Capital Project 1021

Substation Feasibility Assessment - Finglas 400 kV Connection

321084AJ-REP-006 | A03

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EirGrid

CP1021

Capital Project 1021

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Contents

Figures

Executive Summary

Jacobs was requested to prepare a set of substation feasibility reports for EirGrid CP1021 project analysing three sites – Woodland, Finglas and Belcamp. A new 400 kV circuit will originate in Woodland and terminate at either Finglas or Belcamp. This report describes the 400 kV connection requirements at Finglas substation.

Finglas 220/110 kV substation was assessed to determine its suitability to receive the proposed 400 kV circuit from Woodland, requiring initial construction of a 400 kV GIS switchroom capable of housing an 8 bay enhanced ring configuration, 2 x 400/220 kV transformers and reactive compensation for the circuit. It shall be expandable in the future to take another 2 x 400/220 kV transformers and additional 400 kV circuits.

The assessment focused on using the land within the substation site. The usable land is the area where the outdoor 110 kV equipment has recently been decommissioned, except for three bays awaiting outage availability, following the installation of a new 110 kV GIS substation to the north of the substation. It was determined that the site could take the initial 400 kV plant installation. This would be a difficult construction taking place adjacent to live 220 kV outdoor AIS and requiring crossing of multiple in-service 110 kV cables. It would only to be possible to connect one 400/220 kV transformer to the system. There is no spare bay on the 220 kV busbar to connect a second transformer. Therefore, an expansion of the 220 kV busbar system would be required, which is not possible within the existing site boundary.

This configuration would not be capable of accommodating the future requirement of connecting up to four 400/220 kV transformers to the network. It is also not considered feasible to bring more than one 400 kV circuit to the switchroom by either underground cable or overhead line.

A partial solution to the above would be to expand the site in the land to the west. Further assessment would be needed as to whether all required plant could be accommodated and connected to the system. A replacement or expansion of the outdoor 220 kV busbar will be needed to take additional transformer connections. More land will be needed for this.

The potential environmental and social impacts of the proposed connection to Woodland Substation have been considered. Overall, there is a low risk of environmental impact and a low risk of social impacts. Both environmental and social impacts will be considered further and in more detail as the proposed project progresses into the next Steps in EirGrid's grid Development Framework.

Unless it is considered feasible to obtain sufficient additional land in the vicinity of Finglas, then Finglas Substation is not considered suitable as the terminal connection point for the new 400 kV link from Woodland Substation on this project.

Summary Of MCA

400 kV Connection Options	Technical Feasibility	Environmental Feasibility	Social Feasibility	Deliverability	Economic Feasibility		Combined Performance
Overhead line initial installation							
Overhead line future expansion							
Cable initial installation							
Cable future expansion							

1. Introduction

Capital Project 1021 (CP1021) is a Proposed Project to reinforce the electricity network between East Meath and North Dublin. Further details are provided in the Proposed Project Overview Report [321084AJ-REP-001], along with more information to explain EirGrid's approach to Grid Development.

The technology options being considered by EirGrid are:

- 400 kV Overhead Line (OHL); and
- 400 kV Underground cable (UGC).

There are two circuit node connection options:

- Woodland substation to Finglas substation
- Woodland substation to Belcamp substation.
- This report considers the feasibility of a connection to Finglas substation. Please see report 321084AJ-REP-008 CP1021 for the assessment of Belcamp as a suitable termination for the circuit.

1.1 Scale used to assess each criteria

The effect on each criteria parameter is presented along a range from "more significant"/"more difficult"/"more risk" to "less significant"/"less difficult"/"less risk". The following scale is used to illustrate each criteria parameter:

More significant/difficult/risk Less significant/difficult/risk

In the text this scale is quantified by text for example mid-level/moderate (Dark Green), low-moderate (Green), low (Cream), high-moderate (Blue) or high (Dark Blue).

1.2 Relationship to other technical documents

For an in-depth introduction on the Capital Project 1021, please refer to report 321084AJ-REP-001 Proposed Project Overview Report.

Please read in conjunction with the following reports:

- 321084AJ-REP-001 CP1021 Proposed Project Overview
- 321084AJ-REP-002 CP1021 Cable Feasibility Report
- 321084AJ-REP-003 CP1021 OHL Feasibility Report
- 321084AJ-REP-004 CP1021 Environmental Constraints Report
- 321084AJ-REP-005 CP1021 Strategic Social Impact Assessment Scoping Report
- 321084AJ-REP-006 CP1021 Substation Feasibility Report Finglas – this report
- 321084AJ-REP-007 CP1021 Substation Feasibility Report Woodland
- 321084AJ-REP-008 CP1021 Substation Feasibility Report Belcamp

2. The Project

2.1 Site Description

Finglas 220/110 kV AIS substation is an existing substation located in Dublin and is surrounded by farmland and the N2 and M50 motorways. Aerial views of the substation and surrounds are shown in Figure 2-1 and Figure 2-2.

The existing substation contains 220 kV, 110 kV and 38 kV equipment. The 220 kV is an outdoor busbar. The 110 kV busbar was recently replaced with an indoor gas insulated switchgear (GIS) board. The outdoor 110 kV AIS equipment however has not been removed and three bays are still in service (1 x feeder and 2 x transformers), pending outages to transfer them to the new GIS building. The 38 kV equipment consists of indoor switchboards in buildings on the east side.

Existing connections to the site are a mix of overhead lines and underground cable.

Figure 2-1 Aerial View of Finglas Substation

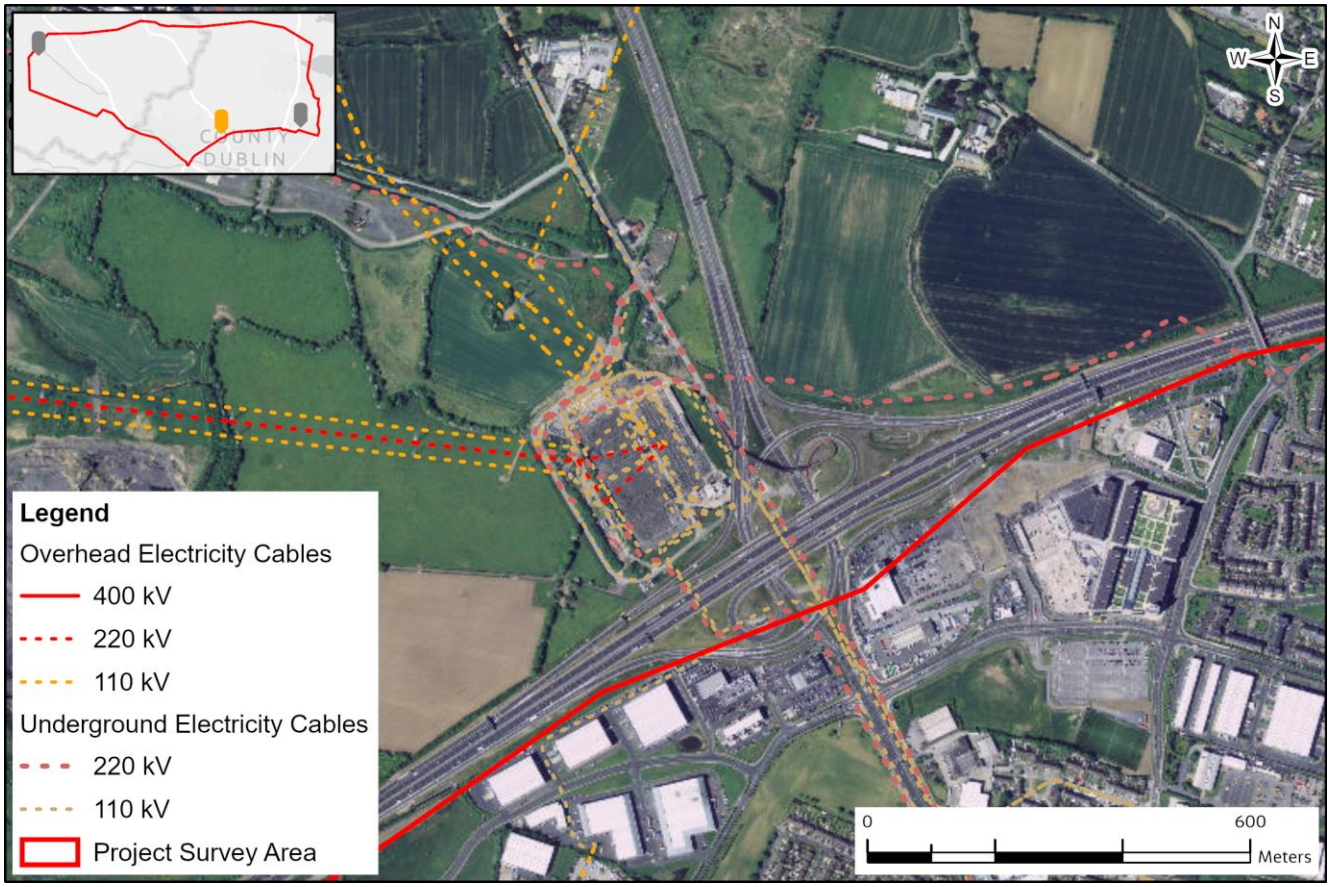

Figure 2-2 Aerial View of Finglas Substation with Utilities overlaid

2.2 Objective

This feasibility report considers the option to connect a new 400 kV circuit (either overhead line or underground cable) from Woodland into Finglas as part of CP1021. It describes the site issues with installing a new 400 kV cable or overhead line connection along with all new primary plant and equipment as described in the EirGrid Request for Proposal document SCF17112L1. These requirements have been confirmed in project meetings between Jacobs and EirGrid.

2.3 Assumptions

- The area of land inside Finglas substation currently occupied by outdoor 110 kV equipment will be available for use for this project. The bulk of this equipment is out of service, having been replaced by a new indoor GIS switchboard. However, three outdoor circuits remain in service awaiting availability of system outages to transfer them to this new switchboard. It is assumed that these transfers will take place before CP1021 works commence. Availability of outages for these works must be considered as a risk for this project.
- Reactive compensation is required for the 400 kV circuit from Woodland. This is estimated as a 100 MVAr shunt reactor.
- If a cable option from Woodland is selected that the cable size will be $\leqslant$ 3000 mm^2. Implications of a larger sized cable are discussed in section 2.4.4.
- It is only required to consider two 400/220 kV transformers. This is as per email from EirGrid 07/01/2022.

- Harmonic filter requirement is for one set, connected at 220 kV. This requirement is not certain and there may be no need for any filters. It will be confirmed pending the outcome of later cable integration studies for CP0966 and CP1021.
- 220 kV bay F6, identified as the connection point for the new 400/220 kV transformer has to have conductors and busbar disconnectors replaced under this project to be used.
- Land to the north of the substation is not available for site expansion. See section 2.5.
- Land to the west of the substation may be available for site expansion. See section 2.5.

2.4 Technical Feasibility

2.4.1 Project Requirements

A new 400 kV circuit connection is to be made from Woodland 400 kV substation. The receiving site for this shall be either Finglas or Belcamp Substation. The circuit will be either overhead line (OHL) or underground cable (UGC). If UGC is selected it will consist of one conductor per phase only. The initial equipment to be installed at the receiving substation is, (Ref SCF17112L1 section 1.2.4.1):

- *The new 400 kV busbar will initially consist of two circuit bays, two transformer bays, two bus sectionalisers and one wing coupler (C-type arrangement).*
- *One or two 400/220 kV transformers will be initially installed, to be determined during the course of Step* 3.

The suitability for future expansion shall also be assessed. Section 1.2.4.1 states:

- *The 400 kV substation must be expandable to 4 circuit bays, 4 transformer bays, and two wing couplers, and four 400/220 kV transformers (8 bay enhanced ring arrangement).*
- *Space may be required at this new substation for reactive compensation and harmonic filters if a new cable circuit is selected. The size of any required reactive compensation or filters will be determined in the course of Step 3.*
- *Cable circuit approaches to the new 400 kV busbar must be considered in the design to ensure future circuits can connect to the busbar.*

Reactive compensation must be considered as it has significant space requirements as well as a high likelihood of being required. Harmonic filters require more significant space-proofing implications, albeit a lower likelihood of being required. However, the presence of harmonic filters cannot be discounted at this stage.

2.4.2 Other Requirements

There are existing projects in progress at Finglas substation. Projects accounted for here include the ongoing transfer of 110 kV outdoor circuits to the new GIS building, allowing removal of the outdoor equipment and the uprating of several sections of the existing outdoor 220 kV busbar.

2.4.3 Design Options

Options for siting the required new plant within the existing substation boundary at Finglas are limited by the existing outdoor AIS equipment, particularly the 220 kV. The main areas of available land are:

1) In the unused area in the west / southwest side of the site. – Area 1 shown below
2) Where the mostly decommissioned outdoor 110 kV equipment is located. – Area 2 shown below

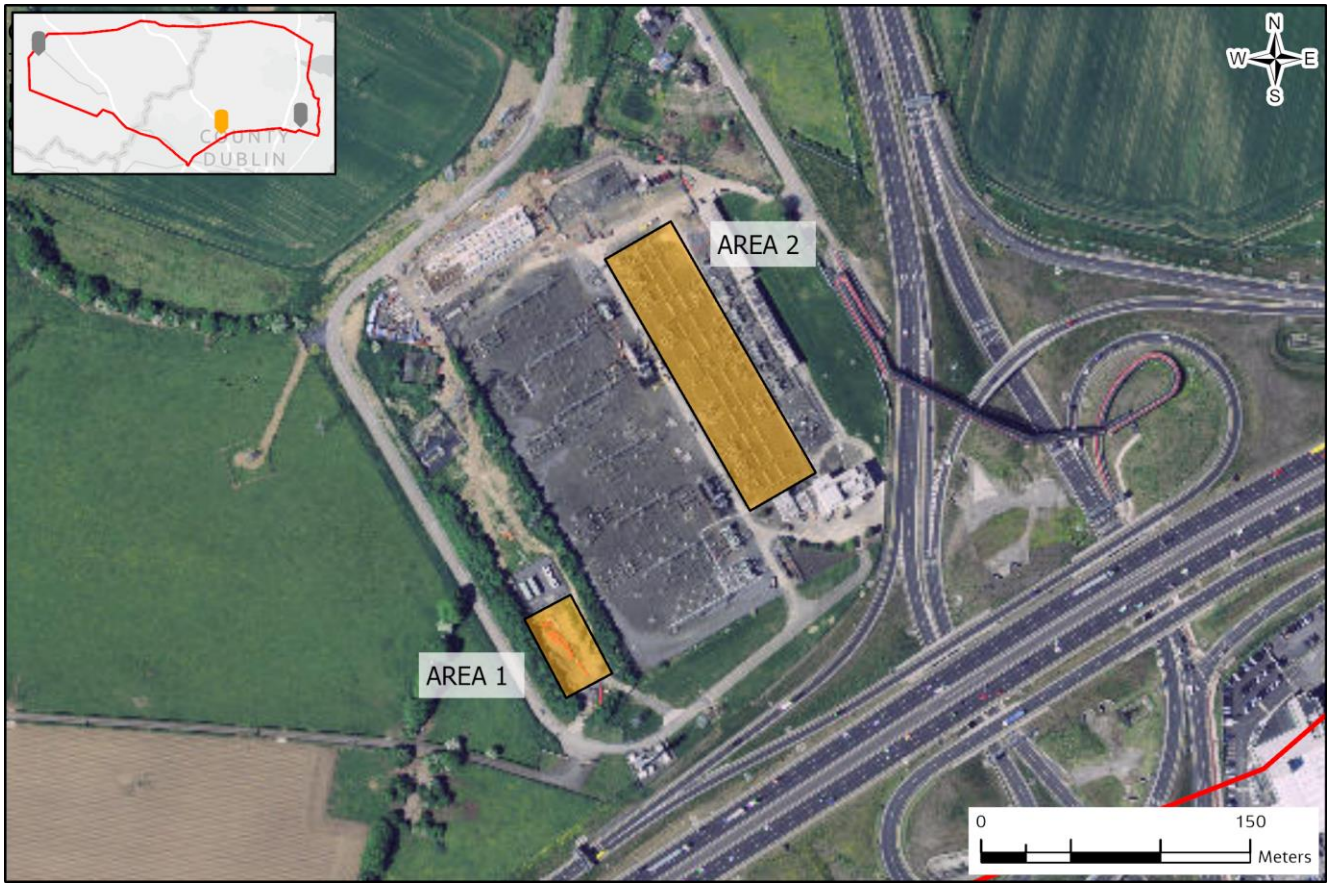

Figure 2-3 Development Areas

For Area 1 the space is insufficient to site a new 400 kV GIS switchroom. This is an area where a single piece of plant such as a transformer, shunt reactor or harmonic filters could be sited; however the access road to Kildonan 110 kV station and the existing configuration of towers in the vicinity of Area 1 would have to be modified.

Area 2, the former outdoor 110 kV area, is sufficient to site a new indoor 400 kV GIS switchroom, 2 x 400/220 kV transformers and 1 x 100 MVAr shunt reactor, refer to Figure 2-4 and Figure 2-5. This represents the minimum plant required for the initial installation. These show options of arrangement for overhead line or underground cable connection to the site. Other variations of these layouts with the plant in different positions and orientations have been considered, but do not significantly change the issues arising.

Design issues for initial installation:

- Whilst the plant can be sited here, discussion with 400 kV GIS manufacturers indicated that the largest cable box compatible with the switchgear is a Pfisterer size 8, which can accept cable up to 3000mm^2. This is likely to be the case with all major manufacturers. If the incoming cable is larger than this, it would need to be terminated to an AIS sealing end structure then connected to the switchgear by busbar to AIS terminations off gas insulated busbar (GIB). Refer to section 2.4.4 for more detail. There is not space within Area 2 to accommodate this. This therefore limits the cable size under this option.
- For the overhead line option, Figure 2-4, the incoming 400 kV circuit would terminate to a gantry structure within the site. The location in the figure is purely indicative and further investigation is required to select a precise location. The ground the gantry is on would be at a higher level than the switchroom, potentially allowing a longer span if needed. The interface to the switchgear would be by outdoor AIS termination to gas insulated busbar (GIB) running above ground.
- Bending radius of the assumed cable – circa 3000 mm^2 copper – is over 5 m. Thus deep excavations will be needed beneath and in front of the buildings. Further assessment is needed to determine the feasibility of

the deep excavations in the vicinity of the access roads east and west of the new switchroom and the 110/38 kV transformers.

- Two 400/220 kV transformers could be sited within the area available, assuming that all existing 110 kV outdoor equipment is decommissioned and the site completely cleared. It has been indicated that there are outage availability issues delaying the final decommissioning of this equipment and this represents a risk to the timing of the project.
- EirGrid have indicated that 220 kV bay F6, currently cable connection to Shellybanks, will become spare in 2023 and would be the intended connection point for the 220 kV side of the first 400/220 kV unit installed. This bay is insufficiently rated for this new connection and the strung busbars and busbar disconnectors require replacement under this project. These works have been assessed as needing a half -station outage on the 220 kV busbar. At present, system constraints only allow such an outage to be taken over two days on a weekend; whereas the works are estimated as taking up to five days. A solution to this issue must be found for any option considered here to be feasible.
- The outline 220 kV cable route from the transformer to bay F6 in either Figure 2-4 or Figure 2-5 requires running in proximity to and / or crossing the 110 kV cables for T2102, T2104 and T2106. This creates de-rating issues for all of these circuits.
- There is a risk that harmonic filters may be required as part of this connection. Estimated land area needed for a 30-50 MVAr filter bank is 30 x 40 m, plus access roads. This could conceivably be located in area 1 as indicated in Figure 2-3. Connection would be by a cable run of approximately 350 m, back to the 400 kV switchroom. There is no other 220 kV bay available. Space for this additional 400 kV cable route creates further constraints with the existing in-ground services as above. This cable would be another service running in the substation main access road.

Design issues for future expansion:

- Jacobs' cable and overhead line investigation teams have indicated in their assessment that it would not be possible to route further 400 kV circuits, by either UGC or OHL, to a new 400 kV switchroom in Area 2. This means that this position is **not** suitable for any future connection.
- A second and any subsequent 400/220 kV transformers have no clear destinations on the 220 kV outdoor busbar. There are no existing spare bays, unless other feeders are decommissioned. It is not possible to extend the 220 kV busbar any further within the existing site. On the north side it is bounded by the 110 kV GIS switchroom and on the south side by the access road and ultimately the M50 motorway. It is therefore difficult to see how any future transformers required for connection to the 400 kV busbar would be connected to the 220 kV network without a major expansion exercise.
- The above two points mean that Finglas, within its existing boundaries, is not a suitable site for this connection, as it cannot meet all the criteria described in SCF17112L1.
- For the site to be suitable for the future connections indicated in the project requirements, the only feasible option would be a significant expansion of the site. This expansion would have to incorporate both the 400 kV plant described here and a new 220 kV busbar. The 220 kV expansion is beyond the scope of this report. For further discussion refer to Section 2.5 Site Expansion.

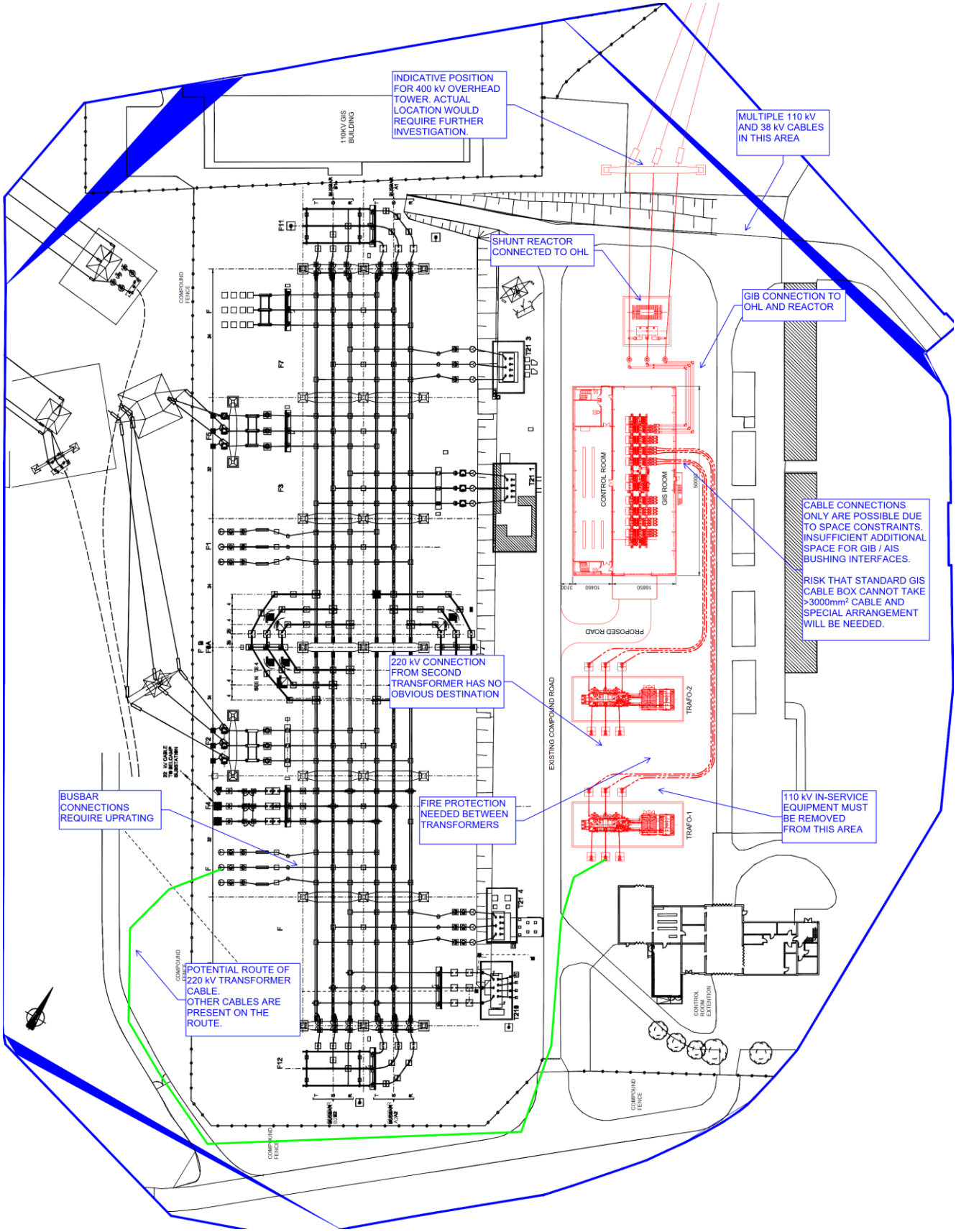

Figure 2-4 Finglas 400 kV layout option – Overhead line

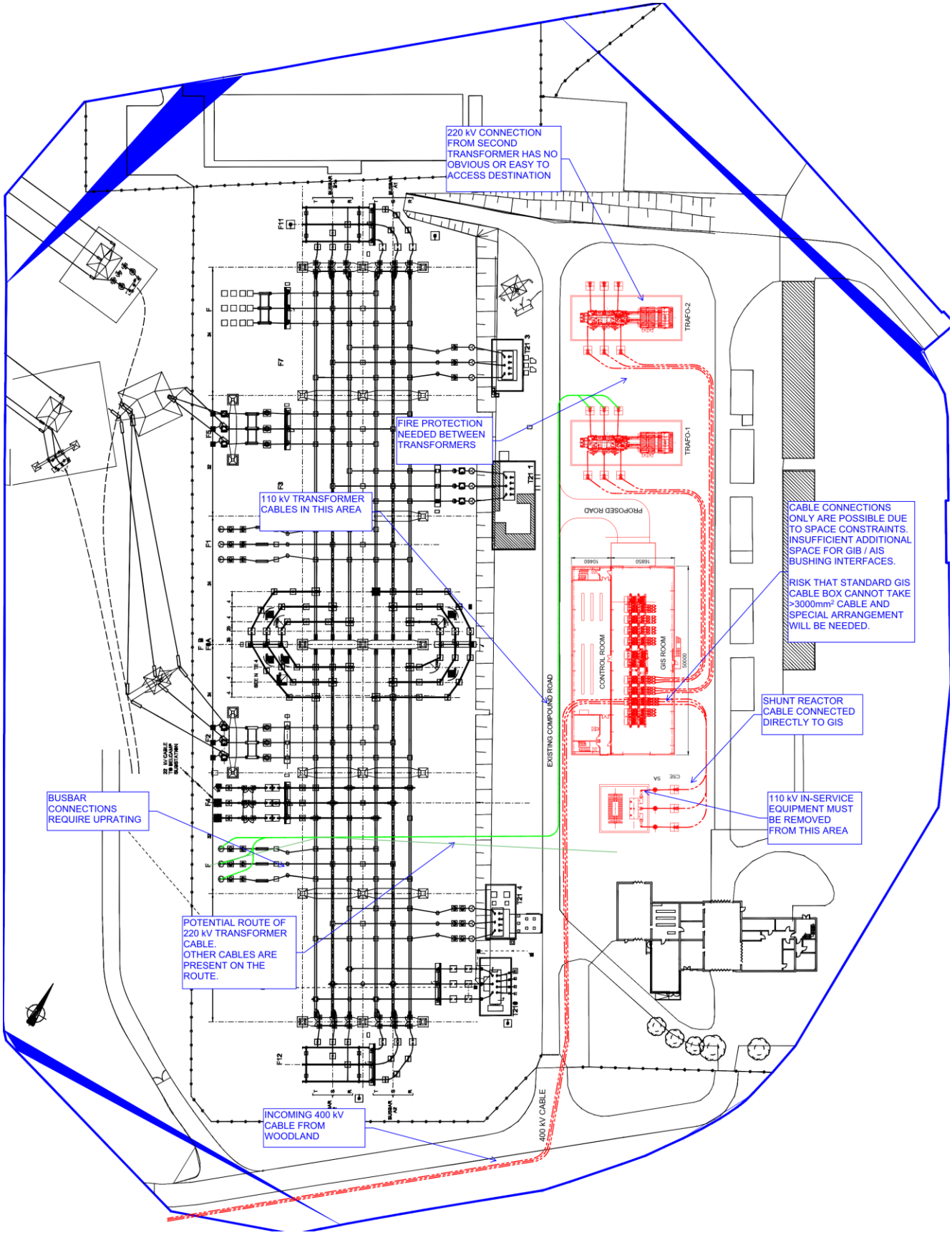

Figure 2-5 Finglas 400 kV layout option – Underground Cable

2.4.4 Impact of Cable Size on GIS

Discussion with 400 kV gas insulated switchgear manufacturers indicated that the largest cable box compatible with the switchgear is a Pfisterer size 8. This can take cable up to 3000 mm^2. This is likely to be the case with all major manufacturers. If a cable larger than this is selected, it would not be possible to terminate it directly into the GIS or a gas insulated busbar (GIB) extension from it. In this case, the cable would need to terminate to an outdoor sealing end structure, then connect via open busbar to the reactive compensation and AIS bushings connected to the GIS. This will affect the size of the 400 kV plant footprint. This is assessed as being feasible with the additional sealing end located between the shunt reactor and road in Figure 2-5, albeit safety clearance to the road from the live sealing ends are very close to the allowable limits.

2.4.5 Connection of Reactive Compensation

It is assumed for this assessment that a 100 MVAr shunt reactor will be needed at each end of the 400 kV circuit as reactive compensation. This is assumed for purposes of this report to be case for both the UGC and OHL options. The actual requirement will not be confirmed until further studies are carried out. EirGrid have indicated that the reactor does not need to be switchable independent of the circuit.

Options considered for connection:

1) Terminate incoming cable / overhead line to an AIS busbar compound; tee the reactor off the busbar; connect the busbar to a cable, GIB or AIS bushing interface and continue to the GIS. This is shown in Figure 2-6

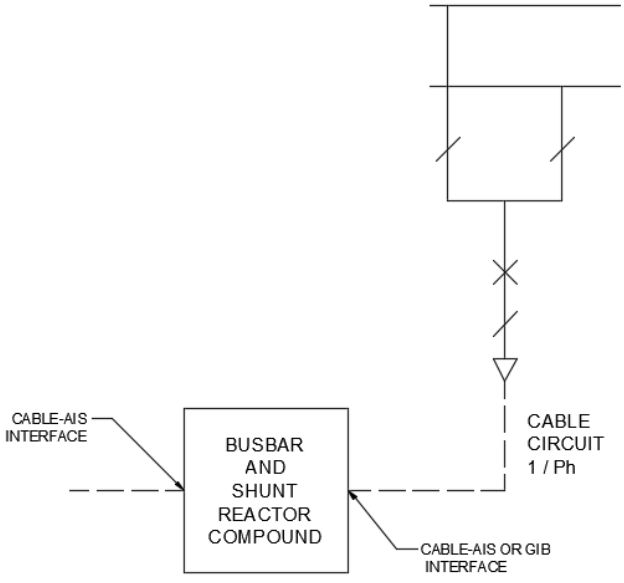

Figure 2-6 AIS Compound Connection

2) Cable or GIB connection directly to GIS by dual cable box or similar. This would be to the same panel that the Woodland circuit terminates to. Alternatively, this connection could be banked onto the same GIS circuit breaker. This would allow the reactor to be independently switchable, however EirGrid have indicated that this is not required. This is shown in Figure 2-7

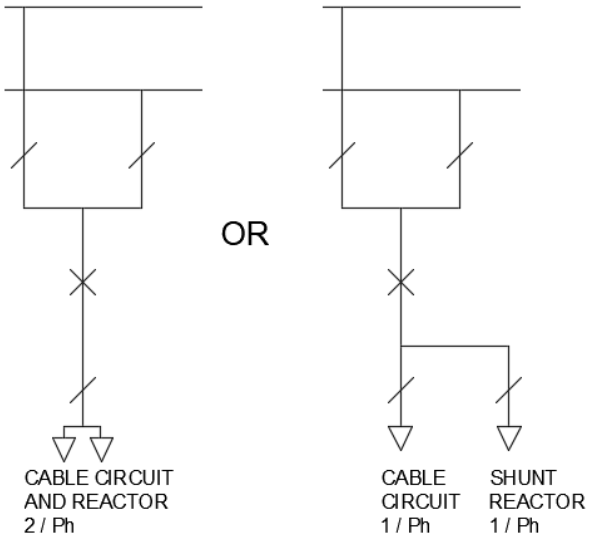

Figure 2-7 GIS Direct Connection

3) Three ended GIB connection from GIS to incoming circuit and reactor. This is shown in Figure 2-8

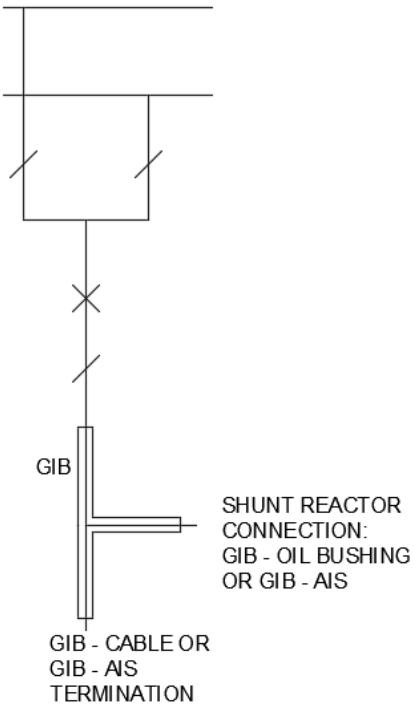

Figure 2-8 GIB Connection

Application to Finglas:

- Option 1: There is insufficient room to create the required cable – AIS busbar compound within the existing substation boundary. This option is not feasible at Finglas.
- Option 2: This is a feasible option for Finglas as long as the cable is ≤ 3000 mm2.
- Option 3: This may be a feasible option for Finglas, as long as the cable is ≤ 3000 mm^2. If a GIB interface directly onto the shunt reactor is acceptable to EirGrid, this option means there will be less exposed 400 kV at Finglas.

Selection of option 2 or 3 would be made during detail design development in consultation with the switchgear manufacturer.

2.5 Site Expansion

For Finglas to be a suitable site to receive the 400 kV connection from Woodland and also able to accommodate the future expansion as detailed in the Project Requirements, the site will need expansion. The 220 kV outdoor switchboard has only one spare connection bay available, which will be taken when the first transformer installed for this project is connected. As a minimum, further 400/220 kV transformers are expected to be associated with this new switchroom to provide system resilience and take power from 400 kV into the lower voltage network. It will not be possible to connect anything more to the 220 kV network at Finglas without constructing additional 220 kV bays. It is not possible to expand the 220 kV busbar any further as it is bounded by the 110 kV switchroom and M50 motorway as described in section 2.4.3.

The minimum initial use of the four 400 kV GIS panels would be one for the Woodland 400 kV feeder and one for the 400/220 kV transformer. Any plans to make use of all of the four panels, even without considering the required expansion capacity, must factor in the construction of a new 220 kV busbar. There is no option other than locating this outside the existing site boundary.

The site has restricted opportunities for expansion. It is bounded on two sides by the N2 National Road (to the east) and M50 motorway (to the south). Investigation of planning applications shows significant development to the north of the site is already approved, refer to section 2.7.3. The most obvious adjacent land for expansion is therefore to the west of the site. This is indicated in the red area in Figure 2-9. The area is approximately 150 x 80 m. This would allow installation of all the CP1021 400 kV primary plant. Further assessment is needed to determine if it allows space for future transformers and reactive compensation. This area would not be sufficient to construct the additional 220 kV busbar that would be needed to take such connections. The expansion requirements of the 220 kV system would require additional development to establish a scope before a full feasibility assessment can be made, but it is a reasonable assumption that more land would be required.

Given the limited access for 400 kV circuits to the Area A2 (in Figure 2-3) and the distances to any connections to any future site expansion, it is therefore recommended that the 400 kV switchroom, transformers and reactive compensation be located outside the existing site. Expansion into the land to the west should be investigated for the initial phase of CP1021. This introduces additional risk of an uncertain land acquisition, with consequent cost and time implications. It would reduce the difficulties of construction works within the live substation.

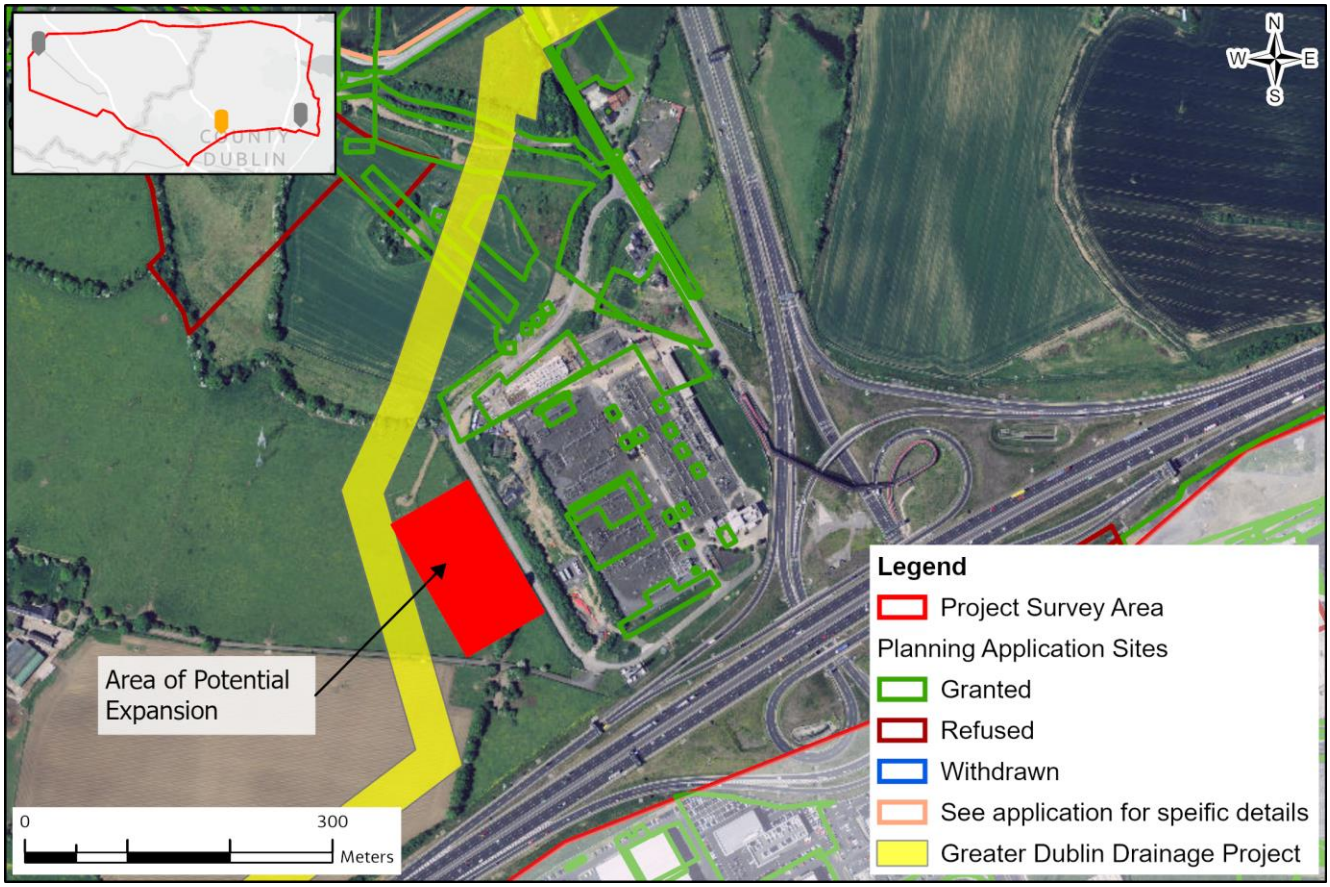

Figure 2-9 Site Expansion with Planning and Development Constraints

2.6 Technical Feasibility Assessment

As per Section 1.1, the following scale is used to assess the technical feasibility of this option.

More significant/difficult/risk — Less significant/difficult/risk

These assessments represent the considered feasibility of the running arrangements discussed in the above sections and consider the ongoing access for operation and maintenance. Note that constructability is specifically addressed in section 2.9. For the initial minimal installation, both overhead and underground cable options are feasible at a medium level. IT must be noted though that only one transformer could be in service due to the lack of a second 220 kV connection. No future expansion is possible without acquisition new land for both the 400 kV plant for CP1021 and an expansion of the 220 kV busbar, hence the dark blue assessment.

400 kV Connection Options	Technical Feasibility
Overhead line initial installation	
Overhead line future expansion	
Cable initial installation	
Cable future expansion	

2.7 Environmental Constraints

As set out in Section 2.5 of this report, for Finglas to be a suitable site to receive the 400 kV connection from Woodland and also able to accommodate the future expansion as detailed in the Project Requirements, the site will need expansion. The potential environmental impacts of the Proposed Project at Finglas are exclusively related to the potential for land take associated with such an expansion. The design options do not have a measurably different impact on environmental topics once the land take is taken into consideration. Therefore the options are not included in this assessment, only the overall likelihood of impacts from any extension to the west.

2.7.1 Biodiversity, Flora and Fauna

For Finglas to be a viable connection option, the feasibility study (Section 2.5) concludes that an extension to the west would be required. This land is currently semi-natural grassland habitat. The land is not a designated habitat; there are no designated sites in the vicinity of Finglas substation and there are no protected species or habitats recorded in close proximity. Any extension to the substation footprint to facilitate works, therefore has the potential to have adverse impacts on biodiversity at a local geographical scale only. There is a hedgerow alongside the substation boundary fence to the west and another, with mature trees within it, bordering a small triangle of land to the south east of the field, which are likely to be lost as a result of any extension. There are no Water Framework Directive (WFD) water bodies in the vicinity, however ditches maybe present alongside field margins and hedgerows.

Potential impacts during construction include:

- Temporary loss of terrestrial habitat within the footprint of the extension to facilitate access roads and construction compounds; and
- Disturbance, and temporary displacement of birds and mammals in habitats within or in close proximity to the Project footprint (although this would be limited given the proximity of the N2 and M50 which present an existing baseline of noise disturbance).
- Potential impacts during operation include the loss of potentially biodiversity-rich hedgerows.

Colour coding for MCA – Biodiversity

As a result of the permanent loss of habitat, a low to moderate impact is likely, at a local geographical scale.

2.7.2 Soils and Water

There are no WFD water bodies in the vicinity of Finglas substation. In terms of groundwater, the area proposed for the extension is a local important aquifer but is not designated as sensitive or protected in any way. There is no history of flooding on the site; preliminary flood maps indicate a potential flood probability of 10% AEP for small parts of the field within which the extension would be sited. There is potential for new development, on a currently greenfield site, to increase flood risk elsewhere, however it is assumed for this assessment that any design would incorporate SUDs features, in line with local planning policies and other EirGrid substation extensions to attenuate flow to ensure no net increase in surface water runoff.

Any access to the proposed extension site at Finglas would need to be mindful of the large diameter sewer proposed by Irish Water which will be in close proximity (See Section 2.6.3) to ensure no impacts would occur on soils or water as a result of interactions during construction of the Finglas site.

Colour coding for MCA – Soils and Water

There are few potential impacts on soils and water and as a result the risk is rated as low.

2.7.3 Material Assets – Planning Policy and Land Use

Planning Policy

Details of policies in the Fingal County Development Plan of relevance to the potential extension of the substation are included in the environmental Constraints Report (Document ref 321084AJ-REP_004). Of particular note, is that the land to the west of the substation, where an extension would be feasible, is zoned for industrial and employment use, although it is currently in agricultural use.

Land Use and Proposed Developments

Finglas substation is located immediately north west of the M50/N2 junction (see Figure 2-10). It is significantly constrained to the east by the N2 and to the south by the M50.

In terms of land use in the surrounding area, south of the M50, land is largely in commercial use and is dominated by large warehouses and business parks. Land to the immediate north and west of the substation is currently in agricultural use; further to the west however is Huntstown Quarry and to the north, Huntstown Power Station. East of the N2, land is currently in agricultural use. Further To the north of this, there are a number of proposed developments with planning consent. There are also a number of approved planning applications in very close proximity to Finglas substation, particularly to the north, as can be seen in Figure 2 7 (Local Authority consents in green; Major Projects with ABP in Purple). These further constrains the substation on its northern boundary, leaving only the western boundary potentially feasible for any extension that may be required.

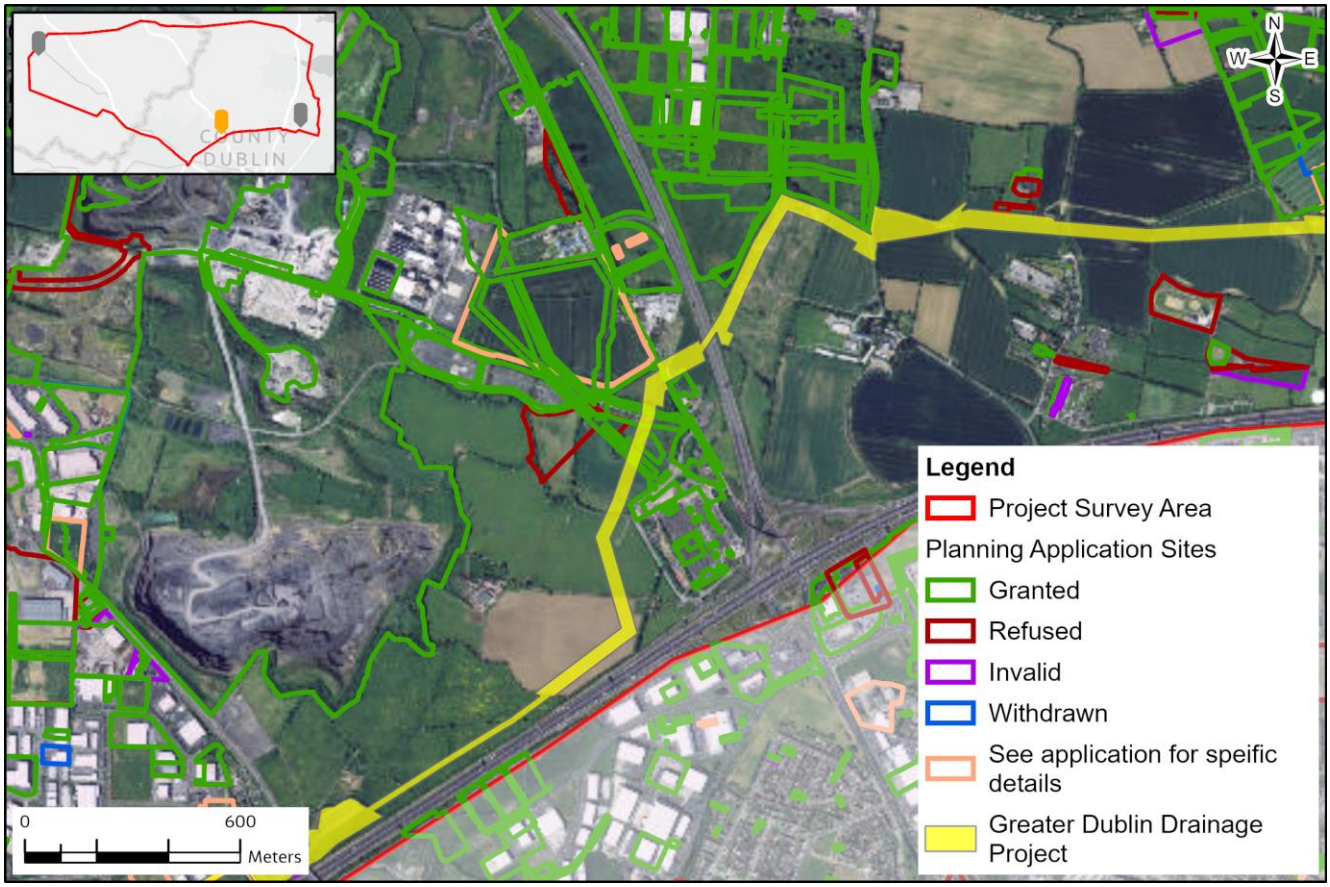

Figure 2-10 Proposed Developments Finglas Substation

Greater Dublin Drainage Project

Whilst the western boundary is the least constrained in terms of existing or proposed infrastructure, it is not without any constraints. There is a proposed development crossing from the immediate south west to the north of the site for the potential extension; Irish Water's Greater Dublin Drainage project (see Figure 2-10).

This was approved, however the Board Order was quashed in November 2020 on the grounds that the Board did not consult with the EPA correctly, as it was legally bound to do. The Application will be reconsidered by ABP following updates to environmental information that may be required since it was first submitted in 2018 and consultation with the EPA. It is likely the Board will make a decision in 2023. If approved, construction could begin in the two to three years following. Construction of CP1021 is unlikely to take place until the late 2020s, which means there is unlikely to be combined impacts from both projects during their construction phases. The need to avoid the sewer during construction of CP1021 will introduce additional complexities to the extension of the site.

Other Projects

Other projects in close proximity include the undergrounding and re-routing of existing OHLs in the field immediately north of the substation, to make way for a proposed new data centre and substation on lands to the east of Huntsdown Power Station. On the north east boundary of the substation, there is planning consent to demolish existing buildings and erect a single storey light industrial unit.

Colour Coding for MCA – Land Use and Planning

The substation is heavily constrained by other proposed and existing infrastructure, making the land to the west the only feasible location for a proposed extension should one be required. This land is identified for industrial use

in the Finglas CDP. There is low risk therefore that it is not compliant with local planning policies. The substation is heavily constrained by other proposed and existing infrastructure

2.7.4 Landscape and Visual

As is detailed in Section 2.6.3, land use in the immediate vicinity of Finglas substation is a mix of major infrastructure, commercial, industrial and agricultural. The rural landscape to the west of the substation is set within an industrial context, with local views dominated by the M50 motorway, the existing substation and OHLs entering the substation. The quarry and power station are currently screened by mature trees and hedgerows.

There are no residential receptors that would be able to see an extension to the west. Views are only possible from the M50 and local roads. An extension to the west of the substation would result in direct adverse impacts on landscape and on views from the M50 slip road and on from local roads as a result of a loss of hedgerows and trees. This would be at a local scale only. The extension of electrical infrastructure would also have an adverse impact on the existing agricultural landscape, however this is mitigated by the fact that it is an extension to existing electrical infrastructure. There is also the possibility that the removal of the trees and hedgerows would have indirect adverse impacts on views from the M50 by increasing the likelihood of views of the power station, as screening would be removed, although, there would be some screening of it afforded by the extension itself.

Colour Coding for the MCA – Landscape and Visual

There would be some adverse impacts on landscape and visual receptors as a result of the extension, however this is limited by the industrial context of the extension and the presence of the M50 motorway. As a result it is considered it presents a low to moderate risk.

2.7.5 Cultural Heritage

There are few sites of heritage importance in close proximity to Finglas substation. Archaeological testing was carried out in an area 300m west of the substation as part of the then (2011) proposed Metro West development. An enclosure was identified, along with corn drying kilns. These were thought to date to the early medieval period (AH 50). There are no other cultural heritage assets that could be potentially affected.

AH50 is, as stated, 300m from the substation boundary. Any extension of the substation to the west would be no greater than 80m in length (outwards from the substation). It would not impact upon the site.

Colour Coding for MCA – Cultural Heritage

Given the distance from the substation to the nearest national monument, AH50, it is considered there is a low risk of impacts upon it from any extension.

2.7.6 Noise and Vibration

The surrounding baseline environment at Finglas is one of significant sources of noise, including the M50 motorway, the N2 national road, a large quarry with associated heavy goods traffic and Dublin International Airport less than 2km to the north east. There are noise sources within the existing substation also; there are approximately ten transformers for the existing 220 kV and 110 kV sections of the substation.

The proposed additional equipment required at the substation would include one, or possibly two 400 kV/220 kV transformers. This is a relatively minor addition, compared to the existing situation at the substation. Given the existing noise baseline of the surrounding area, it is unlikely that the additional transformer(s) would be discernible from a noise perspective.

Colour Coding for the MCA – Noise & Vibration

There is a low likelihood of noise impacts from the proposed new equipment at Finglas substation.

2.7.7 Climate Change

In terms of the potential impacts of the proposed project at Finglas, consideration is given to:

- Climate resilience: new energy infrastructure is a long-term investment and will need to remain operational over many decades, in the face of a changing climate; and
- Material use/embodied carbon

As set out in Section 2.6.2, there is some risk of pluvial flooding on the substation site itself; the land to the west of the of the substation is not at risk from any flooding. It is not anticipated that the proposed project would increase flood risk elsewhere. There is potential for increased storminess to impact the substation, for example, through increased lightning strikes. This would be taken into account in the design of any extension, through detailed lightning studies, as is standard practice for substation design. It is considered the substation will be resilient to a changing climate.

In terms of material use, land take of approximately 150m by 80m would be required. A range of electrical infrastructure would also be required, as described in Section 2.3. There may be some differences in the amount of material required by each of the design options, as indicated by the economic assessment, however this is unlikely to be significant in climate change terms.

Colour Coding for the MCA – Noise & Vibration

There is a low likelihood of impacts on climate change from the proposed new equipment at Finglas substation.

2.7.8 Summary of Environmental Impacts for Finglas Substation

Biodiversity
Soils and Water
Materials Assets
Landscape
Cultural Heritage
Noise and Vibration
Climate Change
ENVIRONMENT

2.8 Social Constraints

As set out in Section 2.5 of this report, for Finglas to be a suitable site to receive the 400 kV connection from Woodland and also able to accommodate the future expansion as detailed in the Project Requirements, the site will need expansion. Therefore, as for the environmental constraints, the potential social impacts of the Proposed Project at Finglas are exclusively related to the potential for land take associated with such an expansion. The design options do not have a measurably different impact on social topics once the land take is taken into consideration. Therefore, the options are not included in this assessment, only the overall likelihood of impacts from any extension to the west.

2.8.1 Amenity and Health

During construction, there is the potential for impacts on amenity as a result of construction activities. Amenity can be impacted by a combination of the following impacts:

- Views (Visual Amenity): impacts on special or protected views / landscapes as well as personal and property views of local communities as a result of construction activities associated with the project;
- Air quality: in the form of dust and emissions from plant, machinery and traffic. This is only a factor during construction; in the absence of mitigation and control measures, air quality could be an issue for local communities during construction;
- Noise: disruption as a result of the excavations. In addition, construction traffic may also be a potential noise issue; and
- Traffic: disruption in the form of construction activities on local and regional roads.

In operation, amenity impacts are associated with the combined permanent impacts on views and noise. There would be no air quality or traffic impacts during operation.

The construction of new electrical infrastructure at Finglas would be temporary and have limited impacts on views. As has already been established, there are no residential receptors and local business receptors would not be sensitive to a change in views.

Impacts on air quality as a result of dust during construction would be mitigated using standard dust management procedures and so would not lead to significant impacts for local businesses.

There are no sensitive receptors near to the substation that could be impacted by any noise during construction; during operation it has been established that there is a low risk of impacts.

There may be some temporary impacts on local businesses as a result of construction traffic accessing the extension area; it is likely a new access track would be required to reach the site as it would not be possible through

the substation itself. This could have an impact on local businesses like the quarry that use the local roads near to the substation.

There are no impacts likely on health as there are no residential receptors in the vicinity.

Colour Coding for the MCA – Amenity and Health

There are potential impacts on traffic during construction, however there are no other amenity-related impacts and so there is no combined amenity impact. There is therefore a low likelihood of impacts on amenity and health from the proposed new equipment at Finglas substation.

2.8.2 Economy

The field within which the extension would sit is approximately 140Ha. The proposed extension would be approximately 12ha in size, however the proposed location for an extension to the substation would result in a small triangle of land becoming inaccessible to the existing landowner and so it is assumed this would be subsumed into the substation boundary. The land take requirement would be approximately 15ha, as a result. This is approximately 11% of the existing field. The south east corner of the field is currently less accessible than the rest as it is divided from the main field by a line of mature trees. The northern third of the field is being farmed, but its potential uses are restricted by the existing OHLs which enter Finglas across it and the pylons which sit within the field. In addition, the orbital sewer for GDD is proposed to traverse this field. Whilst only representing approximately 11% of the field, an extension in combination with existing constraints from the OHLs here could result in the land being less viable.

Economic effects are anticipated to be positive in nature in terms of employment and expenditure. There is potential for disruption to local businesses as a result of traffic impacts during construction, however this is assessed under Amenity and not considered again here.

There are no tourism assets in the local area and so no impacts on tourism are anticipated.

Colour Coding for the MCA – Economy

There are potentially adverse impacts on the viability of the agricultural land within which a proposed extension would be sited. This would impact a single landowner, however. No other landowners would be affected by the proposed extension. There is therefore a low to moderate likelihood of impacts on amenity and health from the proposed new equipment at Finglas substation.

2.8.3 Utilities

The proposed extension site is a greenfield site. There are no underground cables in the vicinity; there are unlikely to be any other existing utilities. Ahead of the extension being constructed, it is likely that the sewer for GDD will be in place; this would be close to but not interacting with the proposed extension site.

Colour Coding for the MCA – Utilities

There is a low likelihood of impacts on amenity and health from the proposed new extension at Finglas substation.

2.8.4 Summary of Social Impacts

Amenity and Health
Economy
Utilities
SOCIAL

2.9 Deliverability

2.9.1 Construction

The options presented for locating the equipment within the existing site boundaries all require a significant construction programme inside a live 220/110 kV substation. This presents challenges for works planning, safety and supervision as well as potentially creating additional outage requirements. Construction of the switchroom will require machine excavation and use of a crane, which both create safety issues inside an operational site.

All layout options require installing 400 kV and / or 220 kV cable in the main substation access road. This presents the issues of:

- Interaction with existing 110 kV cables in this road from the 220/110 kV transformers to the new switchroom.
- Restricting access to key areas of the site while the road is open for cable works.

Site cables are as indicated in drawing PE424-D2002-006-003-013. This is not however an as-installed drawing and further cable surveys would be needed before finalising any designs.

If all new equipment were to be located in an expanded area to the west of the site as discussed in section 2.5, there will be limited issues from working within a live substation area. The general construction would be significantly easier.

2.9.2 Outage Requirements

Finglas is a nationally strategically important substation, directing approximately 11% of all energy required on the transmission network in Ireland. EirGrid has indicated that simultaneous double busbar outages on the 220 kV busbar at Finglas are of limited availability and are only available on weekends. There is still outdoor 110 kV plant in service awaiting outage availability to be transferred to the new GIS building. It is understood that this has been delayed since 2019. This would need to occur before works on this project begin.

The 220 kV bay F6 has been identified as the destination for the 220 kV connection for the first transformer installation. It is required that its busbars and busbar disconnectors are uprated to take the new connection. Those works will require simultaneous double busbar (half-station) outage for up to five days. This may not be allowable with the existing system running constraints. Indication is that such an outage can only be sustained for two days over a weekend.

Installation of 400 kV and 220 kV cables in or adjacent to the main access road may require outages on the 110 kV cables of the 220/110 kV transformers T2101, T2102 (not in service), T2103, T2104, T2106. Outage restrictions on these are not yet established.

2.9.3 Deliverability Feasibility

As per Section 1.1, the following scale is used to assess the deliverability feasibility of this option.

More significant/difficult/risk Less significant/difficult/risk

Given the constraints described above, in particular the outage requirements associated with connecting to the 220 kV busbar, deliverability of any of the options has a high level of difficulty. There is currently no way of installing a second connection to the 220 kV busbar for a second 400/220 kV transformer. The necessity to create a new 220 kV busbar makes feasibility of any further expansion a dark blue rating.

400 kV Connection Options	Deliverability Feasibility
Overhead line initial installation	
Overhead line future expansion	
Cable initial installation	
Cable future expansion	

2.10 Economic

The primary plant costs will not vary significantly between the options under consideration. The main cost factor will be the impact of building within Finglas and carrying out the construction project within a live substation. This will add cost burden to the works in terms of additional supervision for safety and compliance, risk of delays due to operational incidents (faults requiring switching or other network operations) and more burdensome working practices to ensure safety from the live system, such as limitations on use of cranes, excavators and other heavy construction equipment.

To accommodate all future circuits and plant, the site must be expanded. Cost of land has not yet been assessed but can be assumed to be significant given the known land values in this area.

As per Section 1.1, the following scale is used to assess the economic feasibility of this option.

More significant/difficult/risk Less significant/difficult/risk

Given the costs associated with construction inside a live substation and acquisition of a large piece of new land, the economic impact is considered to be high.

400 kV Connection Options	Economic Feasibility
Overhead line initial installation	
Overhead line future expansion	

Cable initial installation	
Cable future expansion	

3. Conclusion

Finglas 220/110 kV substation was assessed to determine its suitability to receive a planned 400 kV circuit from Woodland; requiring initial construction of a 400 kV GIS switchroom capable of housing an 8 bay enhanced ring configuration, 2 x 400/220 kV transformers and reactive compensation for the circuit. It shall have the capacity to expand in the future to take another 2 x 400/220 kV transformers and additional 400 kV circuits.

The assessment primarily focused on using the land within the substation site. The usable land is the area where the outdoor 110 kV equipment has been partially decommissioned following the installation of a new 110 kV GIS substation to the north of the substation. It was determined that the site could take the initial 400 kV plant installation. This would be a difficult construction taking place adjacent to a live 220 kV outdoor AIS and requiring crossing of multiple in-service 110 kV cables. It would only to be possible to connect one 400/220 kV transformer to the system, although to make this connection requires modifying the 220 kV bay and taking outages that are not currently sustainable on the existing network. There is no spare bay on the 220 kV busbar to connect a second transformer.

This configuration would not be capable of accommodating the future requirement of connecting any further 400/220 kV transformers to the network. It is also not considered feasible to bring more than one 400 kV circuit to the switchroom by either method.

A partial solution to the above would be to expand the site in the land to the west. There is sufficient space in the land between the substation and the proposed Greater Dublin Drainage Project to install all the required plant for the initial installation. A replacement or expansion of the outdoor 220 kV busbar will be needed to take additional transformer connections. Further land would be needed for this.

The potential environmental and social impacts of the proposed connection to Woodland Substation have been considered. Overall, there is a low risk of environmental impact and a low risk of social impacts. Both environmental and social impacts will be considered further and in more detail as the proposed project progresses into the next Steps in EirGrid's grid Development Framework.

It is considered feasible, albeit very difficult, to install the minimum plant to make a connection to Woodland at Finglas. Assuming the required enabling works of removing the in-service outdoor 110 kV plant and uprating the 220 kV transformer bay can be carried out, the minimum build could be carried out within the substation. This would risk creating a stranded asset with little to no scope for further use in the future. A better build solution would be install the new plant in land acquired outside the substation boundary. The issue of not being able to further expand the 220 kV busbar will continue to limit use of this site in the future as a load centre.

This overall assessment has been presented in the table below. It is considered that the deliverability issues associated with the lack of outage availability and works within the live substation override the other criteria in the overall assessment.

400 kV Connection Options	Technical Feasibility	Environmental Feasibility	Social Feasibility	Deliverability	Economic Feasibility		Combined Performance
Overhead line initial installation							
Overhead line future expansion							
Cable initial installation							
Cable future expansion							

Appendix A. Drawings

321084AJ-JAC-ZZ-XX-DR-E-0103 Finglas Layout Plan sheets 3A and 3B

PE424-D2002-006-003-013 Finglas 110 kV Station Replacement 110 kV Underground Cables Master Plan Proposed 110 kV Cable Routes