report.

2 Description of Proposed Electrical Infrastructure

2.1 Substation

As described previously, the substation will be subject to a SID application to An Bord Pleanála. The substation will be based on EirGrid design specifications. The substation compound will consist of a two storey GIS substation building, IPP Control Room building, High Voltage (HV) electrical equipment and associated infrastructure including palisade fences and concrete post and rail fences. The installation of HV electrical equipment will include a transformer with associated equipment along with:

- Lightning Masts (LM);
- Back-Up Diesel Generator;
- Harmonic filters if required by EirGrid;
- Capacitor Bank if required by EirGrid;
- Fire/Blast Wall;
- Telecoms Pole;
- 110kV underground cable which will connect into the existing 110kV Great Island to Waterford overhead line via 2 no. new Interface Towers.

The substation compound has a total area of 5,335m^2. Earthworks will be undergone so the compound is level. Figure 1 shows the layout of the substation and all associated works.

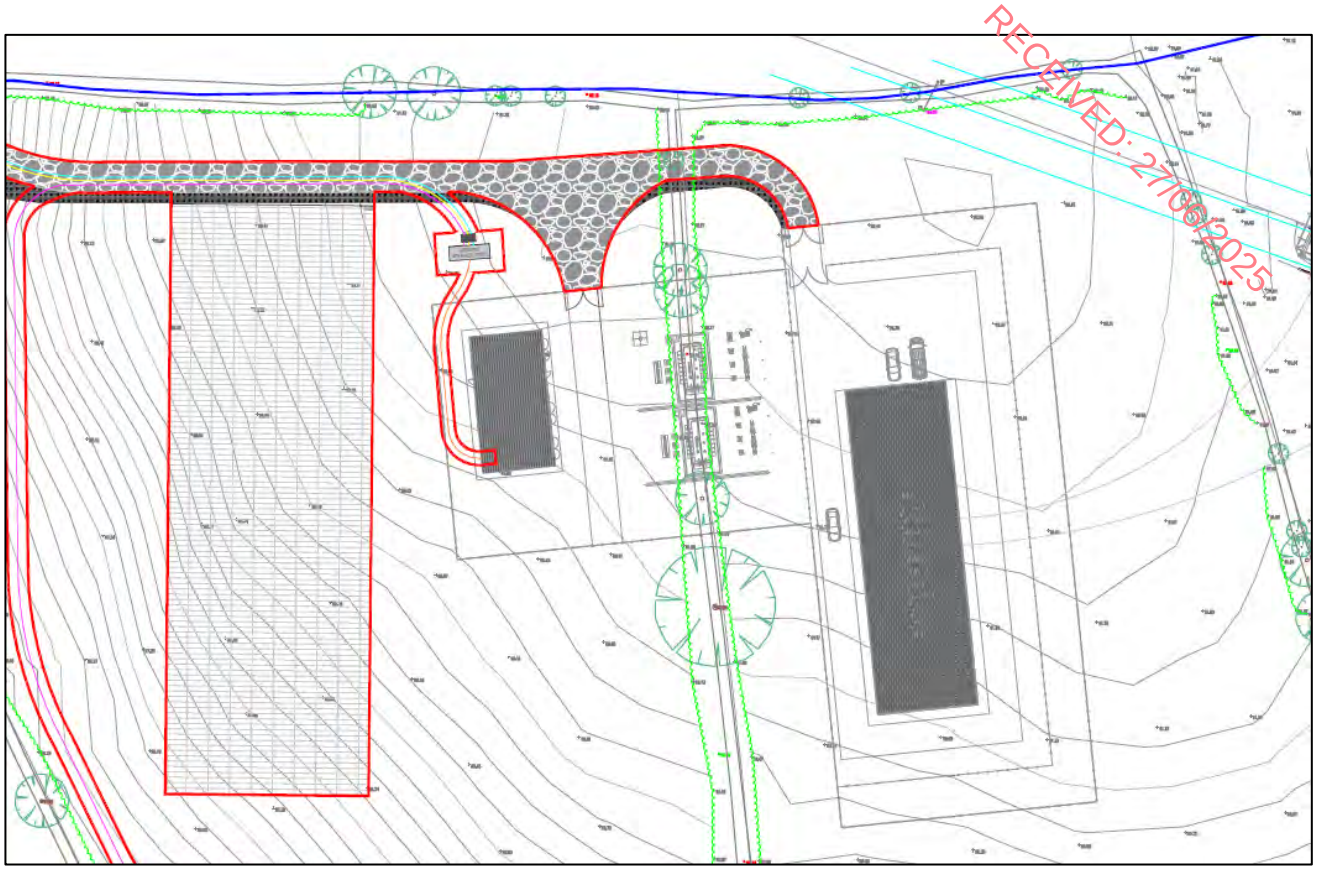


Figure 1: Proposed 110kV GIS Substation

2.2 Grid Connection

The substation will connect into the national grid via a 'loop-in / loop-out' underground 110kV cables grid connection which will connect into the existing 110kV Great Island to Waterford overhead line. Two new interface towers are required to achieve this. The interface towers are approximately 15 metres apart, therefore the similar length of the existing 110kV Great Island to Waterford overhead line will need to be decommissioned. The proposed substation will connect into each interface tower via an underground 110kV cable. This cable is comprised of 3 no. power ducts, 2 no. telecom ducts and 1 no. earth continuity duct. The cables to each interface tower are 68 and 83 metres in length.

2.3 33kV UGC Interconnectors

The 33kV Interconnector cables are required to transport the electricity generated at each land parcel to the proposed substation. The Interconnectors link electricity from each of the inverter/transformer stations to the substation. The locations of the inverter/transformer stations are detailed on the planning application site layout drawings. The inverter/transformer stations convert the direct current (DC) electricity which is generated by the solar panels to alternating current (AC) which is used in the electrical grid, and outputs at a voltage of 33kV which is appropriate for carrying the produced

electricity across the site. The Interconnectors will also connect into Ring Main Units (RMU) which are located next to selected inverter/transformer stations. An RMU is a type of medium voltage (MV) switchgear which will allow for greater circuit control. The 33kV UGC Interconnectors will be located within the solar farm access tracks, within private land lands and within the public road network.

An image of the separate land parcels and the 33kV Interconnector route can be seen below.

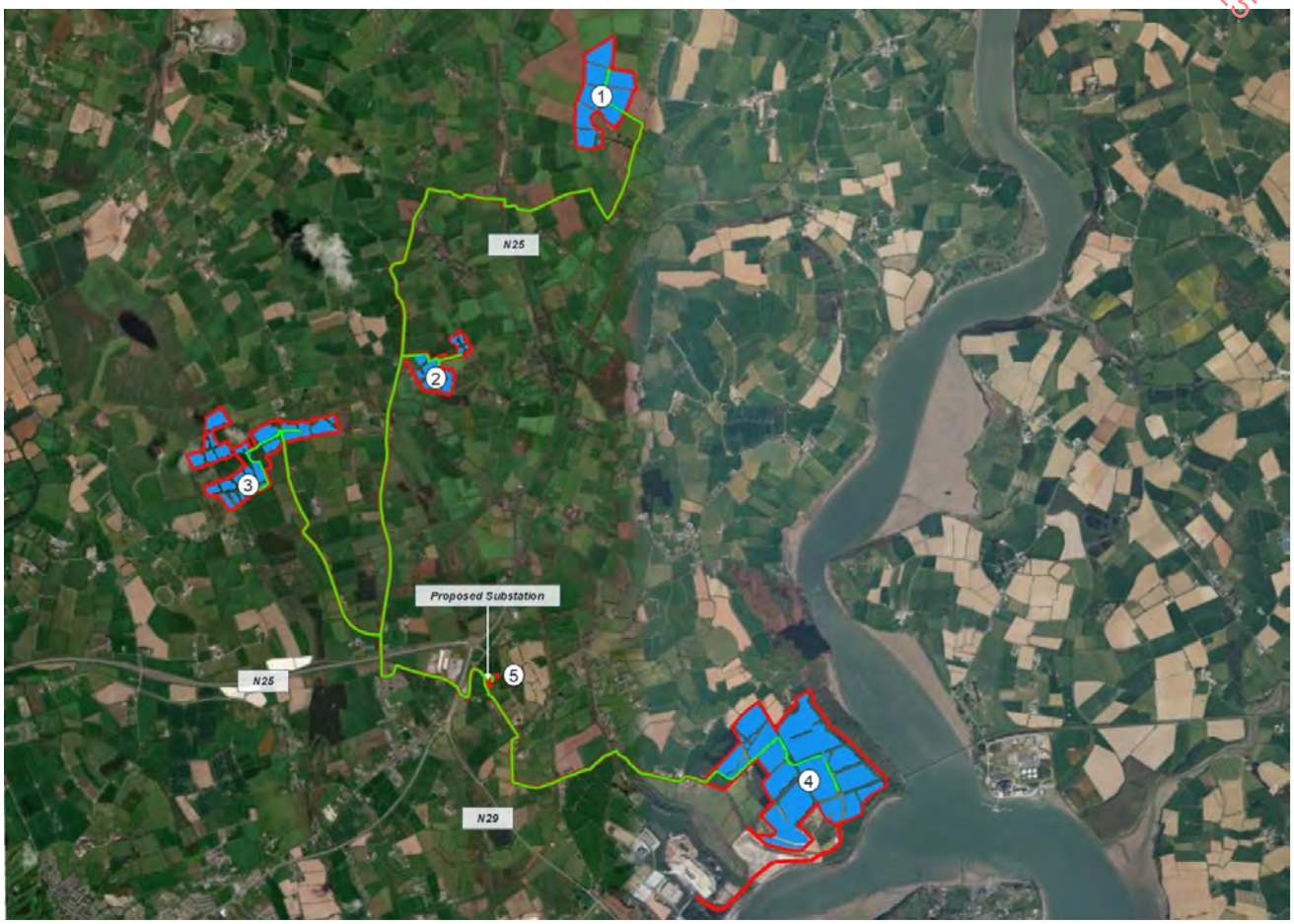


Figure 2: Solar Farm Layout and Parcel Locations

Interconnector 1: Cable from Parcel 1 to Parcel 2

Interconnector 1 will transport the electricity generated from Parcel 1 to an inverter/transformer station in Parcel 2. Interconnector 1 is a proposed single circuit arrangement. The route begins in Parcel 1 where 1.14km of cabling is proposed within private solar farm lands. Interconnector 1 will then enter the public road onto the L3429, travelling for 323m before turning north onto the L7523. A Horizontal Direction Drill (HDD) will then be used to cross underneath the N25. Interconnector 1 will then travel along the L7563. A transmission gas pipeline transverses this road and based on drawings provided by Gas Network an overcrossing is feasible in the location. Following this crossing the cable will continue along the L7563 before turning onto the L7469, where it will travel for 1.65km before entering

Parcel 2. The cable will run within the access tracks of Parcel 2 for 399m before entering the nearest inverter/transformer station.

Figure 3: Interconnector 1 Route

A summary of the route for Interconnector 1 is detailed in the following table;

Location of Interconnector	Interconnector Length (m)
Public Roads	3687
Privately Owned Solar Farm Lands	1546

Interconnector 2: Cable from Parcel 2 to Cable Interface Chamber in Parcel 5

The electricity generated from Parcel 1 and Parcel 2 will be transported to the cable interface chamber adjacent to the proposed 110kV substation, located on Parcel 5 via Interconnector 2. The cable interface chamber which is an underground chamber installed outside the IPP compound entrance of the substation to act as the common interface point for the 33kV interconnector cables coming from the solar farm inverter/transformer stations going into the substation. The solar farm contractor will be typically responsible for routing all the interconnector cables into this chamber and then the separate substation contractor will manage the short connection of the 33kV cables from this chamber into the switchgear housed in the IPP control building.

Interconnector 2 is a proposed single circuit arrangement. The route begins at an inverter/transformer station within the solar farm boundary in Parcel 2 where the Interconnector will travel for 625m within the solar farm access tracks. Of this, 397m will be adjacent to the single circuit Interconnector 1. As such this trench section will accommodate two circuits. The Interconnector will then enter the public road L7469 and travel for 2.5km. A HDD will then be used to cross a bridge and the N25, the HDD is approximately 180m in length. Following this, the Interconnector will continue on the L3407 for 823m. A second HDD will then be used to cross underneath the N29, starting on the L3407 and emerging on the L3414. The Interconnector will then turn north onto the L34144 before entering private lands at Parcel 5. The cable will then travel for 175m before entering the cable interface chamber, located next to the proposed 110kV substation.

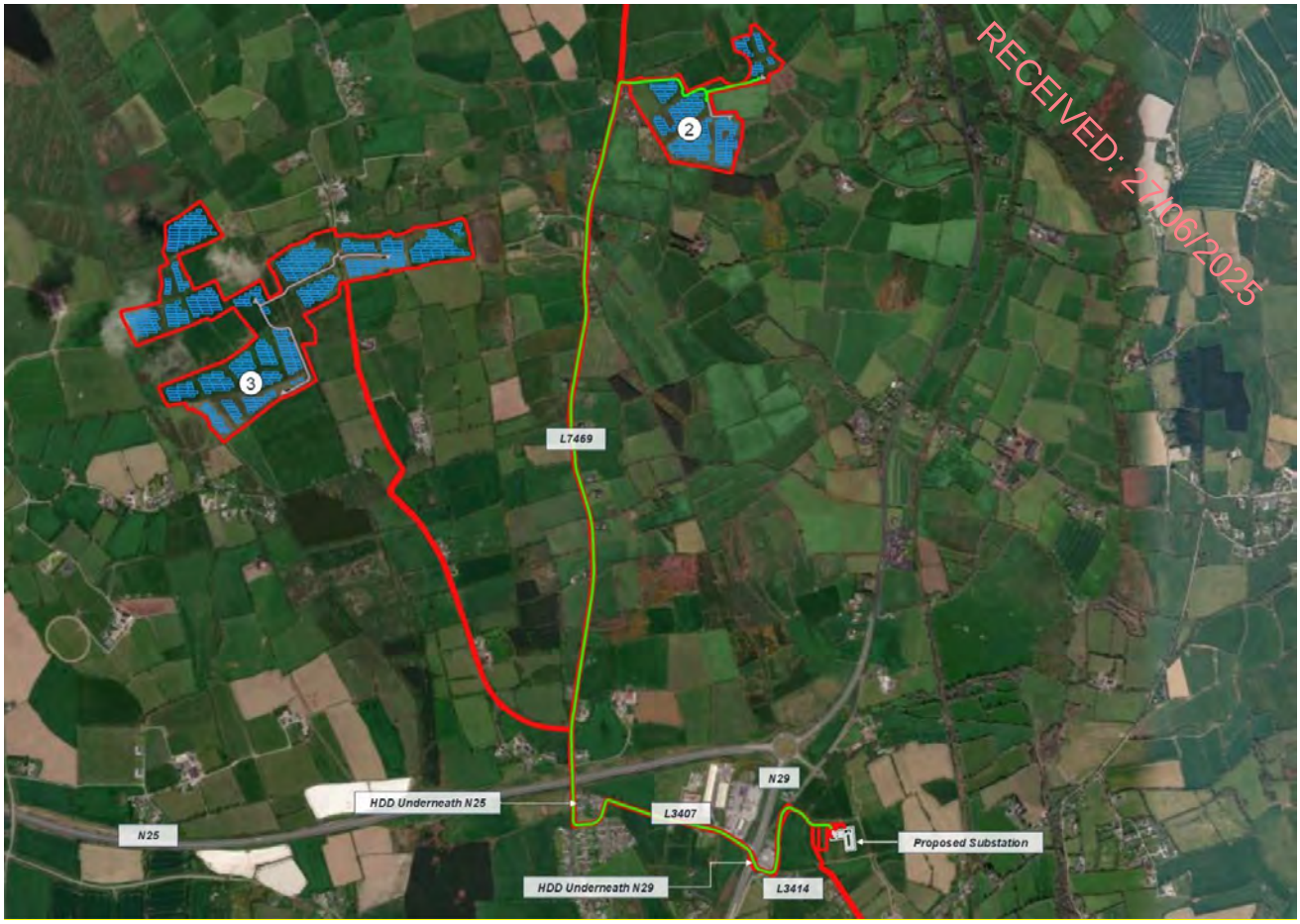


Figure 4: Interconnector 2 Route

A summary of the route for Interconnector 2 is detailed in the following table;

Location of Interconnector	Interconnector Length (m)
Public Roads	3874
Privately Owned Solar Farm Lands	800

Interconnector 3: Cable from Parcel 3 to Cable Interface Chamber in Parcel 5

Interconnector 3 will transport the electricity generated from Parcel 3 to the cable interface chamber adjacent to the proposed 110kV substation, located on Parcel 5. Interconnector 3 is a proposed single circuit arrangement. The route begins at an inverter/transformer station in Parcel 3. The Interconnector will be located within the proposed access tracks of Parcel 3 for 979m before entering the public road L7466. The cable will follow this road and continue onto the L3406. A shared HDD with Interconnector 2 will then be used to cross a bridge and the N25, the HDD is approximately 180m in length. Following this, the Interconnector will continue on the L3407 for 823m. A second shared HDD will then be used to cross underneath the N29, starting on the L3407 and emerging on the L3414. The Interconnector will then turn north onto the L34144 before entering private lands at Parcel 5. The cable will then travel

for 175m before entering the cable interface chamber, located next to the proposed 110kV substation. Interconnector 3 will run alongside Interconnector 2 for 1.45km so a double circuit trench will be needed to accommodate this.

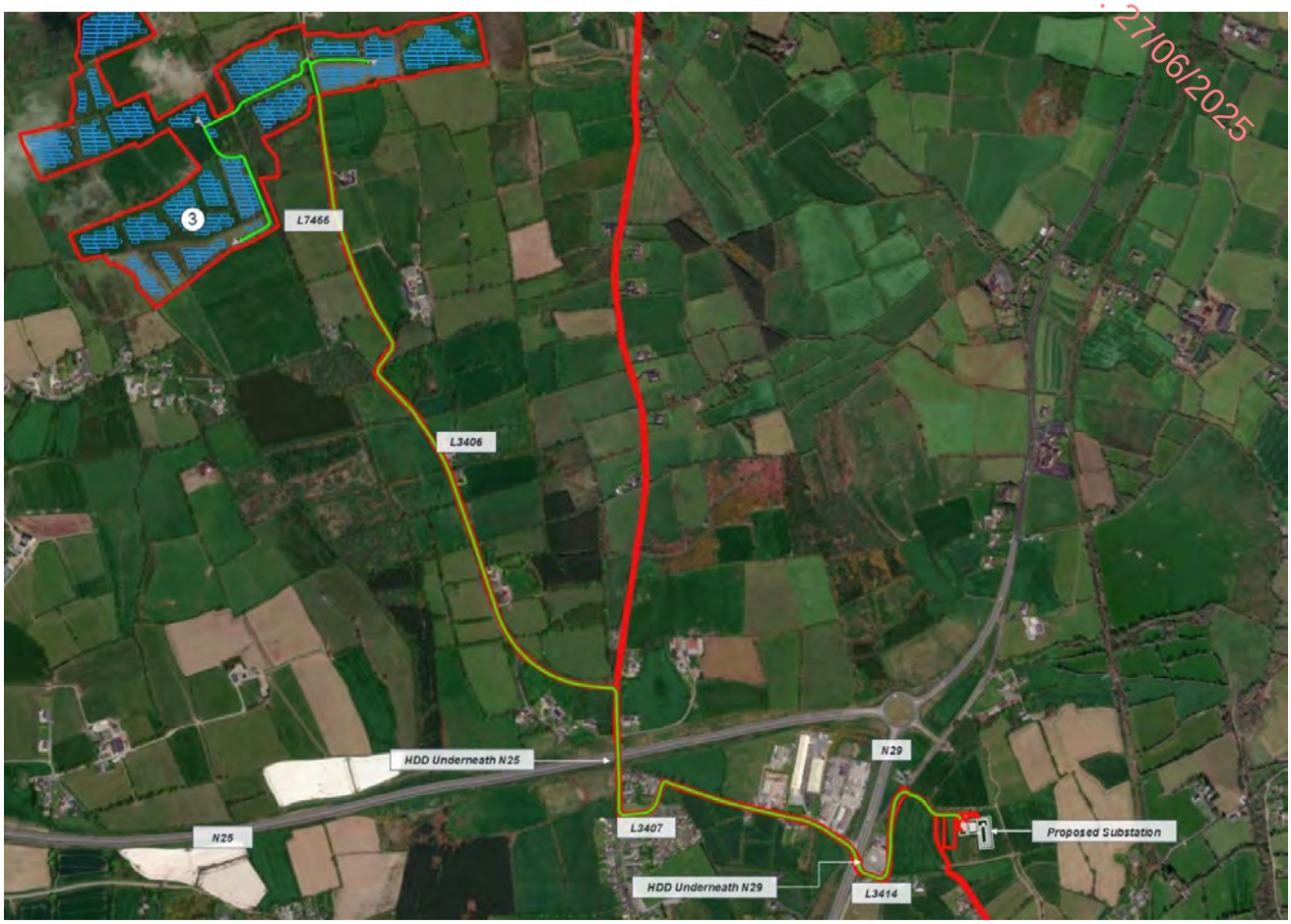


Figure 5: Interconnector 3 Route

A summary of the route for the Interconnector 3 is detailed in the following table;

Location of Interconnector	Interconnector Length (m)
Public Roads	3544
Privately Owned Solar Farm Lands	1154

Interconnector 4: Cable from Parcel 4 to Cable Interface Chamber in Parcel 5

The electricity generated from Parcel 4 will be transported to the cable interface chamber adjacent to the proposed 110kV substation, located on Parcel 5 via Interconnector 4.

Interconnector 4 is a proposed three circuit arrangement. The route begins at an inverter/transformer station within the solar farm boundary in Parcel 4 where the Interconnector will travel for 1.68km within the access tracks. The Interconnector will then turn north-west onto the L7483, entering the public

road. A transmission gas pipeline transverses this road and based on drawings provided by Gas Network an overcrossing is feasible in the location. Following this, a HDD will then be used to cross a bridge and watercourse between the L7483 and L3415. The HDD is approximately 78m in length. Following this, the Interconnector will continue on the L3415 before turning north onto the L3414. The Interconnector will continue along this road before entering private lands. The Interconnector will travel within grasslands as for 234m before entering the cable interface chamber, located next to the proposed 110kV substation

Figure 6: Interconnector 4 Route

A summary of the route for the Interconnector 4 is detailed in the following table;

Location of Interconnector	Interconnector Length (m)
Public Roads	2593
Privately Owned Solar Farm Lands	1914

Interconnector 5: Cable Interface Chamber to IPP Building

Interconnector 5 will transport all the electricity generated within the solar farm into the IPP building within the proposed 110kV substation. The route is entirely within privately owned solar farm lands. Interconnector 5 is a proposed 5 circuit arrangement. The route is 33m in length.

Figure 7: Interconnector 5 Route

A summary of the route for the Interconnector 5 is detailed in the following table;

Location of Interconnector	Interconnector Length (m)
Privately Owned Solar Farm Lands	33

3 Site Investigations

3.1 Substation & Grid Connection

Site Investigations will be required for the detailed design of foundations and compound build-ups prior to construction and to inform project costs prior to detailed design.

The site investigation works will be scoped and specified by a geotechnical engineer during detailed design but will generally include the following:

- Boreholes: will be carried out at the location of GIS and IPP Buildings to determine the depth of bedrock.
- Trial holes: will be carried out in order to obtain information on the ground conditions and measure the thermal resistivity of the soil.
- Dynamic probes: will be carried out to determine soil strength/density characteristics.
- Dynamic Cone Penetrometers and Pavement Cores: will be carried out for pavement design.

It is anticipated that these site investigation works will take approximately 2-3 weeks to complete.

3.2 33kV UGC Interconnectors

Site Investigations will be required to confirm cable design assumptions made on the 33kV UGC Interconnectors prior to construction. The exact location of services will also be determined at this stage.

The following works generally comprise preliminary site investigations:

- Boreholes: will be carried out on either side of each HDD location to confirm ground conditions;
- Slit trenches: will be carried out at the location of service crossing based on the desktop utility search. The slit trench will cover the full road width; and
- Trial holes: will be carried out at the Joint Bay locations once they are determined the electrical contractor, in order to obtain information on the ground conditions and measure the thermal resistivity of the soil.

These preliminary site investigations will take place in advance of construction.

Traffic Management will be required on the public road to undertake these site investigation works. These are described in the Site Access and Drainage Report submitted with the planning application to Kilkenny County Council.

Where temporary road closures are necessary, a suitable diversion will be implemented using appropriate signage, following consultation and agreement with Kilkenny County Council.

All excavations in the road will be carried out in a manner that avoids undue damage or would inhibit the laying of other known or earmarked future services and will be undertaker, and supervised by properly qualified personnel meeting the training and competency requirements contained within the DTTAS Purple Book.

All works will be subject to a road opening licence from Kilkenny County Council. Where diversions are required, these will be agreed with Kilkenny County Council in advance of the preparation of the Traffic Management Plan.

It is anticipated that these preliminary site works associated with 33kV the UGC Interconnectors will take approximately 5-8 weeks to complete.

4 Substation Construction Methodology

4.1 Substation Compound

The proposed substation compound area is approximately 5,335m^2 including the surrounding fence. The substation area will be secured by a 2.6m high palisade fence. The construction sequence will be as follows;

- Any mitigation measures or conditions of the planning permission will be implemented.
- An Assigned Certifier will be appointed in accordance with Building Control Regulations.
- The AF2 Commencement Notice will be submitted upon completion of a comprehensive Preliminary Safety and Health Plan (PSHP) by the PSDP. This Health and Safety Plan will be built up from the Preliminary Plan;
- A temporary construction compound with appropriate mobile sanitary facilities will be set up to facilitate the construction process. The location of this temporary construction compound is shown in on the site location drawings, with further details shown in drawing DRMDY-SD-DR-07 submitted with this planning application. Sanitary facilities will be pumped to a holding tank which will be monitored and disposed off-site by a suitably licensed waste contractor;
- The extents of substation compound and drainage will be marked out by a qualified engineer.
- Earthworks will be undertaken in order to create a level compound level across the entire substation footprint. The cut material is unlikely to be suitable for reuse as fill under EirGrid standards and therefore it will be transported off site to a suitably licensed facility.
- A drainage system will be excavated and installed around the compound area.
- Topsoil and subsoil will be removed from the footprint of the compound using an excavator.
- A layer of geotextile material will be laid over the footprint of the compound.
- Using an excavator, a base layer of Clause 804 material will be laid followed by a 6F2 capping layer which will provide the finished surface.
- Each layer will be compacted using a vibrating roller.
- Earthing cable will be laid underground around the substation for connection to the various electrical components during the electrical fit out phase.
- The construction of the substation compound comprising of two- storey GIS substation building, IPP Control building and all associated outdoor electrical equipment, including 1 no. transformer, associated internal access track, 2.6m high station perimeter fencing and concrete post and rail property boundary fence will be built.
- The construction of the substation control building will begin by setting out the foundations. The building foundations will consist of reinforced concrete rafts or footings. Pre-formed works will be constructed to the specifications of the detailed design. The concrete will be mixed off

site and transported in on cement trucks where the foundations will be poured in-situ in the preformed works.

- Adequate lighting will be installed around the compound on the lighting columns.
- Lightning protection masts will be installed to protect the station from direct lightning strike.
- An underground cable chamber will be installed outside the IPP compound entrance to act as the common interface point for the 33kV interconnector cables coming from the solar farm inverter/transformer stations going into the substation. The solar farm contractor will be typically responsible for routing all the interconnector cables into this chamber and then the separate substation contractor will manage the short connection of the 33kV cables from this chamber into the switchgear housed in the IPP control building.

Following the completion of construction works, the electrical infrastructure can be installed. The following electrical installation works will take place.

- Delivery and installation of transformer. The delivery of the transformer will be managed in accordance with regulations governing the movement of abnormal loads. In advance of undertaking abnormal load deliveries necessary permitting, approvals and infrastructure accommodation works will be agreed with An Garda Síochána and implemented accordingly. Delivery vehicles will only follow agreed routes and where possible will be delivered overnight to minimise potential for delay and obstruction to general traffic.
- Delivery and installation of all other HV equipment.
- Wiring and cabling of HV/LV equipment, protection and control cabinets.
- Commissioning of all newly installed equipment.

The following equipment is required for the construction of the substation compound:

- Tracked Excavators;
- 360˚ tracked excavators (13 ton normally, 22 ton for rock breaker);
- Tracked dumpers / tractors and trailers;
- Vibrating rollers;
- Power Tools;
- Scaffolding;
- Crane;
- Hoist; and
- Generator.

4.2 Access Track

Construction access to the substation will be provided by private lands, with an entrance from the public road L34142. A traffic management plan will be implemented for the delivery of the transformer. This access track will be permanent and will also be used for operational access.

4.3 Drainage

4.3.1 Surface Water

Surface water drainage proposals for the proposed substation compound have been designed to mimic the natural drainage patterns of the site and thereby be in accordance with the Best Management Practices (BMPs) of Sustainable Drainage Systems (SuDS).

This is achieved when the following parameters are considered:

- The compound construction is formed with permeable stone thus mimicking a soakaway scenario. ESB compound stone is single sized for the first 150mm for safety purposes. It then changes to a graded 6F2 material.
- The main areas to be drained includes the roofs and the compound road. These equate to approximately 2301m². The compound road will be drained via series of road gullies.
- Assuming even the most basic of infiltration rates down through the permeable compound stone, the existing greenfield situation is easily maintained.

The surface water generated in the hardstanding areas and in the bunded areas within the substation compound will discharge to soakaway via Class 1 Full Retention Oil Separators. The electrical transformer in the substation is oil filled equipment and, as such, is protected with impermeable bunds. Surface water generated in this bund will be pumped out by an oil sensitive pump ensuring that only non-contaminated water enters the site drainage network.

4.3.2 Foul Water

There are no existing foul sewer water drains on or near the proposed substation site.

The foul drainage proposal must cater for the wastewater generated in the welfare facilities of the proposed substation. These welfare facilities include a toilet and wash hand basin in the IPP control building. The station will be unmanned in normal operation so demand for facilities which generate foul flows will be low.

Onsite treatment and disposal of foul waste was considered by using a suitable septic tank and intermittent filter system and polishing unit or packaged wastewater treatment system and polishing unit. This option would be subject to the results of the site characteristic testing as part of detailed pre-

construction site investigations. However, the low volumes of foul waste that will be generated and consequently the low biological loading may impact on the successful continual operation of a treatment system reliant on bacterial action. For this reason, the alternative of a foul holding tank to be emptied periodically is proposed. Foul holding tanks are normally used in EirGrid and ESB substations.

The foul holding tanks will have a capacity of 5m^3 which is a multiple of the foul water generated over three months of normal operation of the station. The foul holding tank will also be inspected by a suitably qualified and indemnified person at these intervals and records of inspections will be held on site for inspection by the local authority. A freeboard of 300mm will be provided for and the foul holding tank will be fitted with a high-level alarm. This alarm will be connected to a manned control station via the substation's Supervisory Control and Data Acquisition (SCADA) telecom relay system. This will allow for non-scheduled maintenance and emptying of the tank between the regular three monthly intervals in the unlikely event that this is required. The foul holding tank will also be vented to the atmosphere to avoid the buildup of noxious and dangerous gases.

The proposed station will be unmanned and as such will generate small quantities of foul waste. There will be visits to the station for scheduled and unscheduled inspections, maintenance and repairs as necessary. It is anticipated that this will result in a contribution of 60 litres of foul waste per week. In the unlikely event that such a high visitation rate would be extrapolated throughout the year, this would result in 6,323 litres per annum. While such a consistently high visitation is improbable, there is the possibility of increased numbers of staff being present on site for short durations during the commissioning of electrical elements of the station from time to time. It is envisaged that these extraordinary occurrences would balance out with the ordinary operation of the unmanned station to produce foul flows no greater than the 6,323 litres per annum as a "worst-case" scenario.

It is common for much lower usage of the facilities on unmanned stations and therefore a much lower foul loading. A common problem on such unmanned stations is odours in the toilet areas due to the drying out of the water trap in the WC through evaporation resulting from the lack of use. For this reason, it is proposed to use self-flushing toilets in the station, which would flush automatically twice a week. The station will include two 6 litre flush WCs so a minimum weekly foul flow of 24 litres can be expected. The self-flushing WCs will therefore contribute 1,248 litres per annum.

Combining the automatic flush and maximum user demand figures would result in a maximum annual generation of 7,571 litres (7.5m^3) of foul sewer water waste. The 5m^3 tank proposed will be emptied approximately every three months. As outlined, the capacity provided is well in excess of what is required.

4.4 Water Supply

It is proposed to provide the required potable water demand of the station with a bored well on site. The potable water demand within the site will be low as the proposed station is to be unmanned. To avoid issues like stagnation in the water supply line and problems resulting from this, there will be a continual water demand of 24 litres per week from automatically flushing WCs within the station.

The water demand within the proposed development will be low and will be similar to the figures for foul sewer water generation as set out above in this report.

5 Grid Connection Construction Methodology

5.1 110kV Underground Grid Connection Cables

A 'loop-in / loop-out' underground 110kV cable grid connection will be constructed which will connect the substation into the existing 110kV Great Island - Waterford overhead line via 2 no. new Interface Towers.

The 110kV cable grid connection will consist of two underground cables which will run from each of the Interface Towers into the EirGrid Compound of the substation. The cables will be approximately 68m and 83m in length and will be situated in private lands within the confines of the substation site. A typical trench for a 110kV cable is 825mm wide and 1315mm, consisting of 3 no. 160mm HDPE ducts in trefoil formation. The construction of the underground grid connection will use the same approach as for the 33kV interconnector cables which is set out in Section 6.2. See Figure 8 below for details of the single circuit 110kV underground cable trench.

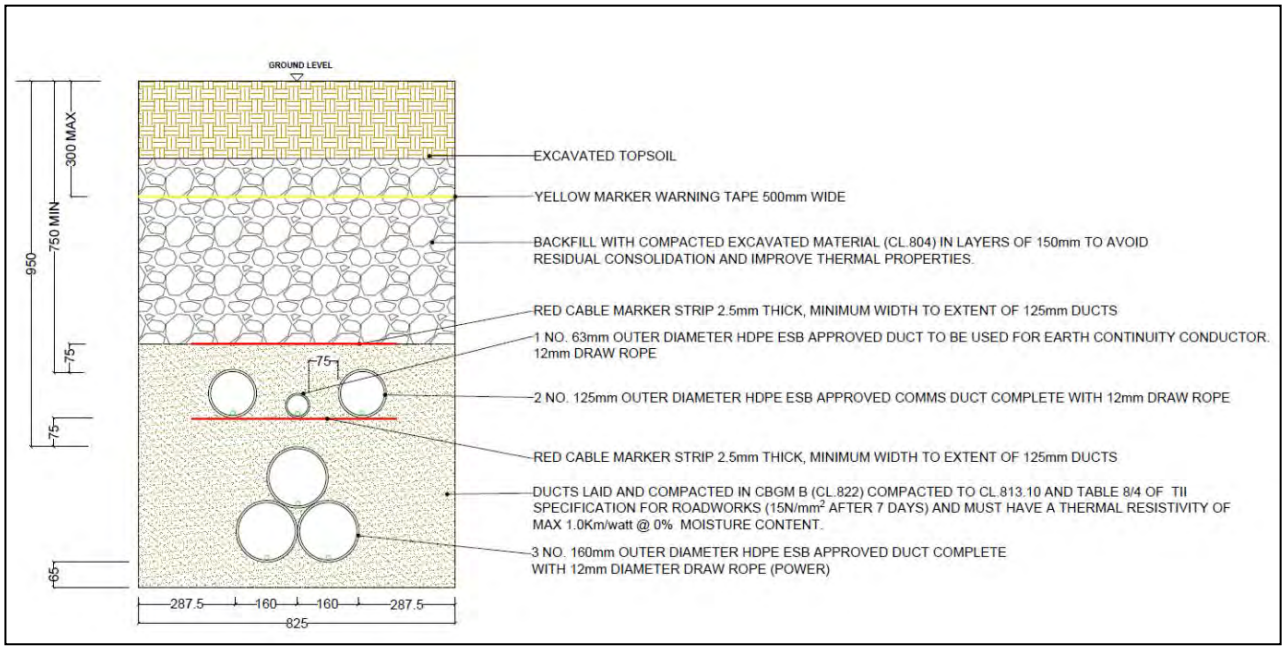


Figure 8: Typical 110kV Underground Cable

5.2 Interface Towers Construction Methodology

The Interface towers will be 16 meters in height and approximately 5.75 metres in width. The construction of the Interface Towers will be as follows;

- Site levelling and clearance works;
- The foundation of the interface tower will be set out;
- The ground will be excavated to the foundation footprint;
- If required, any water will be drained from the excavated area;
- Concrete will be poured in the excavated area to create the foundation for the interface tower. If concrete cannot be poured directly into the excavation, the concrete will either be pumped or transported via dumpers;
- The foundations will be backfilled with the excavated material and compacted;
- The existing OHL will be de-energised by Systems Operator so the body of the towers can be constructed;
- The conductor will be moved off centre using stay wire that is anchored to the ground;
- The body of the tower will be erected via crane using guide ropes;
- The sections of the tower body will be bolted and fixed into position;
- The conductor will be centred over the newly built towers and attached onto each tower. The section of conductor in between the two towers will be removed along with the existing 110kV portal wood pole set which is located between the two proposed interface towers
- Down dropper conductors (For Electrical Connections, Insulators, Surge arrestors) and shackles will be installed;
- All associated accessories required for transition from line to cable will be installed on the interface towers;
- The circuit will be tested and the line will be re-energised.

A typical design for the proposed interface tower is shown in Figure 9.

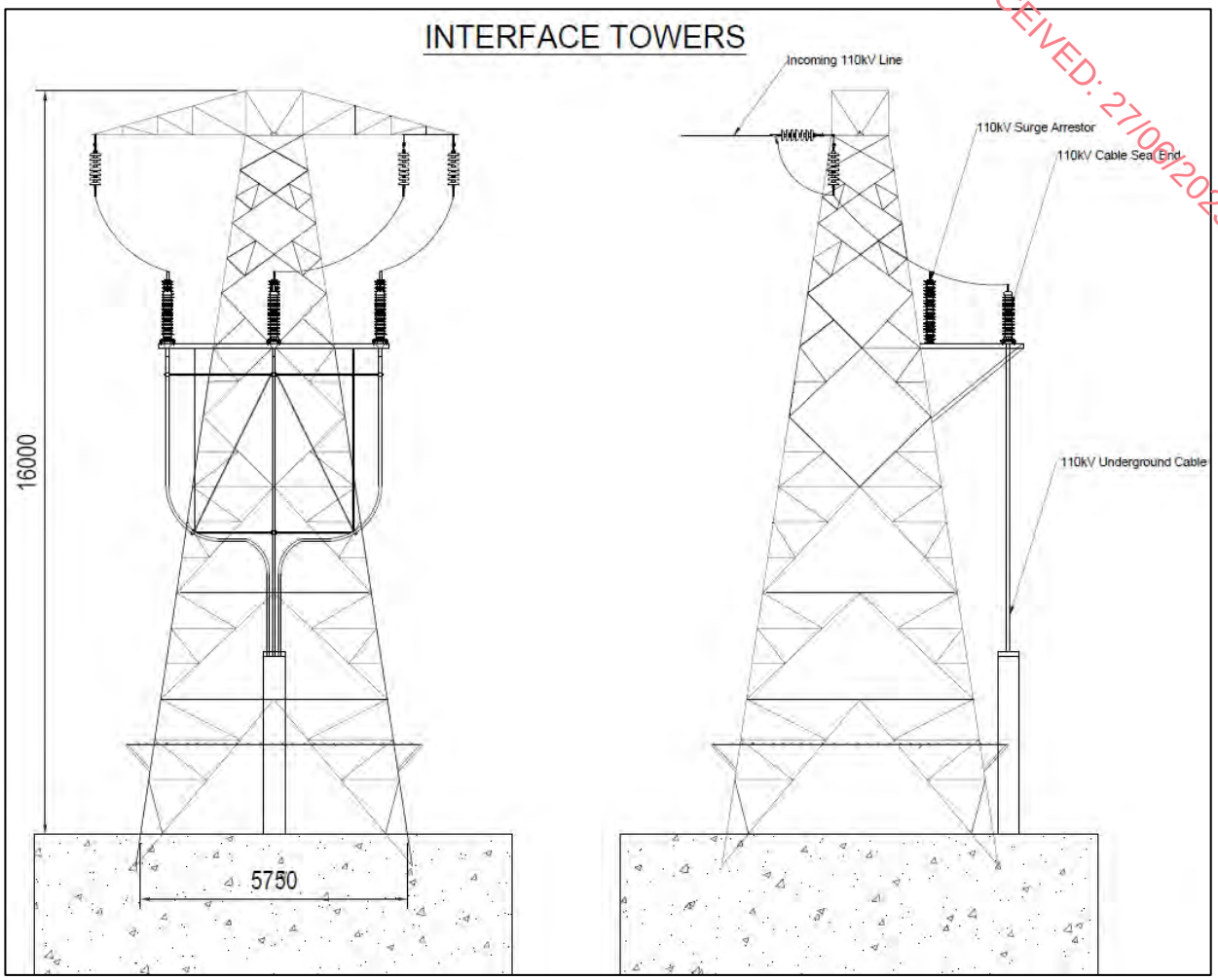


Figure 9: Typical Interface Tower

The expected duration of the above works is approximately 4 weeks. The erection of the Interface Towers is expected to take 5 days per tower. De-energisation of the existing OHL will be coordinated with the System Operator pending detailed design.

6 33kV UGC Interconnectors

6.1 33kV UGC Interconnectors Design Characteristics

6.1.1 Public Road

The proposed single circuit trench within the public road is planned to consist of 3 no. 110mm diameter HDPE power cable ducts in trefoil formation and is associated with Interconnector 1, Interconnector 2 and Interconnector 3. Ducts are also included in the trench to contain earthing and communications cabling.

The cable trench is typically 450mm wide by 1220mm deep, with variations on this design to adapt to service crossings and watercourse crossings. The power cable ducts will accommodate 3 no. power cables each. See Figure 10 below for details of the single circuit trench in the public road. This trench will be present in the L3429, L7523, L7536, L7469, L7466 and L3406. Full details of the single circuit trench section in the public road can be found on drawing DRMDY-ED-DR-01 submitted with this planning application.

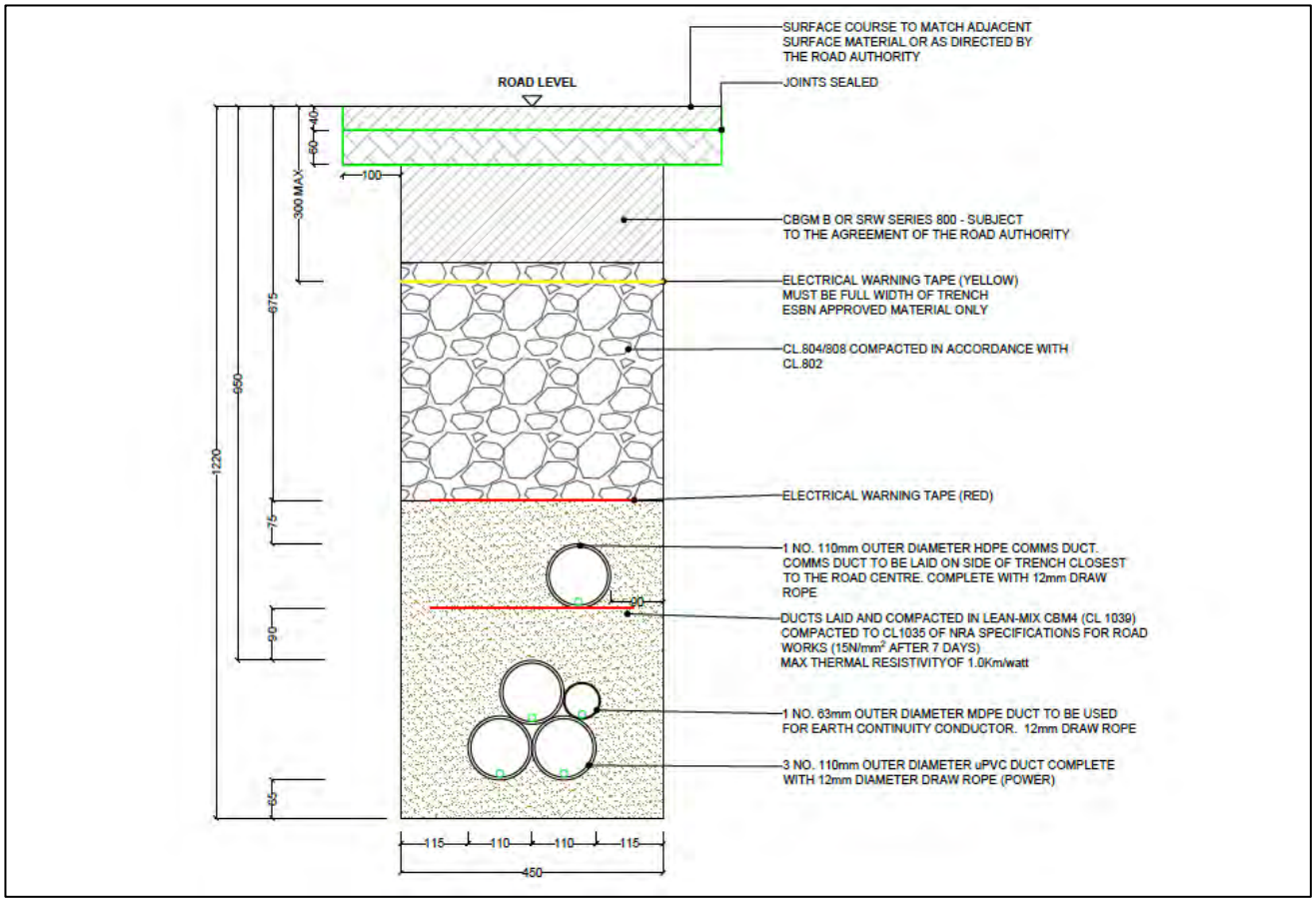


Figure 10: Single Circuit Trench Detail in Public Road

The proposed double circuit trench within the public road is planned to consist of 6 no. 110mm diameter HDPE power cable ducts in trefoil formation and is associated with Interconnector 2 and 3 as they run alongside one another.

The cable trench is typically 740mm wide by 1220mm deep, with variations on this design to adapt to service crossings and watercourse crossings. The installation of the electrical cabling will require cables to be pulled in approximately 600 - 700m sections. See Figure 11 below for details of the double circuit trench in the public road. This trench will be present in the L3406, L3407, L3414 and L34144. Full details of the double circuit trench section in the public road can be found on drawing DRMDY-ED-DR-04 submitted with this planning application.

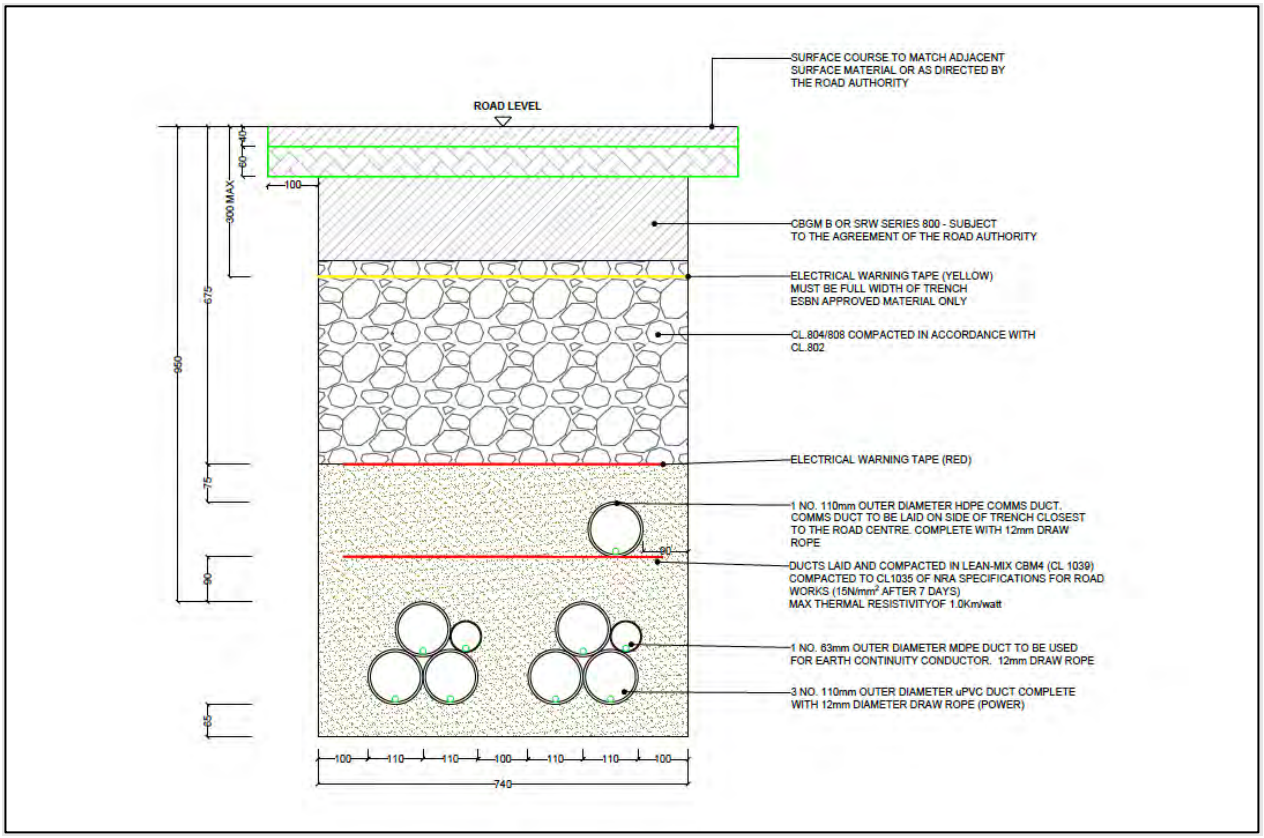


Figure 11: Double Circuit Trench Detail in the Public Road

The proposed three circuit trench within the public road is planned to consist of 9 no. 110mm diameter HDPE power cable ducts in trefoil formation and is present for Interconnector 4. Ducts are also included in the trench to contain earthing and communications cabling.

The cable trench is typically 1060mm wide by 1220mm deep, with variations on this design to adapt to service crossings and watercourse crossings. The power cable ducts will accommodate 1 no. power cables each. See Figure 12 below for details of the three-circuit trench in the public road. This trench will be present in the L7483, L3415 and L3414 public roads. Full details of the three-circuit trench

section in the public road can be found on drawing DRMDY-ED-DR-06 submitted with this planning application.

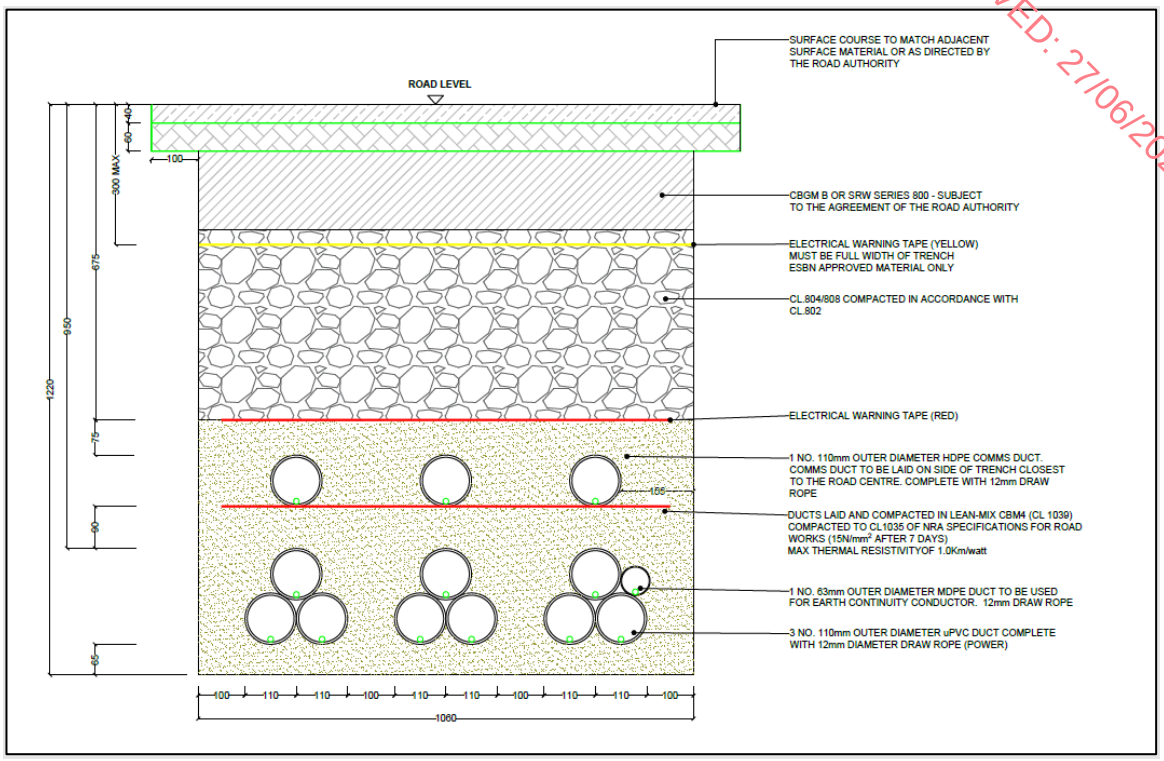


Figure 12: Three-Circuit Trench Detail in Public Road

6.1.2 Private Lands

The single circuit cable will also be located within the access tracks of Parcel 1, 2 and 3 for Interconnector 1, Interconnector 2 and Interconnector 3.

The single circuit within the access track will consist of a cable trench 420mm wide and 1220mm deep. See Figure 13 below for details of the single circuit trench within the access tracks. Full details of the single circuit trench section within the access tracks can be found on drawing DRMDY-ED-DR-02 submitted with this planning application.

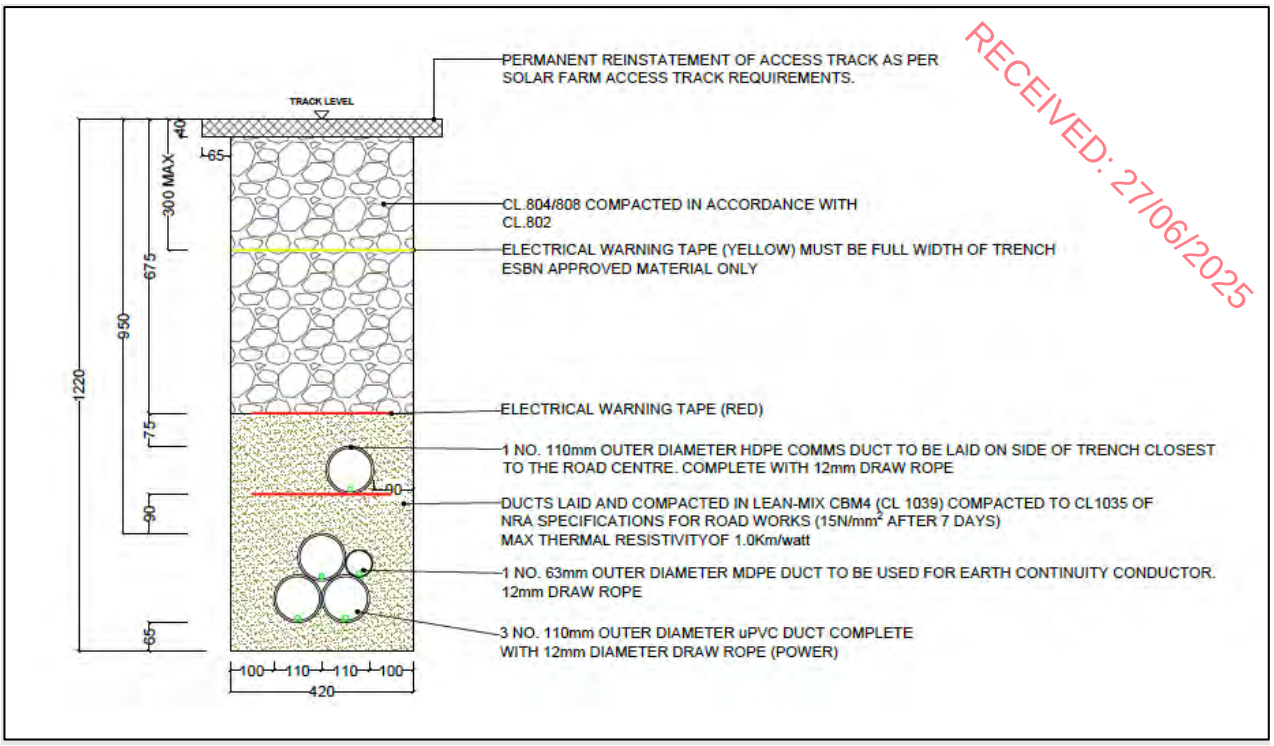


Figure 13: Single Circuit within Access Tracks

A double circuit arrangement will be required within the access track in Parcel 2 and Parcel 3 for Interconnector 2 and Interconnector 3. This will consist of a cable trench 740mm wide and 1220mm deep. See Figure 14 for details of the double circuit trench. Full details of the double circuit trench section within the access tracks can be found on drawing DRMDY-ED-DR-05 submitted with this planning application.

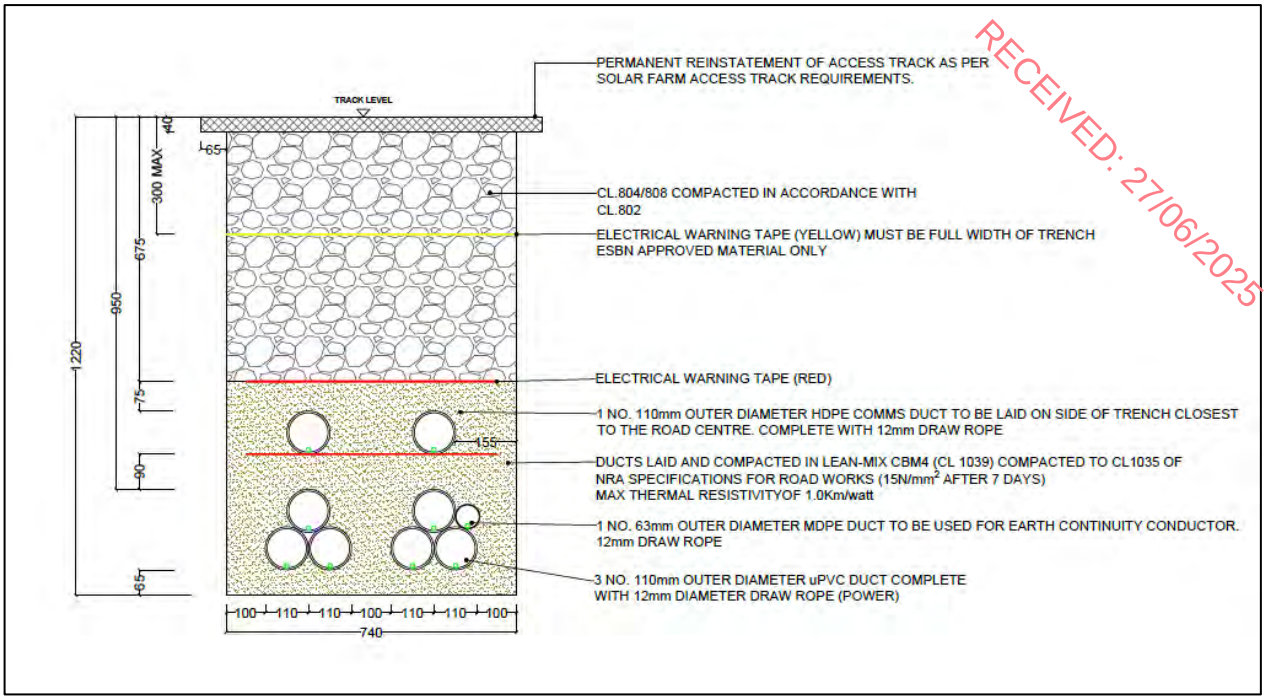


Figure 14: Double Circuit Trench within Access Tracks

A three-circuit arrangement will be required within the access track in Parcel 2 and Parcel 4. This will consist of a cable trench 1060mm wide and 1220mm deep. See Figure 15 for details of the three-circuit trench. Full details of the three-circuit trench section within the access tracks can be found on drawing DRMDY-ED-DR-07 submitted with this planning application.

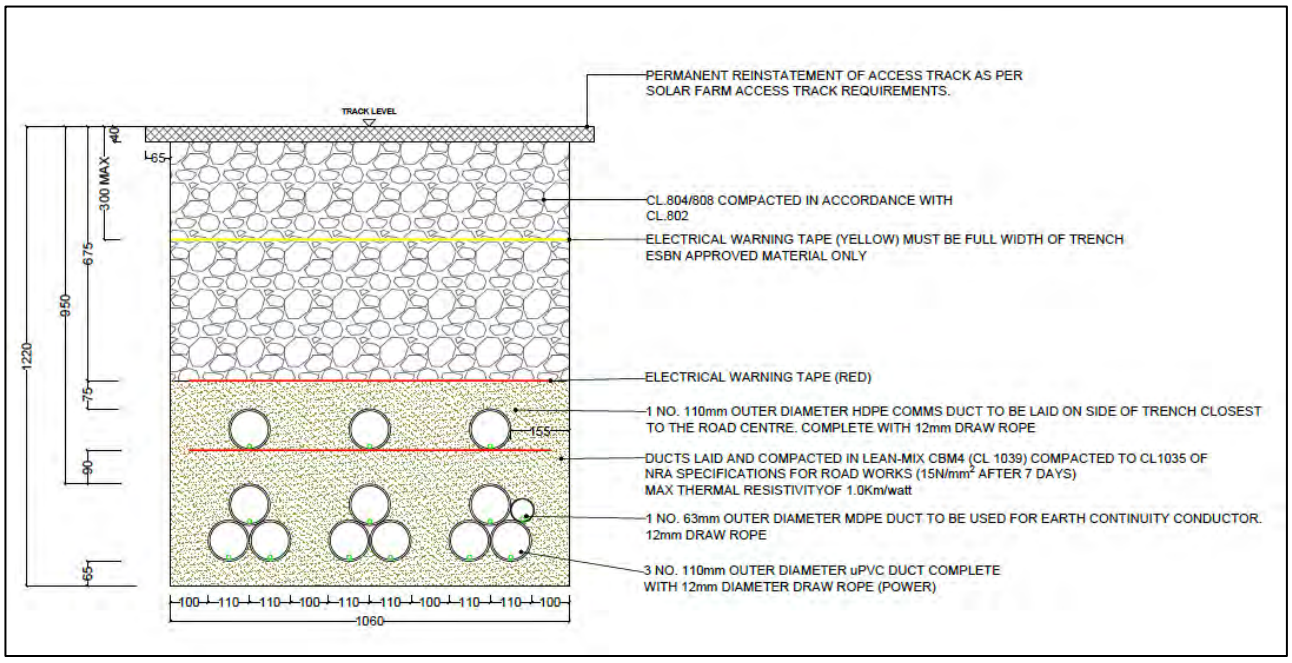


Figure 15: Three-Circuit Trench within Access Tracks

A single circuit arrangement is also proposed in grassland areas of the solar farm. The single circuit trench in grassland will consist of a cable trench 420mm wide and 1220mm deep. See Figure 16

below for details of the single circuit trench in grassland. This trench will be present in areas of Parcel 1 of the solar farm for Interconnector 1. Full details of the single circuit trench section with grassland and off-road sections can be found on drawing DRMDY-ED-DR-03 submitted with this planning application.

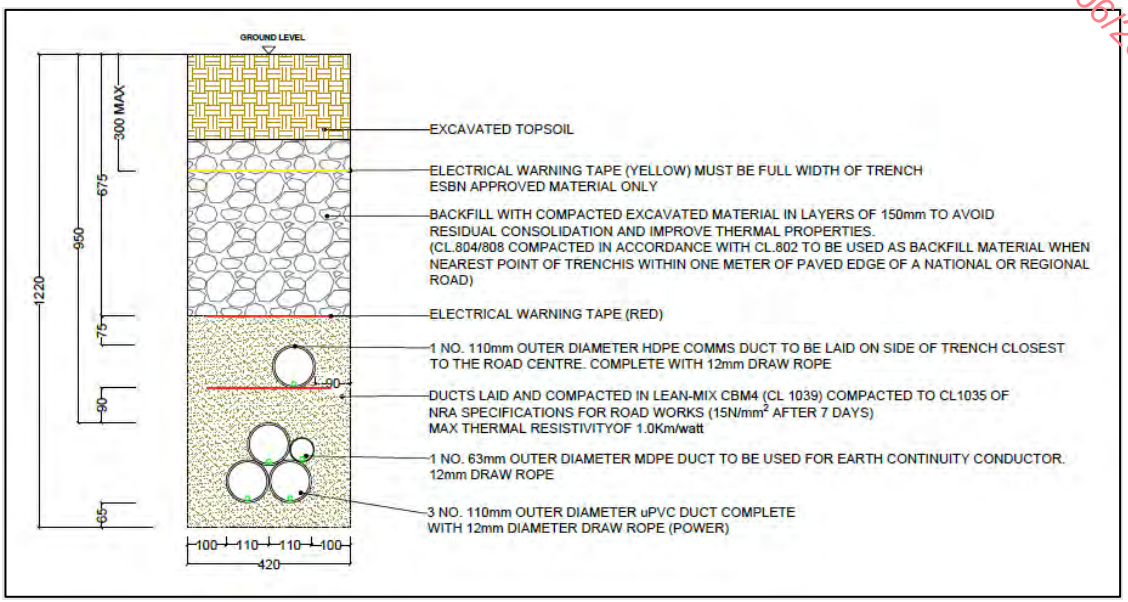


Figure 16: Single Circuit Trench in Grassland

A three-circuit arrangement is also proposed in grassland areas of the solar farm. The single circuit trench in grassland will consist of a cable trench 1380mm wide and 1220mm deep. See Figure 17 below for details of the three-circuit trench in grassland. This trench will be present in areas of Parcel 5 of the solar farm for Interconnector 4. Full details of the four-circuit trench section with grassland and off-road sections can be found on drawing DRMDY-ED-DR-08 submitted with this planning application.

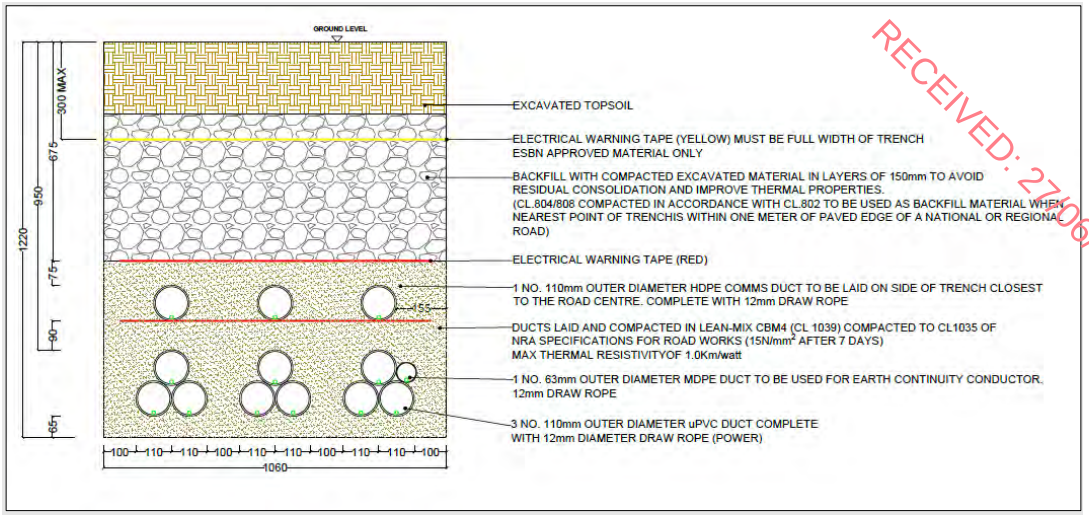


Figure 17: Three-Circuit Trench in Grassland

A five-circuit arrangement within grassland areas of the solar farm is also required. The trench will be 1700mm wide and 1220mm deep. See Figure 18 below for details of the five-circuit trench in grassland. This trench will be present in Parcel 5 of the solar farm for Interconnector 5. Full details of the five-circuit trench section within grassland and off-road sections can be found on drawing DRMDY-ED-DR-09 submitted with this planning application.

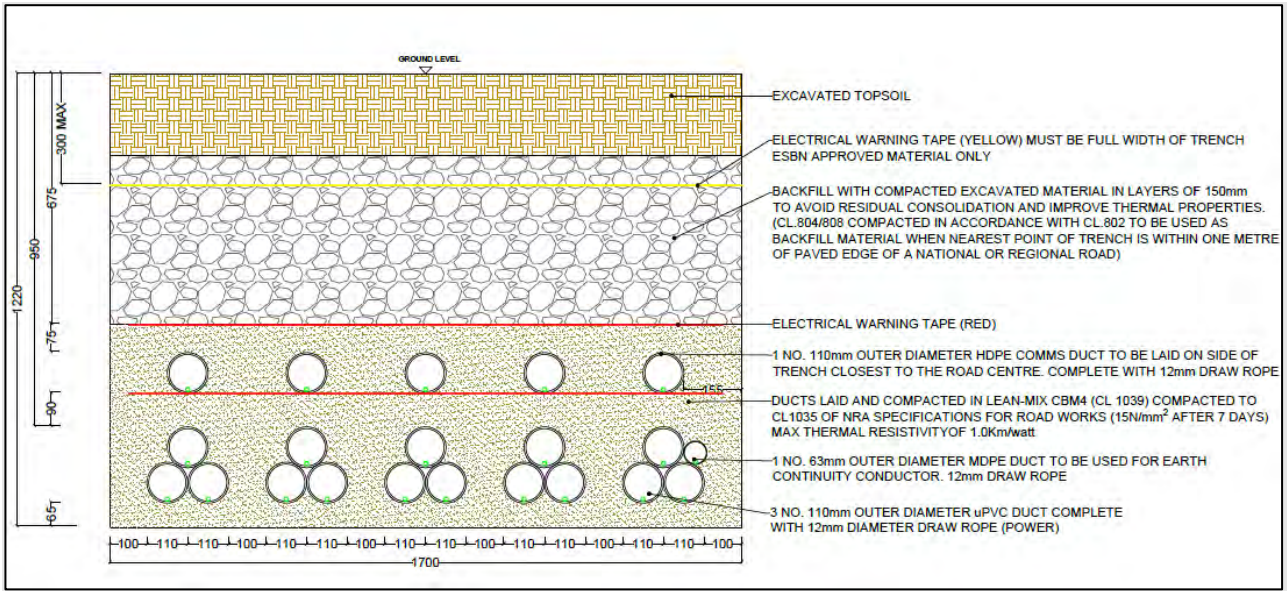


Figure 18: Five-Circuit Trench in Grassland

Cable depth may vary along the route due to existing services or shallow bedrock. Surface cable markers will be placed along the route where cable depth is unavoidably shallow. To indicate the precise location of the underground cabling, these markers will be metallic plates in accordance with ESB standards.

Marker posts will be used on non-roadway cable routes to set out the duct route and joint bay positions. Typically, corrosion proof aluminium triangular danger signs with a 700 mm base and with centred lightning symbol on fluorescent yellow background shall be installed in adequately sized concrete foundations. The precise siting of marker posts will be determined as part of the detailed design process. Figure 19 shows a typical Cable Marker Post.

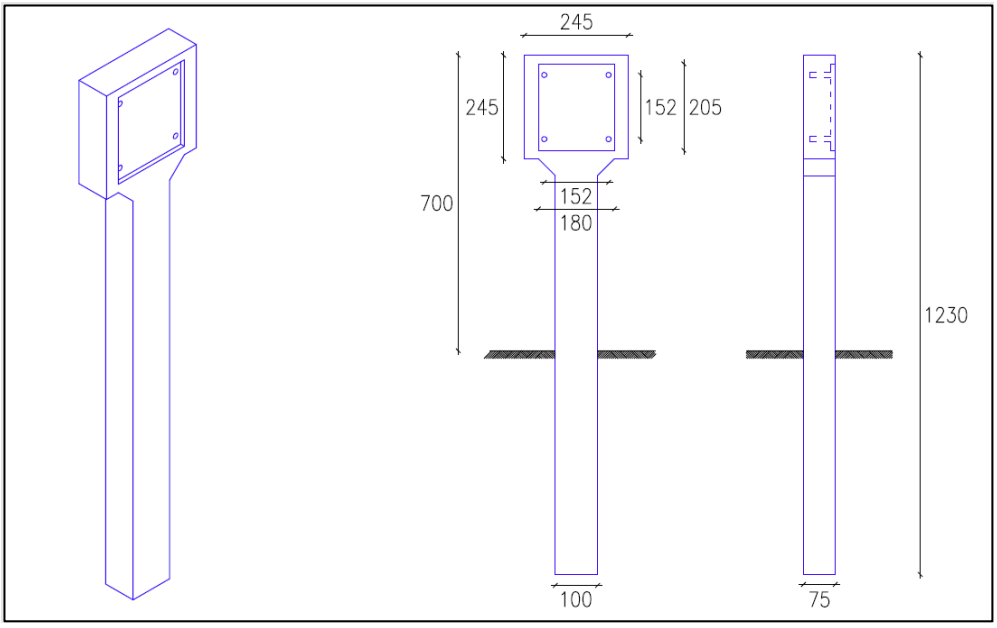


Figure 19: Typical Electrical Cable Marker Posts

6.2 33kV UGC Interconnectors Construction Methodology

The bullet points below outline the construction methodologies to be used during trenching works for the underground 33kV Interconnector cables.

- Prior to construction the Contractor and the appointed Site Manager will prepare a detailed Method Statement for each section of the cabling based on the detailed design of same. The Method Statements will take into account any mitigation measures where required, or any planning conditions set out by Kilkenny County Council;
- All works will be subject to a road opening licence from Kilkenny County Council.
- A detailed traffic management plan will be prepared by the appointed contractor and agreed with Kilkenny County Council at construction stage, outlining how traffic will be managed during the course of the works on the public road. Where road closures and diversions are required to facilitate the works, these will be agreed with Kilkenny County Council and An Garda Siochana and the appropriate road closure licenses will be applied for;
- All existing underground services shall be identified on site prior to the commencement of construction works. Exact locations will be determined via slit trenches as mentioned in Section 3;

- Excavated material will be temporarily stockpiled onsite for re-use during reinstatement. Stockpiles will be restricted to less than 2m in height. Stockpiles will be in suitably safe locations and all stockpiling locations will be subject to approval by the Site Manager;
- Excavated material shall be employed to backfill the trench where appropriate and any surplus material will be transported off site and disposed of at a fully authorised soil recovery site;
- Any earthen (sod) banks to be excavated will be carefully opened with the surface sods being stored separately and maintained for use during reinstatement;
- Where required, grass will be reinstated by either seeding or by replacing with grass turves.
- The trench will be excavated in 100m sections;
- The trench will be laid with a bedding layer for the ducts. This layer will be compacted in accordance with the design specifications.
- The ducts will be lowered into the trench and laid in a trefoil formation. Spacers will be used where appropriate to ensure the ducts are centred within the trench section.
- The ducts will then be carefully covered with the bedding layer and compacted to the required standards, as per the detailed design. The layer with be levelled to the appropriate height. Care will be taken to not damage or displace the ducts.
- A backfill will be placed on top the of the bedding layer and compacted as per the detailed design specifications.
- At the required level a yellow warning tape will be laid in accordance with the ESB Code 2955092.
- The ducts will then be cleaned and tested by pulling through a brush and mandrel. Following this a 12mm draw rope will be installed in each duct. The ducts will then be sealed using end seals, each fitted with rope attachment eyes to allow for cable installation.
- All the above works may be witnessed by ESBN Clerk of Works as required.
- Public road trenching will be reinstated in line with Kilkenny County Council requirements and as per the Guidelines for Managing Openings in Public Roads (Purple Book – April 2017);
- Cable lubricant will be applied to jacket (outer sheath) of the cables. This reduces friction between the cable and the rollers and also prevents the cable from snagging.
- The specialised winch will monitor the tension on the cables being pulled, ensuring the cables do not exceed their tensile limit.
- Works will only be conducted in normal working hours of Monday to Friday 08:00 to 18:00 and Saturday 08:00 to 13:00, with no works on Sundays or Bank Holidays except in exceptional circumstances or in the event of an emergency;
- The excavation, installation and reinstatement process typically take an average of 1 day to complete a 100m section; and

- Following the installation of ducting, pulling the cable will take approximately 1 no. day between each joint bay, with the jointing of cables taking approximately 2 no. days.

The following equipment is required for trench construction:

- 2-3 General Operatives;
- 1 Excavator Operator;
- 1 no. tracked excavator (only rubber tracked machines will be allowed on public roads); and
- 1 no. dumper or tractor and trailer.

The following materials are required for trench construction:

- 110mm diameter HDPE ducting;
- Sand for pipe bedding;
- Ready-mix Concrete where necessary;
- Trench backfilling material to relevant specifications;
- Temporary Surface Reinstatement Materials; and
- Permanent Surface Reinstatement Materials to Kilkenny County Council specifications.

6.2.1 Joint Bays and Associated Chambers Construction Methodology

The final location and number of joint bays will be determined by the electrical contractor during the detailed design phase. Typically, joint bays are required every 600-700 metres for the 33kV UGC interconnectors. 33kV joint bays are typically 1.3m x 2.5m with a flat slab of concrete installed below finished ground level to facilitate the jointing of the cable. Joint bays will be fully reinstated as per Kilkenny County Council requirements once jointing works are complete. A typical 33kV joint bay section is provided in Figure 20. Full details of the proposed joint bays can be found on drawing DRMDY-ED-DR-11 submitted with this planning application.

The location of joint bays for the proposed 110kV grid connection cables will be determined following site investigations. These will be located within the privately owned solar farm lands. Typical joint bays are 8 x 2.1m consists of a precast concrete unit with have link boxes and communication chambers located adjacent to them. These are required approximately every 400-600 metres. A typical joint bay section is provided in Figure 21 for a 110kV cable.

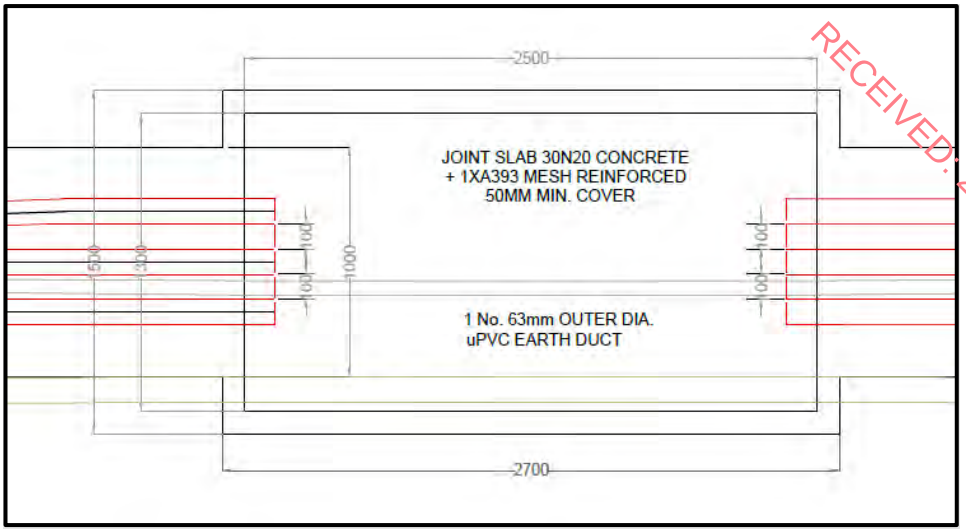


Figure 20: Typical 33kV Joint Bay

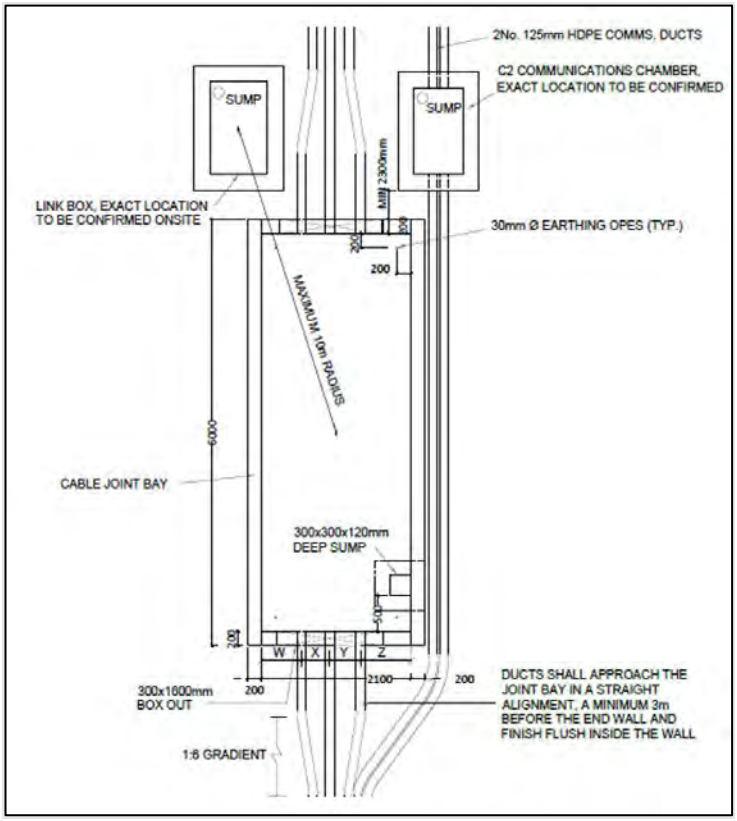


Figure 21: Typical 110kV Joint Bay

6.2.2 Utilities Crossings

A desktop utility search was conducted for the areas of the public road on which the 33kV Interconnectors are proposed. Gas Network Ireland provided as laid drawings of these pipelines at the proposed crossing points. The drawing shows that at the crossing point on the L7469 there is 1.76m of cover above the high-pressure gas pipeline and at the crossing point on the L7483 there is 1.8m of cover above the high-pressure gas pipeline. The Gas Networks Ireland Code of Practice

states "*Where a new service is to cross over the transmission pipeline or distribution strategic mains a clearance distance of 0.6 meters between the crown of the pipeline and underside of the service shall be maintained*." For the standard trench of the 33kV network in trefoil, the underside of the ducts are 1.155m deep. As such there is 0.605m and 0.645m clearance distance remaining, so an overcrossing is feasible at this location.

All design and construction activities associated with this crossing will be undertaken in consultation with the Gas Networks Ireland (GNI). The collaboration will ensure that all necessary precautions are observed, including adherence to GNI's technical standards and operational protocols, and that appropriate risk mitigation measures are implemented. Prior to construction, site investigations will determine if there are any additional existing service within the public roads in which the 33kV Interconnectors are proposed. Should any other existing services be identified, a cable undercrossing/overcrossing will be undergone, depending on as-built drawings and slit trenches. A typical service undercrossing and overcrossing are shown below in Figures 22 and 23. Full details of the service undercrossing/overcrossing can be found on drawing DRMDY-ED-DR-12 submitted with this planning application.

6.2.3 Watercourse Crossings

A topographical survey was conducted to identify any watercourses such as streams and open drains within the solar farm boundary. Where the 33kV electrical interconnector cable must cross open drains or a watercourse, either a pre-cast concrete bridge deck or HDD is used as the method of crossing. There will be no in-stream works associated with the installation of the bridge deck. Ducts and cabling will be laid in a flat formation within the bridge deck. A typical stream/drainage crossing is shown below in Figure 24. Full details of the cable bridge crossing can be found on drawing DRMDY-ED-DR-10 submitted with this planning application.

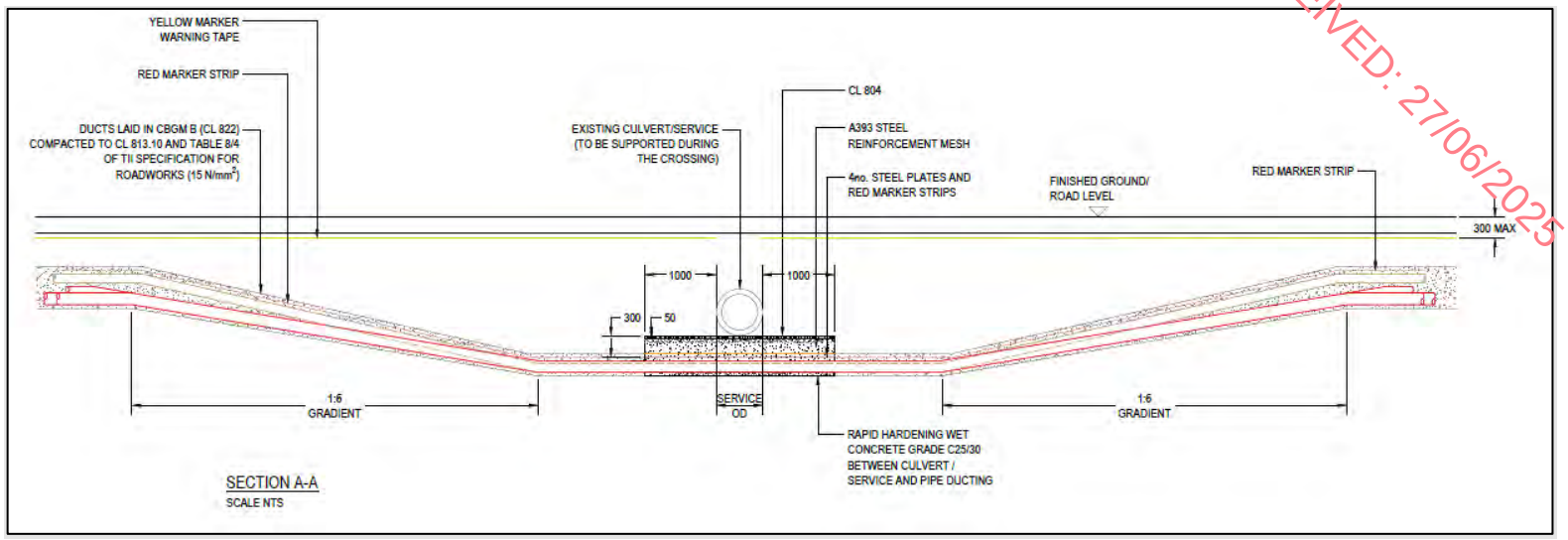


Figure 22: Typical Cable Service Pipe Undercrossing Detail

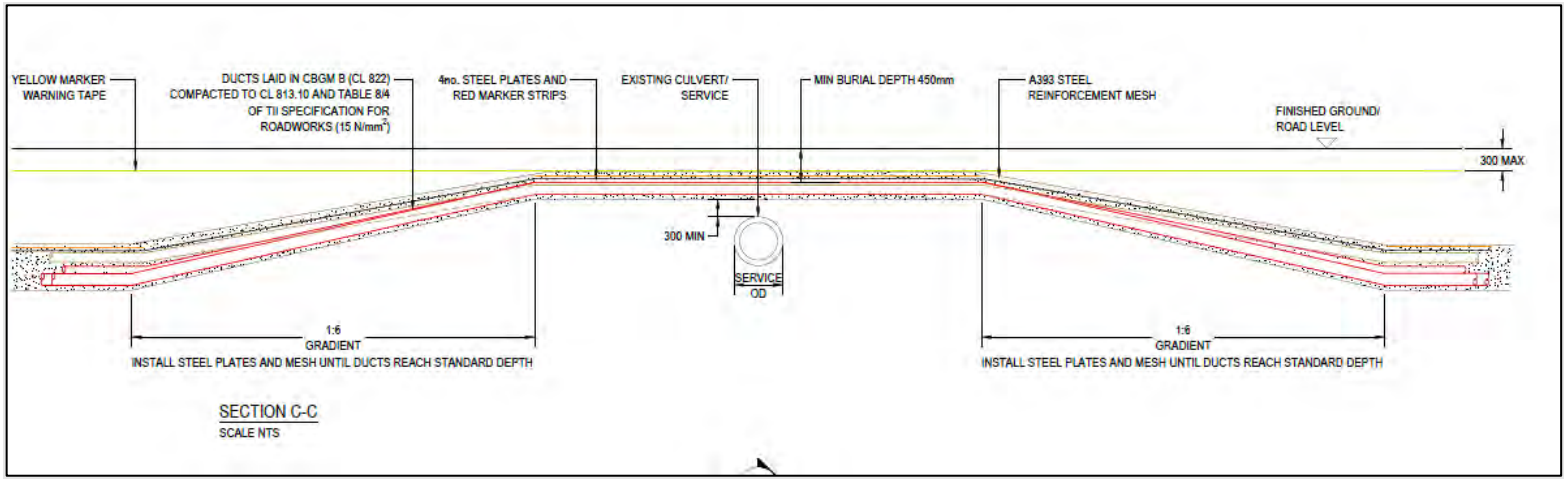


Figure 23: Typical Cable Service Pipe Crossing Detail

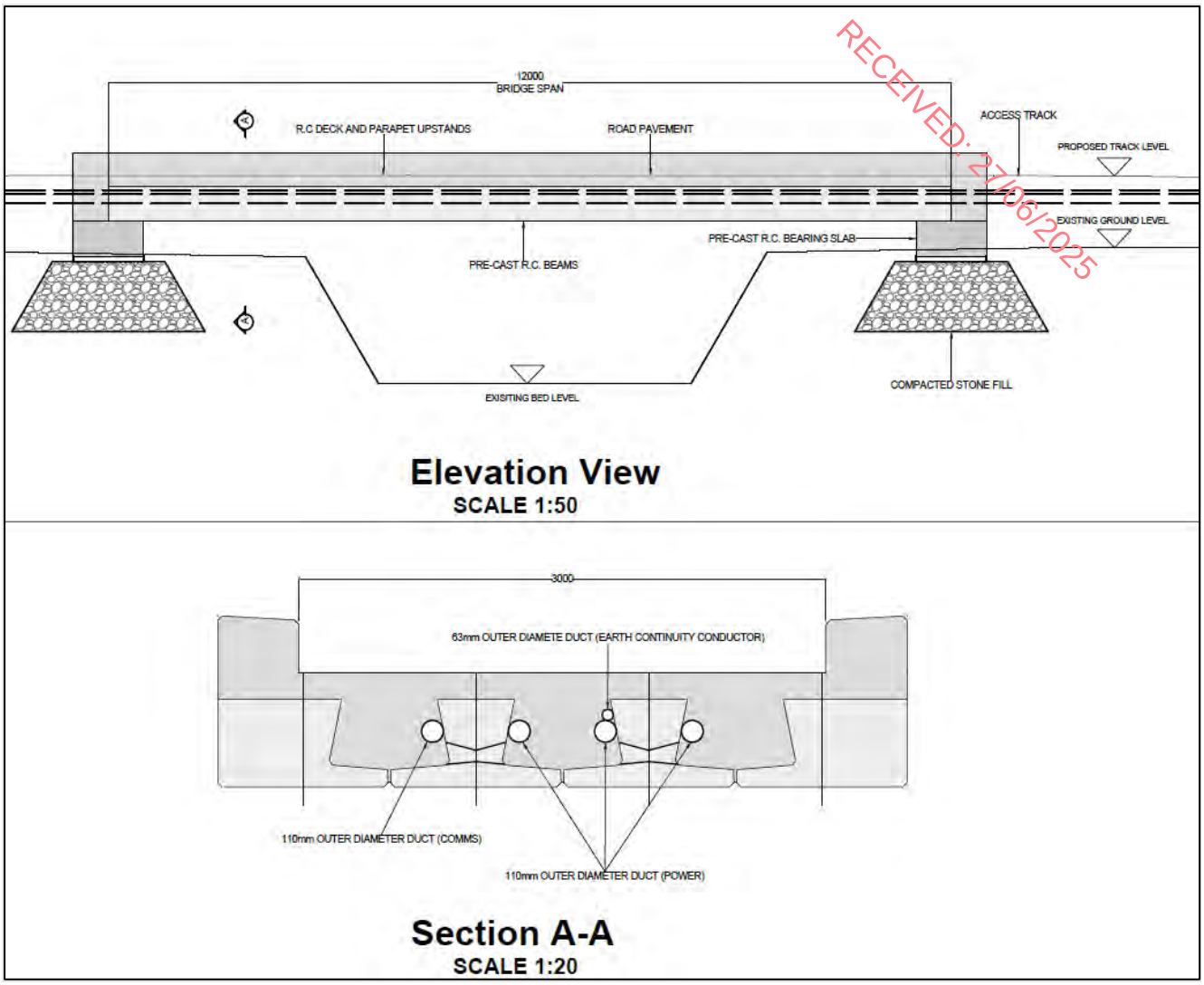


Figure 24: Typical Cable Bridge Crossing Detail

6.2.4 Horizontal Directional Drill Methodology

The proposed drilling methodology for each HDD is as follows:

- A works area of approximately 40m^2 will be fenced on both sides.
- Containment bunds and silt traps will be set up to prevent accidental fluid spills and storm water run-off.
- Entry and exit pits (2m x 3m x 1.5m) will be excavated; the excavated material will be temporarily stored within the works area and used for reinstatement or disposed of to a licensed facility.
- These entry and exit pits will capture any drilling fluid returns from the borehole. The drill bit will be set up by a tracker, and the driller will push the drill string into the ground and will steer the bore path under the stream.

- A tracker will monitor drilling works to ensure that the modelled stresses and collapse pressures are not exceeded and ensure the required clearance from other services in maintained.
- The drilled cuttings will be flushed back by drilling fluid to the entry and exit pits.
- Once the first pilot hole has been completed a hole-opener or back reamer will be fitted in the exit pit. The back-reamers will enlarge the borehole to the required size.
- The ducts are then attached to the drill head in the exit pit and pulled back into position in the borehole, while bentonite is pumped through to surround the ducts in the borehole.
- The drilling fluid is disposed of to a licensed facility.
- The ducts will be cleaned and proven and their installed location surveyed.
- The entry and exit pits will be reinstated as per the landowners' requirements.

It should be noted that the applicant, through its parent company Terra Solar Development, has engaged with various planning authorities and Transport Infrastructure Ireland (TII) in relation to proposed HDDs under the national road network. As stated in in this report, it is proposed to HDD under the N25 at 2 no. locations and the N29 at 1 no. location. Most recently, on the Park Solar Farm in County Carlow (Council Reference: 24/60205), the issued raised by TII as part of a request for further information on that application were resolved following consultation with TII's Network Management and TII's Land Use Planning Unit. The context for the Park Solar Farm which involved a HDD under the M9 Motorway, and which is considered equally relevant in the case of the subject Drumdowney Solar Farm planning application to Kilkenny County Council. This context was as follows:

1. As part of an RFI, TII Land Use Planning Unit advised in relation to the HDD crossing under the M9 that this would require Works Specific Deeds of Indemnities and consent from TII in accordance with Section 53 of the Roads Act, 1993. It was advised that consultation should be undertaken with TII Network Management / Third Paty Works in respect of same.
    - The applicant subsequently consulted with TII Network Management / Third Party Works who confirmed that 1) at the 'planning' stage of projects any queries should be directed to TIIs Land Use Planning Unit and 2) the Third Party Works process is only for developments that have already secured planning permission.

- Following on from the above confirmation, the Applicant consulted with the Land Use Planning Unit who advised that they only consult with the planning authority during the planning application process.
- In response to the RFI, the applicant noted that its understanding and experience of projects of this nature is that Works Specific Deeds of Indemnities and consent take place in advance of the commencement of construction, once planning permission has already been secured. The RFI response noted that this understanding has been confirmed by TIIs Network Management / Third Party Works. The Applicant further noted its commitment to consulting with TII at this time and agreeing all necessary statutory requirements. This commitment will apply on the Drumdowney Solar Farm also.

2. As part of the RFI on the Park Solar Farm, TII Land Use Planning Unit had raised a point in relation to the technical information submitted with the planning application and whether it had demonstrated the feasibility of the HDD crossing under the M9.
   - The Applicant responded that the details in relation to the HDD were set out in the 'Electrical Infrastructure - Construction Methodology' report submitted with the planning application. The level of detail provided was comparative to other projects where the Applicants team has agreed a Deed of Indemnity with TIIs Network Management / Third Party Works team for HDD works. The same level of detail is provided in this report to Kilkenny County Council in respect of HDDs associated with the N25 and N29.
   - In addition to the above, the Applicant also proposed to consult with TII again when finalising the detailed design of the proposed HDD crossing prior to the commencement of the construction phase of development. This Method Statement would set out additional detail on engineering, environmental and safety management procedures of relevance to such works. It was highlighted that this is a process that the Applicant and TIIs Network Management / Third Party Works teams have navigated successfully on other projects.

3. TII also outlined in its RFI its general requirements for HDD under a motorway. These requirements, and how they are considered as part of the Drumdowney Solar Farm, are outlined below:
   - *Requirement 1: "The launch and receptions pits for the crossing are located outside the motorway boundary*" As per the planning application drawings

the launch and receptor pits for the Horizontal Directional Drills (HDDs) will be outside the N25 and N29 road boundaries. The only exception to this is the launch pit for HDD No. 1 which will be located in the verge adjacent to the N25. The final Contractor led CEMP will include a detailed Method Statement relating to the HDD crossings and will provide for any short term temporary traffic management measures associated with this and all other HDD crossings.

- *Requirement 2: "The crossing will be installed at such a depth so as not to conflict with the drainage of the motorway."* The N25 and N29 HDD crossing will follow TII Guidelines and will be placed at depths where there is no conflict with any drainage assets belonging to TII within its ownership boundary. The HDD crossing will be kept at a minimum of 3m below any drainage assets TII have installed in the area. During detailed design as built records for the drainage will be requested from TII by the designer and the design of the crossing will be submitted to TII and its representatives for comment and input prior to construction.
- *Requirement 3: "Neither the works nor the crossing will damage or interfere with the motorway".* The HDDs will not damage or interfere with the N25 or N29. HDD crossings of motorways and national roads are common practice. Works at any one location will be temporary and of short duration. It was proposed that the final Contractor led CEMP would include a detailed Method Statement relating to the HDD crossings. There have been numerous crossings of this style carried out throughout the country on behalf of independent power producers and ESBN/ EirGrid in recent years. The undertaker of construction works will ensure that best practice is adhered to with respect to safeguarding the motorway from damage or interference.
- *Requirement 4: "There are no bolted joints in that part of the crossing within the motorway fence line".* HDD crossings do not use pipes/ducts with bolted joints. HDD ducts are a continuous pipe that are welded together to ensure a smooth transition for the cable pulling process. The pipe/duct will be made from High Density Polyethylene (HDPE). This proven process and material will ensure that there are no potential locations for repair, in contrast with bolted joints which fatigue over time.
- *Requirement 5: "Specific requirements may also arise for these proposed works".* The applicant is committed to consulting with TII and agreeing all

necessary technical details relating to the HDDs prior to the commencement of construction.

4. As part of the RFI, TII provided details of construction stage considerations for the implementation of any permission related to the national road network. These relate to the content of a future Construction Traffic Management Plan (CTMP) and will include:
    - Any proposed works to the national road network including signage shall comply with TII publications and shall be subject to a road safety audits. All necessary licences or agreements shall be secured from TII, PPP Concession, Motorway Maintenance, MMaRC Companies, local road authorities, as necessary.
    - Any proposals or agreements referred to above will be shared with TII;
    - Any damage caused to the pavement of the existing national road shall be rectified in accordance with TII Pavement Standards.

The Applicant can confirm in the case of the Drumdowney Solar Farm that it will reference the above requirements in the final CTMP and will consult with TII, and other parties where necessary, prior to the commencement of development.

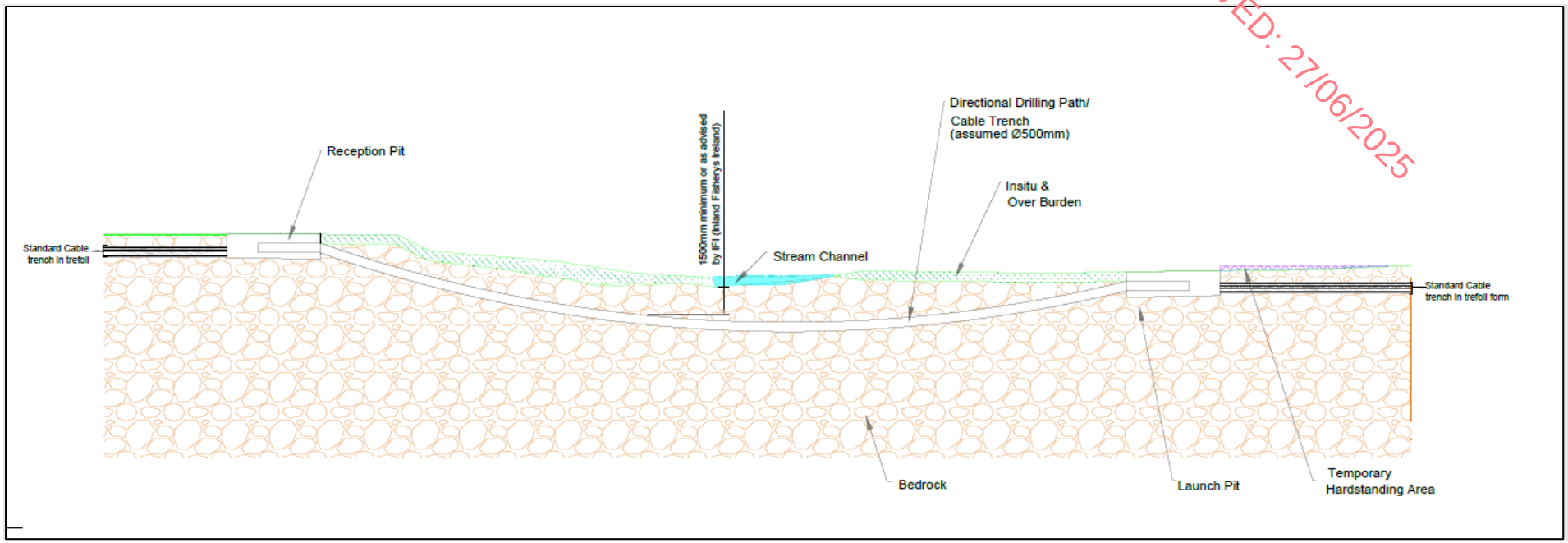


Figure 25: Typical Horizontal Directional Drill Water Crossing

6.2.5 Traffic Management

Road opening licenses will be submitted to cover the full extent of all underground cables within the public roads. In relation to the underground grid connection cable, the length of work exceeds 1000m of rural road and as such a T1 License Notification will be submitted through the MapRoadWorks licensing system to Kilkenny County Council to facilitate coordination and planning of these works with the Roads department. T2 (Road Works) Licenses will be prepared and applied for under the overarching T1 Notification. It is not anticipated that a T1 Notification will be required for the 33kV Interconnectors.

Where road widths permit, the underground cable construction works will allow for one side of the road to be open to traffic at all times by means of a 'Stop/Go' type traffic management system, where a minimum 2.5m roadway will be maintained at all times. Temporary traffic signals will be implemented to allow road users safely pass through the works area by directing them onto the open side of the road. The underground cables will be installed in 100m sections with no more than 100m will be excavated without the majority of the previous section being reinstated.

Some work areas may require a temporary road closure where it is not possible to safely implement a Stop/Go system. Where temporary road closures are necessary, a suitable diversion will be implemented using appropriate signage, following consultation and agreement with Kilkenny County Council.

Full details of any traffic management plan for these works will be developed as part of the Road Opening License application process with a Traffic Management provider and shall be in accordance with Chapter 8 of the Traffic Signs Manual, but the following considerations are identified at this stage:

- Statutory processes for road closures as outlined in Section 75 of the Roads Act 1993 and expanded in Section 8.6.3 of Traffic Signs Manual will be followed – i.e. any proposed road closure is to be approved/implemented by the local Road Authority with consultation of the public, and proposed diversions will need to be approved by the Road Authority.

- An information campaign (letter drop/notification on local radio/advance information signs etc.) will be undertaken to inform local residents of the works.

- The process for applying for, and securing a road closure is separate to that of applying for a Road Opening Licence, but both are to be in place and valid for the full period of

works. Kilkenny County Council advise that a Road Closure Application must be submitted within 5 weeks of the proposed closure. It is intended to engage with the Roads Authority as early as possible due to the length of the works requiring road closures and road opening licenses to be in place.

- Provision of local access to residences along the active works area will be maintained with minimal disruption. This will be coordinated through signposted detour routes, advance notice to residents of anticipated works dates and details and facilitating access and egress of residences adjoining the works area during the periods where the UGC will be installed in the road outside these. The length of closure (as defined on site by signage/cones etc) is intended to be kept to the minimum length practicable for the works to be undertaken where homes are adjacent, and to avoid access restrictions to local residences being in place for multiple working days.

- Minimising the closure period of junctions with other local roads will dictate maximum length of any one closure (unless specified otherwise by Roads Authority) to avoid excessive disruption to the local area.

- Where ground conditions, weather, and third party services permit, approximately 100m of the route can be excavated, ducting installed, backfilled, and reinstated within one working day. This permits indicative time estimates for closures to be provided to locals, and will similarly permit works to be programmed so that restrictions on access to local houses can be kept to a minimum, such as by phasing works between driveways so that disruption to access from the works area is limited to the start or end of a single work day.

Temporary and Permanent Road Reinstatements are envisaged to be in accordance with the standard details provided in the Purple Book – namely SD1 & SD4 where the existing road consists of an Asphaltic Concrete build-up, or SD2 & SD5 in the event that the roads are surface dressed, unless otherwise directed by the roads authority during the T1 consultation period or approval process of specific T2 licenses. All longitudinal and transverse openings will be carried out in accordance with Purple Book drawings GA1 and GA2 respectively.

7 Emergency Response Plan

All site personnel will be inducted in the provisions of the Emergency Response Plan. The following outlines some of the information, on the types of emergencies, which must be communicated to site staff (list not exhaustive)

- Release of hazardous substance – Fuel or oil spill;
- Concrete spill or release of concrete;
- Flood event – extreme rainfall event;
- Environmental buffers and exclusion zones breach;
- Housekeeping of materials and waste storage areas breach; and
- Stop Works order due to environmental issue or concern.

The Emergency Response Plan will be completed by the appointed Contractor before the project begins.

8 Best Practice Design and Construction Mitigation

Prior to commencement of construction works the contractor will draw up a final Method Statement including a Construction Environmental Management Plan which will be based on established best practice measures. These documents will be adhered to by the contractors and will be overseen by the project representative/foreman.

The following documents will contribute to the preparation of the Method Statement and CEMP:

- Inland Fisheries Ireland (2016) *Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters*. Inland Fisheries Ireland*, Dublin,*
- *National Roads Authority (2008) Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes*. National Roads Authority, Dublin.
- E. Murnane, A. Heap and A. Swain. (2006) *Control of water pollution from linear construction projects.* Technical guidance (C648). CIRIA.
- E. Murnane et al., (2006) *Control of water pollution from linear construction projects*. Site guide (C649). CIRIA.
- Murphy, D. (2004) Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites. Eastern Regional Fisheries Board, Dublin.
- H. Masters-Williams et al (2001) *Control of water pollution from construction sites. Guidance for consultants and contractors* (C532).
- Enterprise Ireland (unknown). *Best Practice Guide (BPGCS005) Oil storage guidelines.*
- Law, C. and D'Aleo, S. (2016) *Environmental good practice on site pocketbook*. (C762) 4th edition. CIRIA.
- CIRIA *Environmental Good Practice on Site (fourth edition) (C741) 2015*.

The final Construction Method Statement and CEMP will comply with any planning condition specified by the planning authority or An Bord Pleanála. The environmental measures to be included in the final CEMP will include the measures as set out in the following sections:

8.1 General

The environmental control measures for the solar farm include the following:

- Materials, plant and equipment shall be stored in the proposed site compounds.

- All hazardous liquid materials shall be stored in a bunded area and spill containment measures will be in place.
- Re-fuelling of machinery, plant or equipment will be carried out in the site compounds or using drip trays.
- Fuel pipes on plant, outlets at fuel tanks etc. will be regularly checked and maintained to ensure that no drips or leaks to ground occur. The following precautions will also be installed on fuel delivery pipes:
- Any flexible pipe, tap or valve must be fitted with a lock where it leaves the container and be locked when not in use.
- Flexible delivery pipes must be fitted with manually operated pumps or a valve at the delivery end that closes automatically when not in use.
- Warning notices including “No smoking” and “Close valves when not in use” shall also be displayed.
- Any pouring of concrete will only be carried out in dry weather. Washout of concrete trucks shall be strictly confined to designated and controlled impermeable wash-out areas remote from watercourses, drainage channels and other surface water features.
- Spill kits will be available within each plant/vehicle on site and located close to identified pollution sources or sensitive receptors (fuel storage areas, etc.).
- Interceptor drip trays will be positioned under any stationary mobile plant to prevent oil contamination of the ground surface or water. Plant and site vehicles are to be well maintained and any vehicles leaking fluids must be repaired or removed from site immediately. Any servicing operations shall take place over drip trays.
- Areas used to store fuel and oil on the site will be appropriately lined and bunded to prevent the downward percolation of contaminants to natural soils and groundwater.
- Fuel for construction vehicles will be stored on an impervious base within a bund able to contain at least 110% of the volume stored. Rainwater will not be allowed to accumulate within the bund and in any way compromise the required 110% volume capacity. No tanks or containers may be perforated or dismantled on site. A competent operator shall empty all contents and residues for safe disposal elsewhere.
- Suitable wheel wash facilities, complete with C/W silt traps will be put in place to ensure vehicles entering/existing the site do not carry/transport debris.
- If very wet ground must be accessed during the construction process bog mats will be used to enable access to these areas by machinery.
- Daily environmental toolbox talks / briefing sessions will be conducted for all persons working to outline the relevant environmental control measures and to identify any environment risk areas/works.

8.2 Water Quality

- A buffer of 5-10 m from the closest drain or watercourse will be established and clearly marked out prior to the commencement of construction activities where possible. The buffer will be maintained with the exception of localised areas where fencing, access, crossing or cable trenching is required.
- Silt fencing will be installed within the works area for the proposed interconnector cables. The silt fence will provide protection from sediment and potential site water runoff.
- The silt fencing will be checked twice daily during construction and once per day thereafter to ensure that it is working satisfactorily until such time as the re-instated ground/material has been fully established.
- If dewatering is required as part of the proposed works e.g., in trenches for underground cabling or in wet areas, water must be treated prior to discharge. The Contractor shall employ best practice settling systems to ensure maximum removal of suspended solids prior to discharge of any surface water or groundwater from excavations to receiving waterbodies. This may include treatment via settlement tanks. There will be no direct pumping of water from the works to any watercourses or drains at any time.
- An emergency-operating plan will be established to deal with incidents or accidents during construction that may give rise to pollution within any nearby watercourses or drains. This will include means of containment in the event of accidental spillage of hydrocarbons or other pollutants (spill kits etc.).
- The contractor will ensure that good housekeeping is always maintained and that all site personnel are made aware of the importance of the nearby estuary/aquatic environments and the requirement to avoid pollution of all types.

8.3 Soils

- Excavated material will be temporarily stockpiled onsite for re-use during reinstatement. Stockpiles will be restricted to less than 2m in height.
- No stockpiles associated with the excavation works associated with the proposed grid connection will be located within 10m of drains.
- Imported materials and any site won materials will be tested prior to use to determine its geotechnical and geo-environmental properties to assess their suitability for use
- Any earthen (sod) banks to be excavated will be carefully opened with the surface sods being stored separately and maintained for use during reinstatement.

8.4 Ecology

- No removal of habitats or movement of construction machinery will occur outside of the development works area/footprint during the construction phase, where the works area/footprint will be clearly marked for associated site staff.
- The following best practice measures form part of the construction methodology and will help to contain and/or prevent the introduction of invasive species on the site as follows:
- When deemed necessary, all plant and equipment employed on the proposed works (e.g., diggers, tracked machines, footwear etc.) will be thoroughly cleaned down using a power washer unit, and washed into a dedicated and contained area prior to arrival on site and on leaving site to prevent the spread of invasive aquatic / riparian species. A sign off sheet will be maintained by the contractor to confirm cleaning.
- Material gathered in the dedicated and contained clean down area will need to be appropriately treated as contaminated material on site.
- For any material entering the site, the supplier must provide an assurance that it is free of invasive species.
- Ensure all site users are aware of invasive species management plan and treatment methodologies. This can be achieved through “toolbox talks” before works begin on the site.
- Adequate site hygiene signage should be erected in relation to the management of non-native invasive material.
- All excavations/trenches should be covered at night, or a suitable means of escape provided for nocturnal mammals.

8.5 Noise

All plant will be required to conform to the British Standards (BS) 5228 Code of practice for noise and vibration control on construction and open site. BS5228 provides a comprehensive guidance on construction noise including details of typical noise levels associated with various items of plant or activities, prediction methods and measures and procedures and is an accepted standard for construction practise in Ireland given the absence of statutory Irish guidelines.

8.6 Air Quality

The main activities that may give rise to dust emissions during construction include the following:

- Excavation and removal of earthworks.
- Materials handling and storage.
- Movement of vehicles (particularly HGV's) and mobile plant.
- Suspended solids in surface water runoff.

8.7 Waste Management

All waste arising during the construction phase will be managed and disposed of in a way that ensures the provisions of the Waste Management Act 1996 and associated amendments, and regulations of the Waste Management Plan are followed.

9 Summary

The construction of the proposed substation and grid connection to serve the proposed Drumdowney Solar farm can be summarised as follows:

- Construction of the substation will consist primarily of an electrical compound to house a transformer, high voltage equipment and separate EirGrid and IPP control buildings.
- All substation construction activities will take place within the extents of the proposed site boundary.
- Earthworks will be required to create a level compound area for the substation, with export of cut material and import of fill material required by truck from/to the site.
- The duration of the construction works will be confirmed and agreed with the Local Authority prior to construction. The construction programme for the entire of the electrical infrastructure works associated with the Drumdowney Solar Farm (including the substation) is estimated to be a total of 24 months. Further detail on this programme is provided in Appendix A.
- Prior to commencement of development, a detailed Construction Environment Management Plan (CEMP) shall be submitted to, and agreed in writing with, the planning authorities, following consultation with relevant statutory agencies.
- All planning conditions will be complied with in full and contractor(s) will be supervised and managed closely to ensure full compliance.

Appendices

Appendix A

Solar Farm and Electrical Infrastructure Programme and Construction Vehicles

Estimated Construction Programme & Vehicle Numbers

		Construction Programme (Months)																						
	Week	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**0**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Substation Construction	Enabling Works	250	250	250																					
	Civil Works				20	20	20	20	20	20	20														
	Electrical Works											20	20	15	10	5									
Grid Connection Construction	Civil and Electrical Works													137	138	138	138								
Substation Electrical Commissioning	Pre-commissioning																								
	ESB Commissioning																								
Solar Farm Construction	Solar Farm Site Set Up & Installation							323	440	235	287	99	99	99	202	112	112	301	301	298	22	22	4	96	71
Solar Farm Electrical Commissioning	Electrical Commissioning																					100	100	80	
	Close Out																							80	80
	Estimated Vehicles Per Month	**250**	**250**	**250**	**20**	**20**	**20**	**342.9**	**459.6**	**255.4**	**307.4**	**119.2**	**119.2**	**251.2**	**349.6**	**255.5**	**250.5**	**300.6**	**300.6**	**298**	**22.05**	**122.1**	**104.2**	**256.1**	**151**
	Estimated Vehicles Per Week	**62.5**	**62.5**	**62.5**	**5**	**5**	**5**	**85.72**	**114.9**	**63.84**	**76.84**	**29.81**	**29.81**	**62.81**	**87.4**	**63.86**	**62.61**	**75.15**	**75.15**	**74.49**	**5.513**	**30.51**	**26.05**	**64.02**	**37.7**
	Estimated Vehicles Per Day (5.5 days)	**11**	**11**	**11**	**1**	**1**	**1**	**16**	**21**	**12**	**14**	**5**	**5**	**11**	**16**	**12**	**11**	**14**	**14**	**14**	**1**	**6**	**5**	**12**	**7**
	Peak Daily Vehicles	**21**																							
	Peak Hourly Vehicles	**2.625**																							
	Average Daily Vehicles	**10**																							
	Average Hourly Vehicles	**1**																							