Environmental Impact Assessment Report

NISA

North Irish Sea Array

Volume 2: Introductory Chapters

Chapter 5
Consideration of Alternatives

Statkraft

CIP
Copenhagen Infrastructure Partners

GoBe
APEM Group

ARUP

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5. Consideration of Alternatives

5.1 Introduction

This chapter describes the reasonable alternatives considered by North Irish Sea Array Windfarm Limited, (hereafter referred to as the "Developer") for the North Irish Sea Array (NISA) offshore wind farm and associated onshore infrastructure (hereafter referred to as the "proposed development"), providing an indication of the principal rationale for the options chosen in terms of design, technology, location, size and scale, taking into account the effects of options on the environment.

This chapter of the EIAR has been prepared in accordance with Article 5(1)(d) and Part 2 of Annex IV of the EIA Directive which identifies that the following is required in the EIAR:

"A description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects."

The proposed development will consist of a combination of offshore and onshore infrastructure. The chapter has been structured to describe reasonable alternatives considered for each of the following aspects of the proposed development:

- Offshore development area
- Offshore infrastructure, including:
  - array layout options
  - wind turbine generators (WTGs)
  - offshore substation platform (OSP)
  - inter- array cables (IAC) and
  - export cable routes
- Onshore infrastructure, including:
  - Landfall site options
  - Grid Facility, including the compensation substation and the Bremore substation options and
  - Onshore cable route options.

This chapter also presents a description of the do-nothing scenario, e.g. where the proposed development is not developed.

In order to achieve the legally binding targets and the sector specific targets for offshore wind in Ireland, and in particular the Climate Action Plan (CAP) 2024 and the National Marine Planning Framework (NMPF) 2021 (see Volume 2: Chapter 3: Legal and Policy Framework, hereafter referred to as the "Legal and Policy Chapter" for more details). Alternative renewable energy developments such as onshore wind, solar, wave and tidal have not been considered as 'reasonable alternatives' for the proposed development as they do not meet the project objectives as set out in Section 5.2 below. In order to meet the project objectives as outlined in Section 5.2 below, reasonable alternatives consider the design, technology, location, size and scale to develop a fixed bottom offshore wind farm in Irish Waters.

The design evolution of an offshore wind farm is a complex and multifaceted process. The chronological, staged approach is summarised in Section 5.5 below. The development involves the consideration of a number of disciplines (technical, engineering, environmental and economic) and is ultimately a balance between these. The process also includes extensive engagement with authorities and wider stakeholders.

Site selection and design evolution commenced in 2008 and subsequently multiple site surveys, design iterations and detailed consultation events have been undertaken which has led to the final spatial boundaries, infrastructure parameters and layout options as they are presented in this EIAR for the purposes of the planning application.

5.2 Project Objectives

As noted in Volume 2: Chapter 4: Need for the Proposed Development (hereafter referred to as the "Need for the Proposed Development Chapter"), the key objectives of the proposed development are to deliver an environmentally acceptable and viable offshore wind farm to help deliver the Irish Government's legally binding renewable energy targets, deliver benefits on a local, regional, and national level and to limit the effects of global climate change. The objectives include:

1. To deliver a fixed bottom offshore wind farm to contribute towards the Irish Governments target delivery of 5GW of offshore wind by 2030 and longer-term ambition of 80% of electricity to come from renewable sources[1]
2. To support the European carbon reduction targets of reducing emissions by 95% by the year 2050[2] to support the European Union in becoming carbon neutral
3. To optimise the use of a site with excellent wind resource near to an area of high electricity demand
4. To support the reduction in demand for imported energy from a volatile fossil fuel import market by improving Ireland's domestic energy generation capabilities through the deployment of offshore wind
5. To deliver the proposed development in a safe, efficient, and environmentally sustainable manner within the constraints of technical feasibility and economic viability and
6. To deliver renewable electricity at low cost to the Irish consumer through the use of known, tried and tested, technology (fixed foundation offshore wind turbine generators {WTGs})

Satisfying these project objectives has been the fundamental consideration in the decision-making process throughout project development as outlined below.

5.3 Do-Nothing Alternative

The 'do-nothing' scenario refers to what would happen if the proposed development was not advanced.

In terms of environmental effects, the 'do-nothing' scenario would avoid the potential for likely significant effects on the environment associated with the proposed development. An assessment of the future baseline under the 'do nothing' scenario has been completed for all assessment chapters and this is presented in the assessment chapters (Chapters 10 to 35). As discussed in Legal and Policy Chapter and the Need for the Proposed Development Chapter, climate change underpins a need to deliver low carbon electricity to areas of greatest demand and the Irish Government has set an ambitious target (5GW of offshore wind by 2030) to deliver renewable electricity from offshore wind to meet its climate targets. This supports the delivery of the wider European target of 111GW of offshore wind deployment across Europe by 2030.

In its latest report the Intergovernmental Panel on Climate Change (IPCC) (2023) presents a narrowing window to mitigate and reduce the probability of catastrophic events that could result from climate change. Therefore, any delay in reducing carbon emissions will result in higher global temperatures resulting in greater environmental and social challenges and as such it is critical to advance the acceleration of renewable energy projects such as the proposed development. As a key pillar of Ireland's renewable energy pipeline, it is therefore essential for the proposed development to proceed to contribute to mitigating climate change.

[1] As outlined within the Climate Action Plan (CAP) 2024 and Ireland's Offshore Energy Programme target to deliver 5 GW of fixed offshore wind energy (OWE) by 2030 and a further 2GW of floating OWE to be in development by 2030.

[2] 2050 long-term strategy - European Commission (europa.eu)

As the proposed development is for an offshore wind farm with fixed foundations, it will deliver low cost, renewable electricity to help the Irish Government meet its legally binding targets. The do-nothing scenario would result in the proposed development not proceeding and thus no offshore wind farm in this location (unless subject to a separate allocation process) and a loss of offshore wind capacity in Ireland. The possibility of any other offshore wind farm being delivered in the location is highly speculative and could reasonably be assumed to progress only on significantly longer development timescales than the proposed development, and therefore it is not plausible that it would contribute to the 2030 target.

If the proposed development did not proceed, it would not contribute to Ireland's progress in meeting EU, national or regional planning objectives or in meeting renewable energy and decarbonisation targets, in particular, the targets in the Climate Action Plan 2024 (CAP 2024). Achievement of the total national 5GW offshore wind target set for 2030 would also not be feasible if the proposed development did not proceed.

There are currently six proposed offshore wind farms with a Maritime Area Consent (MAC) enabling them to submit a planning application for development (known as the 'Phase One' projects), which includes the proposed development. However, the combined capacity of all six projects constitutes only 4.3GW of energy from offshore wind. In the event that all Phase One projects (including the proposed development) are completed, additional projects will still be required to meet the 5GW offshore wind target by 2030 so it is essential that the projects are taken forward, in turn ensuring a security of energy to Ireland in addition to supporting the delivery of affordable electricity for the consumer.

In conclusion, the 'do-nothing' alternative is not a reasonable alternative as it does not meet the project objectives listed in Section 5.2 and does not support the delivery of offshore wind in Ireland and Europe nor support addressing the climate emergency.

5.4 Alternative Renewable Energy Technologies

Other renewable technologies (including onshore wind, wave, solar and tidal) were not considered reasonable alternatives to the project as they would not meet or deliver the project objectives.

At project inception, it was recognised that whilst the advancement of floating offshore wind was progressing, in order to deliver an offshore wind farm in Ireland (given the relative immaturity of floating technology on a commercial scale and the licensing regime in Ireland) in time for it to be constructed and operational for 2030, a wind farm with fixed bottom foundations was considered to be the most feasible technical option to help meet the targets.

Floating wind technology remains in its infancy with very few commercial turbines having been deployed to date. In addition, floating offshore wind foundations present a higher overall cost and therefore higher price to the consumer. As testing and demonstration continues if floating foundations were considered for Ireland's Phase 1 projects it would lead to a longer timescale for commercial scale delivery and therefore lead to a longer period of fossil fuel dependency for Ireland. As such floating foundation technology was not deemed a viable and reasonable alternative.

In order to viably construct an offshore wind farm that has its foundations fixed into the seabed the maximum water depth considered at the outset of site feasibility was approximately 60m (deeper water depths were considered to be technically unviable due to a lack of foundations available that could be installed in water depths beyond this limit). Fixed bottom foundations for offshore wind have been deployed over multiple decades within multiple geographical locations with differing seabed conditions. They are a tried and tested technology therefore demonstrating that the most viable option for the proposed development is WTGs upon fixed foundations within a site of water depths <60m.

5.5 Site Selection Framework and Evolution

In March 2023 the Department of the Environment, Climate and Communications (DECC) issued a Policy statement titled 'Accelerating Ireland's Offshore Energy Programme, Policy Statement on the Framework for Phase Two Offshore Wind.' In this statement DECC laid out plans of moving to a plan led approach for the development of the next phases of Offshore renewable energy in Ireland whereby the government would select the sites for development.

Prior to this the identification of suitable sites for development of offshore renewable energy was not planled. Developers undertook site selection and feasibility exercises to identify the most appropriate locations for the siting of offshore wind farms. With regard to the proposed development, the Developer commenced site selection and design evolution in 2008 and has since that time undertaken multiple extensive site surveys, design iterations and detailed consultation events which has led to the final development extent and layout options as they are presented in this EIAR for the purposes of the planning application.

In 2014, the Offshore Renewables Development Plan (OREDP) identified the East-Coast North region (within which the proposed development is located) as being viable for offshore wind.

5.5.1 Relevant Project Status

Marine Planning and Development Management Bill (MPDM), 2019 General Scheme (which was the precursor to the Maritime Area Planning Act) was published in December 2019. The purpose of the MPDM was to replace the Foreshore Act and set out a new regime for the management of development of activities in Ireland's Maritime Area. The Transitional Protocol which was published to give guidance to the offshore renewable energy (ORE) sector regarding the treatment of offshore projects known as 'Relevant Projects' in the context of the MPDM Bill 2020.

A 'Relevant Project' was defined as;

a. offshore wind projects which applied for (and substantially advanced) or were granted a lease under the Foreshore Act 1933, as amended (the Foreshore Act) in respect of which material changes are proposed to that which was originally applied for and assessed under the Foreshore Acts, which changes require further assessment and / or

b. offshore wind projects which have a valid connection agreement from the TSO or are confirmed by the TSO as eligible to be processed to receive a valid connection offer

The proposed development was awarded 'Relevant Project' status.

A Planning Interest was highlighted as the first 'gate' in the proposed new marine planning process and is a pre-requisite for all offshore renewable energy planning applications to An Bord Pleanála. Developers of Relevant Projects therefore had priority over earlier stage projects in accessing the planning process when the new offshore consenting regime is in place.

5.5.2 Grid Connection

On foot of a direction issued by the Commission for Regulation of Utilities in January 2020, EirGrid was required to commence processing grid applications from projects that are designated as a 'Relevant Project' under the Transitional Protocol.

EirGrid determined that the existing Belcamp 220 kV Substation, located in north county Dublin to be the most suitable location and issued a Grid Connection Assessment (GCA) (the first step in obtaining a full Connection Agreement) for the proposed development on this basis. Further detail is provided in Section 5-38. Given that Eirgrid had identified the Belcamp 220kV Substation for the proposed development via the GCA, no other grid connection was considered a reasonable alternative.

5.5.3 Site Selection Framework Conclusion

In summary, the regulatory framework supported the advancement of a fixed bottom offshore wind farm on the East Coast of Ireland to be led by the Developer. As such other locations or development frameworks were not considered reasonable alternatives.

5.5.4 Site Selection Process

The information below is provided as an overview of the site selection and alternatives process that have been considered as the proposed development has evolved.

The process that was undertaken from initial site feasibility in 2008 to the submission of the planning application (2024) is outlined below and further explained in more detail. During this period the proposed development was advanced by different entities. Statkraft Ireland acquired the project in 2018, prior to entering into a joint venture with Copenhagen Infrastructure Partners in 2022.

A high level timeline of the extensive site selection activities undertaken since the early project inception in 2008 is provided below. Image 5.1 outlines the key stages within this site refinement process.

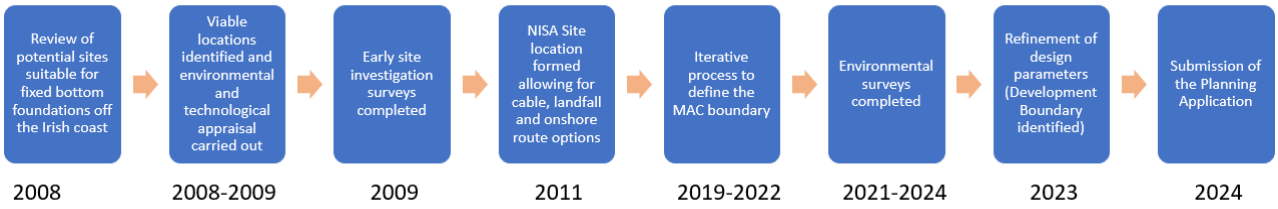

Image 5.1 Site Refinement Process

5.5.5 Initial Site Selection Review

Ireland was identified as a suitable candidate for renewable energy development due to the EU wide and Ireland specific renewable energy targets, as detailed in Section 5.1 above and outlined fully in the Legal and Policy Chapter. The east coast of Ireland was chosen initially as the water depths are favourable with shallower water depths occurring parallel to the coast. Ireland's first offshore wind farm is located off the coast of Wexford.

5.5.5.1 Irish Marine Study Assessment - Gaelectric and University College Cork (2008)

In 2008, Gaelectric commissioned University College Cork (UCC) to carry out an integrated geological and marine desktop study of the Irish Sea in the Irish Economic Exclusion Zone (EEZ) between Dunmore East (Co. Waterford) and Carlingford Lough (Co Louth), from a minimum distance of 5km from the coast to a maximum water depth of 60m. The purpose of the study was to identify target areas of the seabed for which a fixed bottom offshore wind farm could potentially be economically constructed, operated, and maintained. The chief technical criteria for the search in suitable wind farm construction areas were:

- Continuous areas with water depths less than 60m
- Low tidal current speeds, low wave exposure, and low sedimentary bedform displacements
- The presence of sufficiently deep (preferably 30m and more) seabed sediments

To assess the overall effect of a proposed offshore windfarm on marine activities that already take place in proximity to the potential sites, additional environmental criteria considered were:

- Large enough distance to busy shipping lanes, sub-seabed cables, shipwrecks, marine aggregate extraction sites, and existing Foreshore licence and lease areas.
- The absence of environmental protected areas/designated sites, fisheries, and marine, oil and gas resources.

Taking all these factors into consideration, six sites were identified as Recommended Sites (RS) for further investigation (see Image 5.2 below).

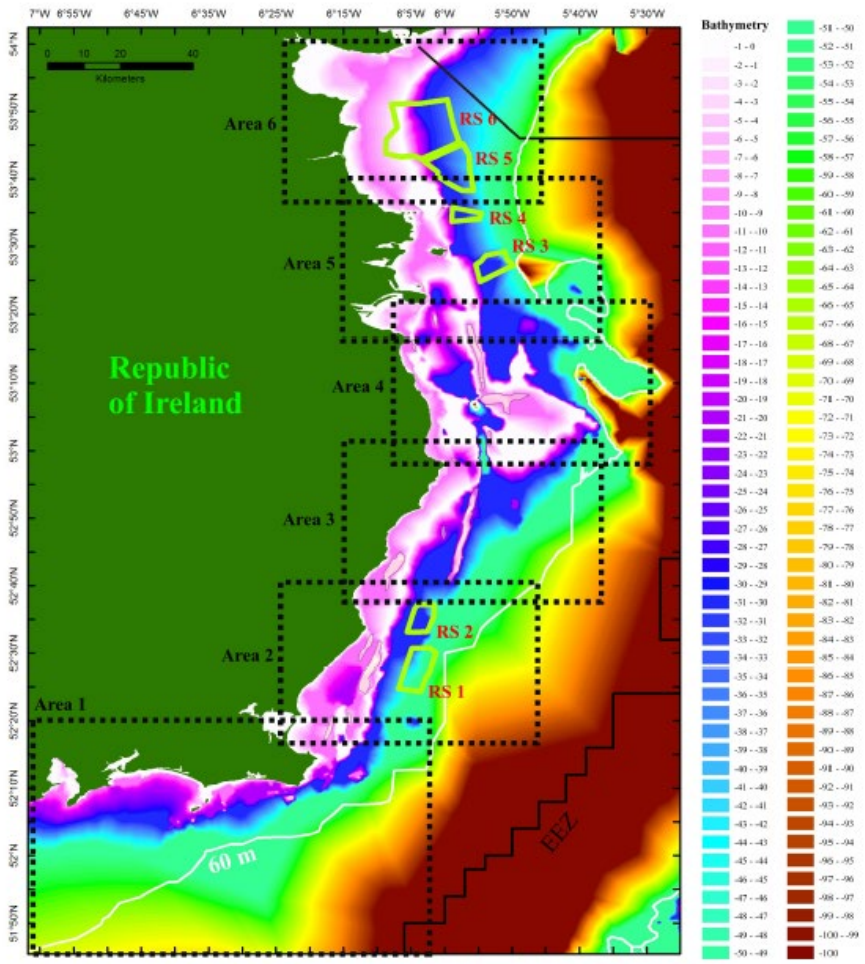

Image 5.2 Overview map showing the location of the 6 Recommended Sites (RS)

Each of the Recommended Sites were evaluated based of the criteria listed above, and were assigned Low, Medium, High or Very High priority status for further investigation. These priority ratings and key comments can be seen in Table 5.1 below.

Table 5.1 Overview of the RS Priority ratings and key comments.

Recommended Site	Priority	Comments/ recommendations
RS 1	Low	Suggested: Low mobile sediment supply but strong currents: concern surrounding possible scour around foundations. Whelk fishing ground present
RS 2	Low	Suggested: Low mobile sediment supply but strong currents: concern surrounding possible scour around foundations.
RS 3	Medium	Recommended: Well-documented, low energy environment, thick sediment cover and away from busiest ferry routes. However still 500-1000 ferries passing each year
RS 4	High	Well, recommended but undocumented: low-energy environment and away from ferry routes
RS 5	Very High	Highly recommended and partly documented: low-energy environment and away from ferry routes
RS 6	Very High	Highly recommended and partly documented: low-energy environment and away from ferry routes

The study identified the Northern Irish Sea as an offshore wind zone that would be more suitable/economic for development applying the latest fixed foundations technology. The proposed offshore development area can be seen to broadly correlate to areas RS6, RS5 and RS4 in Image 5.2 above.

5.5.5.2 Irish Sea Marine Assessment (2009)

Following the initial identification of the recommended sites as outlined above, University College Cork (UCC), the Geological Survey of Ireland (GSI), the University of Bangor, the Marine Institute (MI), and Gaelectric carried out a collaborative research offshore survey (ISMA) in 2009 to assess the seafloor and its substrates. The aim of the research was to provide integrated seabed and sub-seabed mapping data of the areas identified in the desktop study of the Irish Sea and to assist in a fundamental understanding and evolution of the seabed.

The areas identified as being suitable for offshore wind development in the 2008 Marine Study of the Irish Sea were the basis of survey efforts to be conducted and the 4 site study areas of the ISMA research cruise undertaken in conjunction with University College Cork and INFOMAR. The areas surveyed were the Codling Deep, the Lambay Area, the Rockabill Area and the Northern Mudbelt (see Image 5.3 below).

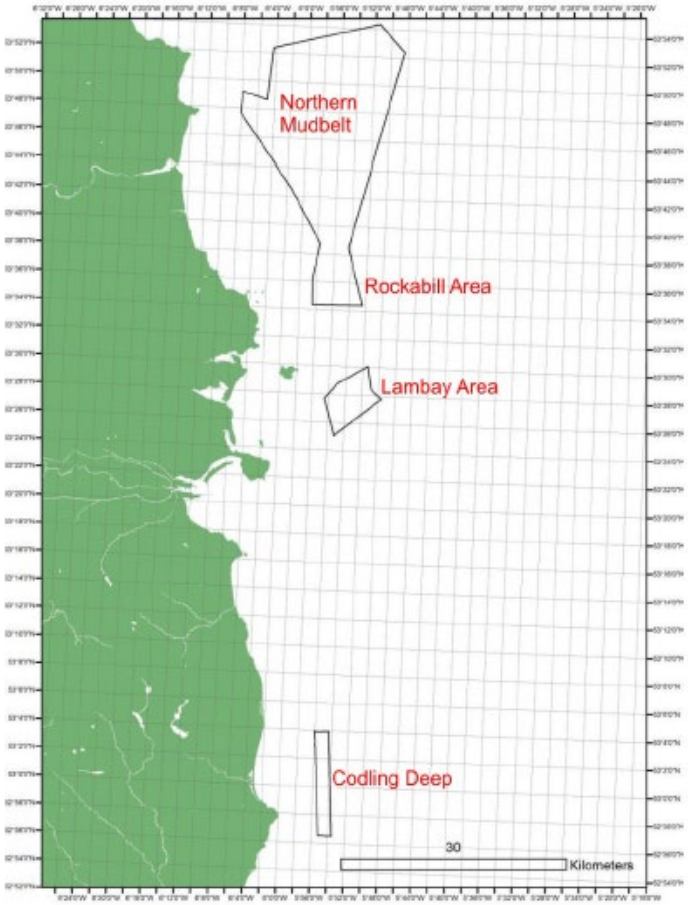

Image 5.3 Location of the ISMA survey efforts

For the purposes of this early site identification and characterisation of site conditions, Geophysical (Multibeam echosounder (MBES) and shallow seismic) and ground truthing (surface grabs and shallow core) data was acquired from each of the areas, along with data recorded by the onboard Marine Mammal Observer (MMO) with regards to the presence of marine mammals and birds. Acoustic doppler current profiler (ACDP) and a conductivity-temperature-depth (CTD) profiler were also deployed in order to conduct a study of the properties of the water masses encountered.

The proposed development offshore development area can be seen to broadly correlate to areas within the Northern Mudbelt, Rockabill Area, and Lambay Area.

5.5.5.3 *IMAR Study (2009)*

Gaelectric commissioned an independent constraint study to identify socio-economic and competing marine interests. This assessment is known as the IMAR Survey. The IMAR desktop study identified key constraints, (including separation distance from busy shipping lanes, avoidance of subsea cables where practicable, avoidance of marine aggregate extraction sites and proximity to shipwrecks which were then overlain on top of the previously collected geological datasets from the ISMA Study (2009) and the Marine Study of the Irish Sea (2008) and identified two preferred development zones as identified below in Image 5.4.

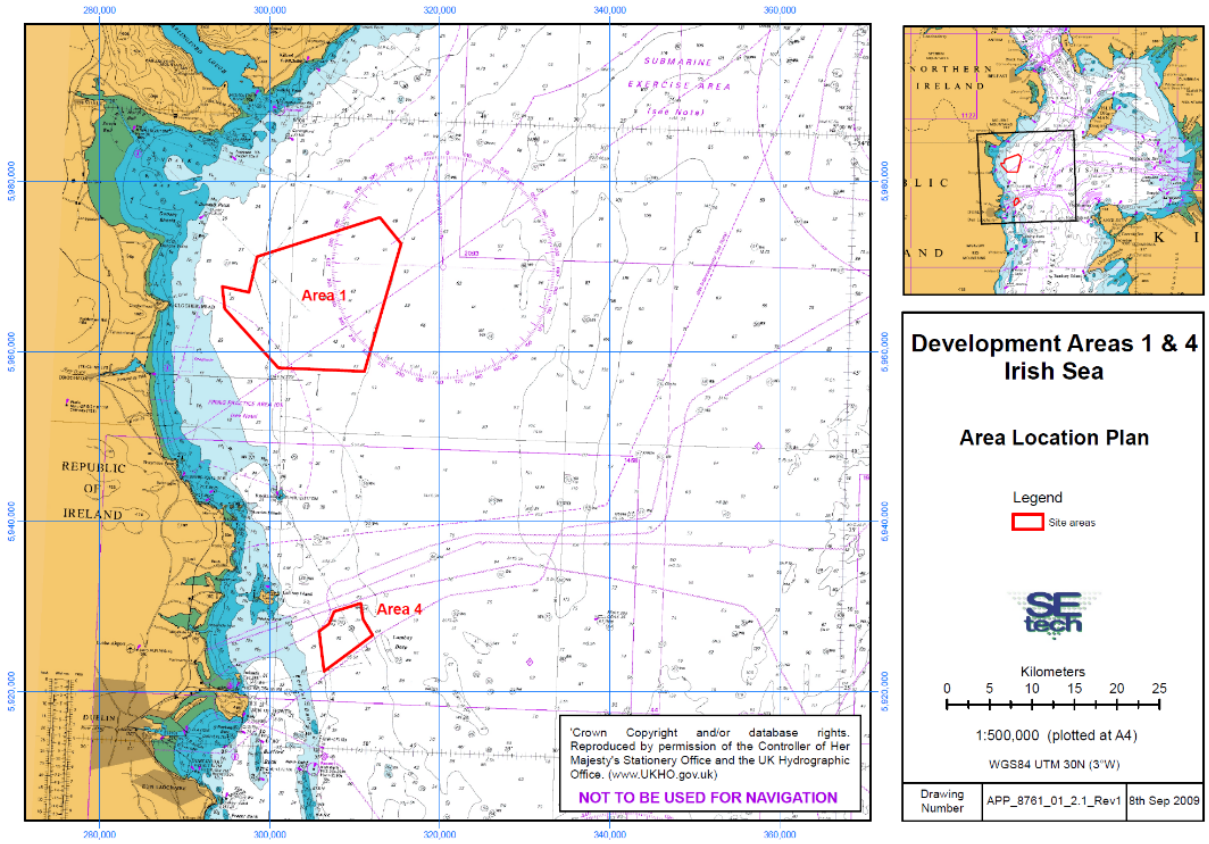

Image 5.4 Two preferred development zones identified by the IMAR Study.

5.5.6 Environmental and Technical Appraisal

Following the multiple survey efforts outlined above a robust constraints analysis was undertaken by the Developer. Constraints considered included:

- Technical considerations of the metocean, wind, and seabed characteristics
- Overlapping Foreshore licences
- Distance to shore (visibility perception from the coast) - siting of infrastructure at the furthest distance practicable from the coast – due to the ground conditions and water depths required for deployment of fixed foundations a 10km buffer from the coast was applied
- Avoidance of Designated Sites
- Shipping and navigational features
- Commercial fisheries activity
- Proximity of the onshore electrical and grid infrastructure
- Potential interaction with civil and military aviation and Radar and military danger areas

- Proximity to the energy demand centres e.g. larger population centres where the electricity will be required
- Onshore grid constraints and upgrade requirements
- Economic efficiency for the Irish electricity consumer
- Bathmetry - water depths not exceeding 60m and
- Avoidance of existing offshore cables and pipelines.

The evolution of the array area for the proposed development is shown on Image 5.5 below.

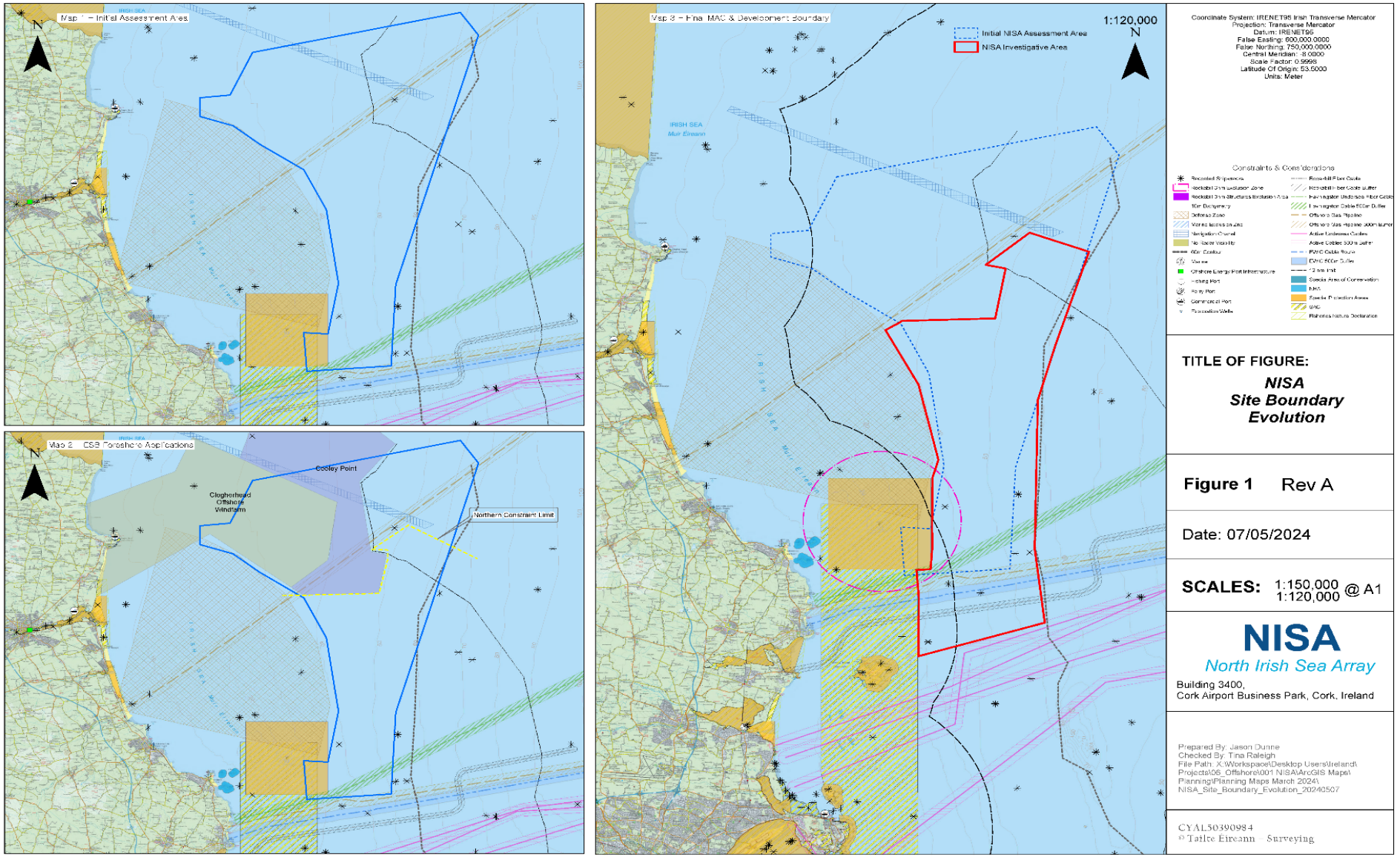

Image 5.5 Evolution of the Array Area of the Proposed Development

The initial assessment area (which was the extent of the Foreshore Licence Application in 2011) was identified on the basis of an amalgamation of those areas identified in the IMSA, ISMA and IMAR studies detailed above (the figure at the top left-hand side in Image 5.5). Following the identification of overlapping Foreshore Licences submitted by ESB (the figure at the bottom left-hand side of Image 5.5), the northern extent of the investigative area was refined to exclude these areas. Finally, following the environmental and technical appraisal process outlined above, the investigative area extents were further modified and refined to the area identified in the figure on the right-hand side of Image 5.5.

On completion of the above appraisal and review, a further Foreshore Licence application was submitted in 2019 for further investigative work. The area outside the 12 nautical mile (nm) limit was excluded from the Foreshore Licence Application due to the licensing regime at the time. This Foreshore Licence was granted in 2021 and site investigation works as detailed in Section 5.5.8 have been undertaken under this licence. A Foreshore Licence was also submitted for the Export Cable Corridor extent – this is outlined in Section 5.6.5 below.

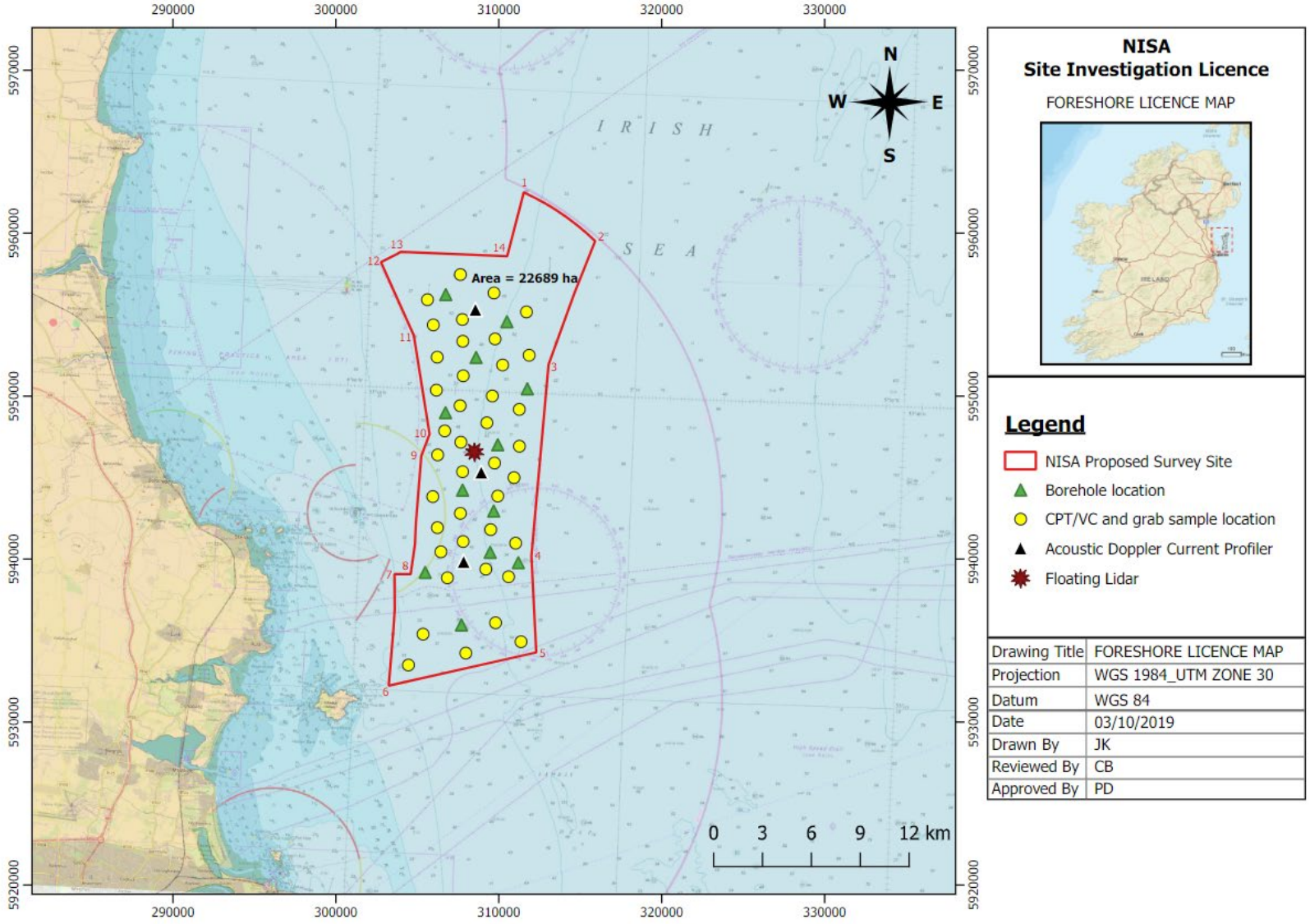

Image 5.6 Foreshore Licence Survey Area for the Array Area of the Proposed Development

5.5.7 Confirmation of the Preferred Array Location

Following the robust process detailed above and the existing constraints as indicated in the image above (Image 5.6) the preferred location and extent of the proposed development offshore development area were identified, and this formed the boundaries of the area as identified in the Maritime Area Consent (MAC) application.

The MAC boundary is provided in Image 5.7 below. Note this figure also includes the MAC export cable corridor extents – the process for identification of these extents is outlined in Section 5.6.5 below.

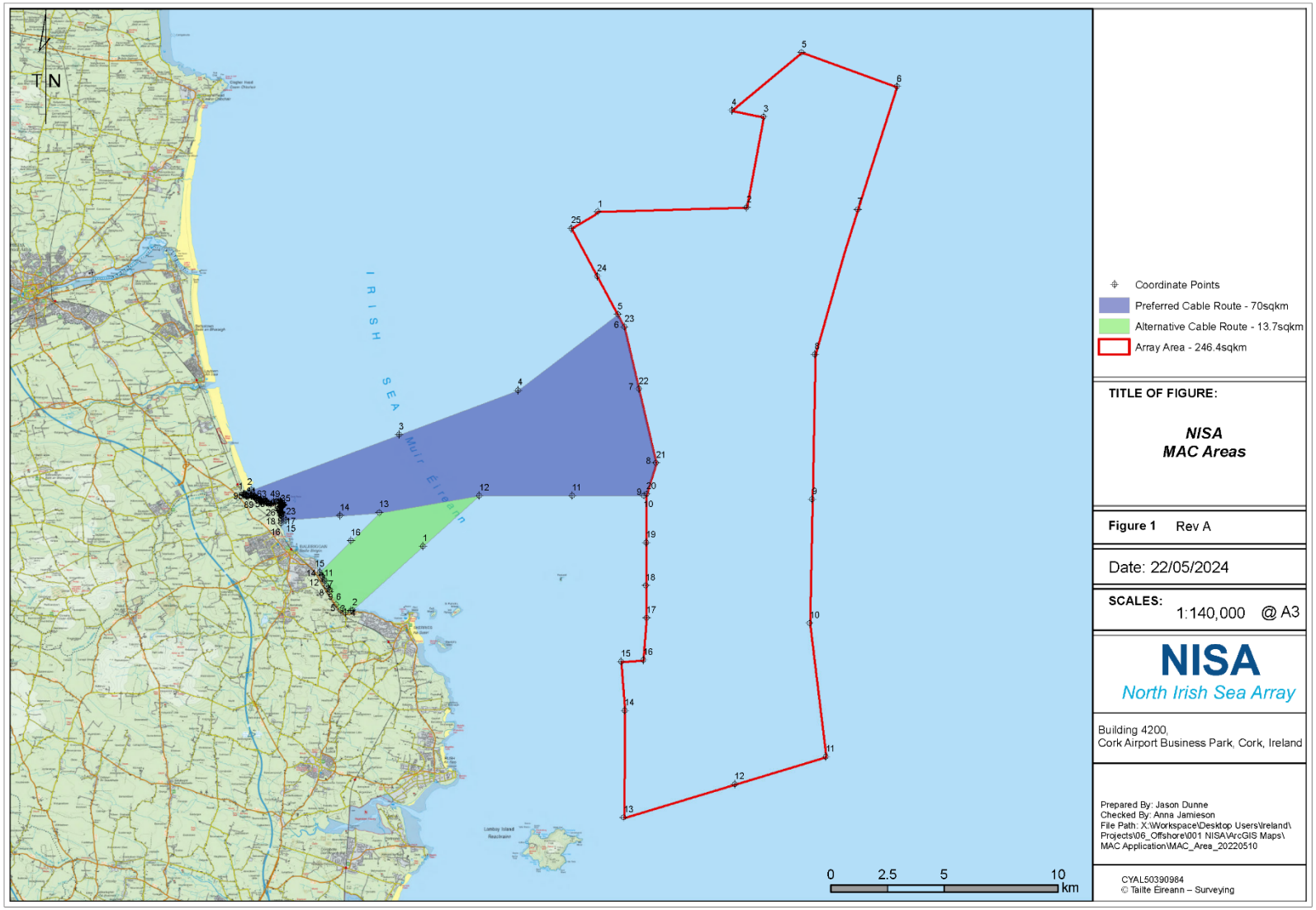

Image 5.7 MAC Area for the Proposed Development

The Developer was successfully granted a MAC for the proposed development in December 2022. The granting of the MAC established the extent of the consent area within which the permitted maritime use (construction and operation of an Offshore Wind Farm and associated infrastructure {including decommissioning}) was permitted and provided the mechanism to subsequently apply for development consent within that maritime area.

5.5.8 Site Surveys

Further information on the site location developed through extensive baseline characterisation survey work of the MAC extents for the proposed development and appropriate buffers. This resulted in the refinement of the project design, resulting in the parameters and design shown in Volume 2: Chapter 6 Description of the Proposed Development – Offshore (hereafter the "Offshore Proposed Development Chapter") and Volume 2: Chapter 7 Description of the Proposed Development – Onshore (hereafter the "Onshore Proposed Development Chapter") of this EIAR.

This survey work offshore included:

- 29 months of Digital Aerial Surveys (DAS) for ornithology and marine mammals (May 2020 to October 2022)
- Seven vessel based ornithological surveys undertaken between November 2019 and July 2022
- Four periods of six coastal ornithological vantage-point surveys between September 2019 and May 2021 across two sites
- 24 months of ornithological landfall surveys (January 2021 to December 2022)
- Geophysical (2023) and geotechnical surveys (2023) to provide greater understanding of the seabed make up (which strongly influences the different types of foundations, sizes, and WTG locations)
- Metocean surveys, which provide greater understanding on the sea and wind conditions (which also influences foundations sizes and turbine locations)
- Marine Traffic Surveys (2021, 2022 and 2023)
- Benthic ecology surveys to characterise the marine habitats (2022 and 2023).

The survey efforts undertaken led to the design evolution of the offshore infrastructure as outlined in Section 5.6 below.

5.5.9 Siting Within the North West Irish Sea cSPA

It should be noted that at an early stage, all designated sites at that time including all Special Areas of Conservation (SAC), Special Protection Areas (SPA), in the locality off the east coast were mapped. The offshore location of the proposed array area was sited to avoid overlap with any designated sites at that time. In the context of designated sites, it should be acknowledged that in 2023, subsequent to the project's Maritime Area Consent (MAC) being awarded and following the Offshore Renewable Energy Support Scheme (ORESS) contract being entered into, a candidate SPA (cSPA), named as the North-west Irish Sea SPA was identified which overlapped with the offshore development area.

This cSPA overlaps fully with the proposed development's MAC boundary. However, the Natura Impact Statement (NIS) that is submitted with this application concludes that the proposed development will not have any adverse effect on the integrity of the cSPA, or any other European Sites, either alone or in combination with any other plan or project. The co-location of the proposed development within the cSPA is therefore mutually compatible (to note in the UK, Gunfleet sands and Kentish Flats offshore wind farms are both located in the Outer Thames Estuary SPA). Further information is included in the NIS and in Chapter 15: Offshore Ornithology (hereafter referred to as the "Offshore Ornithology chapter") of this EIAR.

5.6 Design Evolution of the Offshore Infrastructure

The following sections summarise the evolution of the key design parameters associated with the offshore infrastructure required to develop the project. As more environmental and technical information about the site has been gathered and further detail on the viable technology types that could be deployed understood in greater detail, it has been possible to refine parameters accordingly.

5.6.1 Offshore Development Area

In order to ensure efficient use of the seabed, the offshore development area has been refined to reflect the most appropriate area within the MAC area to develop the wind farm.

This section outlines the site refinement process undertaken to select the proposed offshore development area (the area taken into the planning application and shown in Image 5.8 below), along with all reasonable alternatives considered. Building on the approach outlined in Section 5.5.6 above which details the technical and environmental constraints considered in initial site selection.

The original MAC boundary and the comparison of the proposed development boundary is shown in Image 5.8 below. The environmental considerations in choosing the selected option are provided below.

5.6.1.1 Environmental Considerations

The factors used to undertake this site selection process to reduce the MAC boundary area to the offshore development area included:

- Seabed and ground conditions, utilising geophysical and geotechnical survey data to exclude areas unsuitable for foundation installation
- Wind resource, focusing areas of the site where wind speeds are uniform and > 10m/s allowing for the greatest yields and thus provision of renewable energy
- The interaction with the newly designated cSPA, completing extensive ornithological assessment upon layout options, as well as increasing the distance between the array and Rockabill Island SPA – therefore reducing ornithological connectivity where practicable
- Commercial fisheries interests – reducing the offshore development area to exclude the areas with the greatest static fishing grounds and reduce overlap with key nephrops fishing grounds
- Shipping and navigation – ensuring areas of the highest intensity vessel movements were excluded and also facilitating a reduction in the deviation for vessels which may choose not to route through the array, in comparison to routing around the entire MAC boundary and
- Existing interconnectors – crossing of the existing electrical and gas interconnectors may be challenging, therefore this area and the area south of the interconnectors was removed from the offshore development area.

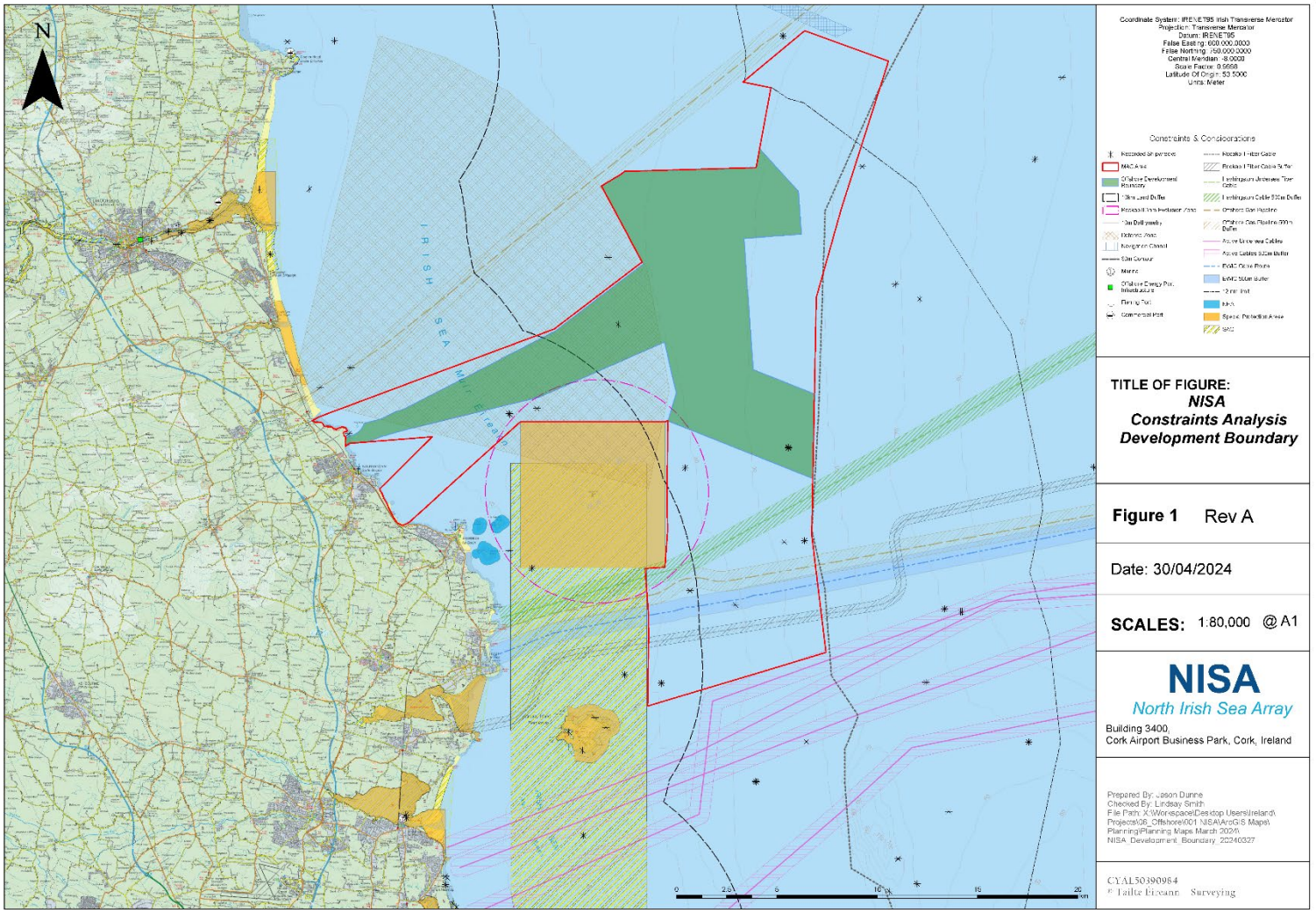

Image 5.8 Offshore Development Area and associated constraints

The offshore development area represents only 36% of the full MAC boundary area and was reduced as a commitment by the Developer to ensure optimal seabed usage where possible, whilst seeking to ensure the key environmental constraints and other marine users are impacted as minimally as possible.

5.6.1.2 Offshore Development Area – Environmental Comparison (Ornithology)

Both the collision risk and displacement assessments for ornithological species are undertaken based on abundance/density estimates of birds from site specific DAS data within the array area (plus relevant buffer for the displacement assessment). Through this process, 'hotspots' of birds may be identified which may indicate key foraging/loafing areas if they are consistently identified across multiple surveys across multiple months. Image 5.9 below shows the abundance of key species from the site-specific surveys undertaken. Refinements to the project boundary removed these hotspots, reducing the risk to birds by not undertaking any activity that could result in impacts in key areas.

While undertaking refinements, a key consideration was guillemot, for which high abundances of birds were consistently located in the breeding season in the south-east of the original project boundary, neighbouring the large guillemot colony of Lambay Island. In addition, for several key species high concentrations of seabirds were evident in the south of the MAC area (outside of the array area), and in proximity to Lambay Island during the breeding season.

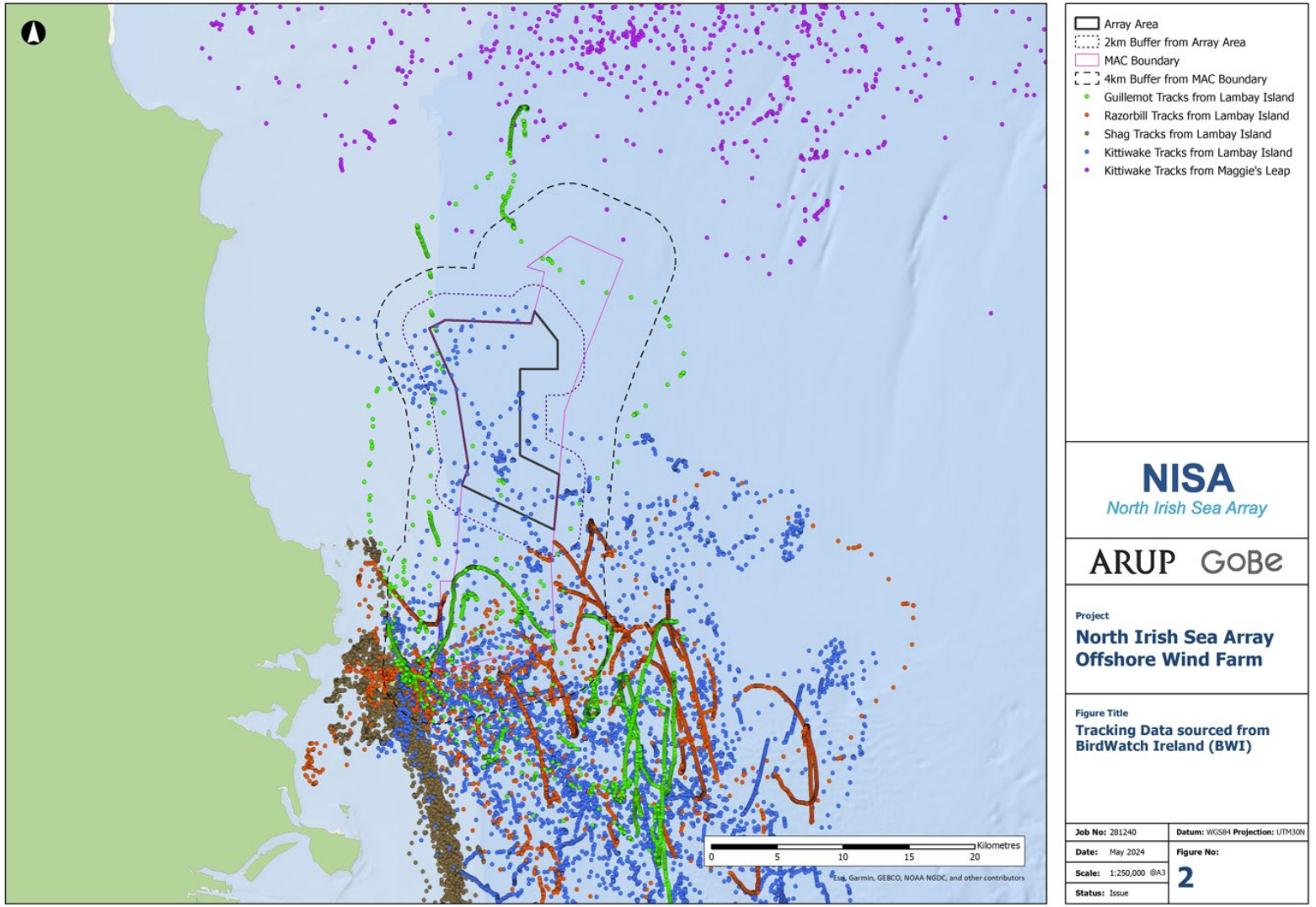

Image 5.9 Tracking Data

By reducing the extent of the offshore development area, the distance from Rockabill Island is increased, which leads to a reduction in interaction with bird species that inhabit Rockabill Island and are qualifying features of the Rockabill SPA, and therefore reducing ornithological connectivity between the Rockabill SPA and the proposed development where possible and consequent potential impacts upon those species. Further information is included in the ornithological assessment included in the Offshore Ornithology Chapter.

5.6.2 WTG Layout Refinement

Within the offshore development area, a range of WTG numbers and locations have been considered during the development of the project. These layouts have ranged from 30 to 49 WTG numbers (depending on WTG capacity) as shown in Image 5.10. The key aims from the design evolution were to consider the environmental and technical constraints at all times by:

- Reducing the area of array which will impact upon commercial fisheries static fishing grounds
- Reducing the overall visual impact of the array on local communities and receptors
- Avoidance of high-density shipping areas and
- Located within the areas of highest wind speed to ensure greatest yields and thus provision of renewable energy.

WTGs capacity, dimensions and quantity (determined by the likely WTGs on the market at the time of procurement and construction of the proposed development), foundation technology options as well as yield were also key parameters in the array design evolution process. Early designs were based upon feedback from WTG OEMs (Original Equipment Manufacturers) and expectations of WTG models which may be available based on the supply chain. Foundation screening assessments (i.e. studies whereby the available geological information was used to prepare a conceptual model of the site and a qualitative assessment of the technical suitability of foundation options undertaken) have been carried out.

Based on these, the viable foundation solutions have been refined, in conjunction with zonation of the site (i.e. differentiation of the site into 'go' and 'no-go' areas based on subsoil conditions and bathymetry) to establish the most advantageous ground conditions. This helps ensure an optimal foundation design solution and minimise the intrusiveness of the proposed infrastructure by availing of more advantageous ground conditions and minimising the extent and size of offshore structural elements. It reduces the penetration into the seabed and the diameter (i.e. footprint) in the case of piles.

A description is provided below of each of the alternative array layouts considered during the design evolution phase of the proposed development and environmental considerations associated with each.

5.6.2.1 Pod Layout

The pod layout was the earliest concept layout considered and comprised WTGs sited within three clusters or 'pods' located within the MAC boundary area. Each pod was located approximately 5km from the next, with the Southern pod located 12.7km to shore at its closest point, the central pod located 16km to shore, and the Northern pod located 23.5km to shore. The Pod layout is provided in Image 5.10 below.

The pod layout is a novel concept which is untested in UK and Irish waters to date. Several iterations of turbine locations within the pod layout were established, based on the following environmental criteria:

- Keep Search and Rescue (SAR) corridor width and orientation according to regulations
- Provide sufficiently wide lanes within the WTGs to allow for trawling in favourable directions
- Manage turbine loads due to wake-induced turbulence
- Mitigate the visual perception of the project by introducing the pod concept, with the intention to break the farm up into smaller clusters and
- With all the above taken into account - maximise renewable energy production.

As a result of the initial geotechnical investigations and subsequent foundation screening assessments and feasibility design, it was identified that the Northern pod was located in unfavourable ground conditions, as well as being located within a shallow gas field. Shallow gas can be considered to be a marine geo-hazard and can pose issues for the design, installation and operation of offshore infrastructure. However, evidence of shallow gas has been observed in the Irish Sea (shallow gas occurrence in the Irish Sea has been documented and described in various literature from 1992 through to 2023) and the extent of the shallow gas field that underlies the MAC boundary area has been clearly identified via the site specific geophysical surveys and mapped in the ground model. Due to the risk posed by shallow gas, primarily the effect on strength of the soil, this area has been deemed to be a 'no go' area and unsuitable for foundations. Thus, further layout iterations took place to find locations to site the WTGs from the Northern pod within the remaining two pods. However, the required spatial extent to accommodate a layout that would be sited on suitable ground conditions and on a suitable wind yield arrangement, whilst still maintaining a pod concept was not available. As such, the pod layout option was not considered a reasonable alternative.

5.6.2.2 Grid Layout

The grid layout consisted of 30-49 WTGs located in a grid-like formation within the larger MAC boundary area. Several iterations of the layout were created (including layouts endeavouring to maintain trawling lanes by re-orientating the grid following feedback from commercial fisheries stakeholders), based upon the same criteria as the pod layout. The grid layout (which is a tried and tested offshore wind farm layout approach from other markets) was initially considered as a standardised layout for the purposes of preparing an ORESS bid cost model utilising industry best practice alongside the constraints considerations as outlined in Section 5.5.6 above. The grid layout is provided in Image 5.10 below.

During the geophysical campaign of the array area in 2022 it was identified that within the southern extent of the array area there were areas of both outcropping and shallow bedrock. The shallow thickness of soil cover was identified as precluding the design and installation of foundations. Additionally, prior to carrying out site specific survey work, existing linear infrastructure (i.e. Havhingsten Telecommunications cable, Rockabill Cable, Gas Interconnector and Segment 'C' of the EXA Atlantic Fibre optic cable) were known to cross the MAC boundary in the southern extents.

Whilst the presence of pre-existing infrastructure is known not to be a prohibitive factor to offshore wind farm development, it is preferable to site infrastructure where there is no existing infrastructure (and avoid the need for protective cable crossing features), hence this part of the site was considered a "no-go" area for the siting of WTGs (and associated inter array cabling network).

On completion of the geophysical and geotechnical surveys a ground model was produced. The geophysical survey provided data on the seabed and sub-seabed (soil stratigraphy) but carries uncertainty as it relies on the interpretation of seismic reflection data. The geotechnical data allows 'ground truthing' of these seismic stratigraphic units, determination of the soil and rock lithologies and yields mechanical properties of the soil for design purposes. The ground model offered more understanding of the geotechnical conditions and identified the key complex ground condition areas which were deemed 'no go' areas. Ultimately, this allowed the development area to be reduced such that it availed of the most optimal ground conditions and reduced the spatial extent that was required for the proposed offshore infrastructure.

Consideration had been given to a true grid layout, which would have the WTGs in a notional gridded layout (e.g. WTGs set out equidistance from each other along nominal grid lines). However, the retention of a true grid layout would require WTGs to be sited in areas of challenging ground conditions (i.e. certain locations would have been sited within areas of extremely weak soil or shallow bedrock horizon). As such, the grid layout option was not considered a reasonable alternative.

As a result of this process, fixed layout options, Project Option 1 and 2 were considered as most appropriate to maximise the energy yield of the site and turbine suitability at the expected procurement dates, whilst ensuring environmental impact were minimised. Full details are provided below.

5.6.2.3 Project Options 1 & 2

Project Options 1 and 2 were identified as the most suitable layout options within the offshore development area and were subsequently confirmed as the layouts to be taken into the planning process. These are described in further detail below and full details are provided in Chapter 6: Description of the Proposed

Development – Offshore (hereafter referred to as the "Offshore Description Chapter") and details are provided in planning drawings 281240-ARP-OFS-OA-DR-PL-1010 and 281240-ARP-OFS-OA-DR-PL-1010, as well as 281240-ARP-OFS-OA-DR-PL-2001 to 281240-ARP-OFS-OA-DR-PL-2007.

The application for consent includes flexibility as to project design as secured through the design flexibility opinion issued to the proposed development by An Bord Pleanála under section 287B of the Planning Acts dated 26 January 2024. As the detailed site investigations had not been completed on site, a 500m Limit of Deviation (LoD) is required to allow for unforeseen seabed conditions and obstructions, and to also allow for the incorporation of mitigation measures such as micrositing around any Annex I habitat that is identified during the detailed site investigation campaign.

Further details of Project Options 1 and 2 are provided in the Offshore Description Chapter and Chapter 7: Description of the Proposed Development – Onshore (hereafter referred to as the "Onshore Description Chapter").

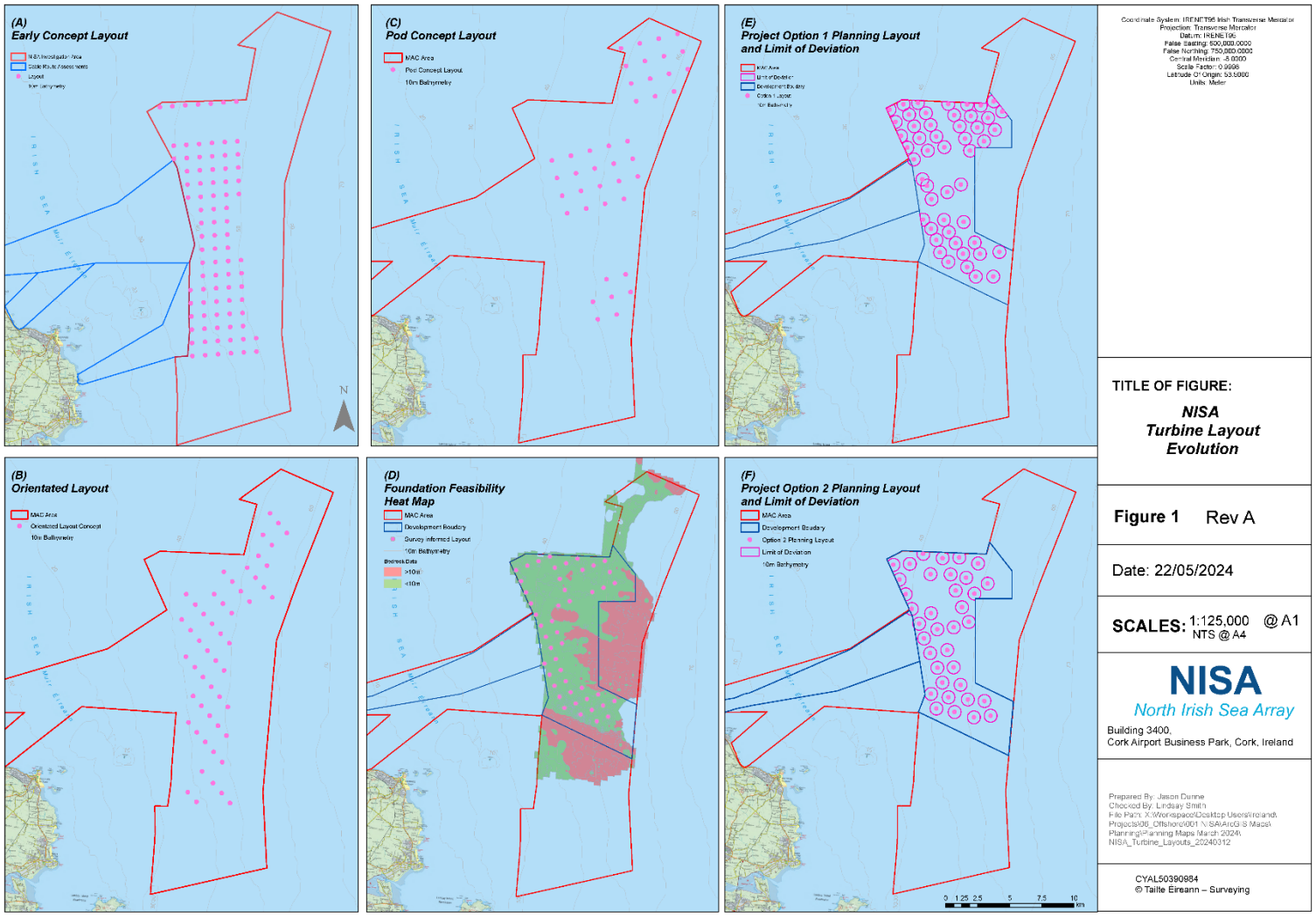

Image 5.10 WTG Layout Refinement

5.6.3 Offshore Infrastructure Refinement

To refine the infrastructure choices and types within the development boundary area, numerous technology types were considered in relation to the key environmental and technical constraints whilst ensuring economic viability of the project.

5.6.3.1 WTG Dimensions

In the context of offshore wind developments, minimum tip heights taken forward by the OEMs in the design of the WTG are considered relative to 22m mean high water springs (MHWS), representing the lowest possible tip height as a result of navigation limits. For the proposed development, key collision risk species (as identified in the Offshore Ornithology Chapter) are considered to be herring gull, great black-backed gull and black-legged kittiwake (based on sensitivity from available literature (e.g., Bradbury et al., 2014) and site-specific digital aerial survey (DAS) data. For these species, Image 5.11 shows the reduction in the proportion of birds at collision risk height based on different tip heights above 22m. For all three, a clear reduction in the proportion of birds at collision risk height is identified as the minimum tip height is increased, with the largest difference being at 40m.

Based on this, an increase in minimum tip height was a clear solution to reduce the number of birds at collision risk height, which directly translates to a reduction in collision mortalities. Therefore, the approach taken by the Developer of using a minimum tip height of 40m (relative to LAT) has provided a demonstrable reduction in collision risk to several key species and as such was taken forward within the basis of design for WTGs within both Project Options. Based on the combination of WTG parameters anticipated by the WTG OEMs and the proposed minimum tip height, no other WTG dimensions were considered reasonable alternatives.

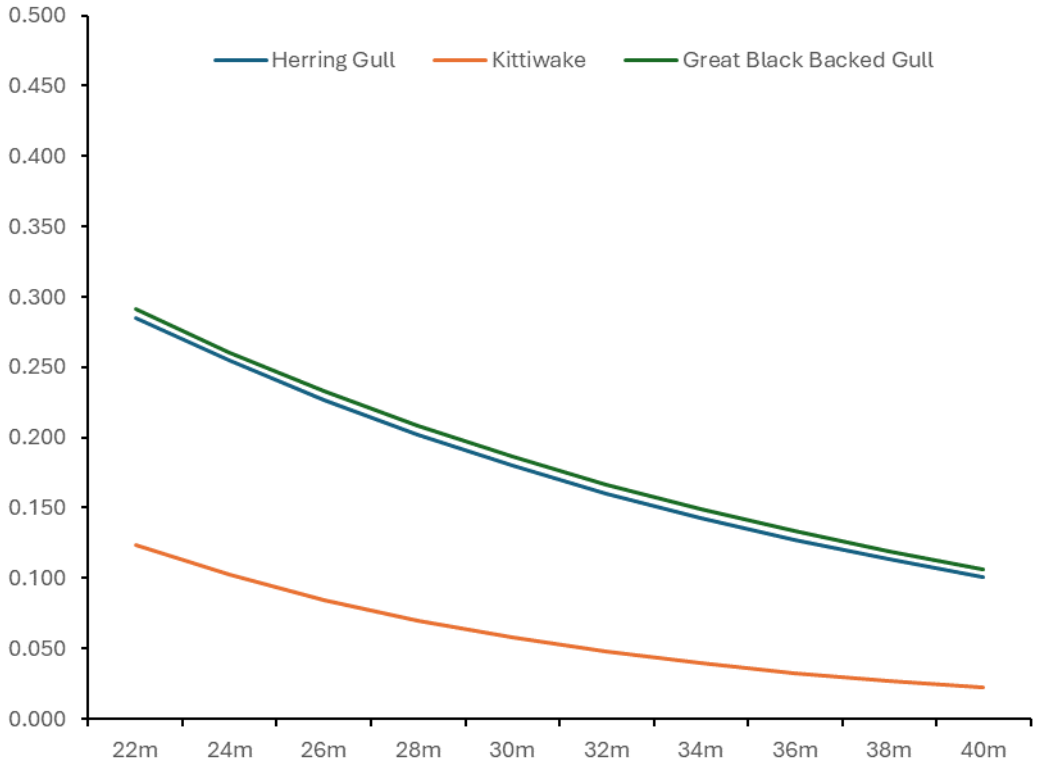

Image 5.11 Proportion of birds at collision risk height based on different turbine minimum tip heights.

5.6.3.2 WTG Foundations

A number of standard offshore WTG foundation types were initially considered for the proposed development including:

- Monopiles
- Jacket foundations on pin-piles
- Jacket foundations on suction caissons
- Gravity base foundations and
- Tripod foundations.

The proposed standard fixed bottom offshore wind foundation types are shown in Image 5.12 below.

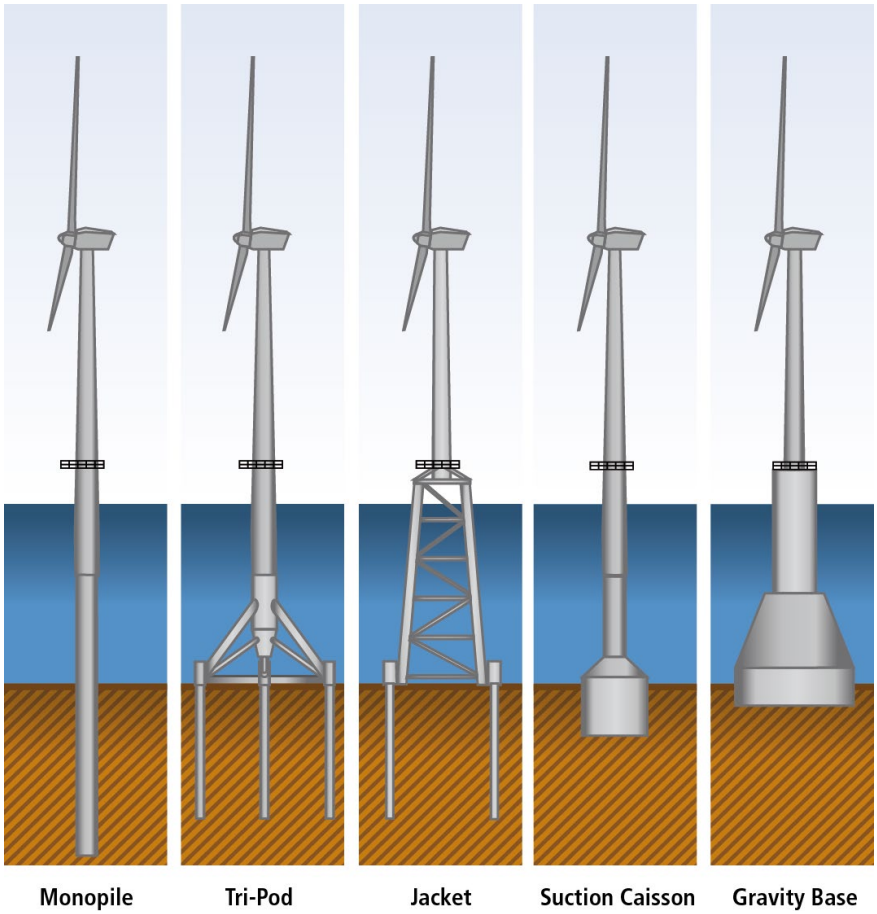

Image 5.12 Fixed Bottom Foundation Designs[3]

The key driver for refining the foundation options was the sub-seabed conditions within the MAC boundary and subsequent development boundary as identified through multiple survey campaigns (geophysical and geotechnical surveys in 2023).

The ground conditions dictate which foundation types would be required in relation to both installation and operation. The optimum foundation is dependent on both the final WTG selected and the site conditions which cannot be confirmed until after the detailed site investigation campaigns which have not yet been completed. Other parameters also considered include manufacturability (where and how easily can the foundation be manufactured), availability (will the foundations be available when the Developer requires them to be deployed), suitability for installation (linking to ground conditions, how easily can the foundation be built out on site) and cost (will the cost of the foundation be viable in relation to the ORESS price achieved for the project).

Tripod foundations have not been installed on a commercial basis to date with only one offshore wind farm having utilised the concept, and hence were not considered a reasonable alternative in the project design

[3] https://www.researchgate.net/publication/311339042_Wind_turbines_current_status_obstacles_trends_and_technologies

process. This foundation concept is considered to add unnecessary technical risk and complexity to the proposed development (the manufacturing and installation requirements are overly onerous given the prevalent ground conditions across the array area).

Given the absence of a proximate fabrication/ manufacturing location, gravity-based foundations are not considered a mature technology at present and hence were not considered a reasonable alternative, noting gravity-based foundations are also likely to have a higher environmental impact on benthic and physical process receptors (due to the increased footprint and weight of reinforced concrete elements associated with this concept) than other options.

Whilst technically viable in discrete areas of the array area, jacket foundations on suction caissons were discounted as a possible foundation type due to the seabed and sub-seabed conditions identified during the geophysical and geotechnical survey campaigns. Suction caisson foundations are still in their infancy in offshore wind development, and the footprint and penetration of the caissons required were deemed to be a precluding factor from a manufacturing and installation perspective and as such were not deemed a viable alternative.

As such, the current foundation options being proposed include both monopiles and jackets on pin-piles. Both foundation types have been widely used in offshore wind, and in the case of jackets, long established track record exists for their use in the oil and gas industry globally in multiple water depths.

Monopiles remain the predominant foundation type for offshore wind due to their structural efficiency. Monopiles essentially provide an extension of the WTG tower in which the sub-structure element (i.e. portion of the foundation that is exposed above the seabed in the water column) and the pile (i.e. embedded portion that penetrates into competent soil stratum), are provided in one, singular structural element. This has proven to be an optimal concept for design, manufacturing, and installation, yet minimising the size, footprint and intrusiveness of the foundation. Design development has allowed the length and diameter of monopiles to increase such that they can be scaled up as appropriate for ever increasing WTG sizes.

Jackets are a stiffer structure in that they comprise of a series of welded braces, and their footprint and complexity can be scaled up to account for the higher loads of larger WTGs and water depths. The jacket design concept requires a separate pile element to be installed into the seabed first, onto which the sub-structure element of the jacket itself must be fixed. As jackets are multi-leg, this requires three or four piles to be installed, each of which necessitates strict tolerances. This involves pre-piling (whereby a template is required to be temporarily placed on the seabed) or post-piling (whereby the jacket is lowered to the seabed with a pre-installed frame to guide the piles).

Due to appraisals conducted to date on the ground and oceanographic conditions across the array area, coupled with conceptual design work to date, both monopile and jacket design solutions have been developed for the project, but it cannot yet be determined which are the most viable given the uncertainty on WTG type, further investigation of ground conditions, supply chain considerations etc.

Project Option 1 proposes monopiles only whilst Project Option 2 considers both monopiles and jackets on pin piles.

5.6.4 Offshore Substation Platform (OSP)

As per the WTG locations, the OSP has a 500m LoD and it has been located in the optimum position to reduce the requirement for inter-array cables and export cables, ensuring a reduction in the footprint of the cables on the seafloor so reducing the potential for environmental impacts, as well as delivering technical and construction efficiencies and therefore reducing the cost to the consumer.

The selection of the foundation types for the OSP was driven by feasibility considerations as per the reasons detailed above for the foundations of the WTGs. It was considered that either monopiles or jackets on pin-piles would be the most suitable foundation type for the seabed conditions within the array area, rather than other alternatives such as suction caissons and gravity base foundations which were ruled out for the same reasons as detailed in Section 5.6.3.2 for WTG foundations.

5.6.5 Offshore Export Cable Corridor Evolution

Three potential Export Cable Corridors (ECC) were identified to connect the offshore development area to the three corresponding landfall areas which were initially considered. Detailed landfall site selection criteria are provided in Section 5.7.2 of this chapter.

These three potential ECC's were outlined in the 2019 foreshore licence application. The identification of these three ECC considered the following environmental considerations, informed by detailed GIS data constraints layers and review of existing data where available:

- Shipping and navigational features
- Designated sites
- Commercial fisheries activity
- Proximity to landfall and length of corridor
- Proximity of the onshore electrical and grid infrastructure
- Technical considerations of the metocean, and seabed characteristics and
- Economic efficiency for the Irish electricity consumer.

As discussed in Section 5.6.5 and 5.6.5.1, the export cable route selection was driven by finding the most optimal route to the identified landfall options in order to reduce the length of the offshore export cables. This delivers technical efficiencies which lowers the cost of construction and therefore overall cost to the consumer, as well as reducing the footprint of the infrastructure and thus the environmental impact of the infrastructure on the seabed floor. The initially identified ECC's are shown in Image 5.13 below:

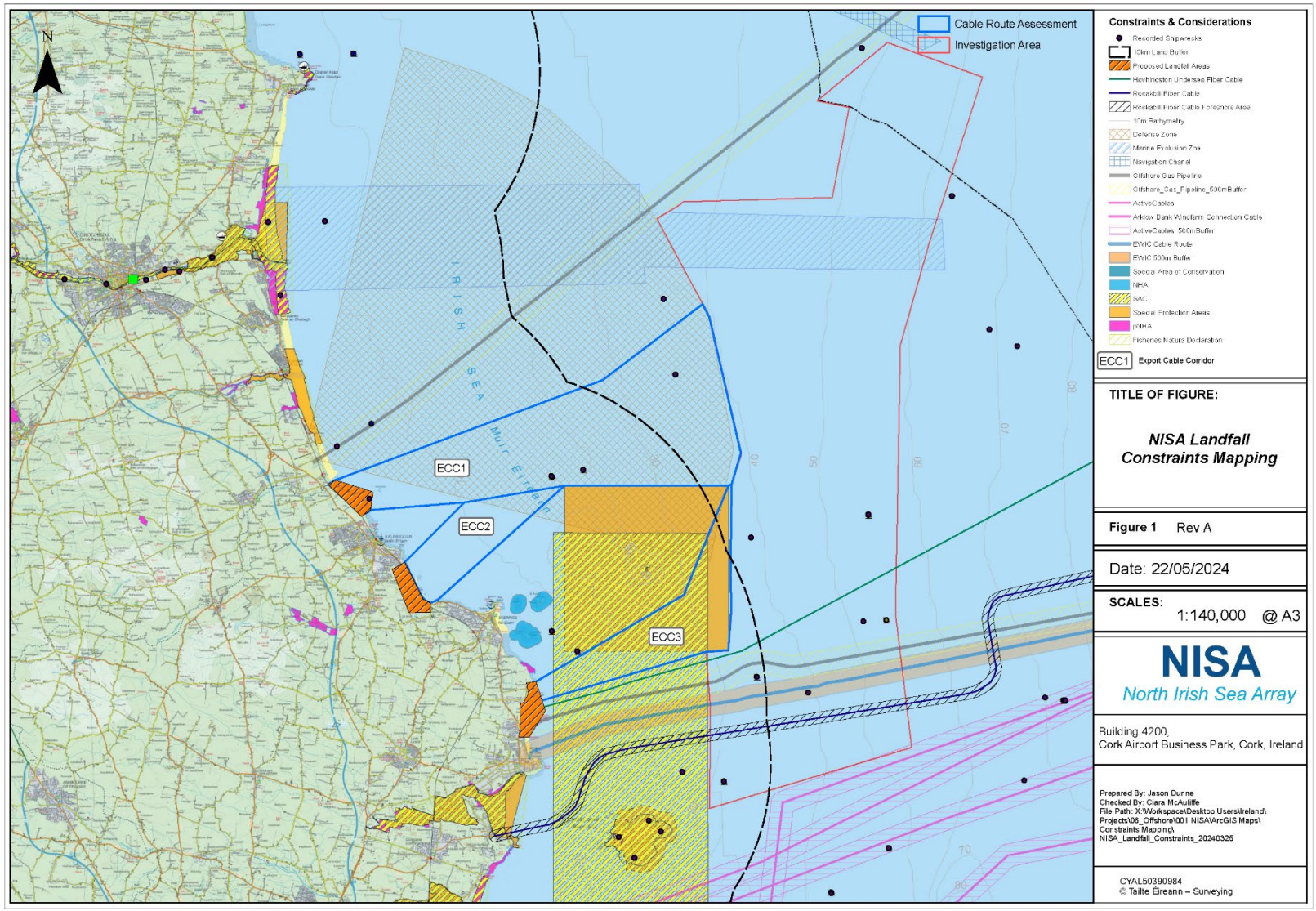

Image 5.13 Export Cable Routing Alternatives - Environmental Considerations

5.6.5.1 Export Cable Routing Alternatives - Environmental Considerations

ECC 3 traverses through designated sites – the Rockabill SPA and the Rockabill to Dalkey Island SAC. It also passes close to existing infrastructure of existing cables and pipelines. The associated landfall site was also assessed for HDD bore feasibility but was discounted due to the presence of coastal cliffs and unsuitable ground conditions. As such, ECC option 3 was not considered a reasonable alternative to ensure a reduction in environmental impact on designated sites where practicable.

ECC 2 followed a very similar route to that proposed by ECC 1 however, ECC 2 connected to an unsuitable landfall (due to a lack of space for the HDD and landowner constraints as detailed in Section 5.7.2) and as such was discounted as it was not deemed a viable alternative when the landfall was also deemed not a viable alternative.

ECC 1 is deemed to be the most suitable of the three options considered. It provides the shortest route to the preferred landfall from the OSP, making it the most economical with the least environmental impacts option. The landfall site was also deemed to be suitable from a HDD feasibility perspective, with sufficient space and access for construction and different options for landfalling the export cable (multiple HDD concepts were derived, along with an open cut trenching option, which was subsequently discounted).

Although this ECC requires the export cables to be partly routed through the Gormanstown E1-D1 firing exercise area, where the Irish military conduct live surface-to-air firing practice, this is not considered a hard constraint as Marine Notices will be issued by the Department of Transport, Tourism and Sport informing when these firing practices will be conducted and applying an exclusion zone within the area for marine users during these periods. All construction teams will be made aware of this constraint and will comply with all exclusion zones as required. Although ECC 1 contains shipwrecks, buffer zones around the wrecks will be established with consultation with the National Monuments Service (NMS) and the export cable route will be refined to avoid the wrecks. More details on the mitigation measures for the archaeological features can be found in Chapter 18: Offshore Archaeology and Cultural Heritage, hereafter referred to as the "Offshore Archaeology and Cultural Heritage Chapter".

Further assessments and site surveys have been carried out on ECC 1 to refine the extents of the corridor. A desktop appraisal whereby data gathered as part of the INFOMAR programme (primarily hydrographic and geophysical) were assessed such that a preliminary ground model report could be developed. This gave an understanding of the expected subsurface geology and preliminary route selection for the purpose of follow-up hydrographic and geophysical surveys, whilst attempting to reduce the area required for cable routing and site-specific surveys.

Specific constraints were taken into consideration for possible cable route options through the corridor, namely reported location of wrecks (with associated exclusion zone), presence of outcropping, and shallow bedrock, and any discernible seabed features such as bedforms, steep gradients and shallow gas.

Due to limitations in the age and resolution of the available INFOMAR data, other constraints could not be factored into the route corridor options, such as potential UXO, seabed debris from fishing activities, boulders or other seabed obstructions. Based on this pre-routing appraisal, a 'heat map' for export cable installation was produced, which then subsequently informed the scope of the initial site-specific geophysical survey.

Cable spacing is a key design consideration for offshore development. Where two or more cables are installed in parallel, a minimum spacing is required to allow for construction and repair activities. The separation distance is related to the water depth, and with the large spatial extent of a WTG array, the required space to optimally route cables such that an adequate cable spacing is maintained necessitates a 'funnel' where the cable corridor meets the array area. Based on the expected number of WTGs and associated electricity output, two export cables are now required to bring the electricity from the OSP ashore, whilst also providing electrical redundancy, meaning that if one of the cables were to experience a fault, there is redundancy in the system and electricity can still be carried onshore via the other cable. This has allowed the extents of the initial ECC 1 corridor to be refined, such that three main cable route options each with a nominal width of 1000m (denoted as a northern, central, and southern corridor) were developed and formed the primary basis for preliminary geophysical and geotechnical survey effort.

Based on the findings of the site-specific survey campaigns and a least cost path analysis (LCPA), the three main routes were subjected to further assessment and review. This multi-criteria analysis (encompassing considerations such as bathymetry, seabed slopes, ground conditions, sediment classification, boulder, seabed debris etc.) allowed the merits of each route to be assessed. Whilst there were no precluding factors identified for any of the three routes assessed, and none of the routes were shown to be interfering with environmentally sensitive or protected areas, the southern corridor was discounted, and the northern and central corridors amalgamated. This refinement has allowed the extent of the export cable corridor to be reduced and forms the basis for the development boundary.

The refinement process for the ECC is shown in Image 5.14 below.

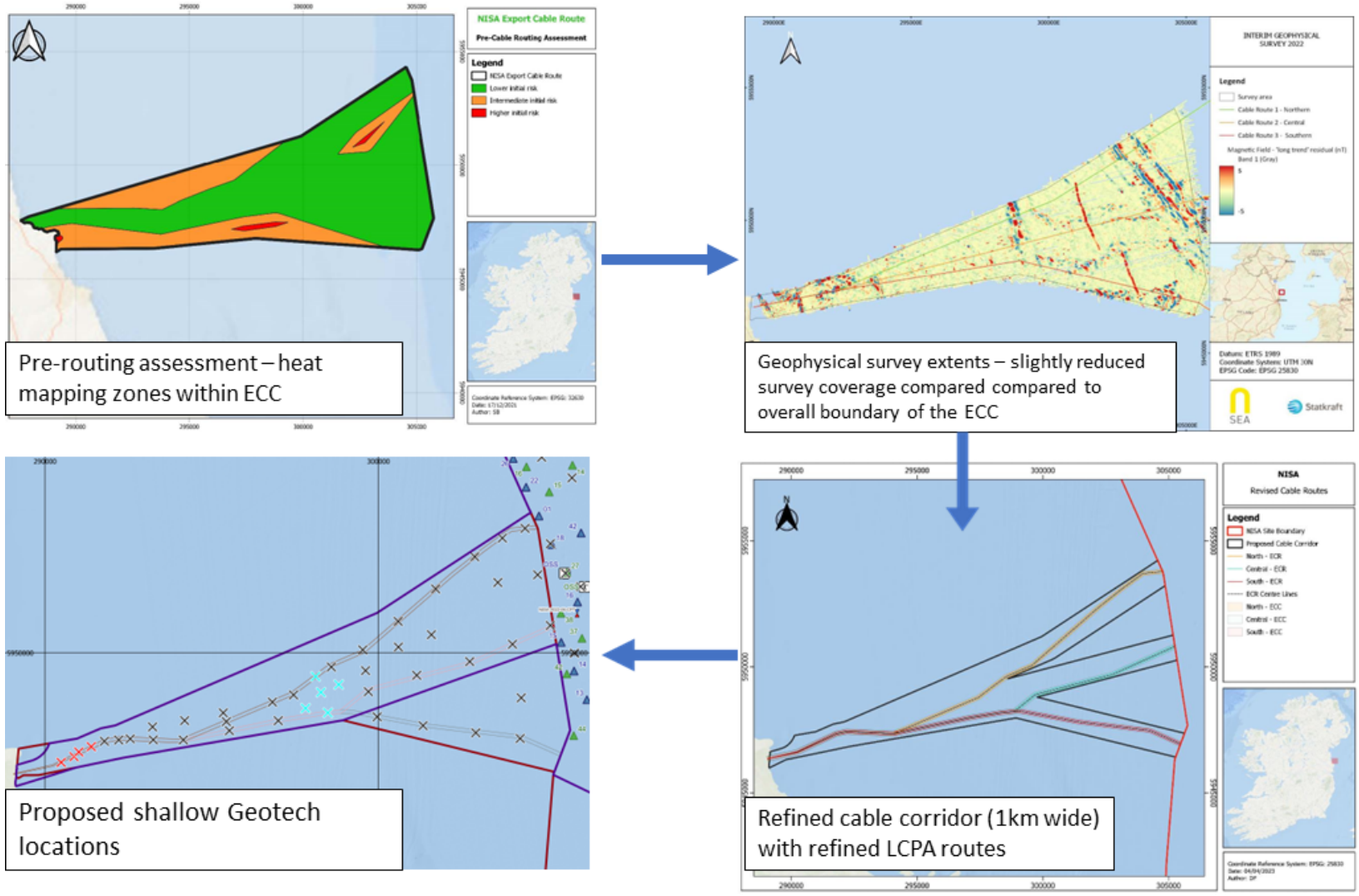

Image 5.14 ECC Refinement Process

Details of the onshore landfall areas and subsequent onshore cable routes which connect the proposed development into the 220kV network are provided in Section 5.7.

5.7 Alternatives Considered for the Onshore Infrastructure

5.7.1 Introduction

To deliver the power generated offshore to the transmission network, there is a need for onshore infrastructure.

The three key aspects of the onshore infrastructure considered were:

- Landfall site selection
- Grid Facility (including the 220kV onshore substation and compensation station) site selection and
- Onshore cable route options.

This section describes the alternatives studied during the evolution of the onshore infrastructure design and the main reasons for the final landfall, grid facility and onshore cable route options chosen, taking into account the effects on the environment alongside the technical and economic factors. The key assumptions (basis of design) which guided the optioneering process for each of these three items are summarised in the sections below.

As noted in Section 5.5.2 above, EirGrid determined that the existing Belcamp 220 kV substation, located at Belcamp in north county Dublin was the most suitable location for connection to the existing electricity transmission network and issued a Grid Connection Assessment (the first step in obtaining a full Connection Agreement) for the proposed development on this basis. Consequently, no alternative grid connection locations were investigated by the Developer as no such locations were identified by EirGrid as preferable to the Belcamp 220 kV substation in the process described above.

5.7.2 Landfall Site Selection

The landfall is the transition point between onshore and offshore infrastructure. This section describes the reasonable alternatives studied during the evolution of the landfall site selection process and the main reasons for the site selected, taking into account the effects on the environment.

5.7.2.1 Landfall - Basis of Design

Before landfall sites could be assessed, it was necessary to identify the key constraints (basis of design) associated with the landfall and which enabled the identification of feasible landfall options which could be considered. These included the following:

- Proximity to the array offshore
- The topography and bathymetry (offshore) which will affect the distance the construction vessels can reach from the shore and the length of the intertidal zone
- The need for sufficient space to locate the transition joint bay (TJB) and a horizontal directional drilling (HDD) pit onshore (if HDD is the preferred methodology)
- Avoidance of designated sites where practicable
- Avoidance of known archaeological features and areas of geophysical constraints
- Proximity to surrounding infrastructure (e.g the local road network for deliveries of components etc)
- Accessibility for construction - good access is required both onshore and offshore, with alternative access enabled for landowners and a suitable lay-down area for landfall construction works required onshore

- Coastal migration – which includes landward migration (erosion) or seaward migration (accretion/ emergence) and
- Supportive engagement with landowners.

The constraints assessment included multiple site visits and landowner engagements to enable the feasible landfall site options to be identified.

The methodology adopted for the site walkover involved:

- Evaluating aerial photography images prior to site visit
- Annotated sketches and take note of features and hazards in the area
- Photographs of the sites from various angles and
- Compilation of notes of features and observations inherent to each site.

On the basis of the criteria above, three feasible landfall sites were identified in 2020, which met the basis of design requirements.

5.7.2.2 Description of Landfall Sites Considered

The three landfall sites emerging from the constraints assessment above were:

- Landfall 1 – Bremore Point
- Landfall 2 – Skerries North
- Landfall 3 – Skerries South.

These landfall site options are shown on Image 5.15 and are described below.

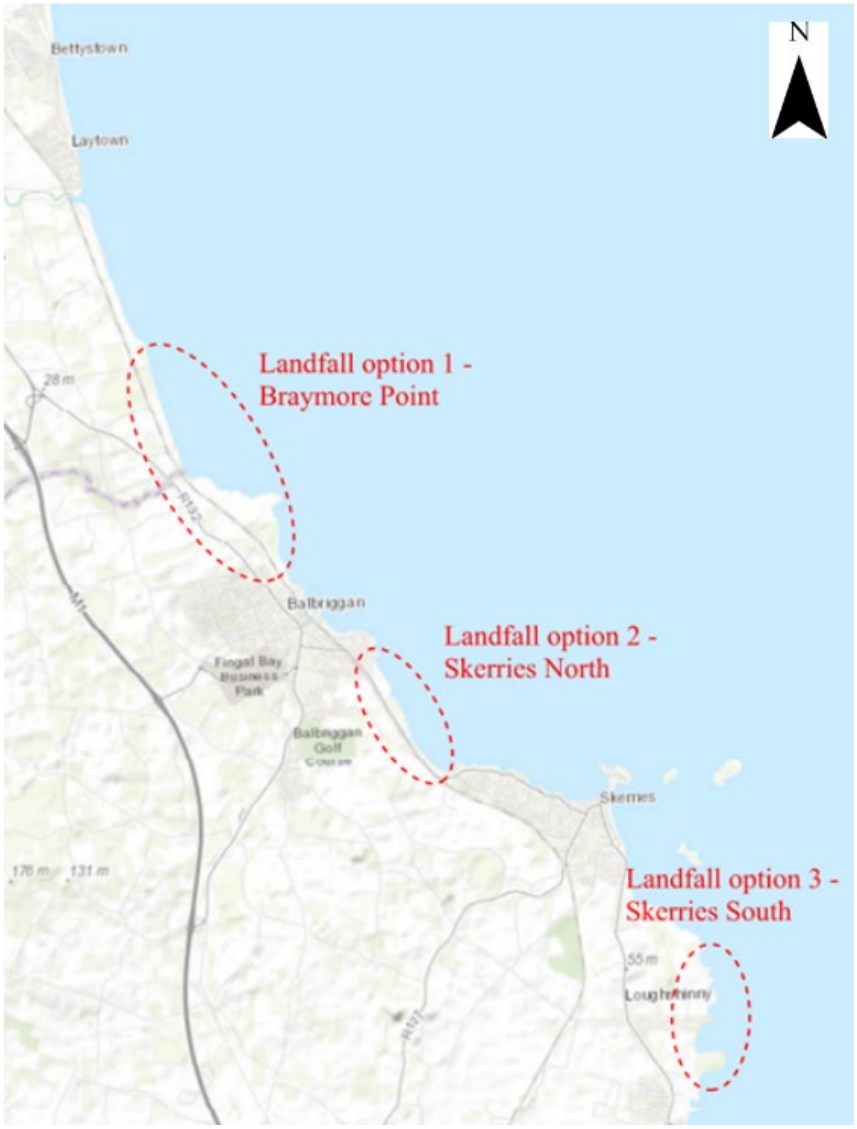

Image 5.15 Location of Landfall Site Options

Landfall 1 – Bremore Point

Landfall 1 covers a stretch of coastline around Bremore Point, between Balbriggan to the south and Gormanston Camp (Military Camp with disused runway) to the north on the Dublin/Meath border. The area considered is approximately 4.2km in length, trending North-Northwest to South-Southeast. The Delvin River runs through this area, in a west-east direction, discharging to the sea in the northern portion of this landfall area. Image 5.16below shows the Landfall 1 area.

The northern section of Landfall 1 is a flat sandy/cobbled beach that sits in front of a predominantly soft sediment cliff face while the southern section is a flat sandy beach that sits in front of a hard rock cliff. North of the Delvin River, the area is comprised mainly of soft sediment deposits such as unconsolidated muds and glacial tills. Above the cliffs and beaches lies agricultural land with hedgerow and occasional pockets of dense vegetation, bounded to the west by the Dublin to Belfast railway line which runs roughly parallel to the coast.

There are two public road access points for Landfall 1 as shown in Image 5.16. The first runs parallel to the Delvin River but has a height restriction in place of approximately 5m as it passes under the Dublin-Belfast railway line.

The second access point is located 500m north of the first and passes over the railway line, with the road being narrow in places. While this access is unrestricted by height, there may be weight restrictions at the overbridge which would need to be considered. The northern section of Landfall 1 is also considered to be located within the Department of Defence military danger area (Gormanston Camp).

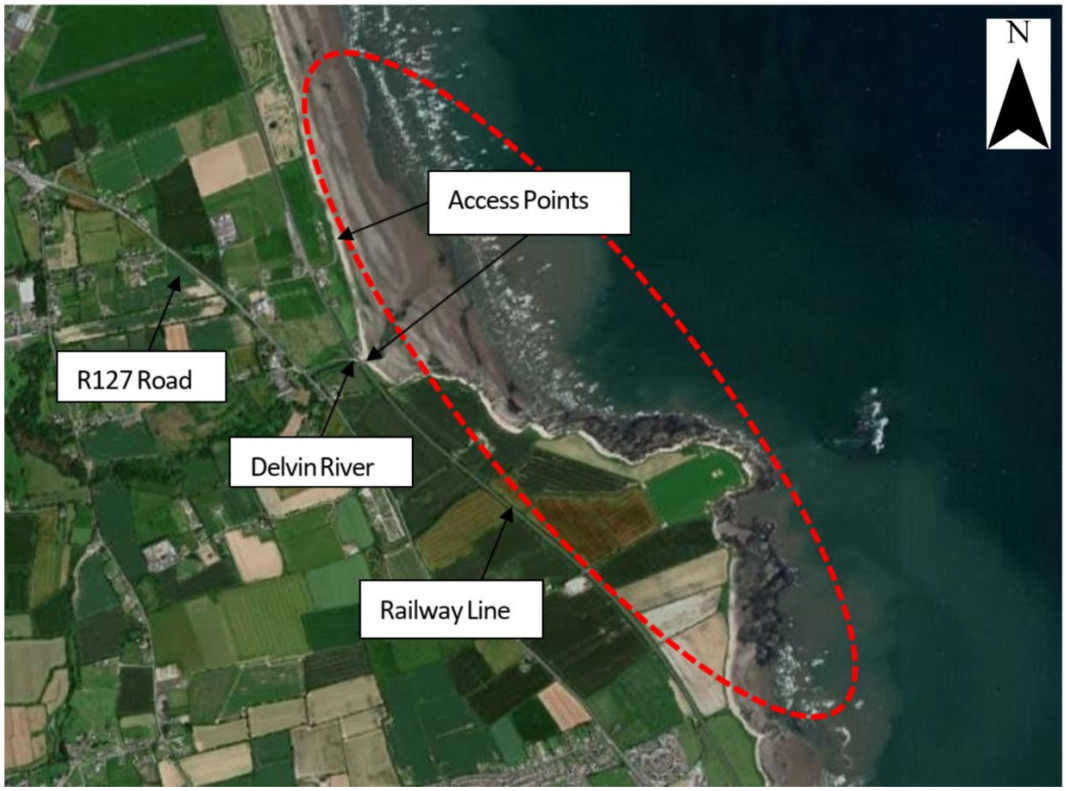

Image 5.16 Landfall 1

Landfall 2 – Skerries North

The stretch of coastline identified as Landfall 2 lies between the towns of Balbriggan and Skerries, approximately 25km north of Dublin. Landfall 2 is a flat to undulating sandy/cobbled beach that sits in front of a high steep cliff. The total area is approximately 2km in length and trends North-Northwest to South-Southeast. The railway line (and the adjacent R127 road) runs parallel with the coast and there are also a number of residential properties in the vicinity. In addition, a public museum in the form of Ardgillan Castle is located approximately 500m from the coast just south of the centre of the site. Ardgillan Castle and Demesne is shown in Image 5.17 and this would need to be avoided.

The main geological units present are well bedded greywacke sandstones interbedded with finer siltstones. Due to the dip of the bedrock in this region, large sections of the cliff face are comprised of soft sediment glacial tills. The cliff height varies between 10-15m with sections showing signs of erosion. The southern section of Landfall 2 has several erosional defences in place in the form of sea walls and groynes. The seawalls are both reflective and vertical and act to reduce the erosive effects of incoming waves. Groynes are in place to prevent longshore drift and the removal of sediment from the beach. There is a public road access point to the south of the site and a pedestrian access via a set of stairs located approximately 800m north of this access point.

Image 5.17 Landfall 2

Landfall 3 – Skerries South

This stretch of coastline lies to the south of Skerries and to the north of Rush, approximately 20km north of Dublin. Landfall 3 is located near Loughshinny beach (See Image 5.18) in close proximity to Loughshinny Harbour and is approximately 3km in length, trending North to South.

The landfall area comprises of several small beaches and a prominent headland. Much of the site contains exposed bedrock. The geology of Landfall 3 is structurally complex with extensive folding present throughout the site. Where there are cliffs present within this landfall area, the heights range from 3-4m in the northern section up to 15m in the southern section, with sections where the composition of the limestones show an increase in mud, making the outcrop more malleable.

Loughshinny beach is flat and sandy and exposed rock outcrop can be seen on both this beach and the one located just Southwest, before the prominent headland. There are erosional defences in place in the form of a rock berm. Multiple cliff faces show fresh signs of erosion. A Martello Tower referred to as the "Drumanagh Promontory Fort National Monument" is situated on the headland and is regarded as a significant archaeological site. Access points are located in the northern section of the landfall area, via a public car park at Loughshinny beach and at Loughshinny Harbour.

The western boundary of this landfall area is broadly along the line of Mine Road and Skerries Road (R128). A second watercourse flows west to east through the site approximately 200m north of the southern boundary.

Image 5.18 Landfall 3

5.7.2.3 Assessment of Landfall Sites

A comparative assessment of the three potential landfall site areas was undertaken, in accordance with a colour coded ranking as detailed in Table 5.2 with the comparative assessment of the landfall sites, detailed below in

Table 5.3. This comparative assessment included technical, cost, landowner and environmental criteria.

Table 5.2 Legend for Colour Coded Assessment

Colour Coding	Ranking
Green	Most preferable – few or no constraints identified at this stage
Amber	Some constraints or risk identified, further assessment required
Red	Least preferable – significant constraint or risk identified, further assessment required

Table 5.3 Comparative Assessment of Landfall Sites

Considerations	Landfall 1	Landfall 2	Landfall 3
Environmental			
Geophysical			
Archaeological			
Technical			
Shoreline Substation Location			
Onshore Cable Route			
Social / Stakeholder			
Commercial			
Health & Safety			

Landfall 3 was ruled out as there were a number of significant constraints associated with the landfall. In particular, at this early stage of the project, the fact that to reach this landfall, there was a requirement for the offshore export cables to pass through both Rockabill SPA and Rockabill to Dalkey Island SAC was identified as a key constraint. Landowner engagement also proved to be challenging.

Landfall 2 had a number of technical and constructability constraints given the cliff heights in the vicinity, the narrow local roads and the potential substation locations. Further, there were multiple landowners associated with this landfall option, making landowner negotiations more challenging.

Landfall 1 was considered the most preferable as it had the least constraints at this early stage of the project. From a technical and constructability perspective, there were no significant constraints identified – there was plenty of space available at the landfall and the topography was appropriate, with an almost level approach from the beach to the landfall site.

In terms of environmental considerations, at the time of site selection, there were no European sites in the vicinity and no significant environmental constraints were identified other than archaeological/heritage constraints. In terms of archaeology/heritage, a number of features are present in the northern part of this landfall area, including a Megalithic Tomb, a number of areas of heritage interest around Bremore Point as well as a historic quay towards the south of Bremore Point. There is also a landmark known as "Sailors Grave" immediately south of the historic Quay.

Geophysical constraints were identified for all three landfall options but were not seen as being more significant for Landfall 1 over other options. The northern area has a number of faults and steeply dipping bedrock which could be challenging. Landfall 1 was considered the most stable with regards to coastal migration, with data from EMODnet, showing imperceptible change between +/- 0-2m ensuring stability of ground conditions for cable installation.

Given the above, it is clear that Landfall 1 was the most preferable option albeit it had some constraints. As a result, this landfall option was refined, to reduce the area to the southern part of the wider study area, thus avoiding the most significant archaeological/heritage and geophysical constraints. In respect of this reduced area, there were also only two landowners (one of which was Fingal County Council) so landowner negotiations were likely to be less challenging than for other options.

This refined area was selected as the preferred landfall site and was taken forward through design development and detailed environmental assessment. The full onshore archaeological assessment is presented in Chapter 25: Archaeology.

5.7.2.4 Preferred Landfall Location at Conclusion of Assessment

In summary, Landfall 1 was chosen as the preferred landfall location at the conclusion of the assessment as detailed above. The landfall extents were refined from the original study area to include only the southern portion of the area given the known recorded archaeological resources in the northern portion of the landfall.

Following selection of the preferred landfall site, it should be noted that both HDD and open cut trenching techniques were initially identified as potential construction methodologies for Landfall 1. However, during design development and following detailed biodiversity surveys, open cut trenching was subsequently disregarded due to presence of Annex 1 Habitat at the landfall area.

5.7.3 Grid Facility Site Selection

A grid facility is required to take the power coming ashore and process it for onward connection to the existing transmission network.

It should be noted that once the preferred landfall location was identified by NISA and shared with EirGrid, the location and fundamental design of the grid facility were specified by EirGrid to the Developer and stipulated by the provisions of the GCA. EirGrid, in its role as Transmission System Operator (TSO), carried out studies of the transmission system to determine the most suitable location to connect renewable energy generation projects.

In this case, EirGrid determined that a location close to Bremore in north county Dublin is required for this purpose. The grid facility will comprise two substations – the NISA 220kV Compensation Substation and the Bremore 220kV Substation.

EirGrid's decision on the Bremore location was also driven by its requirement as the TSO to future proof the transmission network and to design the Bremore 220 kV Substation (part of the proposed grid facility) to accommodate potential future connections from other projects (e.g. other renewable energy generators, electricity demand customers or grid services infrastructure). As such, the proposed development was designed to comply with these requirements and this is consistent with the approach taken in grid facility site selection.

With this in mind, this section describes the reasonable alternatives considered during the evolution of the grid facility (onshore substation) location selection process and the main reasons for the site selected, taking into account the effects on the environment.

5.7.3.1 Grid Facility - Basis of Design

Given that the grid facility is to be located at Bremore, the next step was to identify key constraints (basis of design) for the proposed grid facility site. The following principles were considered in the grid facility site selection process:

- Proximity to Landfall
- Constructability (accessibility and topography etc.)
- Avoidance of designated sites and sensitive habitats
- Land use Zoning
- Screening/view of coastline
- Proximity to sensitive receptors (including residential properties)
- Flood risk
- Areas large enough for both the 220 kV Bremore substation and the compensation substation and
- Supportive engagement with landowners.

When the constraints above were considered, in parallel with the requirement for the grid facility to be located at Bremore and from initial landowner engagement, it became evident that the number of feasible sites was limited. Two potential grid facility sites were identified for further consideration:

- Grid facility site 1 – east of the R132 at the landfall
- Grid facility site 2 – west of the R132 at the landfall.

It is noted that both sites are owned by the same landowner, who is also the landowner of the selected landfall area, namely Landfall 1. Image 5.19 below shows the land area covering the two identified potential grid facility sites.

Image 5.19 Area covering the two potential grid facility sites including land use zoning classifications

Both sites are similar in terms of land use (currently in agricultural use) and consist of a number of fields separated by hedgerows. In terms of environmental considerations, it was clear from the constraints included in the basis of design above, that there was no significant differentiator between the two sites, with the key differentiators being in respect of two criteria, namely land use zoning and landscape/visual impact. The two sites were therefore comparatively assessed against these criteria:

- Land use zoning
- Landscape and visual considerations

Land Use Zoning

At the time of the site selection process, the Fingal Development Plan 2017 to 2023 was in place. The Fingal Development Plan 2023-2029, which entered into force in the interim has also been reviewed and no significant changes have resulted.

The purpose of zoning is to indicate the land use objectives for all the lands within the County. Zoning aspires to promote the orderly development of the County by eliminating potential conflicts between incompatible land uses and establishing an efficient basis for investment in public infrastructure and facilities.

Each land use zoning objective has a supporting vision which elaborates on the zoning objective and sets the context for the type of development which would be acceptable. Uses which are neither 'Permitted in Principle' nor 'Not Permitted' are assessed in terms of their contribution towards the achievement of the zoning objective and vision.

Grid facility site 1, is to the east of the R132 and is zoned HA (High Amenity) and Open Space. Grid facility site 2, is to the west of the R132 and is zoned RU (Rural). Refer also to Figure 26.1 in Volume 7A of the EIAR which depicts zoning at the landfall.

The Open Space zoning objective is “preserve and provide for open space and recreational amenities”.

The vision in respect of this objective is to: “provide recreational and amenity resources for urban and rural populations subject to strict development controls. Only community facilities and other recreational uses will be considered and encouraged by the Planning Authority”.

The High Amenity (HA) zoning objective is “protect and enhance high amenity areas*”.*

The vision in respect of this zoning objective is to: “protect these highly sensitive and scenic locations from inappropriate development and reinforce their character, distinctiveness and sense of place. In recognition of the amenity potential of these areas opportunities to increase public access will be explored”.

The Rural (RU) zoning objective is to “protect and promote in a balanced way, the development of agriculture and rural-related enterprise, biodiversity, the rural landscape, and the built and cultural heritage”.

The vision in respect of this zoning objective is to “protect and promote the value of the rural area of the County. This rural value is based on:

- Agricultural and rural economic resources
- Visual remoteness from significant and distinctive urban influences
- A high level of natural features.

Agriculture and rural related resources will be employed for the benefit of the local and wider population. Building upon the rural value will require a balanced approach involving the protection and promotion of rural biodiversity, promotion of the integrity of the landscape, and enhancement of the built and cultural heritage”.

Taking into account the zoning matrix of both the previous Fingal Development Plan (2017 – 2023) which was in place at the time of the site selection and the current Fingal Development Plan (2023 – 2029), the proposed grid facility would be generally akin to a ‘utility installation’.

A utility installation is defined in Appendix 7 of the current Fingal Development Plan (2023-2029) as a “structure composed of one or more pieces of equipment connected to or part of a structure and/ or a facility designed to provide a public utility service such as the provision of heat, electricity, telecommunications, water or sewage disposal and/or treatment”.

A utility installation use class is permitted in principle in lands zoned RU (i.e. Grid facility site 2). For lands zoned HA and Open Space, (i.e. Grid facility site 1), a utility installation use class is not ‘Permitted in Principle’, nor is it noted as being ‘Not Permitted’.

Consideration was given to the likely contribution towards the achievement of the Zoning Objective and Vision and their compliance and consistency with the policies and objectives of the previous Fingal Development Plan (2017-2023) in place at the time. This has since been checked against the current Fingal Development Plan (2023-2029) and it is noted that there are no changes to the zoning objectives which impact the site selection process.

Grid facility site 2 was clearly preferable from a land use zoning perspective. While a case could be made for Grid facility site 1 in overall policy terms – e.g. contribution to the achievement of renewable energy and sustainable development objectives - its status as High Amenity lands, where the overarching objective is to protect these highly sensitive and scenic locations from inappropriate development and reinforce their character, distinctiveness and sense of place would be a significant constraint, particularly when there is a more favourably zoned site identified. Therefore, Grid facility site 2 to the west of the R132 was preferred from a land use zoning perspective.

Landscape and Visual Considerations

Grid facility site 1 to the east of the R132 is contained in a 'Highly Sensitive Landscape' zoning relating to the coastline, which ends at the R132. Grid facility site 2 to the west of the R132 is not contained within that

landscape zoning. Furthermore, a designated scenic route runs along this specific section of the R132 and is designated for seaward views across the broad coastal plateau.

In comparison, the inland westward view is unremarkable. The siting of the grid facility therefore to the east of the R132 (Grid facility site 1) would have the potential for impacts on a sensitive coastal landscape and seaward views, as well as a potential visual obstruction of a scenic route designation. Therefore, Grid facility site 2 to the west of the R132 was preferred from a landscape and visual perspective.

5.7.4 Onshore Cable Routing

5.7.4.1 Introduction

As outlined in Section 5.7.2 above, the offshore cables transition to onshore cables at the landfall. Onshore export cables are laid between the landfall and the grid facility, with the onshore cables then laid from the grid facility to the connection to the existing transmission network. EirGrid, in its role as Transmission System Operator (TSO), carried out studies of the transmission system to determine the most suitable location to connect the proposed development to the existing transmission network. In this case, EirGrid determined that the connection to the existing transmission network should be at Belcamp substation.

Once the landfall and grid facility sites were selected, the route for the onshore export cables was relatively direct, between the transition joint bays at the landfall and the grid facility. This route crosses under the Dublin-Belfast railway using HDD and then crosses the R132 to connect to the Compensation Substation within the grid facility compound.

The onshore cable routing assessment therefore assessed the options for routing the onshore cables between the grid facility and Belcamp Substation.

The route selection process for the onshore cable route is illustrated below in Image 5.20.

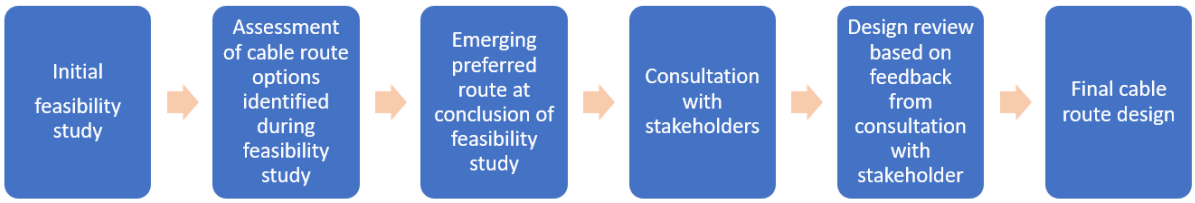

Image 5.20 Route Selection Process for Onshore Cable Route

5.7.4.2 Basis of Design

The key design objectives for the onshore cable routing assessment have been primarily informed by Sections 4.3 and 4.9 of the EirGrid Functional Specifications (CDS-GFS-00-001-R1) as follows:

- Underground cables shall as a standard, be routed within the reserve of public roads
- If it is absolutely necessary and no other reasonably practical option exists, routing cables on private lands may be proposed, subject to a design review and acceptance by EirGrid
- The routing of cables through private lands shall only be considered if all other options have been exhausted (to the satisfaction of EirGrid)
- Underground cables to be constructed via open-cut trench technology
- Trenchless technology, such as Horizontal Directional Drilling (HDD), may only be permitted in specific circumstances such as at motorway crossings, railway crossings and watercourse crossings where standard design is not feasible and
- Consultation with EirGrid is required at the earliest opportunity and throughout routing process

In addition to the Eigrid requirements above, other key constraints (between the grid facility at Bremore and Belcamp Substation) which informed the study area and basis of design for the route options assessment were identified as follows:

- Rogerstown Estuary and Malahide Estuary – an early decision was made to avoid crossing either estuary due to complex constructability and environmental factors and as a result, all cable routes would have to come west of both estuaries
- As any feasible cable route would have to come west of both estuaries, at least one crossing of the M1 motorway would be required and
- M1 Motorway - it is TII's policy not to permit high-voltage electrical cables to be routed along motorways. Thus, a route along the M1 was disregarded as a feasible option

5.7.4.3 Study Area

The key constraints within the study area are shown on Image 5.21 below. Due to the distance between the grid facility and Belcamp Substation, the study area was divided into two sections, ZA and ZB, at a natural node point, node 1, to optimise the number of potential route options, and combinations thereof, available. Section ZA extended from the grid facility to node 1 whilst section ZB extended from node 1 to Belcamp Substation. Node 1 is located at Estuary Roundabout at the intersection of the R132, R125 and L2141 near Fingallians GAA club just north of Swords.

The key features of note in study area section ZA include the Dublin to Belfast railway line, the M1, Rogerstown and Malahide Estuaries and the population centres of Balbriggan, Skerries, Balrothery and Lusk. A number of watercourses, protected structures and proposed Natural Heritage Areas (pNHAs) are located throughout the study area in both sections ZA and ZB.

The key features of note in study area section ZB include the M1, Malahide Estuary, Dublin Airport and the population centres of Swords, Malahide, Kinsealy, Belmayne and Clongriffin. The majority of the study area section ZB along the road network is built up due to its suburban nature. The routes of the proposed (not yet consented) MetroLink rail track are located within section ZB. Supporting high voltage (HV) electrical cables for the MetroLink development are also planned (not yet consented) to be routed from Belcamp Substation. The route of the consented Aviation Fuel pipeline from Dublin Port to Dublin Airport is also located within section ZB.

Image 5.21 Key Constraints which informed study area (Source OpenStreetMap)

On the basis of the above key design objectives, constraints and features, a number of onshore cable route options were identified for assessment, as detailed in Table 5.4 below. These were the shortest and most direct routes from the grid facility to Belcamp Substation, which also avoided key environmental constraints such as the designated sites at Malahide and Rogerstown Estuaries. Four onshore cable route options (Z1-Z4) were identified within section ZA. These are described in Section 5.7.4.4 below. Three onshore cable route options (Z5-Z7) were identified within section ZB. These are described in Section 5.7.4.5 below.

Numerous site visits were carried out as part of the assessment to review the onshore cable route options on the ground, to compare and contrast these and to investigate the constructability challenges associated with major infrastructure crossings. The data and insights gathered from these visits informed the assessment. The onshore cable route options are shown on Image 5.22 and Image 5.23 below and on Figure 5.1.

Table 5.4 Cable Route Options

Study Area Section	Onshore Cable Route Option
Section ZA	Onshore Cable Route Option Z1
	Onshore Cable Route Option Z2
	Onshore Cable Route Option Z3
	Onshore Cable Route Option Z4
Section ZB	Onshore Cable Route Option Z5
	Onshore Cable Route Option Z6
	Onshore Cable Route Option Z7

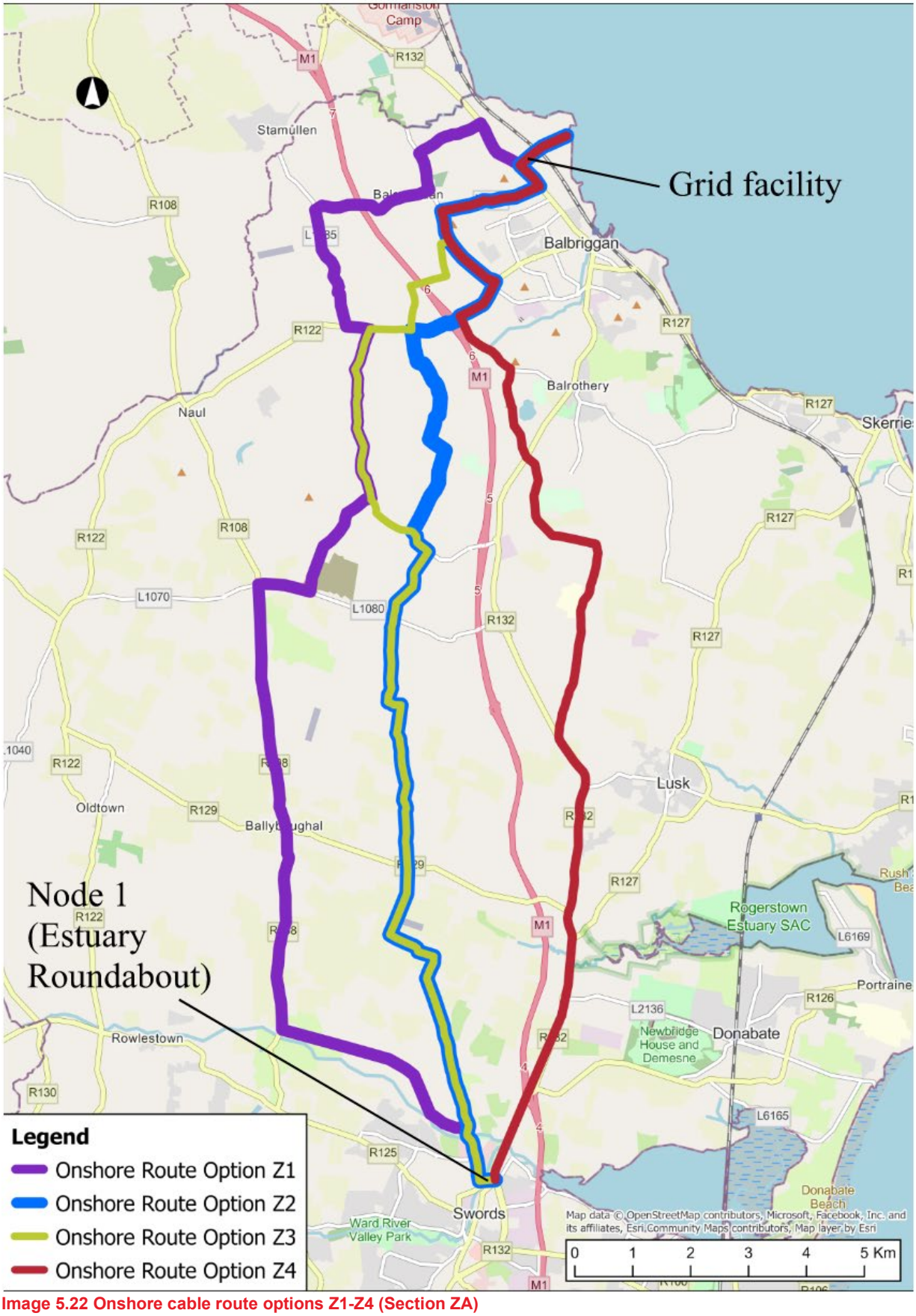

Image 5.22 Onshore cable route options Z1-Z4 (Section ZA)

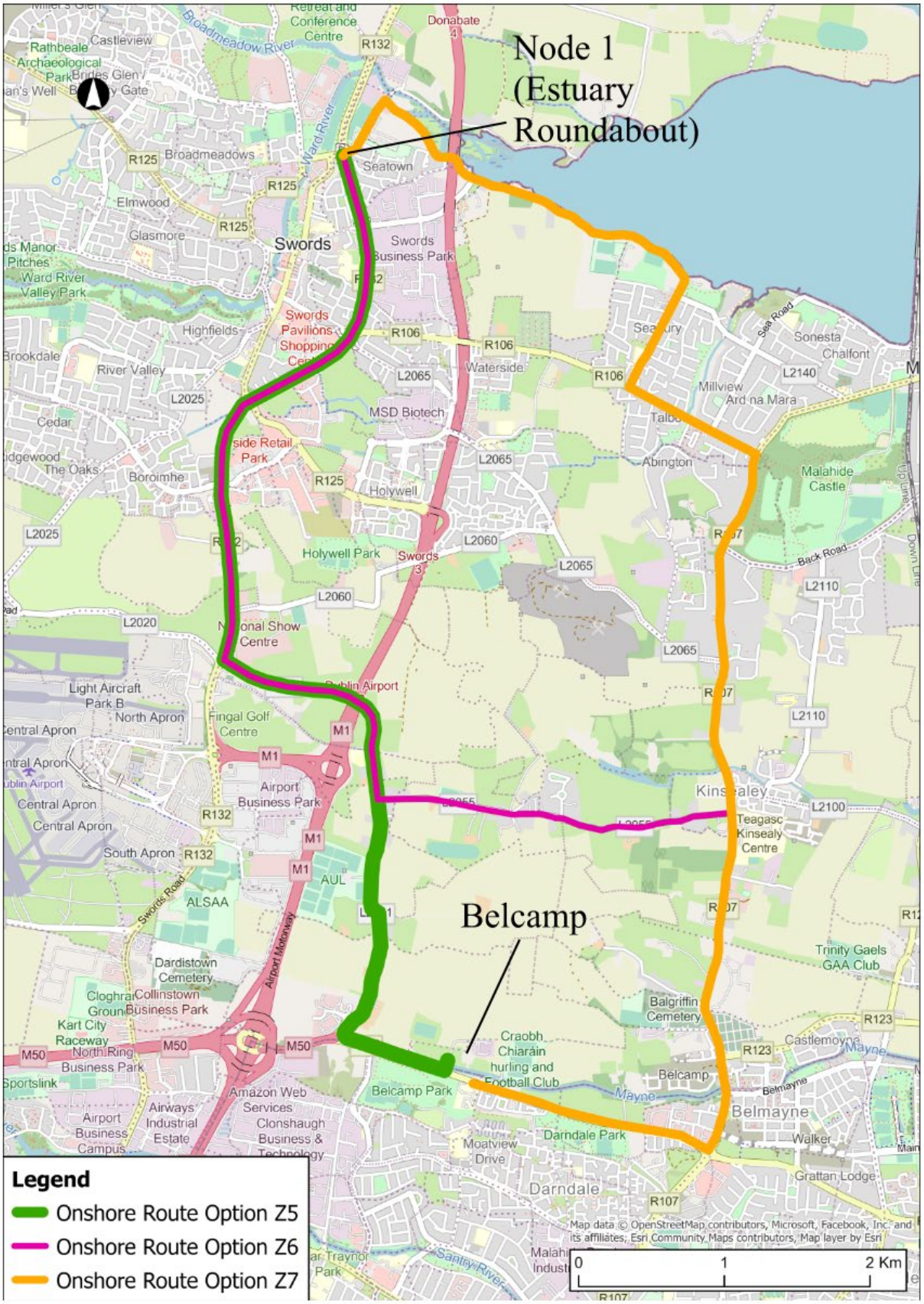

Image 5.23 Onshore cable route options Z5-Z7 (Section ZB)

5.7.4.4 Description of onshore cable route options Z1-Z4 (Section ZA Landfall/Grid facility to Node 1)

Section ZA – Onshore cable route option Z1

Route option Z1 begins at the grid facility at Bremore, turning north-west onto the R132 and continuing as far as Knocknagin Lane, where it turns west, and then south on to L1130 Bridgefoot/Flemington Road. The route continues south as far as Balscadden, where the route turns west, through Balscadden, and crosses the M1. This crossing would require Horizontal Directional Drilling (HDD) under the M1. The route continues along this road, to its junction with the L1085 Tobertown Road where it turns south and travels through Grangemount to the junction with the R122 Naul Road. At this junction, the route turns east onto the R122 and then turns south onto the L1120 Haystown Road. The route continues south along the L1120 and then turns southwest and travels towards Rathgreat along the L1080.

At Rathgreat, route option Z1 then turns south onto the R108 and follows the road through Ballyboughal as far as the Roganstown Golf Club where the route turns east at the junction with the R125. Following the R125, route option Z1 travels southeast before turning north and then east along the Balheary Road (R125) adjacent to Fingallian's GAA club. Route option Z1 terminates at Node 1 at the junction with the R132, R125 and L2141.

The following characteristics of route option Z1 were noted during the cable route option assessment process:

- Route option Z1 does not directly interact with any Natura 2000 sites or natural heritage areas (NHAs)
- Route option Z1 crosses two bridges which are included on the Record of Protected Structures (RPS). It was noted during the assessment that the construction methodology would need to consider the crossing of these two bridges
- Route option Z1 would only have an impact on visual amenity during the construction phase of the project, as excavations are required along the length of the route for installation of the cable ducts and cables, as well as joint bays. No long-term visual impact is envisaged due to the cable installation along route (common to all route options)
- Route option Z1 would be largely contained within public carriageways and would not infringe on any zoning specifications. Land acquisition would be required where the cable route goes offline at motorway crossings, major watercourse crossings and sharp bends
- This route does not travel directly through any major centres of population
- Constructability at major roads, utilities and most bridges were deemed feasible with the exception of some bridges where offline or HDD crossing might be required and
- No significant planning constraints were identified on the roads travelled by this route.

Section ZA – Onshore cable route option Z2

Route option Z2 begins at the grid facility at Bremore, turning south-east onto the R132 and continuing as far as Flemington Lane, where it turns west, and then south on to the L1130 Bridgefoot/Flemington Road. The route continues south as far as the R122, where the route turns west, and crosses the M1. The route travels to the junction of the L5150 (Dermotstown Road), where it turns south and travels through the Bog of the Ring pNHA and further south along unmarked roads and continuing as far as the L1140. At the L1140, the route turns southeast and south again onto an unmarked roadway, where it continues south for a number of kilometres, crossing the R129 onto Harlockstown Lane. The route continues south along this road until it reaches the Balheary Road. From here, the route continues south as far as the R125 where it turns east adjacent to Fingallian's GAA Club and terminates at node 1 at the junction with the R132, R125 and L2141.

The following characteristics of route option Z2 were noted during the cable route option assessment process:

- Route option Z2 travels through the designated pNHA 'Bog of the Ring' for a length of approximately 450m. Over this length however, the cable route is contained within the public roadway. Thus, it was considered not likely to have a direct material effect on the pNHA. Regardless, it was noted further ecological assessment would be required if this route was chosen as preferred route
- Route option Z2 does not directly interact with any Natura 2000 sites
- Route option Z2 crosses two bridges which are listed on the National Inventory of Architectural Heritage (NIAH) and one of them is a protected structure (RPS). It was noted during the assessment that the construction methodology would need to consider the crossing of these two bridges
- Similar to route option Z1, no long-term visual impact is envisaged due to the cable installation along the route
- Route option Z2 would be largely contained within public carriageways and would not infringe on any zoning specifications. Land acquisition would be required where the cable route goes offline at motorway crossings, major watercourse crossings and sharp bends
- This route does not travel directly through any major centres of population
- Constructability at major roads, utilities and most bridges was deemed feasible with the exception of some bridges where offline or HDD crossing might be required and
- No significant planning constraints were identified on the roads travelled by this route.

Section ZA – Onshore cable route option Z3

Route option Z3 begins at the grid facility at Bremore, turning south-east onto the R132 and continuing as far as Flemington Lane, where it turns west, and then south on to Flemington Road. The route continues south as far as Grouga Lane, where the route turns west, and crosses the M1 in a private laneway. The route travels south and turns west onto the R122 and then turns south onto the L1120.

The route continues south along the L1120 and turns south again onto an unmarked roadway, where it continues south for a number of kilometres, crossing the R128 onto Harlockstown Lane. The route continues south until it reaches the Balheary Road and continues south. The route travels south as far as the R125 where it turns east adjacent to Fingallian's GAA Club and terminates at node 1 at the junction with the R132, R125 and L2141.

The following characteristics of route option Z3 were noted during the cable route option assessment process:

- Route option Z3 does not directly interact with any Natura 2000 sites
- Route option Z3 crosses two bridges which are listed on the NIAH and one of them is a protected structure (RPS). It was noted during the assessment that the construction methodology would need to consider the crossing of these two bridges
- Similar to route options Z1 and Z2, no long-term visual impact envisaged due to the cable installation along route
- Also, as described for all options, route option Z3 would be largely contained within public carriageways and would not infringe on any zoning specifications. Land acquisition would be required where the cable route goes offline at motorway crossings, major watercourse crossings and sharp bends
- This route does not travel directly through any major centres of population though it does travel close to the outskirts of Balbriggan
- Constructability at major roads, utilities and most bridges was deemed feasible with the exception of some bridges where offline or HDD crossing might be required and

- No significant planning constraints were identified on the roads travelled by this route.

Section ZA – Onshore cable route option Z4

Route option Z4 begins at the grid facility at Bremore turning south-east onto the R132 and continuing as far as Flemington Lane, where it turns west, and then south on to Flemington Road. The route continues south as far as the R122, where the route turns west and then south again onto the L1125 (Matt Road). The route continues southeast along the L1125 and then turns south onto an unmarked local road as far as the R132 (just north of M1 Business Park). Route Z4 travels south and south-west along the R132 and terminates at node 1, at the junction with the R132, R125 and L2141.

The following characteristics of route option Z4 were noted during the cable route option assessment process:

- Route option Z4 interacts with Rogerstown Estuary SAC/pNHA at three distinct locations where the cable route crosses three watercourses directly at the boundary of the SAC/pNHA, where the watercourses feed into the estuary. One of these crossings is a protected structure (Daws Bridge) and as a result, the cable would likely need to come offline from the carriageway at this location. Thus, it was noted during the assessment that detailed ecological and architectural heritage assessments would be required if this route was chosen as the preferred route
- Route option Z4 crosses three bridges which are protected structures (RPS), and another listed on NIAH
- Similar to route options Z1, Z2 and Z3, no long-term visual impact was envisaged due to the cable installation along route
- Similar for all options, route option Z4 would be largely contained within public carriageways and would not infringe on any zoning specifications. Land acquisition would be required where the cable route goes offline at motorway crossings, major watercourse crossings and sharp bends
- Constructability at major roads, utilities and most bridges was deemed feasible with the exception of some bridges where offline or HDD crossing might be required
- This route does not travel directly through any major centres of population though it does travel close to the outskirts of Balbriggan and along some busy roads and
- No significant planning constraints were identified on the roads travelled by this route.

5.7.4.5 Description of Onshore Cable Route Options Z5-Z7 (Section ZB: Node 1 to Belcamp substation)

Section ZB – Route option Z5

Route option Z5 begins at Node 1 and travels south along the Swords Outer Ring Road (R132), until the junction with Stockhole Lane (L2753) where it turns east. The route then crosses the M1 and continues along Stockhole Lane turning south and onto Clonshaugh Road (L2051) before meeting the R139. The route then turns east along the R139 as far as the entrance to Belcamp Substation where the route terminates.

The following characteristics of route option Z5 were noted during the cable route option assessment process:

- Route option Z5 does not directly interact with any Natura 2000 sites
- Minimal interaction with heritage assets was expected
- Route option Z5 would have a temporary impact on visual amenity during the construction phase only of the project (common to all route options)
- Route option Z5 would be largely contained within public carriageways and would not infringe on any land use zoning specifications. Land acquisition would be required where the cable route goes offline at motorway crossings, major watercourse crossings and sharp bends. Constructability at bridges was deemed feasible

- Route option Z5 interacts directly with the proposed MetroLink rail project (not yet consented) along the Swords Outer Ring Road (R132)

  The MetroLink rail project comprises a retained open cut track and cut and cover sections adjacent to the R132 on the southern and eastern side. It was noted during the assessment process that consultation with MetroLink would be required if this route was chosen as the preferred route to determine if the cable route could co-exist with MetroLink along this section of the R132

- Route option Z5 interacts directly with the proposed aviation fuel pipeline (AFP) (consented) along Stockhole Lane and Clonshaugh Road (L2051) and along the R139 approach to Belcamp Substation. The R139 is a large four-lane road with footpaths on both sides. It was noted during the assessment process that should this route be chosen as the preferred route, consultation with the developers of the AFP and a detailed survey of existing services along this section of the route would be required to ensure that there would be adequate room for a 220kV cable and

- Route option Z5 does not travel directly through Swords town centre, however the majority of the road network along which route option Z5 travels is within urbanised areas.

Section ZB – Route option Z6

Route option Z6 begins at node 1, and travels south along the Swords Outer Ring Road (R132), until the junction with Stockhole Lane (L2753) where it turns east. The route then crosses the M1 and continues along Stockhole Lane turning south, and then east along Baskin Lane. The route then turns south onto the R107 (following the same route as Route Option Z7), and then west onto the R139. The route continues along the R139 (following the same route as Route Option Z7) as far as the entrance to Belcamp Substation where the route terminates.

The following characteristics of route option Z6 were noted during the cable route option assessment process:

- Route option Z6 does not directly interact with any Natura 2000 sites

- There is a high density of heritage sites in the vicinity near St Doolaghs. It was noted during the assessment process that detailed heritage assessments would be required to investigate the overall significance of the features identified if this route was chosen as the preferred route

- Route option Z6 would have a temporary impact on visual amenity during the construction phase only of the project (common to all route options)

- Route option Z6 would be largely contained within public carriageways and would not infringe on any land use zoning specifications. Land acquisition would be required where the cable route goes offline at motorway crossings, major watercourse crossings and sharp bends. Constructability at bridges was deemed feasible

- Similar to route option Z5, route option Z6 interacts directly with the proposed MetroLink rail project (not yet consented) along the Swords Outer Ring Road (R132). The MetroLink rail project comprises a retained open cut track and cut and cover sections adjacent to the R132 on the southern and eastern side. It was noted during the assessment process that consultation with MetroLink would be required if this route was chosen as the preferred route to determine if the cable route could co-exist with MetroLink along this section of the R132

- Similar to route option Z5, route option Z6 interacts directly with the proposed aviation fuel pipeline (AFP) (consented) along Stockhole Lane and along the R139 approach to Belcamp Substation. The R139 is a large four-lane road with footpaths on both sides. It was noted during the assessment process that should this route be chosen as the preferred route, consultation with the developers of the AFP and a detailed survey of existing services along this section of the route would be required to ensure that there would be adequate room for a 220kV cable and

- Similar to route option Z5, route option Z6 does not travel directly through Swords town centre, however the majority of the road network along which route option Z6 travels is built up.

Section ZB – Route option Z7

Route option Z7 begins at Node 1 and travels northeast along Estuary Road and turns east to continue along Estuary Road. The route then crosses the M1 within the underpass and continues along Estuary Road alongside the Malahide Estuary and follows the road as it turns south. The route then turns east onto the R106, and then turns south onto the R107. The route follows the R107 to the south and turns west onto the R139 (following the same route as Route option Z6) where the two roads meet. The route continues along the R139 as far as the entrance to Belcamp Substation where the route terminates.

The following characteristics of route option Z7 were noted during the cable route option assessment process:

- Route option Z7 travels along Estuary Road which is adjacent to the Malahide Estuary SAC/SPA/pNHA for a length of approximately 2.5km. It was noted during the assessment process that a detailed ecological assessment would be required to assess any impacts on the designated site if this route was chosen as the preferred route
- Route option Z7 runs beside an area at risk of fluvial flooding along Estuary Road. It was noted during the assessment process that a flood risk assessment would be required if this route was chosen as the preferred route
- Similar to route option Z6, along route option Z7, there is a high density of heritage sites in the vicinity near St Doolaghs. It was noted during the assessment process that detailed heritage assessments would be required to investigate the overall significance of the features identified if this route was chosen as the preferred route
- Route option Z7 would have a temporary impact on visual amenity during the construction phase only of the project (common to all route options)
- Route option Z7 would be largely contained within public carriageways and would not infringe on any land use zoning specifications. Land acquisition would be required where the cable route goes offline at motorway crossings, major watercourse crossings and sharp bends. Constructability at bridges was deemed feasible
- Similar to route options Z5 and Z6, route option Z7 interacts directly with the proposed aviation fuel pipeline (AFP) (consented) along the R139 approach to Belcamp substation. The R139 is a large four-lane road with footpaths on both sides. It was noted during the assessment process that should this route be chosen as the preferred route, consultation with the developers of the AFP and a detailed survey of existing services along this section of the route would be required to ensure that there would be adequate room for a 220kV cable and
- Route option Z7 does not travel directly through Malahide town centre or the centre of Kinsealy, Belmayne and Clongriffin, however the majority of the road network along which route option Z7 travels is built up.

5.7.4.6 Assessment of Onshore Cable Route Options

In order to inform the decision making to choose an emerging preferred route, the proposed onshore cable route options were assessed and ranked accordingly against a set list of criteria as follows:

- Cable route length: shorter cable routes generally preferred to longer cable routes
- Ecology, heritage assets and visual amenity
- Planning and land use zoning: routes were investigated for any planning applications or major developments that may impact route construction or operation. Land use zoning designations and specific objectives were also considered
- Land ownership: in general, it was assumed that the local authority owns the public roads and the bordering ditches/verges. Routing the cable along public roads allows minimal interruption of privately-owned land and therefore limits the number of negotiations needed regarding land use.

It may be necessary to go off-road at locations such as motorway and water crossings. In these instances, affected landowners would be identified through the Land Registry at the detailed routing stage

- Centres of population: in general, preference was to route away from centres of population (such as the centre of Balbriggan, Skerries, Balrothery and Lusk in section ZA and the centre of Swords, Malahide, Kinsealy, Belmayne and Clongriffin in Section ZB) where feasible to minimise construction disruption. It was noted that this was more challenging in section ZB where the majority of the study area along the road network is within areas of urbanisation and
- Constructability considerations: This included consideration of constructability at motorway crossings, watercourse crossings and utility crossings. Construction safety (including flood risk) was also considered.

The assessment of the cable route options was based principally on the findings of the various desktop studies along with the route options drive/walkover survey and subsequent targeted site visits. A comparative assessment of the cable route options was then carried out to determine the emerging preferred route, see Table 5.6 below. The emerging preferred route was the route deemed the most technically suitable and environmentally acceptable whilst also being cost effective. The assessment of the cable route options is summarised in a matrix that covers each assessment criteria identified above. Criteria were graded using a colour-coded system described in in Table 5.5 below.

Table 5.5 Legend for colour coded assessments

Legend	Colour	Notes for each colour
Low potential impact/risk		Low potential impact. To be confirmed at detailed design stage.
Medium potential impact/risk		Further assessment will be required at detailed design stage.
High potential impact/risk		Potential significant issue. Further assessment and design required to define potential impact. Due consideration to be given at detailed design stage.
'Fatal Flaw'		There is such a significant impact or 'fatal flaw' that the option is not progressed further.
Not Applicable		Criteria does not apply to this specific section.

Table 5.6 Summary of comparison of cable route options

		Section ZA				Section ZB		
Assessment Criteria		**Route option Z1**	**Route option Z2**	**Route option Z3**	**Route option Z4**	**Route option Z5**	**Route option Z6**	**Route option Z7**
Length		27.3km	23.5km	23.5km	22.5km	8.2km	12.2km	11.5km
Ecology								
Heritage								
Visual Amenity								
Zoning								
Land ownership								
Centres of population								
Planning								
Constructability	Motorway crossings							
	Rail crossings							
	Watercourse Crossings							
	Utilities							
Safety								
Construction Cost								
Emerging preferred feasible route(s)		Route Option Z2				Route Option Z5		

Route Length
In section ZA, cable route option Z1 was considerably longer than options Z2, Z3 and Z4, being nearly 5km longer than Z4. Consequently, option Z1 would likely have more impact in terms of environmental considerations, cost and overall disruption associated with construction works. Route option Z1 was classified red accordingly under this criterion with cable route options Z2, Z3 and Z4 classified green.

In section ZB, cable route option Z5 was considerably shorter than the other route options, by circa 3 to 4km. In the same context as for section ZA above, cable route option Z5 was deemed preferable and was classified green with route options Z7 and Z6 being classified orange and red accordingly due to their longer length.

Route length was also the most significant contributor in terms of construction cost, with shorter routes ranking comparatively better than longer routes.

Ecology
In section ZA, under ecology, all cable route options were designated amber with medium perceived risk in relation to the potential impact on designated sites and with a recommendation for further assessment during the next stage.

In section ZB, the main ecological area of interest is the Malahide Estuary SAC/SPA/pNHA with cable route option Z7 running in parallel with the estuary along the southern side over a distance of approximately 2.5km. If this route is brought forward, it was noted that a detailed ecological assessment would be required to ensure that any potential impacts on the designated sites could be appropriately managed and mitigated. To reflect this, cable route option Z7 was classified as red under the ecology criterion. Cable route options Z5 and Z6 avoid this section of the estuary completely, instead running along the Swords outer ring road and as a result were classified amber.

Heritage
In section ZA, all cable route options were classified as amber. In section ZB, cable route options Z6 and Z7 were classified as amber. It was noted that further assessment would be required for the emerging preferred route to investigate the overall significance of the features identified and in particular the potential for impact on bridges.

Visual Amenity
In both sections ZA and ZB, all cable route options were classified amber with similar temporary visual impacts during the construction stage.

Zoning
In both sections ZA and ZB, all cable route options were largely contained within public carriageways and would not infringe on any sensitive zoning objectives. Land acquisition would be required where the cable route goes offline at motorway crossings, major watercourse crossings and sharp bends. All cable route options were classified green accordingly for zoning.

Land Ownership
In both sections ZA and ZB, all cable route options were classified as amber as no engagement had taken place with associated landowners. It was noted that landowner engagement would be required for the emerging preferred route.

Centres of Population
In Section ZA, all of the cable route options were classified as green as none travel through major centres of population. In section ZB, whilst none of the cable route options pass through village/town centres, all of them pass through built up areas due to the suburban nature of the study area in section ZB. All routes were classified amber accordingly.

Planning

In section ZA, no planning constraints were identified on the roads travelled by the routes and all routes were classified green accordingly.

Cable route options Z5 and Z6 both interact directly with the future MetroLink[4] rail project (not yet consented) along the Swords Outer Ring Road (R132). The MetroLink rail project comprises retained open cut track and cut and cover sections adjacent to the R132 on the southern and eastern side. The construction methodology, timing and sequencing all need to be carefully considered if this was to be progressed. It was noted during the assessment process that consultation with MetroLink would be required if either of these routes were chosen as the emerging preferred route to determine if the cable route could co-exist with MetroLink along this section of R132.

Additionally, the consented Aviation Fuel Pipeline[5] (AFP) development coincides with cable route Z5 and Z6 along Stockhole Lane and Clonshaugh Road. It also coincides with all cable route options Z5, Z6 and Z7 along the R139 approach to Belcamp Substation. It was recommended that consultation with the developers of the AFP and a detailed survey of existing services along these route sections of the route would be required to ensure that there would be adequate room for a 220kV cable.

Cable routes Z5, Z6, and Z7 were all classified amber as a result of the above.

Constructability

Constructability was deemed feasible at the rail crossing and major road crossings for all route options (Section ZA and ZB) during the cable route option assessment process, however it was noted that further engagement with TII, affected landowners and Irish Rail would be required. At the watercourse crossings, it was noted that a number of different crossing options may need to be considered for some of the watercourses (such as in-road open trench or in-road HDD) and if these were not feasible, that off-road (offline) crossings may need to be considered such as open trench or offline HDD. Further analysis would be required for the emerging preferred route.

In relation to utilities, given the lack of significant constraints beyond standard crossings, all routes in Section ZA were classified green. As noted previously, the MetroLink project (and associated HV cables), plus the aviation fuel pipeline would all need to be considered. Each cable route in Section ZB was classified amber accordingly.

Route option Z7 runs beside an area at risk of fluvial flooding along Estuary Road and was therefore classified red. It was noted that a flood risk assessment would be required if this route was chosen as the emerging preferred route.

5.7.4.7 Emerging Preferred Route at Conclusion of Cable Route Options Assessment

As discussed previously, the proposed cable route options for each section were assessed and ranked accordingly against a set list of criteria and presented in Table 5.6 above.

At this stage of the assessment, all of the cable route options in both sections ZA and ZB were deemed feasible (ie no “fatal flaws” identified) subject to further design and environmental assessment and subject to engagement with relevant stakeholders and landowners. Whilst noting the above, an emerging preferred cable route was identified for each of the sections ZA and ZB further to the multi-criteria assessment as outlined above.

Section ZA

Route option Z2 was identified as the emerging preferred cable route in section ZA. It is one of the most direct routes, in terms of potential disturbance during construction (though noted that Z3 and Z4 are also similar in length).

[4] Home - MetroLinkWeb (metrolinkro.ie)

[5] Aviation Fuel Pipeline - Planning Application

In terms of constructability, the associated M1 motorway crossing for Z2 was noted to have good options in terms of an offline HDD with good flexibility on both sides of the crossing. Whilst there were similar numbers of major watercourse crossings on both route options Z2 and Z4, on route option Z2 it was envisaged that these HDDs could be completed in-line within the public roadway, whereas those associated with route option Z4 would potentially require offline HDDs with more extensive land acquisition, (listed bridges, etc.).

Section ZB

Route option Z5 was identified as the emerging preferred cable route in section ZB. It is the shortest most direct route and has the least associated cost. In terms of constructability, the associated M1 motorway crossing for Z5 has good options in terms of an offline trenchless crossing with good flexibility noted on both sides. It was noted that route option Z5 would potentially travel in parallel with the MetroLink development and further consultation would be required with Metrolink to determine feasibility. Further consultation would also be required with the developers of the Aviation Fuel Pipeline. Route option Z5 does not interact with any Natura 2000 sites.

The emerging preferred route for the onshore cable route therefore, at the conclusion of the cable route options assessment stage was Route Option Z2 + Route Option Z5 (as shown on images Image 5.22 and Image 5.23 and on Figure 5.1), although it was also noted that other routes considered remain feasible, if any refinement of the routes were needed as the project progressed through design and detailed environmental assessments. Further development and refinement of the Emerging Preferred Cable Route

Following the initial optioneering process and the identification of the emerging preferred route as described in previous sections, further studies and consultation commenced, to support the preparation of the EIAR and the statutory consent application. These studies and consultations identified areas along the emerging preferred route which required further consideration, and in some instances, refinements.

These areas included:

- Cable route options north of Malahide Estuary
- Cable route options around Balbriggan
- Cable route options south of Malahide Estuary
- Alternative Route Z7 along Estuary Road
- Malahide Community Forum feedback
- Alternative Route Option along L2100 (Chapel Road), R124 (Drumnigh Road) and L2145 (Hole in the Wall Road).

The consideration of these areas is discussed below.

5.7.4.8 Cable Route Options – Study Area ZA (utilising R132)

As noted above, **Route option Z2** was initially identified as the emerging preferred cable route for study area ZA at the conclusion of the feasibility study. However, further design and technical analysis of this route as the project concept design developed highlighted that a significant proportion of the route east of the M1 was located on very narrow local and unmarked roads (in particular the section between the L5150 (Dermotstown Road) and Balheary Road before joining back onto the R125. This presented considerable challenges in terms of constructability and construction traffic management.

During this design development stage, it became clear that a route utilising more of the R132 should be reconsidered given much of it has a wide carriageway with verges and therefore there is capability to accommodate larger volumes of traffic.

Therefore, a new alternative cable route option was introduced at this point and was analysed against the same criteria as those for previous routes as presented in Table 5.5 above. The alternative cable route option is shown below in Image 5.24.

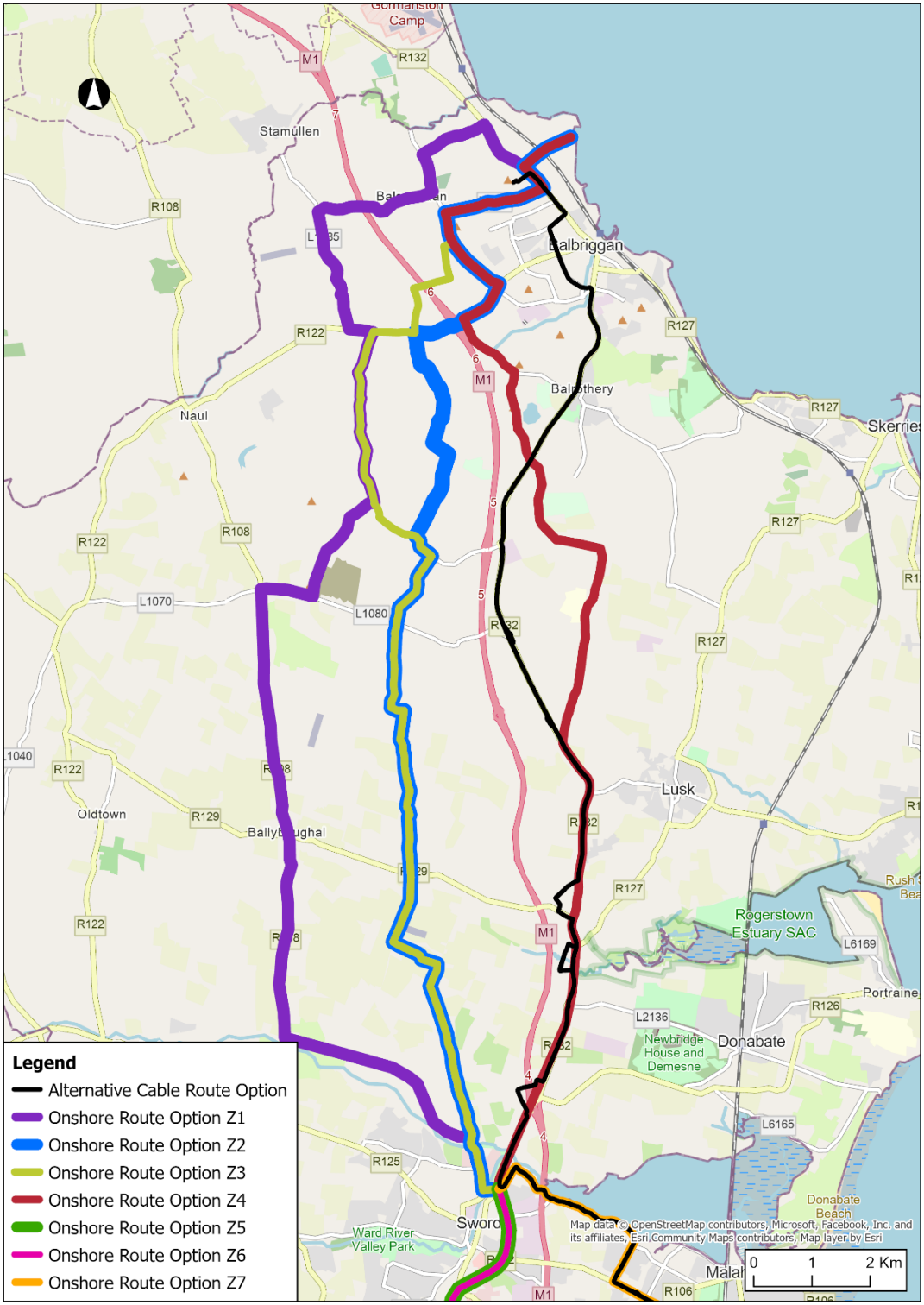

Image 5.24 Alternative cable route option

The cable route option begins at the grid facility and travels south-west to join the public roadway on the R132. The route turns south-east onto the R132 and continues as far as Drogheda St, where it turns west on to Harry Reynolds Road and then south. The route continues south before rejoining the R132 just south of Balbriggan. The route continues south along the R132 as far as Junction 4 of the M1 where it leaves the R132 to pass underneath the M1 via HDD crossing before rejoining the R132 again. It then continues south again on the R132 and terminates at node 1, at the junction with the R125. A summary of the comparison of the cable route options, including this alternative route option is given in Table 5.7 below.

Table 5.7 Summary of comparison of cable route options including alternative route option utilising R132

		Section ZA				
Assessment Criteria		**Route option Z1**	**Route option Z2**	**Route option Z3**	**Route option Z4**	**Alternative Route Option utilising R132**
Length		27.3km	23.5km	23.5km	22.5km	20.6km
Ecology						
Heritage						
Visual Amenity						
Zoning						
Land ownership						
Centres of population						
Planning						
Constructability	Motorway crossings					
	Rail crossings					
	Watercourse Crossings					
	Utilities					
Safety						
Construction Cost						
Preferred feasible route(s)						Alternative route option utilising R132

It is clear from the above that the new alternative route had no significant disadvantages, or fatal flaws, when compared with the emerging preferred route from the earlier cable route options assessment study. This route was the shortest and least cost in comparison to the other routes, but it also offers the benefit of being more able to accommodate the construction requirements for a linear project of this nature (as we are utilising a wider road in the R132).

For that reason, the alternative route considered was adopted as the **preferred cable route option** between the grid facility and node 1 (node 1 is located at Estuary Roundabout at the intersection of the R132, R125 and L2141 near Fingallians GAA club just north of Swords).

5.7.4.9 Route Options around Balbriggan

When the preferred option for north of Malahide Estuary had been defined (see above), it identified the need to consider the cable route around the area of Balbriggan, such that potential impacts on the town could be minimised. Two cable route options around Balbriggan were considered during the further design development in 2022:

- Balbriggan Outer Ring Road and
- Balbriggan Inner Ring Road.

A multi-criteria assessment (including technical and environmental aspects) of the two route options around Balbriggan was carried out.

Both options are shown on Image 5.25 below. The Balbriggan Outer Ring Road route option is shown in red, with the Balbriggan Inner Ring Road route option shown in yellow.

Image 5.25 Route Options around Balbriggan: Outer Ring Road Option (outer route in red, inner route in yellow)

The key features of both route options are provided below:

Balbriggan Outer Ring Road Option

- This route option is approximately 5.4km in length and is routed on local roads including Flemington Lane and Clonard Road, as well as the relatively new Ring Road between the roundabouts on the R122 and R132. The route option along the public road passes through mixed residential, industrial and commercial areas.
- There are number of archaeological sites within 100m of the cable route option. However, as the cable remains within the width of the public road, the risk of encountering undisturbed archaeology is low.
- It is noted that there is a proposed cycle/pedestrian route along Flemington Lane. Further, Fingal County Council (FCC) zoning highlights large areas of residential, as well as open spaces, general employment and high technology in the vicinity of the route.
- At the time of the assessment, there were between 500-1000 new homes with planning permission granted in the lands adjacent to Flemington Lane and Clonard Road. A large Strategic Housing Development of 582 dwelling units was also at pre-planning stage in some of the same lands, east of Clonard Road. There are likely to be considerable traffic volumes associated with the above proposed developments.
- The Fingal Development Plan (2023-2029) objectives mapping identifies the future extension/upgrade of the outer ring road from the roundabout on the R122 to Flemington Lane, approximately parallel to Clonard Road.

- In terms of utilities, along the route these include a medium pressure gas main, 3 no. medium and low voltage electric cables, Irish Water mains, fowl sewer mains and a potential watercourse crossing close to the junction with the R132.

Balbriggan Inner Ring Road Option

- This route option is approximately 2.4km in length and is routed along Drogheda Street and Harry Reynolds Road, connecting back onto the R132 to the south. The route along the public road passes through mixed residential, industrial and commercial areas.
- Harry Reynolds Road is a wide road with grass verges and footpaths either side of Harry Reynolds Road and is also part of a pedestrian and cycle initiative planned along the entirety of the route. There was therefore potential identified for synergies between the projects.
- There are few archaeological sites and protected structures within 100m of the cable route option. However, as the cable remains within the width of the public road, the risk of encountering undisturbed archaeology is low.
- There are two potential watercourse crossings along the route, along the eastern branch of Harry Reynolds Road and close to the junction with the R132 and utilities along the route include a medium pressure gas main, 2 no. medium and low voltage electric cables and Uisce Éireann watermains.

Assessment of Options

A comparative assessment of these two route options was carried out against a number of assessment criteria, see Table 5.9 below. The criteria adopted here differ slightly from those adopted for the earlier cable route options assessment but were chosen to be the most applicable for the route options being considered. Given that these route options apply to a more 'urban' area, and the more detailed information available at the time as the design evolved, it was possible to provide a more detailed assessment for example, in terms of key environmental criteria such as noise and air quality. Similar to the previous assessments, a colour coded system of comparative rankings was used to grade the criteria in the comparative assessment, as described in Table 5.8.

Table 5.8 Legend for colour coded assessments

Legend	Colour	Notes
Low potential impact/risk		Low potential impact. To be confirmed at detailed design stage.
Medium potential impact/risk		Further assessment at detailed design stage.
High potential impact/risk t		Potential significant issue. Due consideration to be given at detailed design stage.
'Fatal Flaw'		There is such a significant impact or 'fatal flaw' that the option is not progressed further.
Not Applicable		Criteria does not apply to this specific section.

Table 5.9 Comparison of route options around Balbriggan

Noteworthy Criteria	Balbriggan Outer Ring Road	Balbriggan Inner Ring Road
Length	5.4km	2.4km
Ecology	No considerable differentiator between options. Cable is within public road. 1 watercourse. Crossing methodology to be considered	No considerable differentiator between options. Cable is within public road. 2 watercourses. Crossing methodology to be considered
Archaeological, Architectural & Cultural heritage	Archaeological sites within 100m of route. No considerable differentiator between options. Cable is within public road.	Archaeological sites and protected structures within 100m of route. No considerable differentiator between options. Cable is within public road.
Noise and Vibration	Residential areas/sensitive receptors along route	Residential areas/sensitive receptors along route

Noteworthy Criteria	Balbriggan Outer Ring Road	Balbriggan Inner Ring Road
Air Quality & Climate	No differentiator between options. Residential areas/sensitive receptors along route	No differentiator between options. Residential areas/sensitive receptors along route
Land and Soils	No differentiator between options. No evidence of contaminated land. Cable is within public road so no direct impact on adjacent landowners.	No differentiator between options. No evidence of contaminated land. Cable is within public road so no direct impact on landowners.
Water	1 watercourse. Low flood risk	2 watercourses. Low flood risk
Landscape & Visual	Temporary impact during construction	Temporary impact during construction
Land Use	No differentiator between options. Cable is within public road	No differentiator between options. Cable is within public road
Utilities	Various utilities	Various utilities
Constructability (including traffic)	Considerable number of future developments (with associated services) proposed along and adjacent to this route option. Potentially substantial construction traffic & disruption arising & would need to be considered in combination with NISA. Traffic diversions if required would likely be longer than Inner Ring Road. If chosen, traffic plan to be developed for NISA	Proposed cycle/pedestrian route along Harry Reynolds Road offers potential synergies to minimise disruption, could be considered at detailed design stage. Traffic diversions if required would likely be shorter than Outer Ring Road. If chosen, traffic plan to be developed for NISA

Preferred Option

Following the comparative assessment above, the Ballbriggan Inner Ring Road was selected as the preferred option based on the following aspects:

- Constructability
  - There were a considerable number of future developments and road upgrades proposed along the Balbriggan Outer Ring Road in the short and medium term – these will likely see potentially significant construction related traffic over a number of years and
  - Traffic diversions if required for NISA would be longer along the Balbriggan Outer Ring Road than along the Balbriggan Inner Ring Road.
- Length of Route
  - Balbriggan Inner Ring Road is shorter in length (approximately 2.4km) than Balbriggan Outer Ring Road (approximately 5.4km).

5.7.4.10 Route Options (south of Malahide Estuary)

Alternative Route Option Z7

As described in Section 5.7.4.7, **route option Z5** was initially identified as the emerging preferred cable route in section ZB (south of the Malahide Estuary to Belcamp substation) at the conclusion of the cable route options assessment. This route option was along the R132 coming south from Swords to Dublin Airport and then along Stockhole Lane (L2753) approaching Belcamp Substation from the west.

Again however, as the concept design, consultation with stakeholders and EIA studies continued, details emerged about parallel projects in development, which resulted in the need to reconsider this route afresh. The key reasons for this were in respect of consultation with the developers of Metrolink and the Aviation Fuel Pipeline, as described below. Information also became available on the proposed supporting electrical infrastructure for MetroLink, which includes 220kV and 110kV cables to support the transition system. The routes for the supporting electrical cables for MetroLink would be routed from Belcamp substation to MetroLink. The proposed alignments of the Metrolink railway line, the Metrolink electrical cables and the aviation fuel pipeline are shown on Figure 5.1.

MetroLink rail track and MetroLink 110kV electrical cables

As noted above, initial early-stage cable routing options recommended a route along the R132 and then along Stockhole Lane (L2753) to Belcamp Substation.

It was identified that this route would have significant lengths in parallel with the MetroLink project along the R132. The Developer team undertook extensive consultation with MetroLink during the cable routing stage between 2021 and 2022 (see Appendix 1.2 in Volume 2 of the EIAR for further details). At the time of consultations, the proposed MetroLink project was with An Bord Pleanála for planning approval. During those consultations, it emerged that there would be significant conflicts with key infrastructure planned for MetroLink rail track along the R132, including stations, existing services diversions, etc. MetroLink was very concerned about the impact of any such conflicts on both projects.

Information also became available on the proposed route options for the supporting 110kV HV electrical cables for the MetroLink rail track. ESB Networks (ESBN) were designing the 110kV cable routing for MetroLink at that time. One of these 110kV cable route options is along Stockhole Lane and Baskin Lane Another 110kV option runs along the R107 Malahide Road from Baskin Lane to the junction with the R139 at Northern Cross before turning west along the R139 and connecting into Belcamp Substation. Arising from the consultations with ESBN, it became clear that routing of the onshore cable route along Stockhole Lane in parallel with the 110kV cables would be challenging due to the limited room within the narrow road carriageway. As such, the decision was made not to take this route option forward as it was deemed unviable.

Aviation Fuel Pipeline

The consented Aviation Fuel Pipeline (Dublin Port to Dublin Airport) is routed along the R139 and Stockhole Lane. The Developer also undertook consultation with the designers of the consented Aviation Fuel Pipeline during the cable routing stage in 2021/22 (see Appendix 1.2 in Volume 2 of the EIAR for further details) and in early 2024. The Aviation Fuel Pipeline (refer to Figure 5.1) is to be laid underground from Dublin Port via the R107, turning west at Northern Cross and running down the R139 past the Belcamp Substation entrance. The pipeline is then routed north onto Stockhole Lane, following the orientation of the lane, and turns west into Dublin Airport. It is currently under construction.

During those consultations, it was noted that the Aviation Fuel Pipeline and the preferred onshore cable route would travel in parallel along Stockhole Lane and along the R139. In terms of constructability, whilst the R139 is a wide four-lane carriageway with footpaths, the section along Stockhole Lane is narrow and already congested with existing services and with limited room remaining in the carriageway to route further services.

Following consultation with both MetroLink and the Aviation Fuel Pipeline, it became clear that there were significant conflicts with both projects with the Developers emerging preferred cable route. Further consultation with Fingal County Council (FCC), as detailed in Appendix 1.2 in Volume 2 of the EIAR, also identified Stockhole Lane as being particularly congested with utilities and with very limited room remaining in the carriageway to route further services.

As a result, a decision was made by the Developer to re-consider this route and to assess whether there was a viable alternative available which could be considered.

Alternative Route Assessment

As a result of the above, consideration was given to the alternative route options which had been assessed in the earlier cable route options assessment, to see, with the more detailed information now available, if either of these (Z6 or Z7) would be viable alternatives to the emerging preferred route.

As the need for this alternative route emerged during the design development and the detailed EIAR studies, significant additional information was available to assist in the selection process. This helped to identify Route Option Z7, as described in Section 5.7.4.3 and analysed in Section 5.7.4.4 above as a suitable alternative to the previously selected route.

Route option Z7 begins at node 1 Fingallians Roundabout (intersection of R132 and R125/L2141 Lissenhall) and travels northeast along Lisssenhall L2141 and turns east to continue along Estuary Road. The route then crosses the M1 within the underpass and continues along Estuary Road alongside the Malahide Estuary and follows the road as it turns south. The route then turns east onto the R106 Swords Road, and then turns south onto the R107 Dublin/Malahide Road. The route follows the R107 Malahide Road to the south and turns west onto the R139 as far as Northern Cross. The route continues along the R139 as far as the entrance to Belcamp Substation where the route terminates.

Two key differentiators in the initial cable route options assessment which resulted in this route not originally being selected as the emerging preferred route were:

- Proximity to Malahide Estuary SAC/SPA/pNHA
- Proximity to a flood risk zone.

At the time of consideration of this route refinement, extensive surveys had been carried out to understand the area and the route in relation to the EirGrid specifications and the proposed construction strategy as outlined in Chapter 9: Construction Strategy - Onshore. This information, together with the more detailed environmental surveys and assessments underway to support the consent application confirmed that it should be possible to avoid significant effects on the Malahide Estuary. Chapter 22: Biodiversity details the thorough assessment of this preferred route with regard to potential biodiversity impacts.

Similarly, with the more detailed flood risk information available at the time of this decision and with the ongoing detailed flood risk assessment underway, it was also clear that there was no significant risk from flooding associated with this alternate route. Chapter 23: Water details the thorough assessment of this preferred route with regard to potential impacts on water, including flood risk.

5.7.4.11 Malahide Community Forum

During stakeholder and public consultations undertaken for the proposed development in November 2023, an alternative option (to the proposed route along Estuary Road Z7) was put forward by the Malahide Community Forum (MCF). This alternative option identified an area between Estuary Road and Belcamp through which the cable could be routed offline, shown in Image 5.26 below.

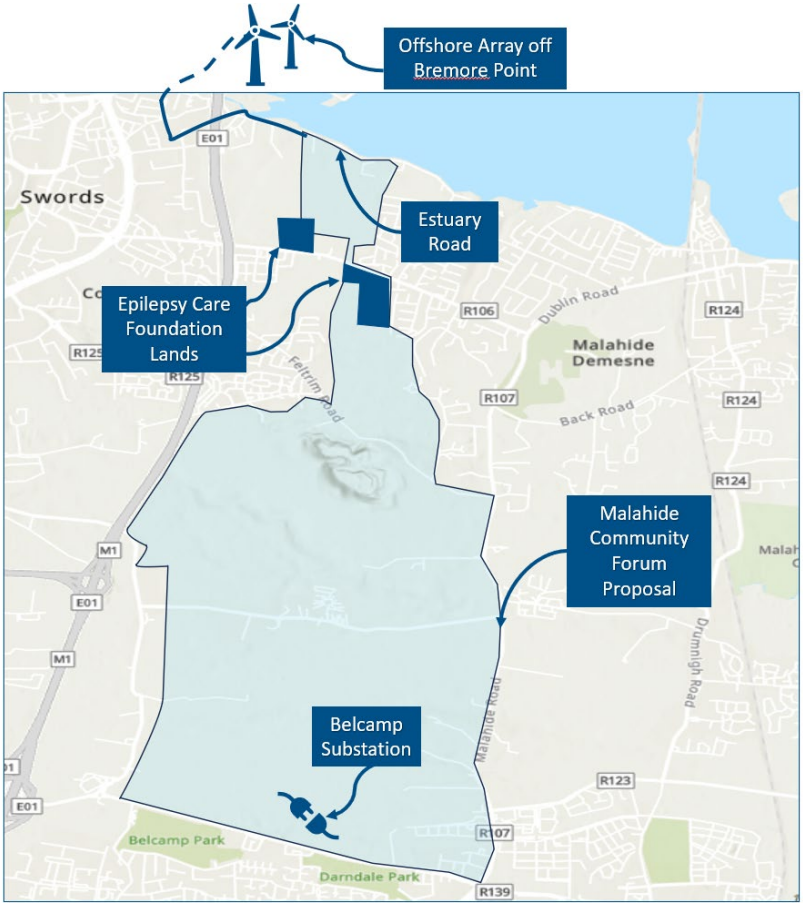

Image 5.26 Malahide Community Forum route proposal

The MCF proposal would involve moving the current proposed route offline (off-road) at Malahide rugby football club, to run south through Epilepsy Care Foundation lands. The MCF proposal then considers a wider area to the south of Swords Road. The alternative route area as tabled by MCF was considered and a constraints assessment was undertaken to review this proposal and to assess it comparatively against the proposed route along Estuary Road (Z7).

While it is acknowledged that routing the cables through private lands would reduce the construction stage effects of the cable laying on Estuary Road (most notably traffic and associated impacts on the local community), the proposed area for the alternate route does have other constraints which needed to be considered. In particular, this potential route runs through private lands, which is not the preferred methodology as per Eirgrid Functional Requirements (see Section 5.7.4.2 above). Further, there are biodiversity (ecological buffer zone), land zoning, land ownership and other planned developments, which resulted in significant challenges in identifying a viable route through these lands and one where the potential effects could be significantly reduced. As a result, this proposed alternate route has not been progressed.

Further details of this assessment are provided in Appendix 5.1 of this EIAR.

5.7.4.12 Addition of Alternative Route Option along L2100 (Chapel Road) and R124 (Drumnigh Road) and L2145 (Hole in the Wall Road)

While the MCF proposal was not carried forward, the Developer is keenly aware of, and wishes to minimise the effects on local communities from the proposed development. The alternate route Z7 therefore continued to be assessed as the design developed and the EIAR studies progressed.

The southernmost section of the preferred onshore cable route as it approaches Belcamp Substation is shown on Image 5.23. The preferred cable route (Z7) leaves the R132 at the Fingallians roundabout and travels northeast towards Estuary Road. The cable route is then proposed to traverse beneath the M1 along Estuary Road and continue south where it turns east onto the R106 for approximately 1km before turning south onto the R107.

This route then follows the R107 to the south for approximately 5km before turning west onto the R139 where the two roads meet at Northern Cross. The route continues along the R139 for approximately 1.9km to the entrance of the existing Belcamp Substation.

The route between the junction of the Malahide Road (R107) and Chapel Road (L2100) and Belcamp Substation was given particular focus. Within this section of the route, there are a number of existing utilities and from MetroLink consultation, it became clear that one of the proposed ESB MetroLink 110kV cable route options, if deemed preferred, may also be laid in this area, coinciding with the proposed development's onshore cable route for approximately 2.4 km along the Malahide Road (R107) from Baskin Lane to the junction with the R139.

Potential alternative cable route options were therefore considered from Baskin Lane to Belcamp Substation to address concerns regarding the feasibility of accommodating the onshore cables, with the ESB MetroLink cable route, within the R107 section of road, whilst minimising environmental effects.

While online and offline options were initially identified, offline options were quickly discounted as there were feasible online options available and given the Eirgrid requirements (see 5.7.4.2 above). Four routes to the east of Malahide Road (R107) were considered and are described in detail in the following sections. All of these routes start from Node B which is the junction between Malahide Road (R107) and Chapel Road (L2100) and end at Node S which is Belcamp Substation. The four route options are as follows:

1. Route Option 1
2. Route Option 2
3. Route Option 3
4. Route Option 4

Each of these route options is described in the following sections.

Route Option 1

This route option is presented on Image 5.27 below. This route starts from Node B, the junction between Malahide Road (R107) and Chapel Road (L2100) and continues on Chapel Road to Node L, the junction between Chapel Road and the Drumnigh road (R124). At Node L the route turns south onto Drumnigh Road and continues on Drumnigh Road to Node M, the junction between Drumnigh Road and the R123. From Node M the route turns west onto the R123 and continues on this road to Node E, the junction between the R123 and Malahide Road. At Node E the route turns south onto Malahide Road and continues on Malahide Road to Node H, the junction between Malahide Road and the R139. At Node H the route turns west onto the R139 and continues on the R139 to the Belcamp Substation.

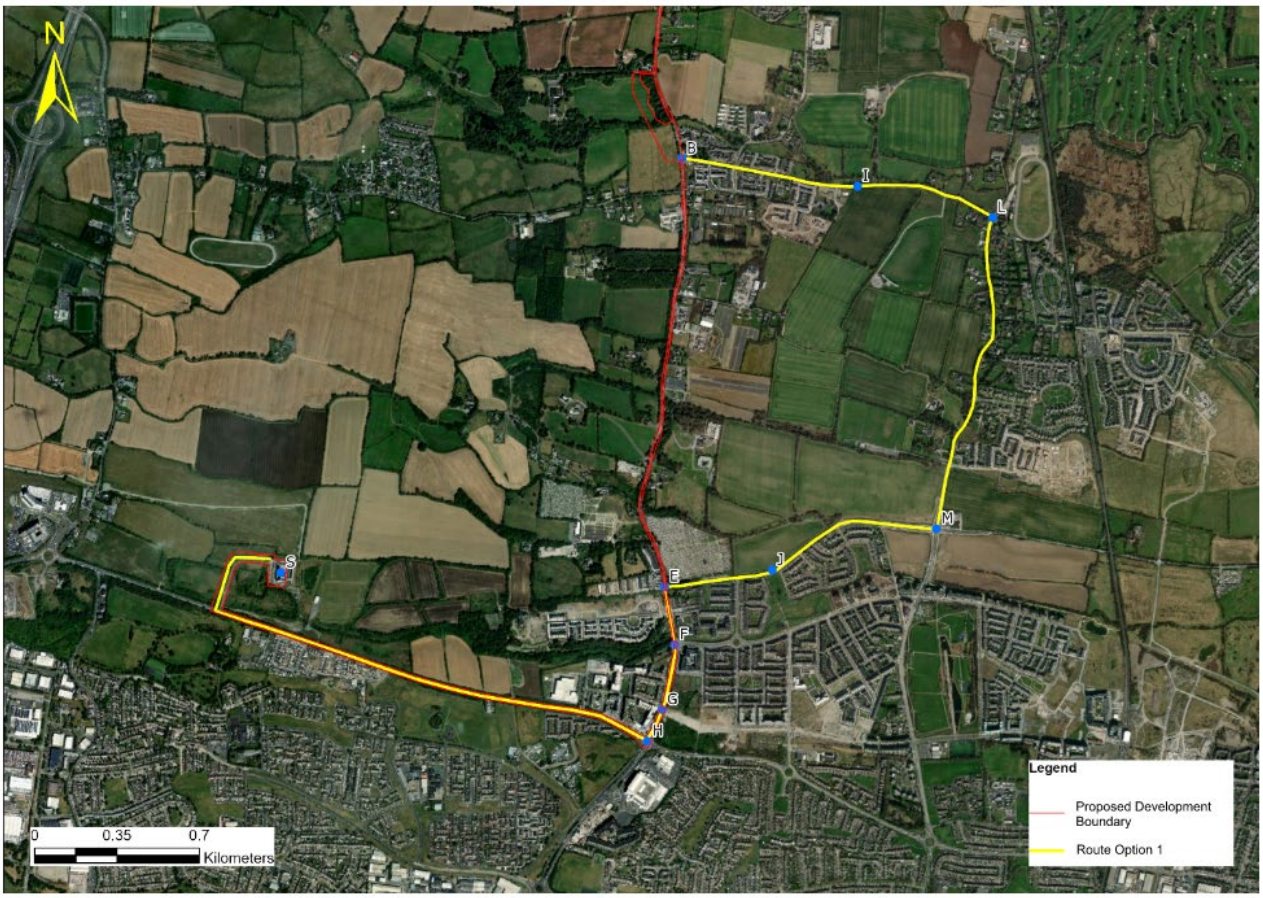

Image 5.27 Route Option 1

Route Option 2

This route option is presented on Image 5.28. This route starts from Node B and follows the same route as Route Option 1 to Node M then continues south on the L2145 to Node N, the junction between the L2145 and Marrsfield Avenue Road. At Node N the route turns west onto Belmayne Road and continues on Belmayne Road to Node F, the junction between Belmayne Road and Malahide Road.

At Node F the route turns south onto Malahide Road and continues on Malahide Road to Node H after which it follows the same route as Route Option 1 to the Belcamp Substation. At node M there is a short localised alternative route west onto Moyne Road before turning south onto Balgriffin Park Road and rejoining the route at Belmayne.

Image 5.28 Route Option 2

Route Option 3

This route option is presented on Image 5.29. This route starts from Node B and follows the same route as Route Option 2 to Node N before continuing south on Hole in the Wall Road to Node O, the junction between Hole in the Wall Road and New Priory Road. At Node O, the route turns west onto New Priory Road and continues on New Priory Road for approximately 200m to Node G, at the junction with Malahide Road.

At Node G the route turns south onto Malahide Road and continues on Malahide Road to Node H after which it follows the same route as Route Option 1 to the Belcamp Substation. At node M there is a short localised alternative route west onto Moyne Road before turning south onto Balgriffin Park and then turning east onto Belmayne before rejoining the route at the Hole in The Wall Road.

Image 5.29 Route Option 3

Route Option 4

This route option is presented on Image 5.30. This route starts from Node B and follows the same route as Route Option 3 to Node O then continues south on Hole in the Wall Road to Node P, the junction between Hole in the Wall Road and the R139. At Node P the route turns west onto the R139 and continues on this road to Node H, the junction between the R139 and Malahide Road. From Node H, the route follows the same route as Route Option 1 to the Belcamp Substation. At node M there is a short localised alternative route west onto Moyne Road before turning south onto Balgriffin Park and then turning east onto Belmayne before rejoining the route at the Hole in The Wall Road.

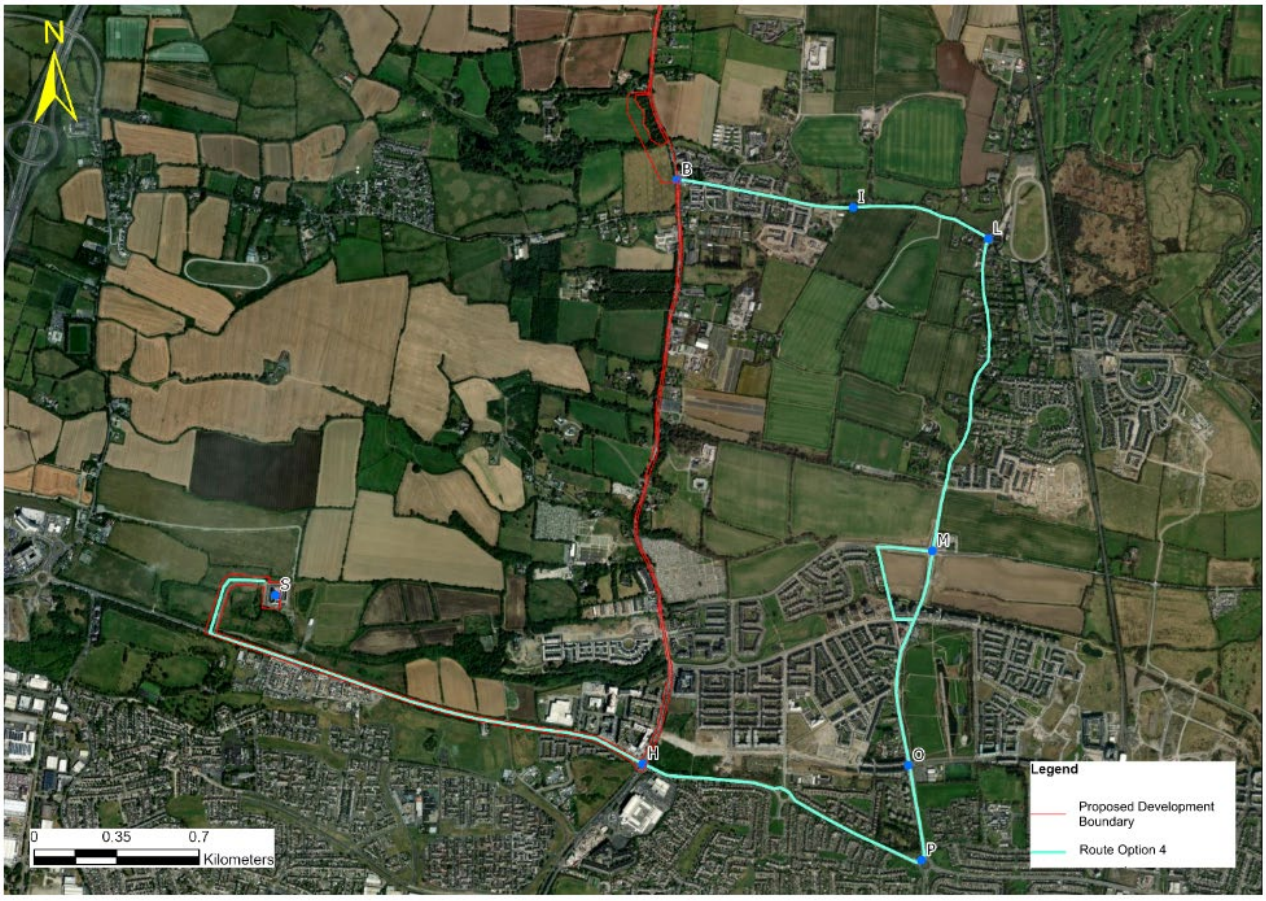

Image 5.30 Route Option 4

A comparative assessment of the four route options is provided below in Table 5.11. A narrative of the key constraints associated with each route option is also provided therein. For this comparative assessment, a ranking as per Table 5.10 below was used, given the relatively localised nature of the routes considered.

Table 5.10 Legend for Colour Coded Assessment

Legend	Colour
Low potential for the development to be constrained	
Intermediate potential for the development to be constrained	
High potential for the development to be constrained	
'Fatal Flaw' - There is such a significant impact or 'fatal flaw ' that the option is not progressed further.	

Table 5.11 Comparison of Cable Route Options

Route options	Cable Route Length from Node A to Belcamp substation	Min. Road Width along the Route	Co-existence length with Metrolink Cable	ESB Underground Lines	Biodiversity River Buffer Crossings**	Monuments/ Protected Structures*	Key Constraints of relevance
Route Option 1	7.3km	6m	3.0km	Yes	1	NA	On Chapel Road there is a 38kV underground line within the road for an approx. 60m length. On the R123 there are also two under-ground 38 kV cables within the road for approx. 200m length which then cross the R123. There is an Architectural Conservation Area (between Nodes L and M) on the Drumnigh Road. The Drumnigh Road in this location also marks the western boundary of the Kinsealy area as designated in the Kinsealy Local Area Plan 2019. A greenway and road proposal are also identified running west to east near Station Road. There are two stream crossings along this cable route. The first stream crossing is the Cuckoo stream which is identified as a biodiversity river buffer zone in the Fingal County Development Plan along the R123 between Node M and Node J. The stream is identified within the Fingal County Strategic Flood Risk Assessment (SFRA) as being within Flood Zone B. The second stream crossing is the Mayne Stream on the Malahide Road between Node E and F. This Option re-joins the Malahide Road at node E where the road width is less than further south.
Route Option 2	7.2km	6m	2.8km	Yes	1	NA	There is a 38kV underground cable along the Belmayne road over a distance of approximately 90m. There is one stream crossing along this cable route, the Mayne stream crossing on the R124 which is identified as a biodiversity river buffer zone in the Fingal County Development Plan. This stream is also identified as being within Flood Zone B within the SFRA. The localised alternative route west onto Moyne Road provides an alternative Mayne Steam crossing to the R124 crossing, with the stream crossing on this alternative route being under the Balgriffin Park Road. This cable route lies on the boundary between Fingal County Council and Dublin City Council between Node N and F.
Route Option 3	7.6km	6m	2.5km	Yes	1	NA	The constraints on Route Option 1 and Route Option 2 from Node B to N, are also applicable for Route Option 3. It is noted that the New Priory Road intersection with Malahide Road, approximately 300m from Node G was still under construction at the time of consideration of this alternative.
Route Option 4	8.0km	6m	2.3km	Yes	1	NA	The constraints on Route Option 1, Route Option 2 and Route Option 3 are applicable for Route Option 4 for the overlapping sections of the route between Nodes B and O. There is a 38kV underground line crossing The Hole in the Wall Road, approximately 85m from Node O. This cable route is also on the boundary of Fingal County Council and Dublin City Council (DCC), with Node N to H being within the DCC jurisdiction.

*Ranking of Monuments/Protected Structures has been undertaken based on the number of structures within a 30m zone of the route option. The importance of each monument/protected structure was not compared for this initial assessment as all monuments/structures were avoided by the routes identified.

**Ranking of the Biodiversity River Buffer Crossings has been undertaken based on the number of crossings. The importance of each crossing was not compared for this initial assessment.

It is clear that all of the route options identified are feasible based on the technical appraisal The comparative assessment did not identify any significant differentiator between the options, but did note the following:

- Route Option 1 requires the longest section of road route in parallel with the MetroLink 110kV cable. This coexistence includes a narrow road cross-section of the Malahide Road which the other options do not traverse
- Route Option 4 required the shortest road route in parallel with the MetroLink 110kV cable, however, was the overall longest route
- Route Option 3 traverses a section of road which is currently under construction and therefore would require consideration of the proposed road planning submission assessment and construction site access for any cable route assessment
- Route Option 2, 3 and 4 all cross the Mayne Stream along the R124. However, the localised alternative route along Balgriffin Park Road provides an alternative Mayne Stream crossing if constraints technically restrict the crossing along the R124
- Route Option 4 was selected as the preferred route option as it has the shortest overlap with the Metrolink 110kV cable route, while complying with the Eirgrid specifications. Refer to Section 0 for further details of the consultation undertaken with Metrolink and
- Should the MetroLink 110kV cable route option along the R107 be constructed, route option 4 would provide a feasible alternative for the proposed development in order to avoid parallelling with the MetroLink 110kV cable route along the R107

5.7.4.13 Final Cable Route from Grid Facility to Belcamp Substation

Following the initial cable route options assessment, the design development, extensive stakeholder consultation and refinement of the cable route as described above, the final onshore cable route is described below, shown on Figures 7.1 and 7.3 and is assessed throughout this EIAR.

The onshore cable route leaves the Bremore Substation within the grid facility and proceeds south down the R132/R132 Drogheda Street towards the town of Balbriggan to the junction of the R132 and Harry Reynolds Road. The onshore cable route turns west along Harry Reynolds Road and continues south along Harry Reynolds Road through the junction of R122 until it meets the Balbriggan Outer Relief Road and R132 south of Balbriggan town centre. The onshore cable route turns south onto the R132 and generally remains on the R132 for approximately 13km until the R132 intersects with Junction 4 (Donabate) of the M1 motorway.

Along this section between Balbriggan and the M1, the onshore cable route proceeds south along the R132 as it passes through Gardners Hill, Balrothery, Knock Cross and Hedgestown to a point just north of the R132 junction with the L1155 Quickpenny Lane. At this point the onshore cable route includes an option to deviate offline from the road to cross a watercourse. Alternatively, the cable will continue along the public road (R132). The onshore cable route continues south along the R132 as it passes to the west of the town of Lusk. It continues south down the R132 through the village of Corduff (Hackett) to a point just north of Blakes Cross. North of Blakes Cross, the onshore cable route deviates offline from the R132 in order to cross another watercourse, the Ballough Stream. The onshore cable route joins the R129 then continues east along the R129 to the junction with the R132. The onshore cable route continues south along the R132, passing Turvey Business Park, to a point just north of its crossing point under the M1 motorway (near Junction 4 Donabate). Towards the north of this route section, at Blakes Cross, the onshore cable route includes an option to deviate offline from the R132 in order to cross two watercourses. An option is also included for the onshore cable route to continue inline down the R132 without deviating offline.

The onshore cable route deviates offline from the R132 in order to cross under the M1 motorway just to the north-east of the M1 Junction 4 (Donabate). The onshore cable route continues south along the R132 to the junction with R125/R132/L2141 (Node 1).

The onshore cable route continues north-east along L2141 Spittal Hill/Lissenhall to its junction with Estuary Road. The onshore cable route continues east along Estuary Road, past the junction of Estuary Road and Seatown Road, crossing under the M1 via the existing underpass.

The onshore cable route continues east along Estuary Road alongside the Malahide Estuary before it turns south. The onshore cable route continues south along Estuary Road through the residential area of Seabury, to the junction of Estuary Road and the R106 Swords Road.

The onshore cable route continues east along the R106 Swords Road through the residential areas of Seabury, Millview and Ard na Mara, to the junction of the R106 Swords Road and the R107 Malahide Road. There is an option to deviate offline into a local amenity area adjacent to the R106 road, to cross a watercourse.

The onshore cable route continues south along the R107 Malahide Road past Mabestown and Streamstown, to the junction of the R107 and L2100 Chapel Road at Kinsealy.

Towards the south of this route section, the route includes an option to deviate offline from the R107 Malahide Road in order to cross a watercourse. If this option is not utilised, the route would continue inline along the R107 road.

Two alternative onshore cable route options are proposed between the junction of the R107 Malahide Road with Chapel Road and the junction of the R107 Malahide Road with the R139.

The R107 route is the preferred route and will be used if it does not conflict with a potential route for the MetroLink 110kV electrical cables which are also proposed to be laid under the R107 in this route section. In the event that the Metrolink 110kV cables are installed along the R107 and if the onshore cable route infrastructure cannot be accommodated alongside, an alternative onshore cable route along Chapel Road/R124/R123 will be utilised.

In the preferred R107 route option, the onshore cable route would continue south down the R107 Malahide Road past St Doolagh's Church and Balgriffin Park to the junction of the R107 Malahide Road and the R139 at Northern Cross.

In the alternative option, the onshore cable route would proceed east along Chapel Road to its junction with the R124 Drumnigh Road, then south down R124 Drumnigh Road to its junction with the R123 Moyne Road. At this point the route would either continue south down the L2145 Hole in the Wall Road to its junction with Belmayne/Clongriffin Avenue. Alternatively, the route will deviate via the R123 Moyne Road, through Balgriffin Park, to connect with the junction of Belmayne and the Hole in the Wall Road. From the junction of the Hole in the Wall Road and Belmayne, the route would continue south along the Hole in the Wall Road to its junction with the R139 Clarehall Avenue, where it would continue west along the R139 Clarehall Avenue to its junction with the R107 Malahide Road.

The onshore cable route continues west along the R139 to a point near the exiting Belcamp Substation, at which point it deviates offline to the north in order to connect into the substation.

5.8 Conclusions

This chapter sets out the reasonable alternatives considered for the proposed development and the criteria used to identify the preferred options, in terms of design, technology, location, size and scale. It is clear from the above, that the effects of the options considered on the environment were given due consideration in this assessment.

The selected options, in terms of both offshore and onshore infrastructure now form the proposed development, as described herein in the Offshore Description Chapter Onshore Description Chapter. It is this development, as described herein that is assessed as the proposed development within the EIAR and is the subject of the consent application.

5.9 References

Department of the Environment, Climate and Communications, Climate Action Plan (2024)

Department of the Environment, Climate and Communications, Accelerating Ireland's Offshore Energy Programme, Policy Statement on the Framework for Phase Two Offshore Wind, March 2023

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Department of Housing, Local Government and Heritage, Marine Planning and Development Management Bill (MPDM), General Scheme, December 2019.

Department of Housing, Local Government and Heritage, Marine Planning and Development Management Bill, January 2020

Intergovernmental Panel on Climate Change, AR6 Synthesis Report: Climate Change 2023.