The Great Grid Upgrade

Sea Link

Sea Link

Volume 7: Other Documents

7.11.2 Design Approach Document - Kent

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Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 Regulation 5(2)(q)

nationalgrid

Revision Log

Revision	Date	Notes
A	14/03/25	STATUS FINAL
B	14/11/25	Updates to diagrams in Section 3, updates to renders in Section 6

Contents

EXECUTIVE SUMMARY

Executive Summary

The design approach has been split across two documents to allow the responses to the site context, requirements and consultation feedback, to be more site specific whilst acknowledging there are many shared constraints and opportunities that apply to both locations:

- **Application Document 7.11.1 Design Approach Document - Suffolk**; and
- **Application Document 7.11.2 Design Approach Document - Kent** (this document).

Both documents follow the same structure.

The site analysis indicates that the proposed converter station will impact the location in terms of visual amenity and sensitivity to nearby existing uses. By examining the surrounding areas, particularly the local vernacular, colours, and textures, a clearer understanding emerges of how the converter station can blend with or be effectively integrated into its environment.

The section on Generic Design Parameters outlines the distinct components of the illustrative converter station massing. Understanding the various buildings helps to define the scale, size, and function of key facilities, including the two main converter halls, the spare parts building, and other structures essential for the operation and maintenance of the converter station.

The Design Evolution section shows how the designs have developed through the pre-application process including how the design approaches have responded to the design feedback from the Statutory Consultation exercises, how it was developed to be presented for the Design Review Panel (DRP) and how the comments in the DRP report have been addressed.

The Design Approaches and Case Studies section includes the four design approach themes identified following the Statutory Consultation and Design Review Panel;

- Conventional Industrial / Agricultural (Baseline);
- Enhanced Cladding;
- Enhanced Roof Form; and
- Fragmented Form.

The case studies, categorised into other converter stations, relevant local development and design inspiration, have been developed to test these design approaches and apply them within the site context.

The Design Responses to Design Principles section shows illustrations of how the different design approaches can work with the Key Design Principles in Table 3.1 and Table 4.1 of **Application Document 7.12.2 Design Principles - Kent**. This exercise has also been used as a means of testing how the design principles are structured and have informed how they are worded.

INTRODUCTION

1.0

1.0 Introduction

1.1 Introduction

The Sea Link Project (hereafter referred to as the 'Proposed Project') is a proposal by National Grid Electricity Transmission plc (hereafter referred to as National Grid) to reinforce the transmission network in the South East and East Anglia. The Proposed Project is required to accommodate additional power flows generated from renewable and low carbon generation, as well as accommodating additional new interconnection with mainland Europe.

National Grid owns, builds and maintains the electricity transmission network in England and Wales. Under the Electricity Act 1989, National Grid holds a transmission licence under which it is required to develop and maintain an efficient, coordinated, and economic electricity transmission system.

This would be achieved by reinforcing the network with a High Voltage Direct Current (HVDC) Link between the proposed Friston substation in the Sizewell area of Suffolk and the existing Richborough to Canterbury 400kV overhead line close to Richborough in Kent.

National Grid is also required, under Section 38 of the Electricity Act 1989, to comply with the provisions of Schedule 9 of the Act. Schedule 9 requires licence holders, in the formulation of proposals to transmit electricity, to:

Schedule 9(1)(a) '…have regard to the desirability of preserving natural beauty, of conserving flora, fauna and geological or physiographical features of special interest and of protecting sites, buildings and objects of architectural, historic or archaeological interest;' and

Schedule 9(1)(b) '…do what [it] reasonably can to mitigate any effect which the proposals would have on the natural beauty of the countryside or on any such flora, fauna, features, sites, buildings or objects'.

The purpose of this document is to:

- Present the site-specific design approaches and illustrative potential solutions for above ground elements of the project in Kent, including how site-specific design principles have been derived following analysis of the site constraints and opportunities.
- Cover the Minster converter station and substation.
- Demonstrate how the design approaches for the above have evolved in response to ongoing design development, feedback from the statutory consultation, further LPA consultation and the Design Review Panel.

Application Document 7.11.1 Design Approach Document - Suffolk has been prepared covering the site-specific design approaches and illustrative potential solutions for above ground elements of the project in Suffolk.

1.2 The Proposed Project

The Proposed Project would comprise the following elements:

The Suffolk Onshore Scheme:

- A connection from the existing transmission network via Friston Substation, including the substation itself. Friston Substation already has development consent as part of other third-party projects. If Friston Substation has already been constructed under another consent, only a connection into the substation would be constructed as part of the Proposed Project;
- A high voltage alternating current (HVAC) underground cable of approximately 1.9 km in length between the proposed Friston Substation and a proposed converter station (below);
- A 2 GW high voltage direct current (HVDC) converter station (including permanent access from the B1121 and a new bridge over the River Fromus) up to 26 m high plus external equipment (such as lightning protection, safety rails for maintenance works, ventilation equipment, aerials, similar small scale operational plant, or other roof treatment) near Saxmundham;
- A HVDC underground cable connection of approximately 10 km in length between the proposed converter station near Saxmundham, and a transition joint bay (TJB) approximately 900 m inshore from a landfall point (below) where the cable transitions from onshore to offshore technology; and
- A landfall on the Suffolk coast (between Aldeburgh and Thorpeness).

The Offshore Scheme:

- Approximately 122 km of subsea HVDC cable, running between the Suffolk landfall location (between Aldeburgh and Thorpeness), and the Kent landfall location at Pegwell Bay.

The Kent Onshore Scheme:

- A landfall point on the Kent coast at Pegwell Bay.
- A TJB approximately 800 m inshore to transition from offshore HVDC cable to onshore HVDC cable, before continuing underground for approximately 1.7 km to a new converter station (below);
- A 2 GW HVDC converter station (including a new permanent access off the A256), up to 28 m high plus external equipment such as lightning protection, safety rails for maintenance works, ventilation equipment, aerials, and similar small scale operational plant near Minster. A new substation would be located immediately adjacent; and
- Removal of approximately 2.2 km of existing HVAC overhead line, and installation of two sections of new HVAC overhead line, together totalling approximately 3.5 km, each connecting from the substation near Minster and the existing Richborough to Canterbury overhead line.

The Proposed Project also includes modifications to sections of existing overhead lines in Suffolk (only if Friston Substation is not built pursuant to another consent) and Kent, diversions of third-party assets, and land drainage from the construction and operational footprint. It also includes opportunities for environmental mitigation and compensation. The construction phase will involve various temporary construction activities including overhead line diversions, use of temporary towers or masts, working areas for construction equipment and machinery, site offices, parking spaces, storage, accesses, bellmouths, and haul roads, as well as watercourse crossings and the diversion of public rights of way (PROWs) and other ancillary operations.

1.3 Structure of the Design Approach Document - Kent (DAD)

The design approach has been split across two documents:

- **Design Approach Document - Suffolk (Application document 7.11.1)**; and
- **Design Approach Document - Kent (Application document 7.11.2)** (this document).

Both documents follow the same structure:

1. Introduction - About the project, purpose of document and document structure;
2. Site Analysis - Site location, baseline analysis, local character;
3. Generic Design Parameters - illustrative converter station massing and layout used as the basis for design approaches;
4. Design Evolution - statutory consultation, design review presentation, design Review Panel Report Responses;
5. Design Approaches and Case Studies - baseline/conventional approach, enhanced cladding approach, enhanced roof approach, fragmented form approach;
6. Design Responses to Design Principles - testing of the four design approaches; and
7. Summary and Conclusions.

The Design Approach Document has been split into two documents to allow the responses to the site context, requirements and consultation feedback, to be more site specific, whilst acknowledging there are many shared constraints and opportunities that apply to both locations.

The level of development of the design approaches is limited by the indicative nature of the site layouts which retain flexibility to allow for designs to accommodate the specific requirements of the preferred suppliers equipment and building layouts. As such the design approaches are intended as guidance to how the **Application document 7.12.2 Design Principles - Kent** could be applied to the selected converter station layout.

This document has been prepared and should be read in conjunction with:

- **Application Document 7.1 Planning Statement**, which provides an assessment of the compliance of the Proposed Project with planning policies relevant to good design; and
- **Application Document 7.3 Design Development Report**, which provides an overview of how the form and design of the Proposed Project has evolved iteratively and how it has been influenced by feedback received from engagement with stakeholders.

This document is primarily focused on the design of the Kent converter station/ substation and it's relationship to the access road and landscape mitigation proposals around it. The scope of the DAD matches the scope of Section 3 in **Application document 7.12.2 Design Principles - Kent** which covers site-specific design principles for Minster.

For the purposes of this document references to the site is to mean the area local to the proposed Kent converter station and Minster substation and not the wider Kent Onshore Scheme.

SITE ANALYSIS

2.0

2.0 Site Analysis

2.1 Site Location

Kent

The site for the Kent Onshore Scheme is situated southeast of Minster and southwest of Cliffsend. Minster is located about 4.4 km inland from the east coast, while Cliffsend lies directly along the east coast. The major roads A299 and A256 serve as key connections between these areas.

Key

Parish Boundary

The analysis in this document has been developed to inform the architectural design constraints and opportunities. Further more detailed analysis relating to specific disciplines can be found in the relevant Environmental Statement chapters.

Image: Location Map, Google Earth (Not to scale).

2.1 Site Location

Thanet

The Kent Onshore Scheme site is situated in an open farmland marsh within the Minster in Thanet Parish. Parts of the Order Limits pass through Ash and St Lawrence in Thanet parishes.

The Order Limits shown cover the whole area of the Kent Onshore Scheme including, access, infrastructure, landscape proposals and mitigation together with construction site compound locations.

Key

Surrounding Kent Parish Boundaries

Order Limits

Image: Location Map, Google Earth (not to scale).

2.1 Site Location

Minster

The site for the Kent converter station and adjacent Minster substation is located between Minster to the north and Richborough to the south with Sandwich beyond that. It is in open low lying agricultural land. Train tracks run along the east and north of the Order Limits, passing through the towns of Minster and Cliffsend. The River Stour flows along the southwest edge of the site, where potential mitigation measures could be implemented to reduce visual impact.

The A256 connects to the A299, linking Minster and Cliffsend to the east coast. South of the site, existing infrastructure includes a wastewater treatment facility and a solar farm. When planning the site, as it is fairly an open agricultural land, it is important to consider existing screening methods to minimise the removal of trees and hedgerows.

Key

Order Limits

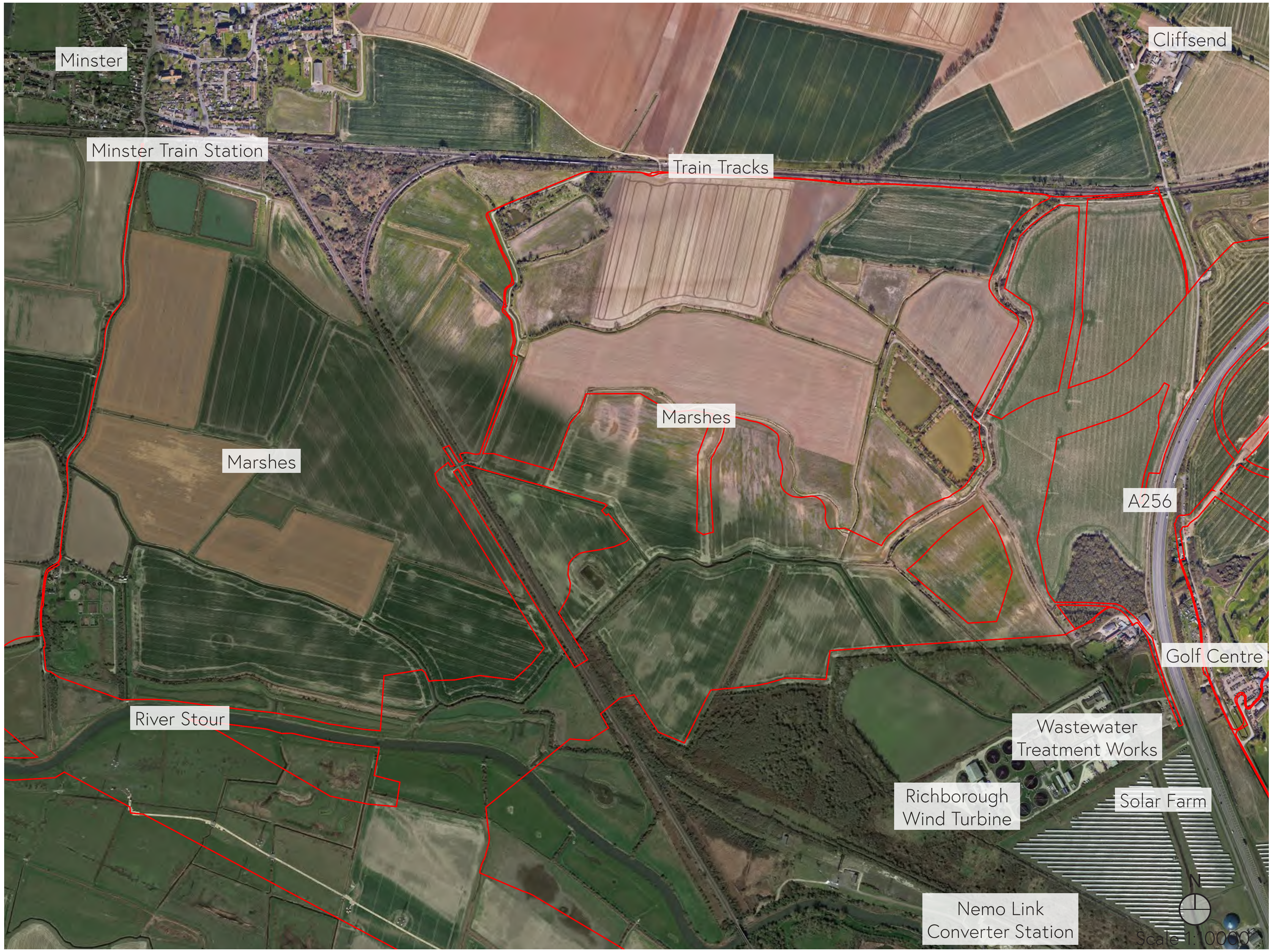
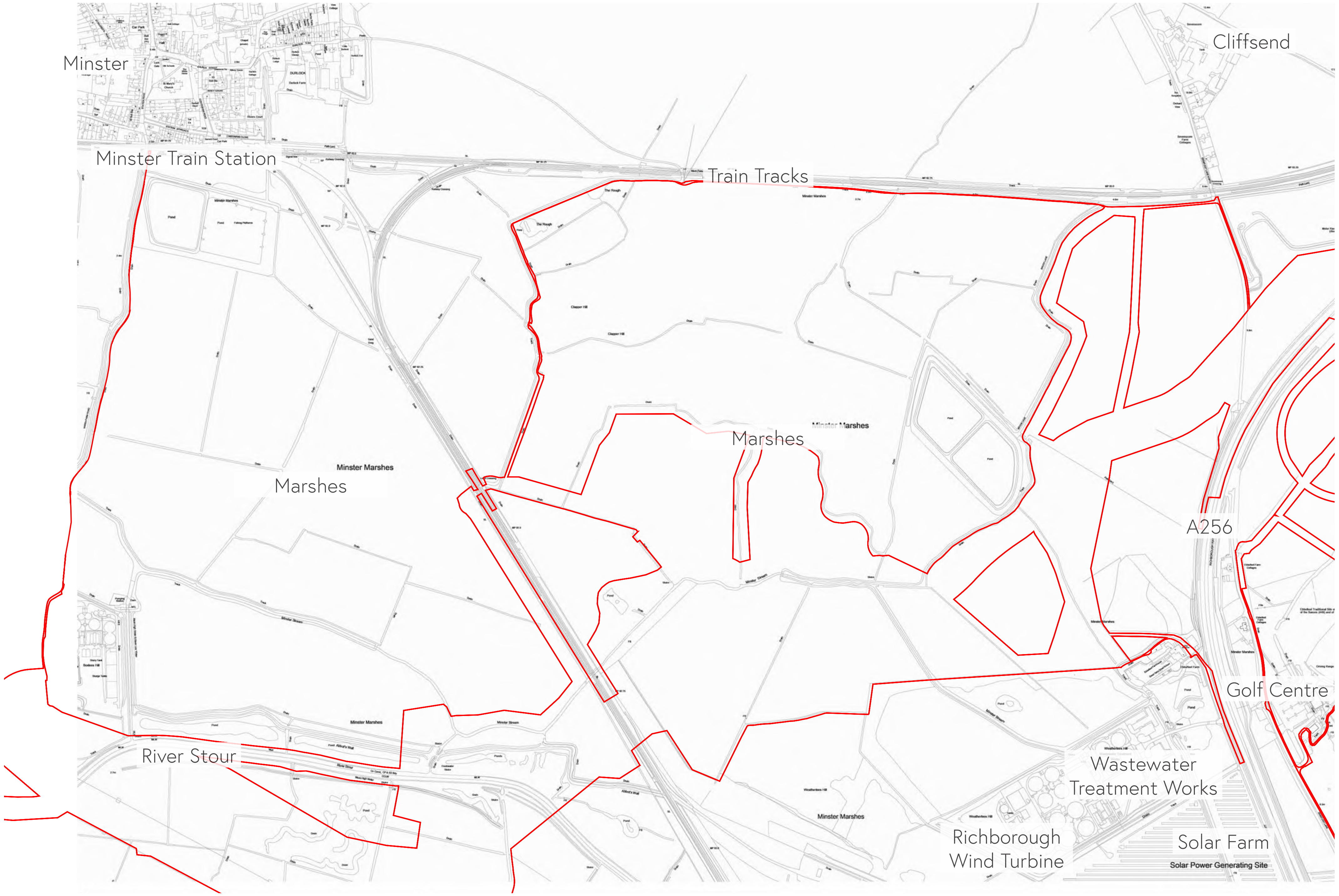


Image: Location Map, Google Earth (Not to scale).

2.2 Baseline Analysis

Order Limits

The plan shown on this page is based on Ordnance Survey information. The red line shown describes part of the Order Limits, local to the site, which form the current anticipated boundary of the surrounding area for the Kent converter station and Minster substation. This also includes, access, infrastructure, landscape proposals and mitigation together with construction site compound locations.



Key

Order Limits

(Not to Scale).

N

Scale 1:10000

2.2 Baseline Analysis

Topographical

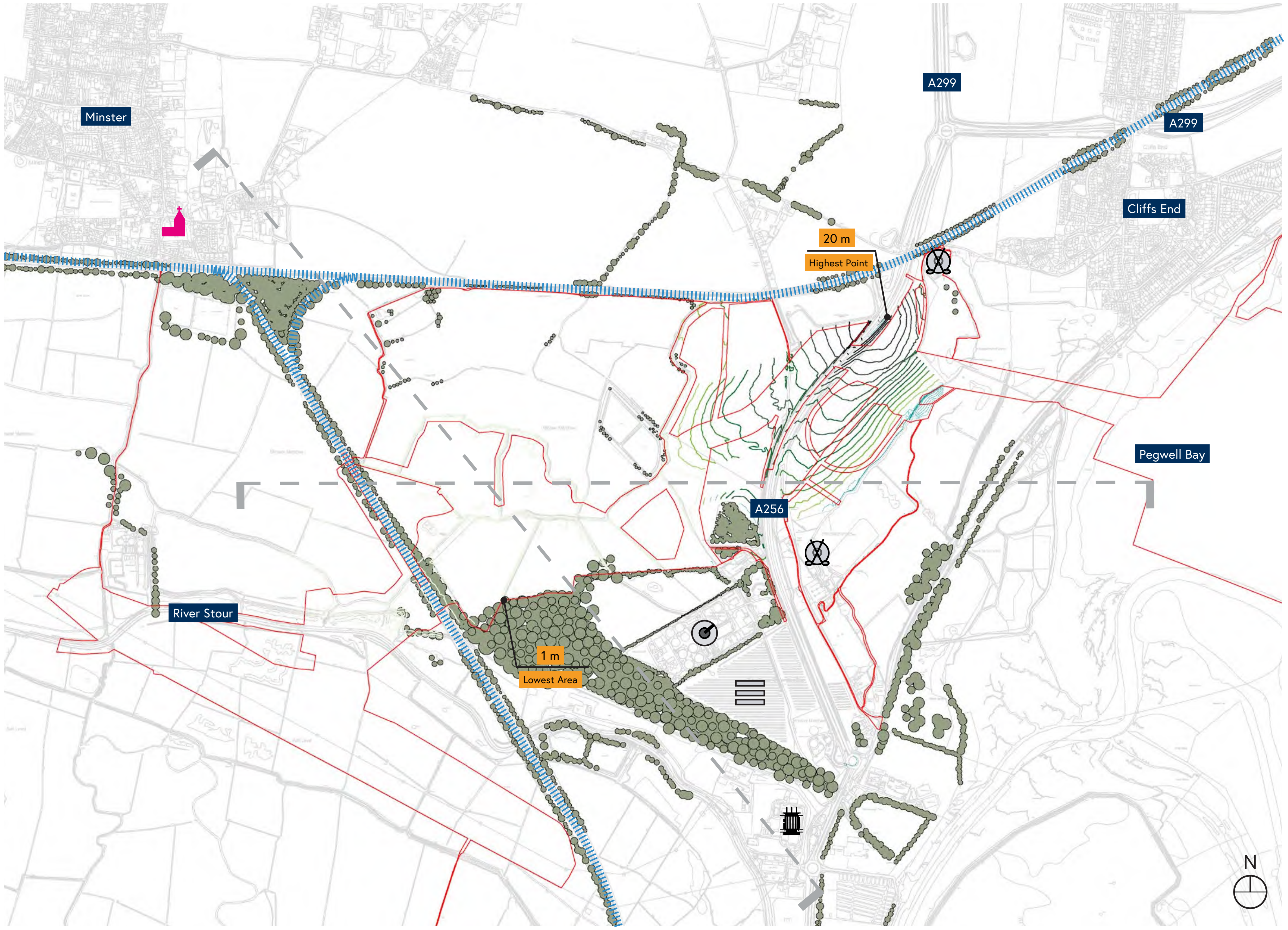
The site in Kent, lies on open farmland between Sandwich to the southeast and Minster to the northwest. Nearby is a solar far.

Topography Gradient Above Ordnance Datum (AOD)

High 31.75 m — Low 13 m

Key

- Wastewater Treatment Plant
- NEMO Link Converter Station
- Solar Farm
- Minster Abbey
- Golf Course
- Existing Railway Line
- Indicative section Line
- Order Limits
- Spot Elevation



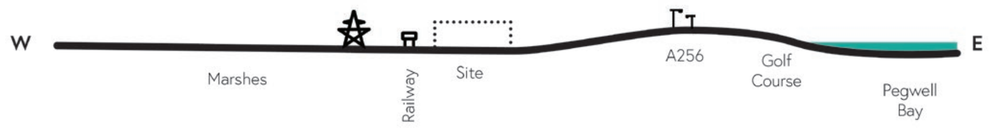
(Not to Scale).

2.2 Baseline Analysis

Site Section West to East

The land to the west of the site is very sparsely populated and is generally difficult to access being mostly marshy farmland. The flat openness of the landscape allows wide views with little elevation gain. The most significant landmarks are the OHL towers (pylons) linking to NEMO Link and substations at Richborough. To the east of the site is a slight ridge which historically linked Great Stonar to the Isle of Thanet when the River Stour drained into the Wantsum Channel. The A256 follows this relatively high ground. Beyond that is Pegwell Bay.

(These cross sections are not to scale and are intended to give an impression of the overall lie of the land and key relationships.)

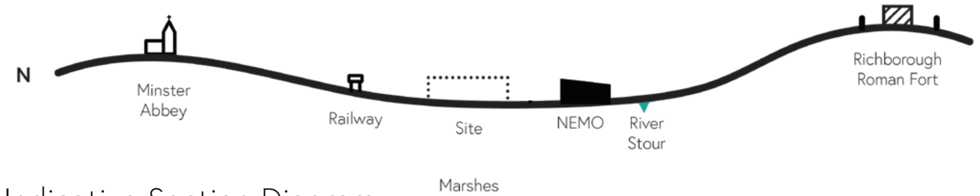


Indicative Section Diagram

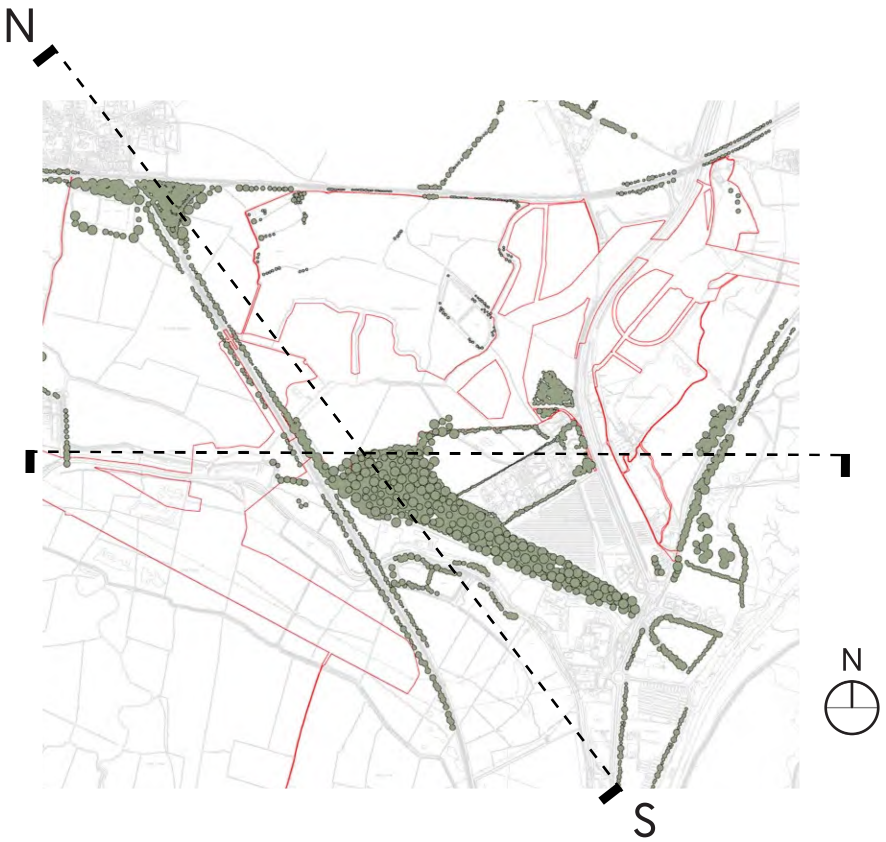
2.2 Baseline Analysis

Site Section North to South

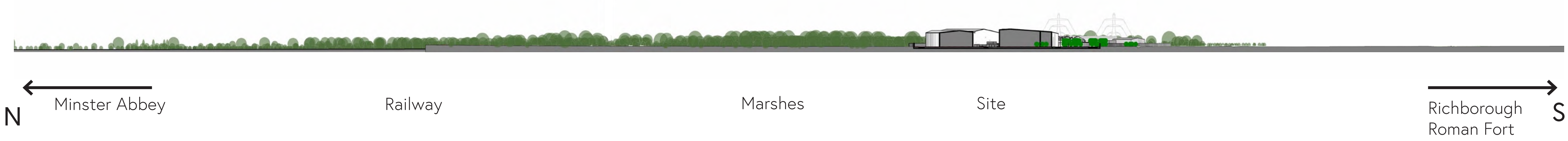
The site is located in the area of improved farmland which historically would have been in the Wantsum Channel which separated the Isle of Thanet from Mainland Kent. To the north is Minster which sits on higher ground and to the south is Richborough with the remains of the Roman Fort. The fort sits on high ground with commanding views in all directions. The site is to the north of Richborough Energy Park where there is already other major infrastructure such as NEMO Link which is another converter station.



Indicative Section Diagram



(These cross sections are not to scale and are intended to give an impression of the overall lie of the land and key relationships.)



2.2 Baseline Analysis

Representative Viewpoints

ES Viewpoint Locations

The views numbered 1 to 14 are the agreed key viewpoints being considered in the landscape and visual impact assessment (LVIA) (see **Application Document 6.3.3.1.D Visual Amenity Baseline and Assessment**). Some of these relate to the landfall and are not looking towards the converter station site.

Heritage Views

The views numbered H1 to H5 are additional views for assessing heritage impacts and are not part of the LVIA.

A selection of the views which cover different aspects of the site are included in this document, showing the winter condition as well as the Rochdale Envelope which is the maximum volume being considered as the worst case impact. The LVIA will also consider summer conditions.

○ Kent LVIA and Heritage Viewpoints ● Key Design Views

Image: Location Map, Google Earth (not to scale).

2.2 Baseline Analysis

These are proposed views without the planting.

Note that the wind turbine and one of the masts have been removed since the baseline photography was taken.

Viewpoint 8

Viewpoint 8 (From Roman Fort Viewing Platform) - Winter Baseline

Viewpoint 8 (From Roman Fort Viewing Platform) - Winter with Rochdale Envelope

2.2 Baseline Analysis

Viewpoint 4

These are proposed views without the planting.

Note that the wind turbine and one of the masts have been removed since the baseline photography was taken.

Viewpoint 4 (From Marshes north of site) - Winter Baseline

Viewpoint 4 (From Marshes north of site) - Winter with Rochdale Envelope

2.2 Baseline Analysis

These are proposed views without the planting.

Note that the wind turbine and one of the masts have been removed since the baseline photography was taken.

Viewpoint 10

Viewpoint 10 (From riverside footpath west of site) - Winter Baseline

Viewpoint 10 (From riverside footpath west of site) - Winter with Rochdale Envelope

2.2 Baseline Analysis

These are proposed views without the planting.

Note that the wind turbine and one of the masts have been removed since the baseline photography was taken.

Viewpoint H3

Viewpoint H3 (From edge of wood east of site) - Winter Baseline

Viewpoint H3 (From edge of wood east of site) - Winter with Rochdale Envelope

2.2 Baseline Analysis

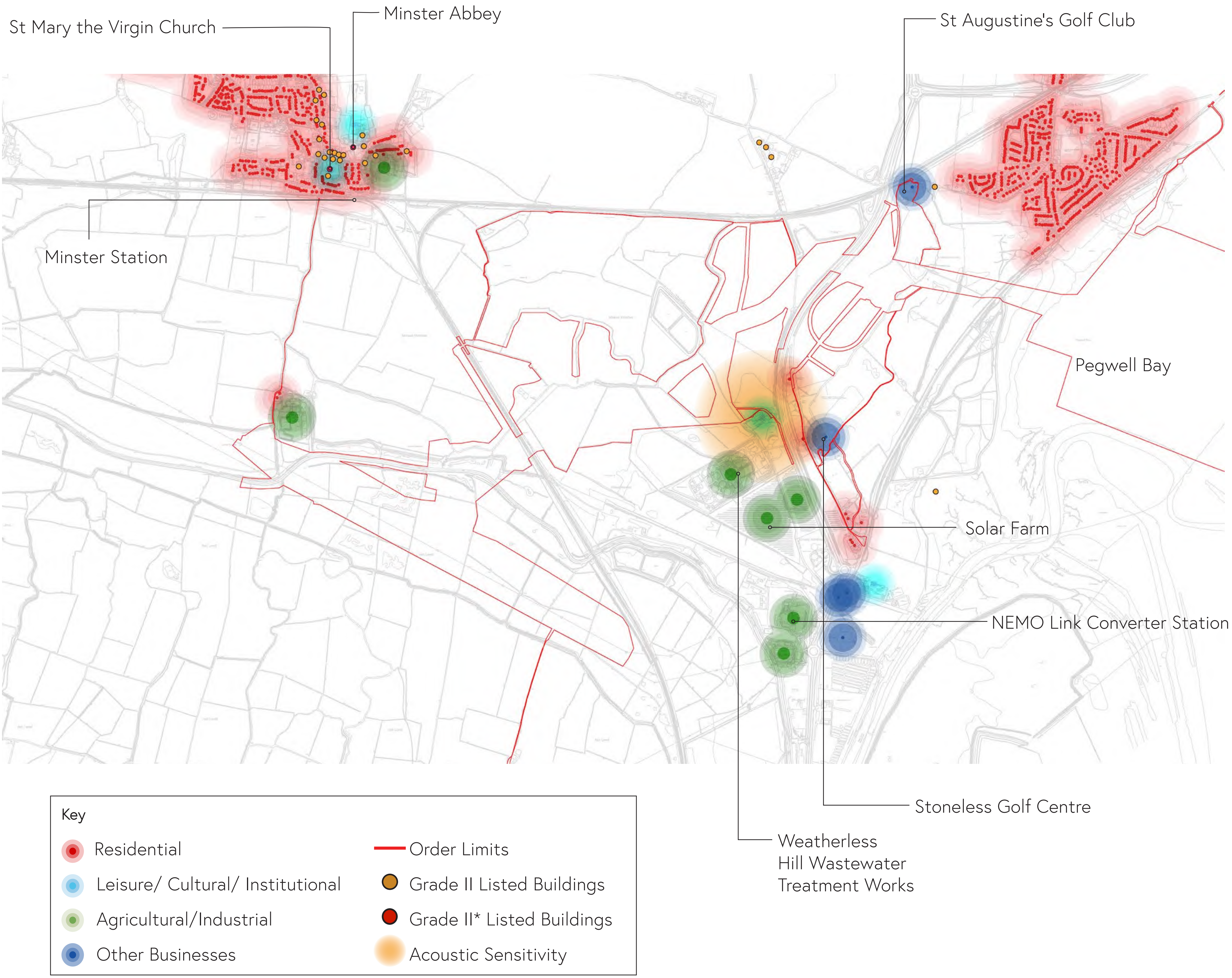
Proximity to Sensitive Receptors

Due to the nature of the Order Limits boundary and the scale of development, the Kent Onshore Scheme will impact existing nearby uses. The adjacent plan identifies locations that may be sensitive to development and require mitigation.

To the northwest and northeast of the site are the towns of Minster and Cliffsend, characterised predominantly by low-rise dwellings.

South of the Order Limits, there are several residential dwellings; however, the area is primarily composed of agricultural and industrial uses. Notably, this includes Weatherless Hill Wastewater Treatment Works, a solar farm, and the NEMO Link converter station, which serve as precedents in later sections of this document.

Sensitivity to visual impact and noise is expected to be low, as there are fewer residential areas in close proximity to the development.

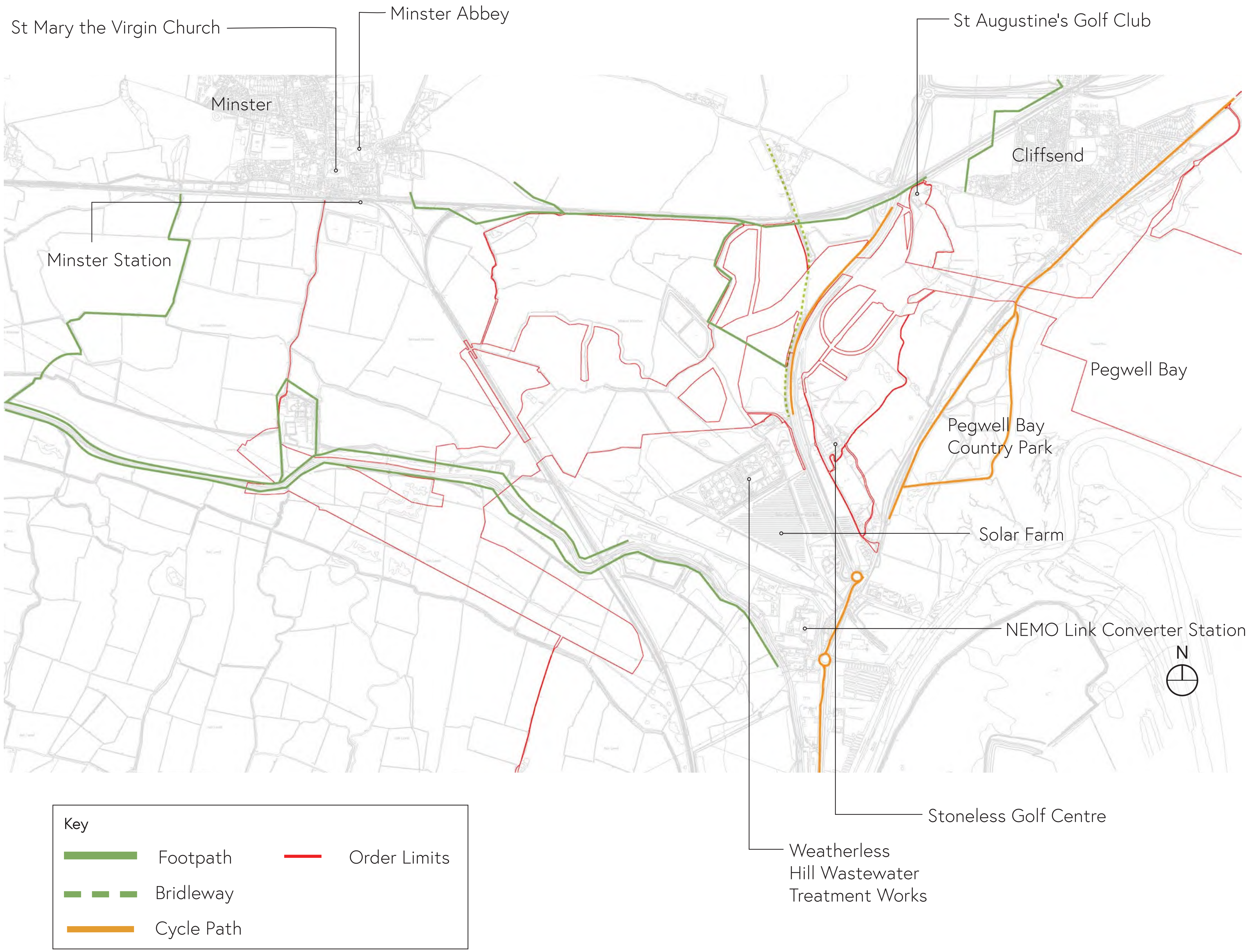


(Not to Scale).

2.2 Baseline Analysis

Private and Community Assets

Community facilities within Minster and Cliffsend towns itself will not be directly affected by the development. These include places of worship, golf courses, agricultural farms and other industrial uses including NEMO Link converter station.



(Not to Scale).

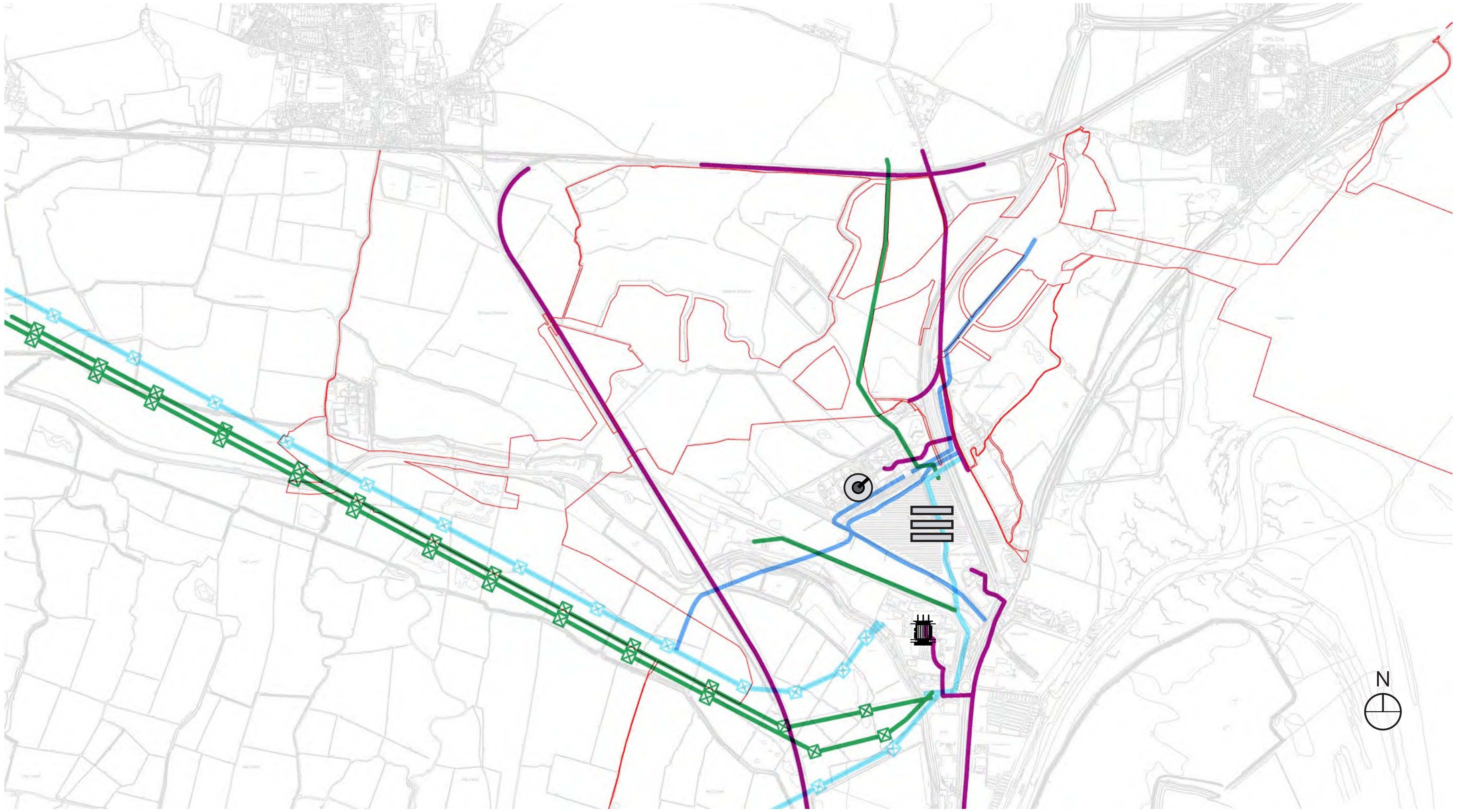
2.2 Baseline Analysis

Existing Utilities

Situated southeast of the Kent converter station and Minster substation site is a waste water plant, solar farm and NEMO Link converter station (interconnector with Belgium). These will not be directly affected by the development.

Southwest of the site, across the River Stour, are three parallel Overhead Lines (OHLs). The two on the far side are UK Power Network distribution lines, and the nearer is a National Grid transmission line. The Minster substation will be connected to this transmission line as part of the Kent Onshore Scheme.

The site is relatively remote and records do not show it crossed by existing utilities. There are existing utilities to the east of the site where connections to serve the converter station and substations are to be made as can be seen in **Application Document 2.5.2 Works Plans - Kent**.



Key

- Electricity Transmission OHLs and Towers (Pylons)
- Electricity Distribution OHLs and Towers (Pylons)
- Distribution Power Lines
- Data Lines
- Water Lines
- Waste Water Plant
- NEMO Link Converter Station
- Solar Farm
- Order Limits

(Not to Scale).

2.2 Baseline Analysis

Tree Belts and Screening

The site lies in open marsh lands, leaving north of the site open from any significant woodlands.

Significant exiting tree belts and Woodlands can be found directly south of the site around the other industrial and agricultural areas and northwest of the site near Minster town with other tree belts scattered around the Order limits.

These areas of the site offer the opportunity to provide some screening of the site, particularly when viewed from Minster. Along the train tracks there is hedgerows scattered, mitigating the visual impact from the public transport.

Key

Order Limits

Existing Trees, Woodland and Hedgerows

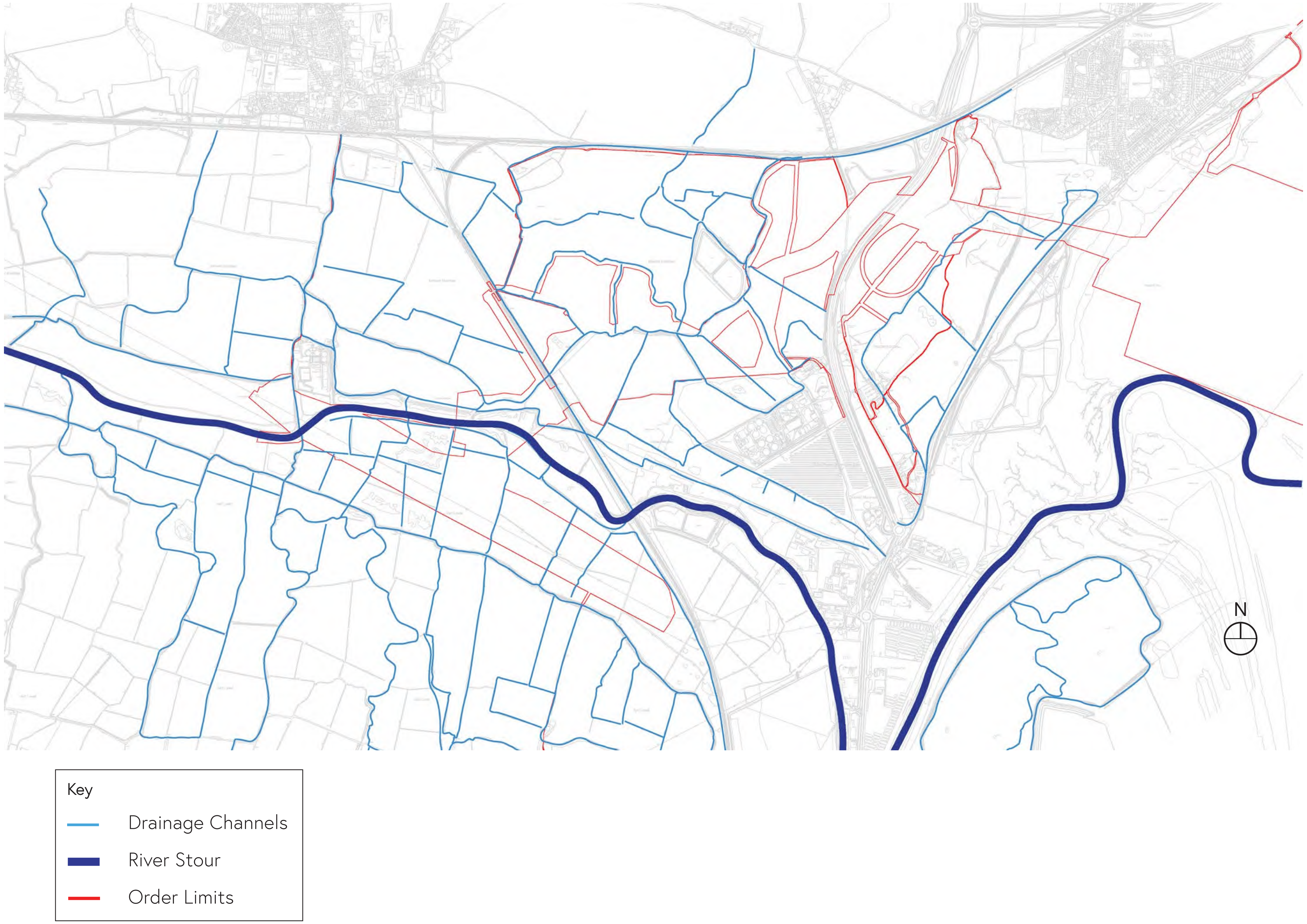
(Not to Scale).

2.2 Baseline Analysis

Watercourses

River Stour is located south of the site with a section of the river within the Order Limits. As the site is situated on low lying open farmland, there a significant number of drainage channels to allow for the efficient flow of water in and out of the fields, regulating the water levels also providing various habitats.

There is a number of drainage channels within the Order Limits and through the converter station site.



(Not to Scale).

2.2 Baseline Analysis

Road/ Street Hierarchy

A256 Is a major A road running along the East coast of Kent between the Isle of Thanet and Dover.

There is no direct vehicle link between Minster town and the site however there is a public right of way (PRoW) along the river called the Saxon Shore Way that connects the site to the nearest town. This PRoW is not directly on the site where the Kent Onshore Scheme is being proposed, however it will offer views into the site.

There are routes popular for cyclists due to the low vehicular traffic. This is caused by section of road blocked for vehicular access along Ebbsfleet Lane North.

(Not to Scale).

2.2 Baseline Analysis

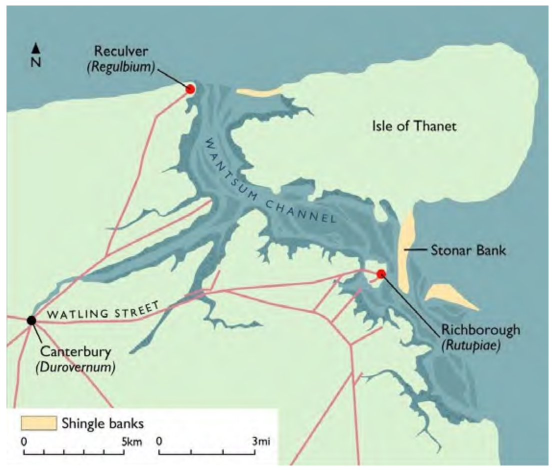
Historic Map

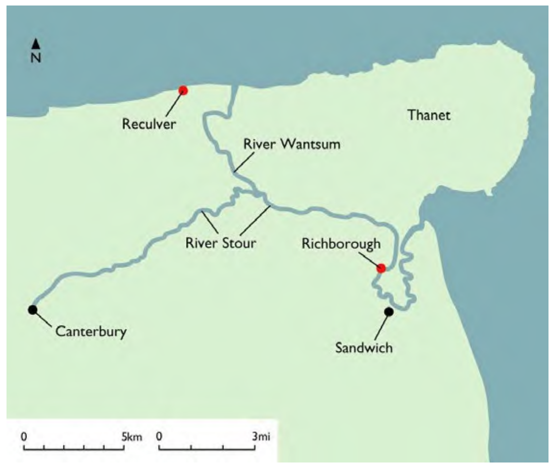
During the Roman Period Kent was split into different islands, with Richborough separated from the mainland. During this time Watling Street, the main Roman road was the main connection between Richborough and London and beyond.

The massive coastal change was due to several factors, firstly the gradual rise of sea level and the second was the slow infilling of the Wantsum, eventually using drains to exclude water around precious land to reclaim it for agriculture. Leaving us with the Land boundaries we see today. Thanet joined the mainland and Richborough was no longer an island.

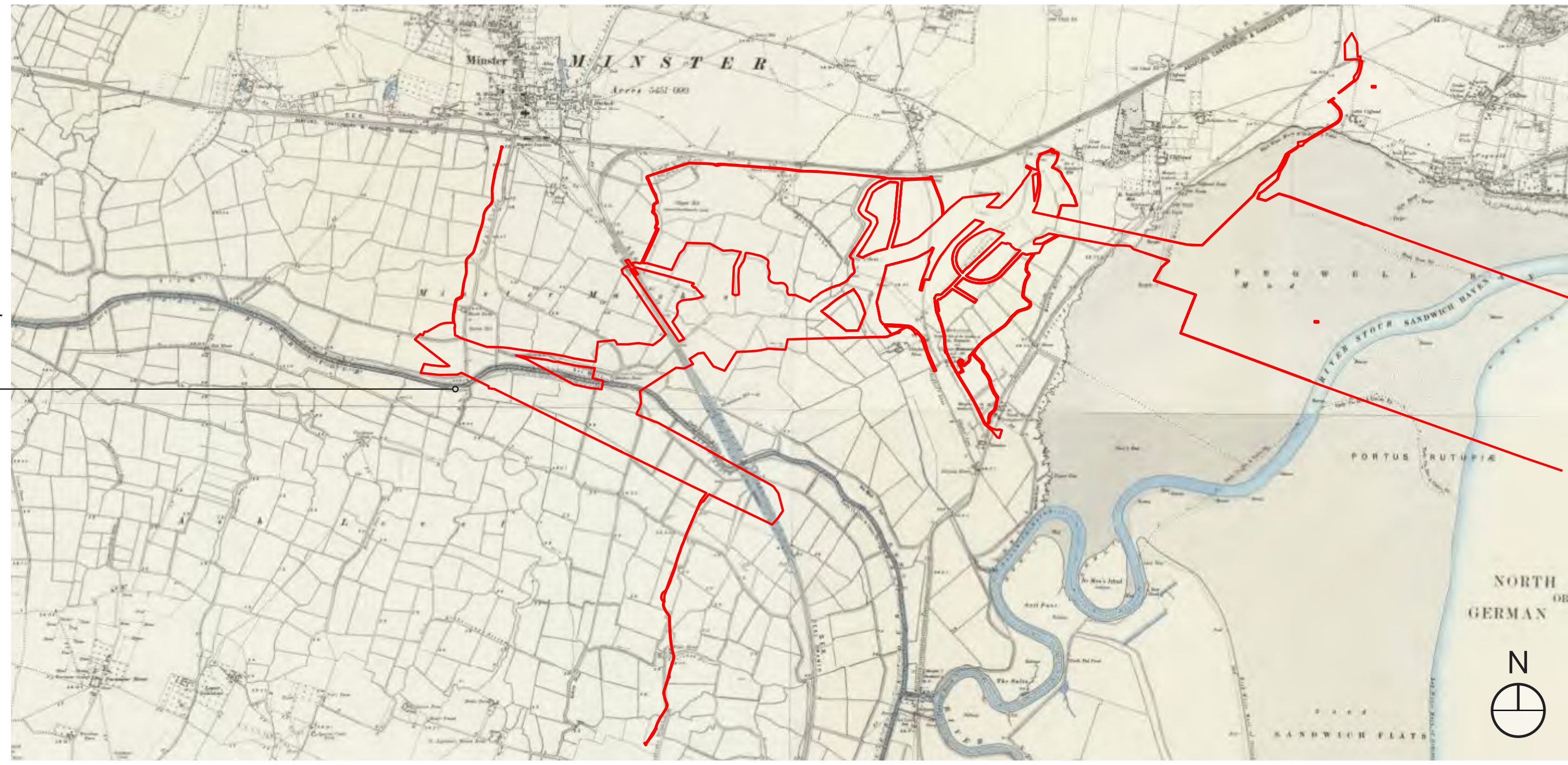
Today the Wantsum Channel remains as a River leading towards a pump in Reculver pushing water into the North Sea and River Stour connects the Pegwell Bay through to Richborough through to Canterbury.

Key
— Order Limits

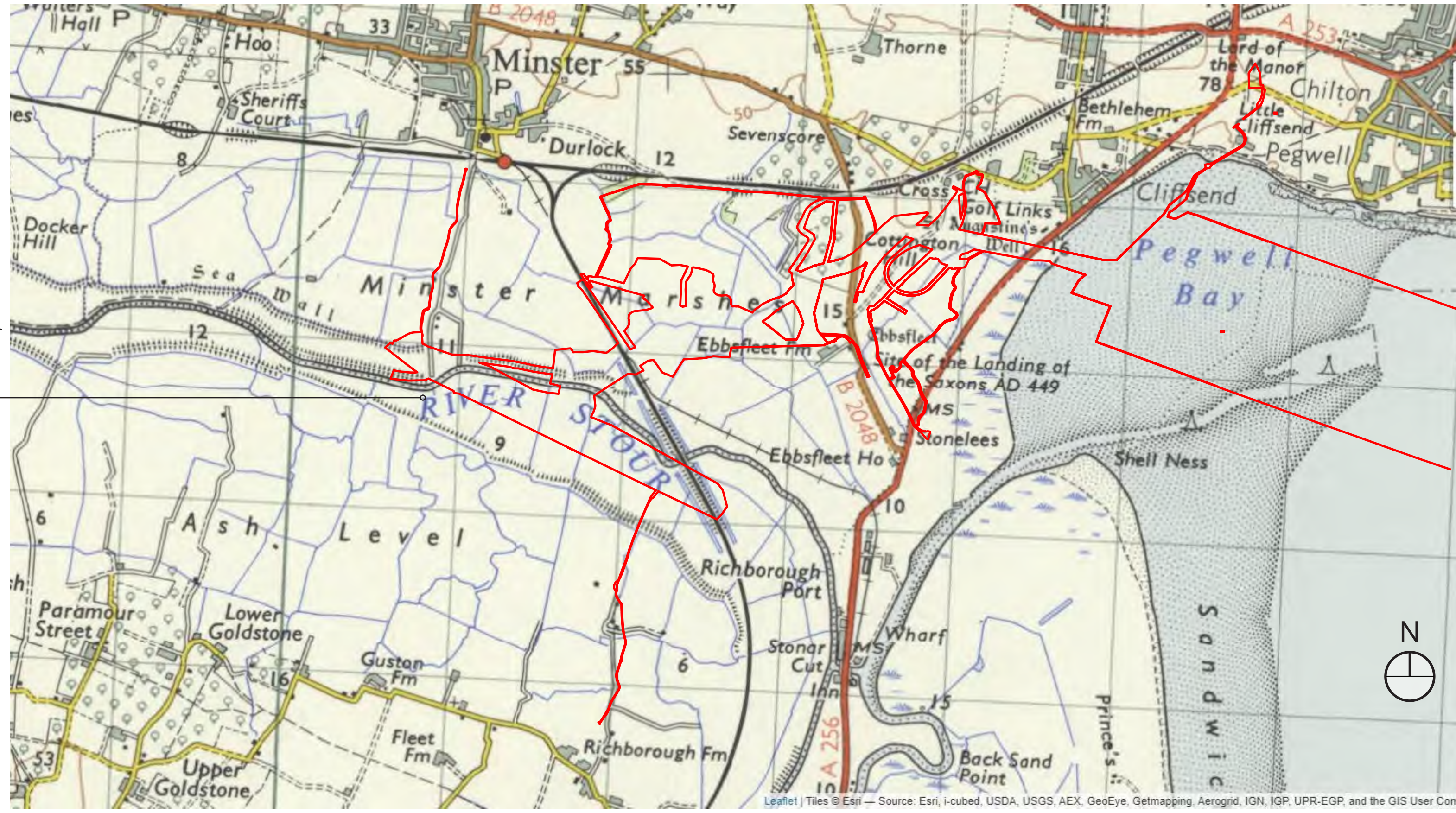




1888-1913



1955-1961

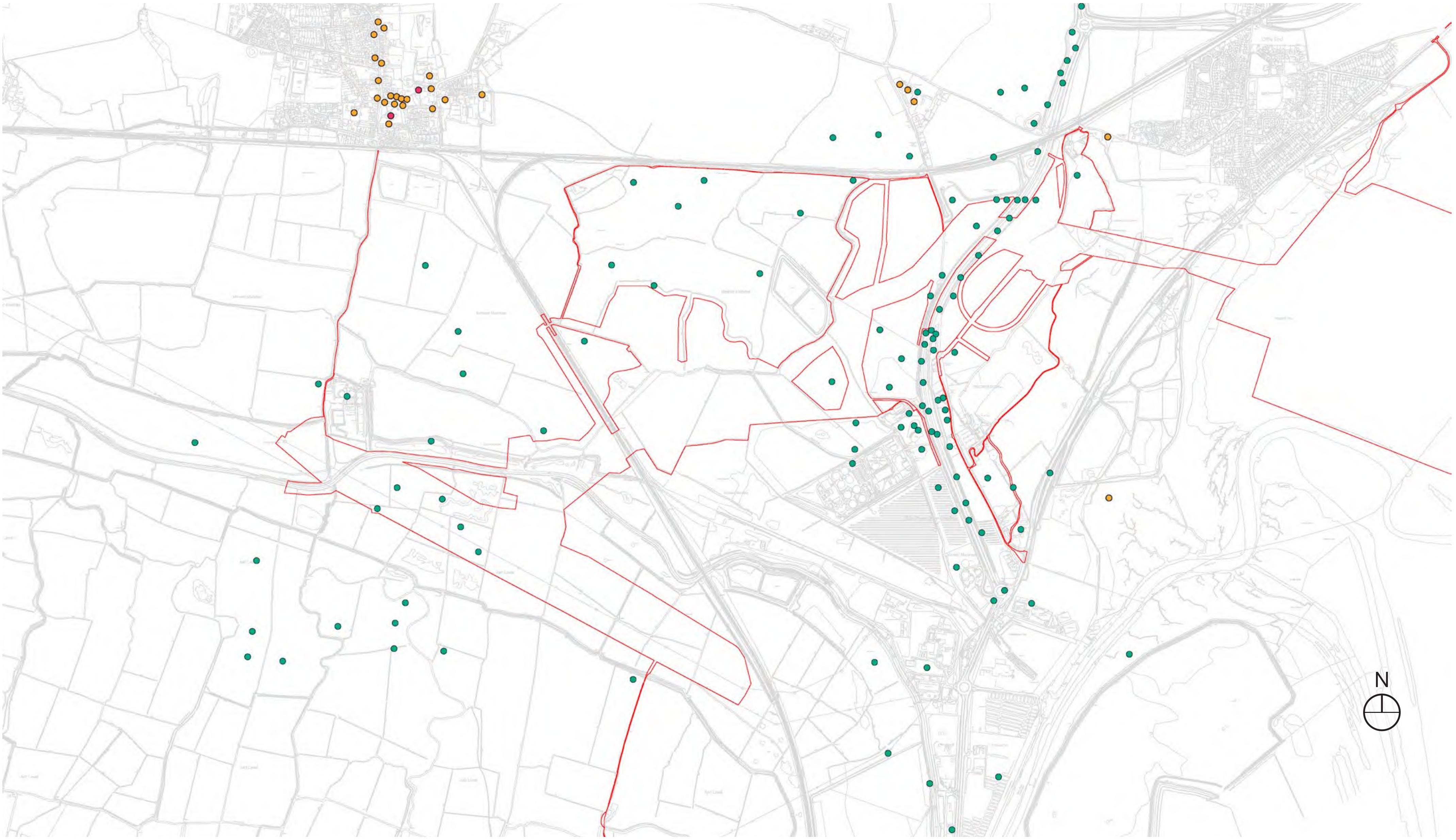


2.2 Baseline Analysis

Key Heritage Data

Key

- Scheduled Monuments
- Grade II Listed Building
- Grade II* Listed Building
- Order Limits



(Not to Scale).

2.3 Site Proposal

Key Site Considerations

In this section, we examine the key considerations for the Kent converter station. The diagram to the right illustrates the various aspects of the site that inform the design approaches.

Key

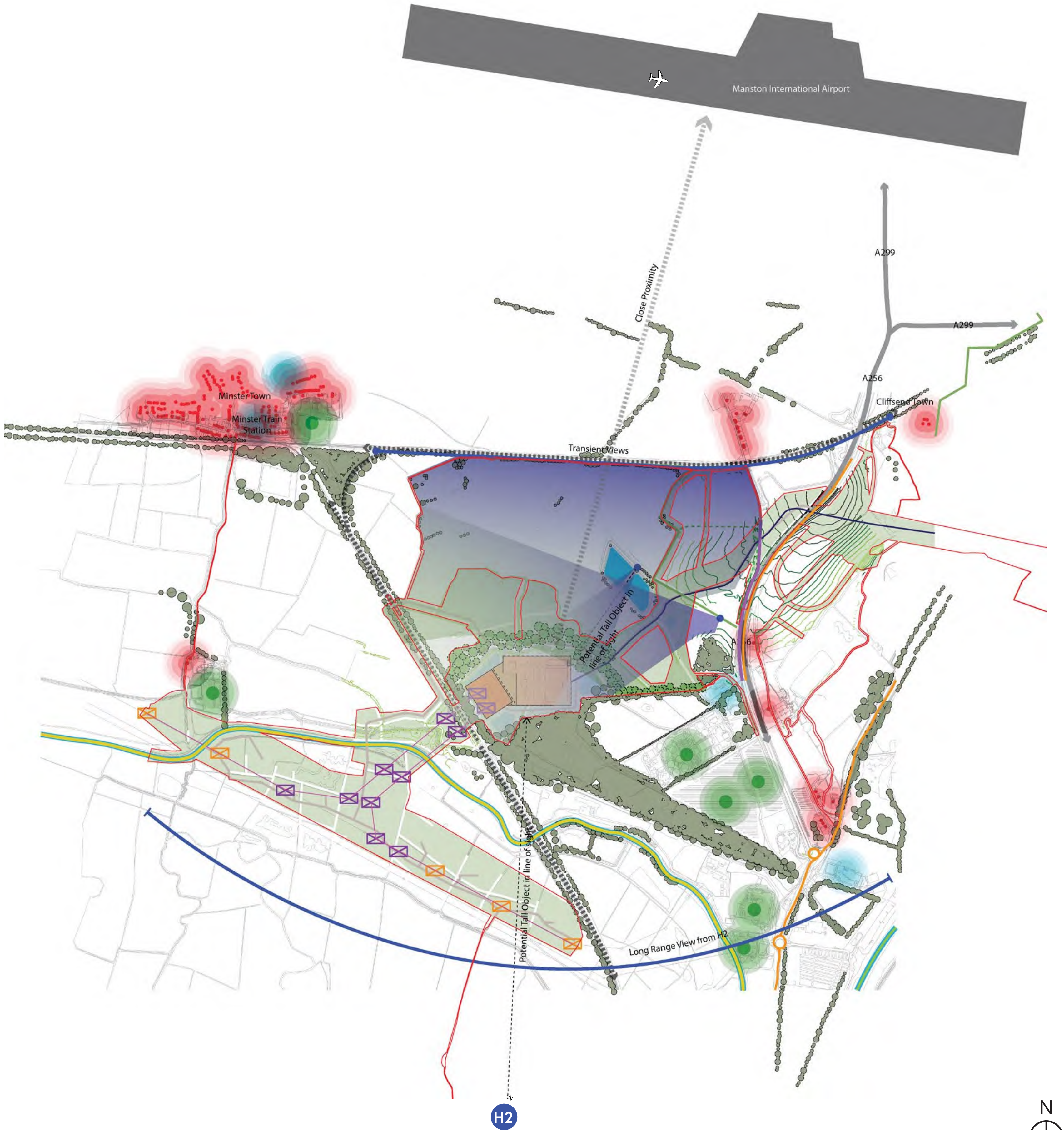
- Order Limits
- Indicative Location of Minster Converter Station and Substation
- Substation Area
- Converter Station Area
- Existing Planting
- Proposed Planting for Screening
- Residential Buildings
- Leisure/ Cultural/ Institutional
- Agricultural/Industrial
- Other Businesses
- Key View Points
- Train Line
- Proposed Overhead Lines
- Proposed Pylons for Substation
- Proposed Pylon Modifications
- HVDC Cable Route
- A- Road
- Proposed Access to Kent Onshore Scheme
- Existing PRoW
- Proposed PRoW
- Cycle Lane
- Blocked Vehicular Access

Topography Gradient (AOD)

High 20 m — Low 1 m

Line of Sight

Closest — Furthest



View point H2 located within the Amphitheatre near the Roman Fort

N

(Not to Scale).

2.3 Site Proposal

Acoustic Sensitivity

The site, being so remote and surrounded by arable fields, has a low baseline sound level. The orientation has the potential to position buildings between noise sources and sensitive receptors to the east which could be beneficial. Refer to **Application Document 7.5.8.2 Outline Construction Noise and Vibration Management Plan** for more information.

Proximity

With Minster and Cliffsend located to the northeast and northwest, respectively, there is potential for the Proposed Project to have impacts on these residential areas and nearby amenities surrounding the site. The site itself is fairly remote from residential areas and PRoW.

Levels / Topography

The proposed site sits in the bottom of a valley running approximately east west with higher ground which is more populated and accessible to the north and south. As such less accessible viewing points tend to be nearer and from a low height and more accessible elevated view points are further away. This affects the relationship with the horizon.

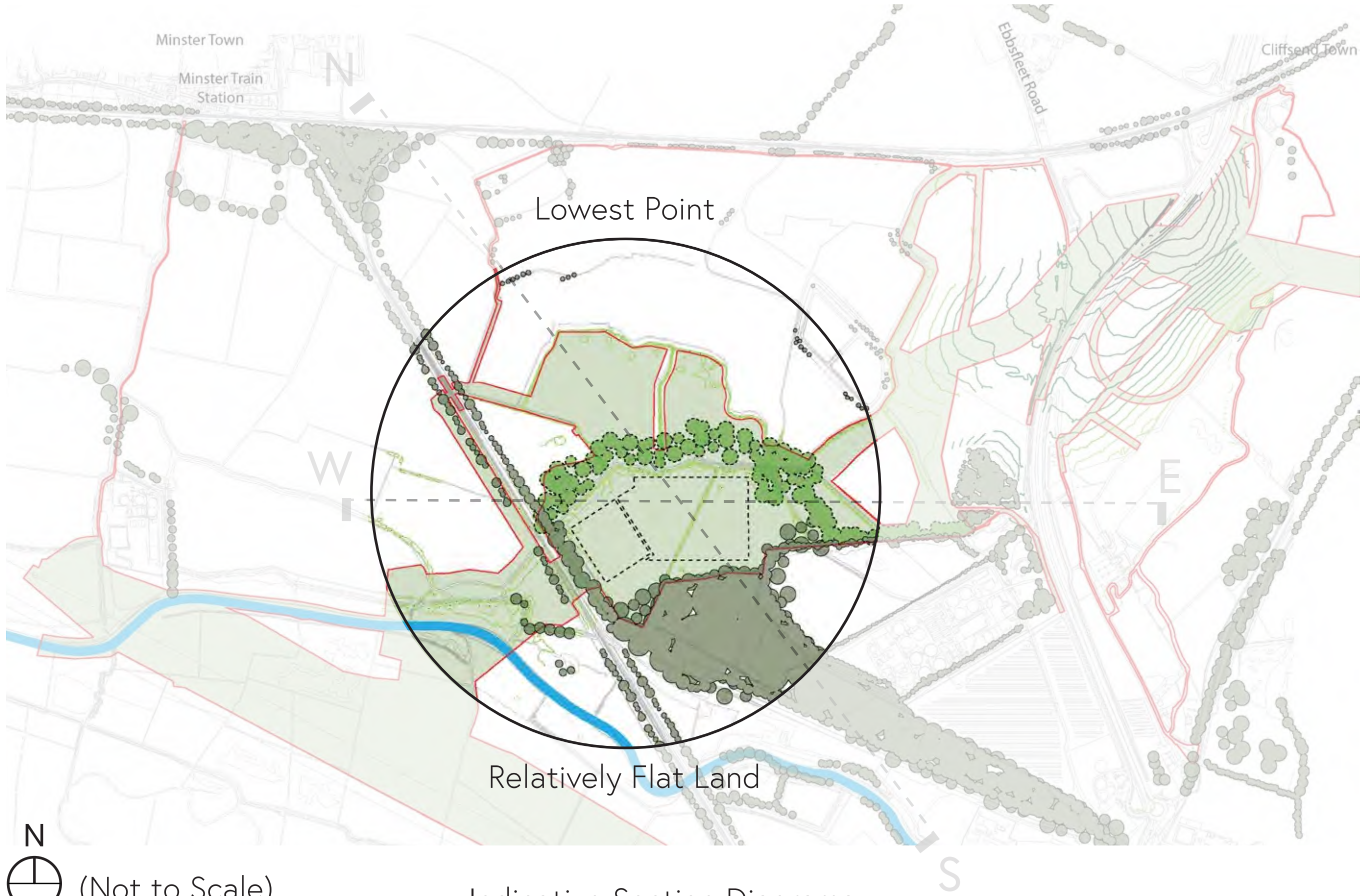
Topography Gradient (AOD)

High 20 m — Low 1-2 m

N (Not to Scale).

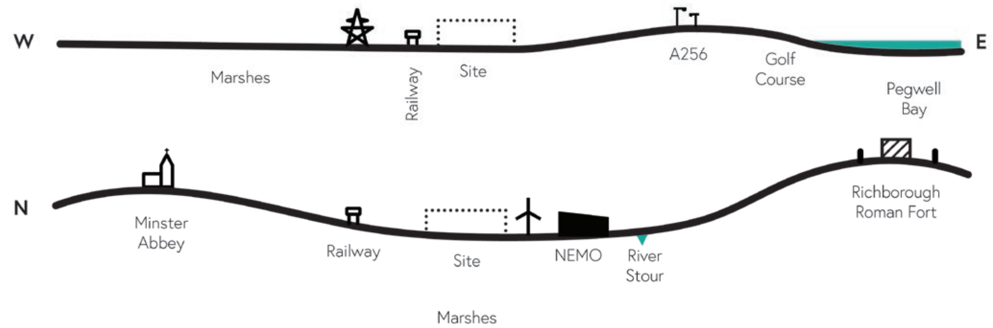
Key

- Indicative Location of Minster Converter Station and Substation
- Existing Trees, Woodland and Hedgerows
- Proposed Planting for Screening
- Residential
- Leisure/ Cultural/ Institutional
- Agricultural/ Industrial
- Other Businesses
- Order Limits



N (Not to Scale).

Indicative Section Diagrams



2.3 Site Proposal

Land Pattern

Where possible, the masterplan will respect the historic land patterns. The shape of the site for the converter and substations will align with the existing field boundaries with a focus on minimising the impact on the existing drainage network.

Key
- Indicative Location of Minster Converter Station and Substation
- Existing Trees, Woodland and Hedgerows
- Proposed Planting for Screening
- Key View Points

Key Views

The site is relatively open, esepcially on the north side. As a result there are transient views from the train lines and open views from Minster which is topographically higher in that direction. The site has been tucked up against the existing woodland on the SSSI to the south for screening effect.

Line of Sight
Closest — Furthest

View point H2 located within the Amphitheatre near the Roman Fort

2.3 Site Proposal

Rights of Way /Access

The new access roads to the proposed site will connect to the A256 road to the east.

No PRoW crosses or lies directly adjacent to the proposed site, however there is a footpath along the banks of the River Stour that offers views into the site.

The highlighted section linking Jutes Lane to Ebbsfleet Lane North has bollards at either end stopping vehicular traffic using it as an alternative to the A256. As it is low traffic it is a popular route for cyclists.

Cable Placement

Due to the nature of this side of the project, there are underground and overhead cable easements. The substation is proposed to be located adjacent to the converter station. Compared to the Suffolk site, there is only a buried HVDC cable from the landfall and a short distance of overhead lines (OHLs) connecting to the substations and the transmission network OHLs on the other side of the river.

Key

- Proposed Overhead Lines
- Proposed Pylons for Substation
- Proposed Pylon Modifications
- HVDC Cable Route
- Train Line
- A- Road
- Blocked Vehicular Access
- Existing PRoW
- Proposed PRoW
- Cycle Path
- Saxon Shore Way
- Order Limits

2.3 Site Proposal

Attenuation Ponds

The attenuation ponds are strategically positioned around the proposed site to allow surface water runoff to be effectively managed. They have been intregrated with the landscape prposals as can be seen in **Application Document Figure 7.5.7.2.1 Minster Converter Station and Substation Outline Landscape Mitigation.**

Micro-siting

The converter station and substation have been positioned adjacent to each other to contain potential impacts in the smallest possible area. The Key Design Principles in Table 3.1 and Table 4.1 of **Application Document 7.12.2 Design Principles - Kent** address this principle..

Key

- Indicative Location of Minster Converter Station and Substation
- Existing Planting
- Proposed Planting for Screening
- Proposed Attenuation Ponds
- Substation Area
- Converter Station Area

2.3 Site Proposal

Manston International Airport

About 1.5 miles north of the site is Manston International Airport. This needs to be considered as an important factor when designing the Kent Onshore Scheme due to the problems that could occur from lighting and glare issues. The height of the building and the overhead mitigation will not pose a problem for aviation.

Key

- Indicative Location of Minster Converter Station and Substation
- Existing Planting
- Proposed Planting for Screening
- Airport Runway
- SSSI

Site of Specific Interest (SSSI) - Sandwhich Bay to Hacklinge Marshes

The Sandwich Bay to Hacklinge Marshes is a Site of Special Scientific Interest (SSSI). It is designated for its ecological and geological importance, covering a diverse landscape of sand dunes, salt marshes, coastal grasslands, and freshwater wetlands.

2.3 Site Proposal

Summary and Conclusions

The proposed Kent converter station and adjacent proposed Minster substation are expected to impact nearby land uses due to its scale and location to the south of Minster. Minster and Cliffsend, situated to the northwest and northeast, consist primarily of low-rise dwellings, while the southern area features a mix of agricultural and industrial uses, including the Weatherlees Hill Wastewater Treatment Works, a solar farm, and the NEMO Link converter station. Sensitivity to visual and noise impacts is generally low due to the limited number of residential areas in close proximity with more detail available in **Application Document 7.5.8.2 Outline Noise and Vibration Management Plan - Kent**.

Community assets such as places of worship, golf courses, and agricultural farms in Minster and Cliffsend will not be directly affected. The project has interfaces with existing infrastructure around the site, most notably the connection of the proposed Minster substation to the National Grid transmission line heading west from the Richborough 400kV substation. Further information of this can be found in **Application Document 2.5.2 Works Plans - Kent**.

The site is predominantly open improved arable land, with tree belts concentrated to the south and northwest, providing opportunities for natural screening, particularly from Minster. Watercourses, including the River Stour and drainage channels, are present within the Order Limits, playing a crucial role in regulating water levels and supporting local ecosystems.

Connectivity is facilitated by the A256, a trunk route along the East Kent coast. While there is no direct vehicular link between Minster and

Key

Multiple Constraints Overlay

High

Medium

Low

(Not to Scale).

2.3 Site Proposal

Summary and Conclusions (continued)

the site, a public right of way along the River Stour offers views into the area. The Jutes Lane to Ebbsfleet Lane North link is popular with cyclists wishing to stay off main roads. See **Application Document 7.5.9.2 Outline Public Rights of Way Management Plan - Kent**. The site itself is not accessible to the public but there are routes that give views into the site and the proposed access road will cross the bridle way that links Jutes Lane to Ebbsfleet Lane North.

Historically, the area has undergone significant coastal changes, with the Wantsum Channel evolving from a major waterway into reclaimed land used for agriculture. The River Stour still connects Pegwell Bay to Canterbury, maintaining some of its historical significance with the Saxon Shore Way following the river. More information is available in **Application Document 6.2.3.3 Environmental Statement Part 3 Kent Chapter 3 Cultural Heritage**.

The open landscape around the site could be a factor in respect of noise with the nearest sensitive receptors being a small number of houses to the north east of the wastewater treatment works, either side of the A256, and the next nearest being a row of houses along Ebbsfleet Lane North on the far side of the railway line north of the site. More details can be found in **Application Document 6.2.3.9 Environmental Statement Part 3 Kent Chapter 9 Noise and Vibration**.

The topography of the area is distinctive with the site at the bottom of a valley alongside the River Stour which is a relatively inaccessible area of countryside, with public walking routes such as the Saxon Shore Way offering low level views from east and west. More populated areas are on higher ground looking down towards the site from more distant views that are more accessible, such as Minster to the North and Richborough to the south. This variable viewing level of key views, and how it affects the horizon is a key consideration for the design approach. **Application Document 6.4.3.1.6 Representative Viewpoint Locations** shows where these key viewpoints are taken from and that have been considered in **Application Document 6.2.3.1 Environmental Statement Part 3 Kent Chapter 1 Landscape and Visual**.

The Proposed Kent converter station and Minster substation will align with existing land patterns to minimise disruption to hedgerows and preserve the landscape. The nature of the topography, the open rural character of the selected site and the adjacent SSSI have informed the landscape plan in **Application Document 7.5.7.2.1 Minster Converter Station and Substation Outline Landscape Mitigation** and this in turn will be taken into consideration in developing design approaches for the architectural elements that are intended provide embedded mitigation for Kent converter station and adjacent Minster substation.

2.4 Local Character

Vernacular

Minster Town






Image: Location Map, Google Earth (not to scale).

2.3 Local Character

Minster Town

Image: Location Map, Google Earth (not to scale).

2.3 Local Character

Roman Fort






Image: Location Map, Google Earth (not to scale).

2.3 Local Character

Colour

Colour, Texture & Pattern

In this section research on colours, patterns and materials, used in the surrounding areas in Kent, is developed through the seasons. In this research, the understanding of what makes the local area distinctive and how it can inform the design principles becomes clearer.

The landforms, flora and architecture will form how new grading and planting can be used to give a sense of place to the proposal. Also, from this research, a palette is established from the colours and patterns that can inform of the kind of cladding schemes that will relate well. The idea is to form a design that belongs to the local environment so that it works with the surrounding landscape and architecture, whether it be to blend in or respond in other ways.

This research is split into three sections, Nature, Traditional Architecture and Agricultural, Industrial and Infrastructure. Looking at the site locations, it will mostly be nature that surrounds the building; however, it is important to understand the local architecture and structures as well. In each section, the photographs selected are prominent in the local area and have subtracted specific colours or patterns from these.

Traditional Architecture

Nature

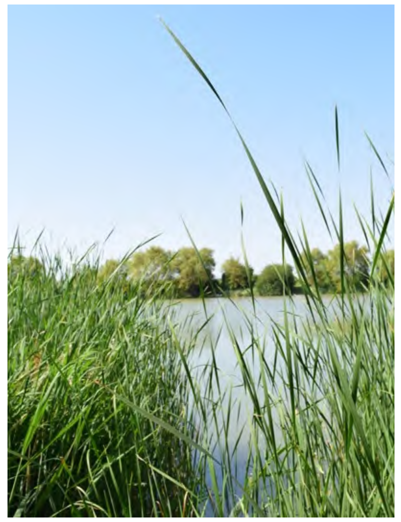
2.3 Local Character

Colour - Local Nature







The photographs selected here have been taken in two different seasons, Summer, and Winter. It shows how the natural colour tones change so we can establish which colours remain through all the seasons. Some photography includes brighter berries, however, have not included these as they do not represent the typical colour tones of the Landscape.

The colour majority here are greens and earthy brown tones. It's interesting to see the variety of green tones portrayed in these photographs from lush greens to cooler green/greys.

2.3 Local Character

Colour - Local Traditional Architecture

These photographs represent the local traditional architecture. This included historic churches, stonework and houses. From these photographs we can understand what the typical building material is and its colour tones. From this research we can see a lot of this architecture is warm brick or stone but in some instances there's cooler render or dark timber cladding. The colours selected also consider the context that the building is located including the sky above which brings in the blues, greens, and greys.

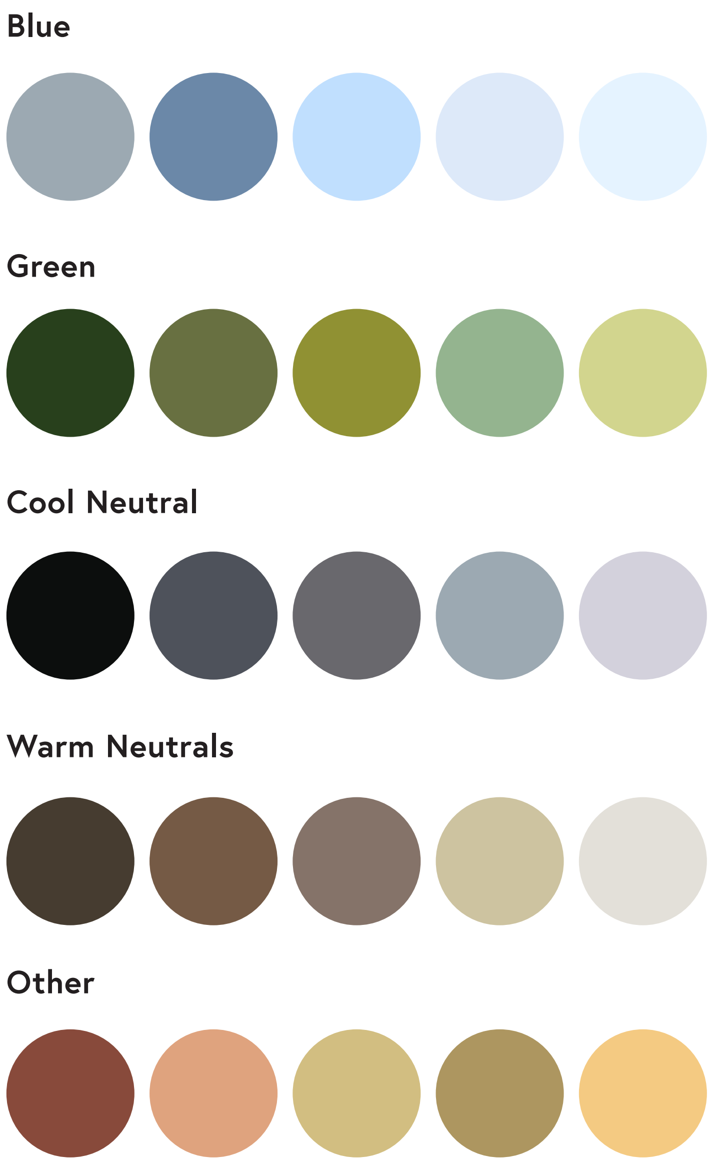
2.3 Local Character

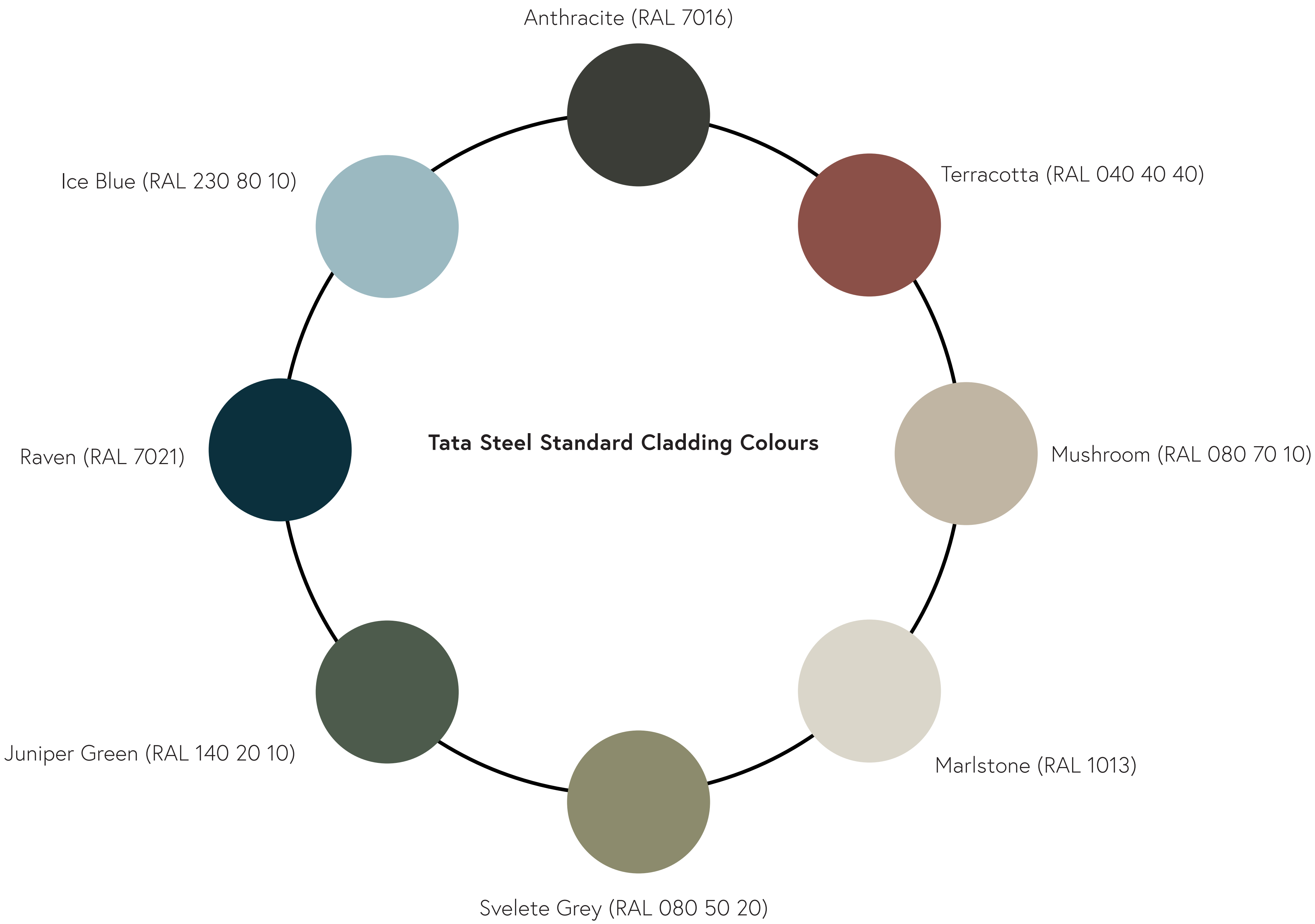
Colour - Local Agricultural, Industrial and Infrastructure

2.3 Local Character

Colour Summary

To summarise our colour research, we have taken the typical colours used in the surrounding areas and categorised them below. Industrial architecture typically uses powder coated cladding on the facades, so we have also shown on the right a few selected colours from Tata Steel's Standard range to show how these work with the colour's tones from the local environment. This is developed further and incorporated within patterns and textures to produce facade design options.

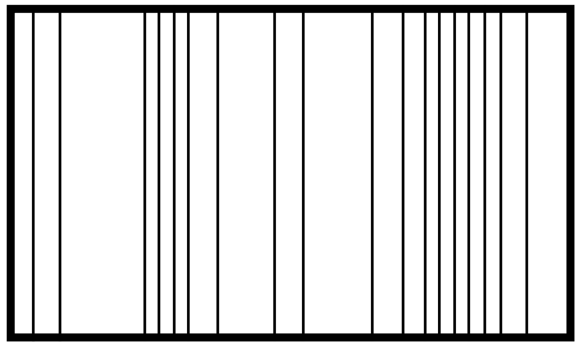
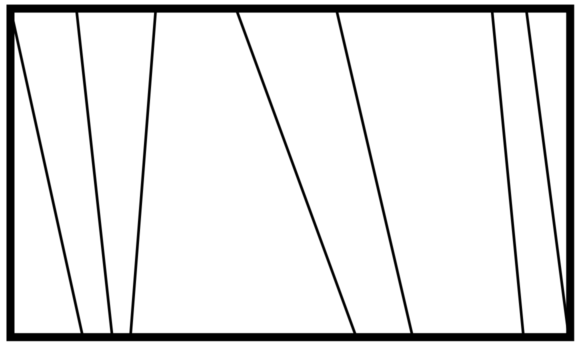
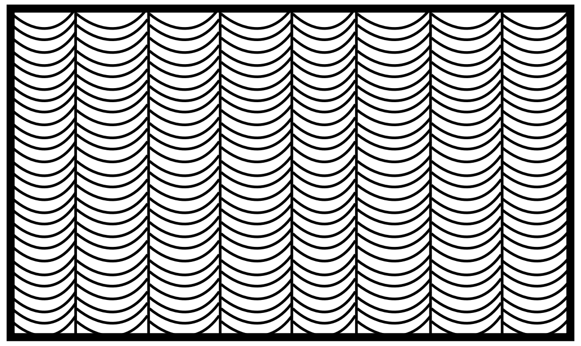
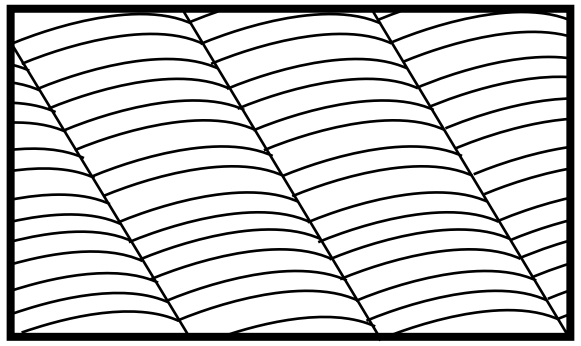
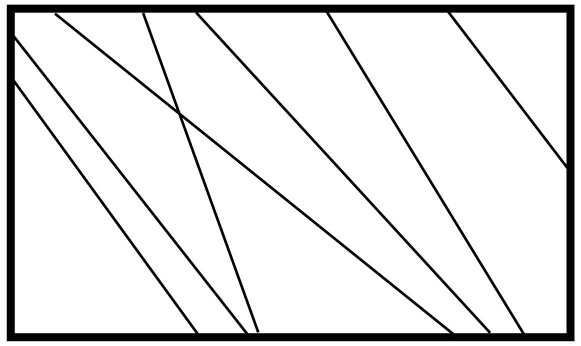




2.3 Local Character

Local Texture



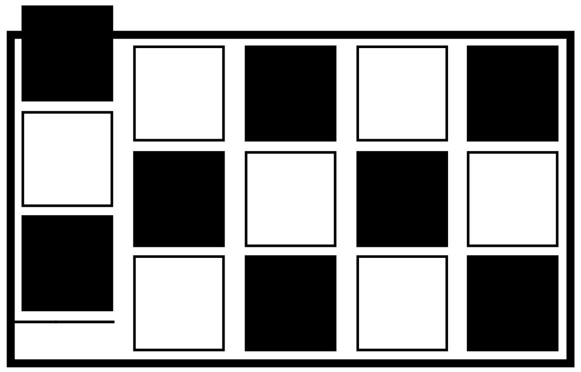
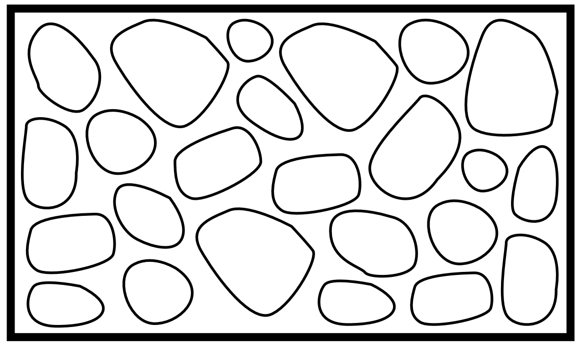
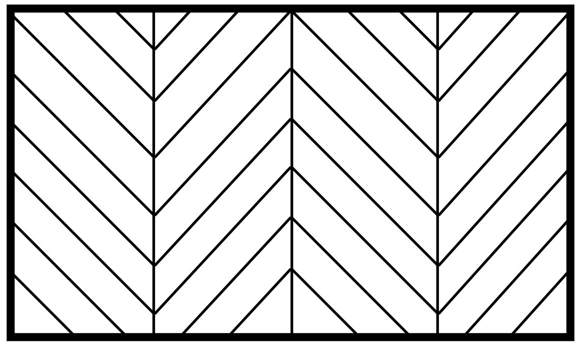
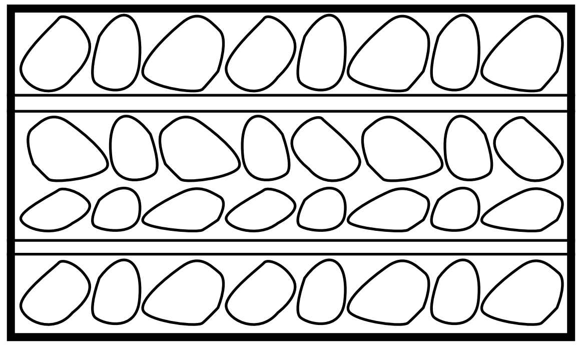







some of these patterns can be pulled out to form a 3D facade which would create more depth. What's interesting with these patterns is that they are very different in style, when simplified for example the pattern that has been created from feel very simple but can be seen as very abstract.

2.3 Local Character

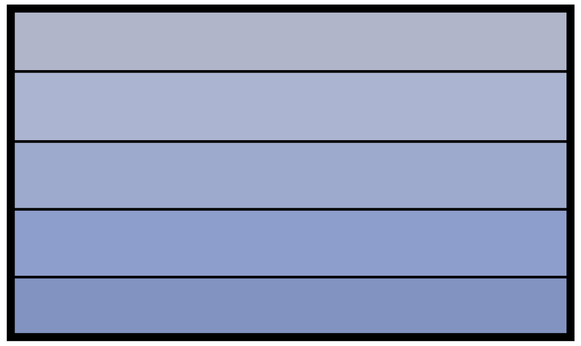
Texture: Local Traditional Architecture



2.3 Local Character

Texture - Local Agricultural, Industrial and Infrastructure

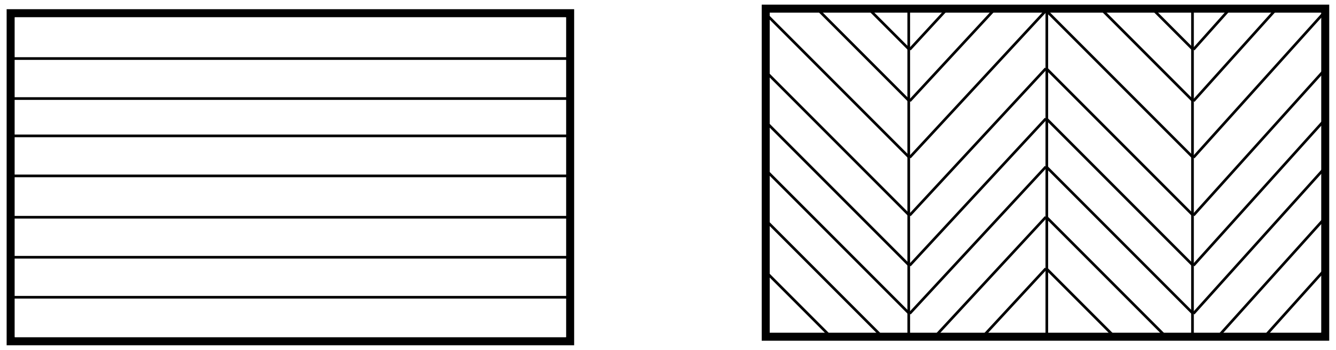


2.3 Local Character

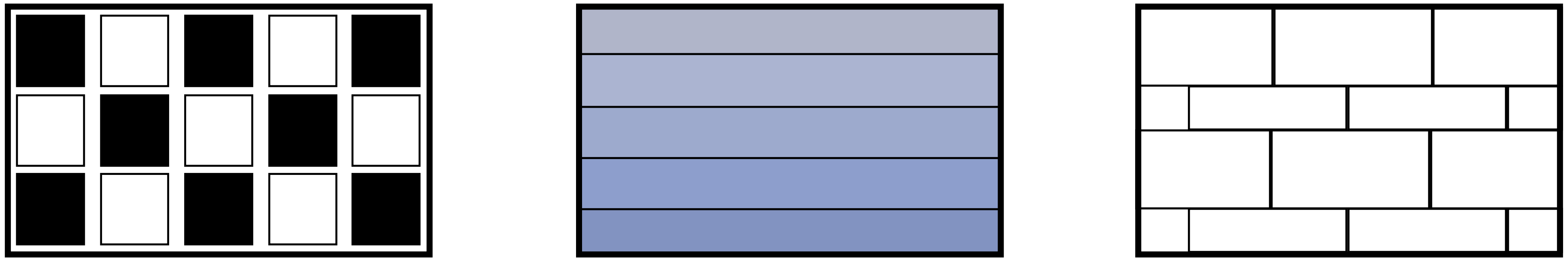
Local Texture Summary

To summarise the texture research, there are a range of patterns that have been inspired from photographs taken in the local areas. These have then been split into Linear, Grid and Patterned, as shown below. Each of these patterns could be used on the facade. The idea is to discover how the building could blend or be integrated well in with its surrounding area.

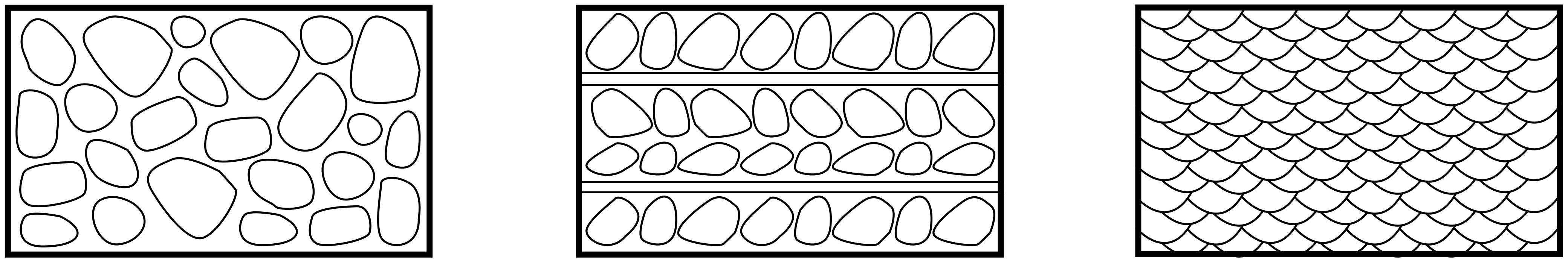
Linear



Grid



Pattern



GENERIC DESIGN PARAMETERS

3.0

3.0 Generic Design Parameters

3.1 Converter Station

Defining area Types

Due to the nature of the site and the key sitting considerations, the substation sits at an angle following the field pattern defined by the perimeter drainage channels.

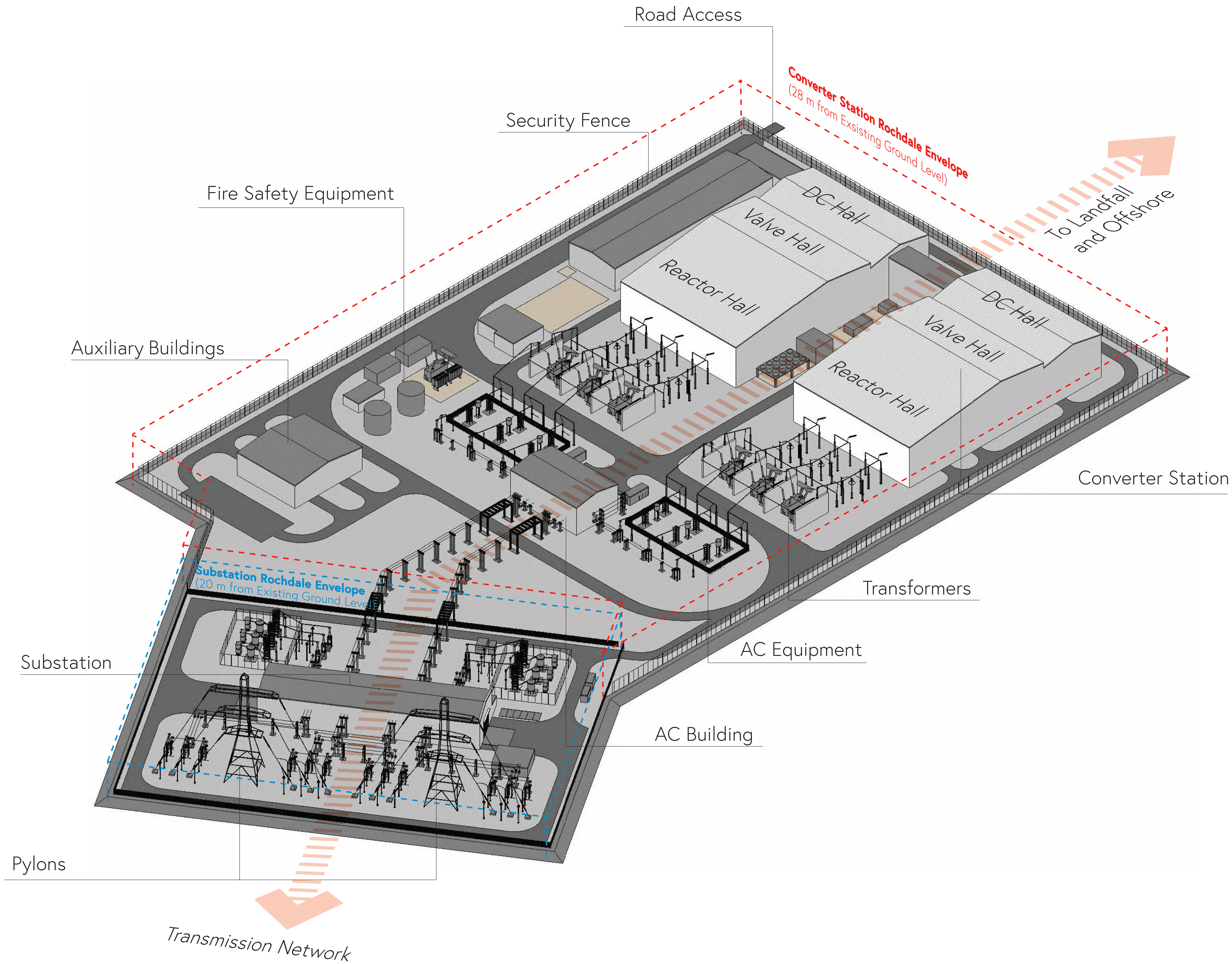
The converter station and substation comprise of multiple buildings including the two main converter halls, spare parts building, pre-insertion resistor (PIR) building, gas insulated switchgear (GIS) building, substation, service building and others that help to run and maintain the stations. The largest are the 2 main converter halls that can be up to 28 m high from existing ground level. However on the side of the substation, pylons taking the energy above ground stand at approximately 46 m and will be located just behind the substation building.

The following key facilities are described within this section of the document:

- Direct Current (DC) Halls;
- Transformers;
- Alternating Current (AC) Equipment and Buildings;
- Ancillary Buildings and Equipment;
- Vehicle Circulation; and
- Substation.

Depending on the selected equipment provider, and subject to detailed design, the disposition of these area types within the site and the exact length and width of the compound may vary. This requirement for design flexibility has been allowed for in the Limits of deviation defining the potential extents of the converter station.

The diagrams and text in this section have been updated to clarify the relationship between the maximum height and the existing ground level.



3.1 Converter Station

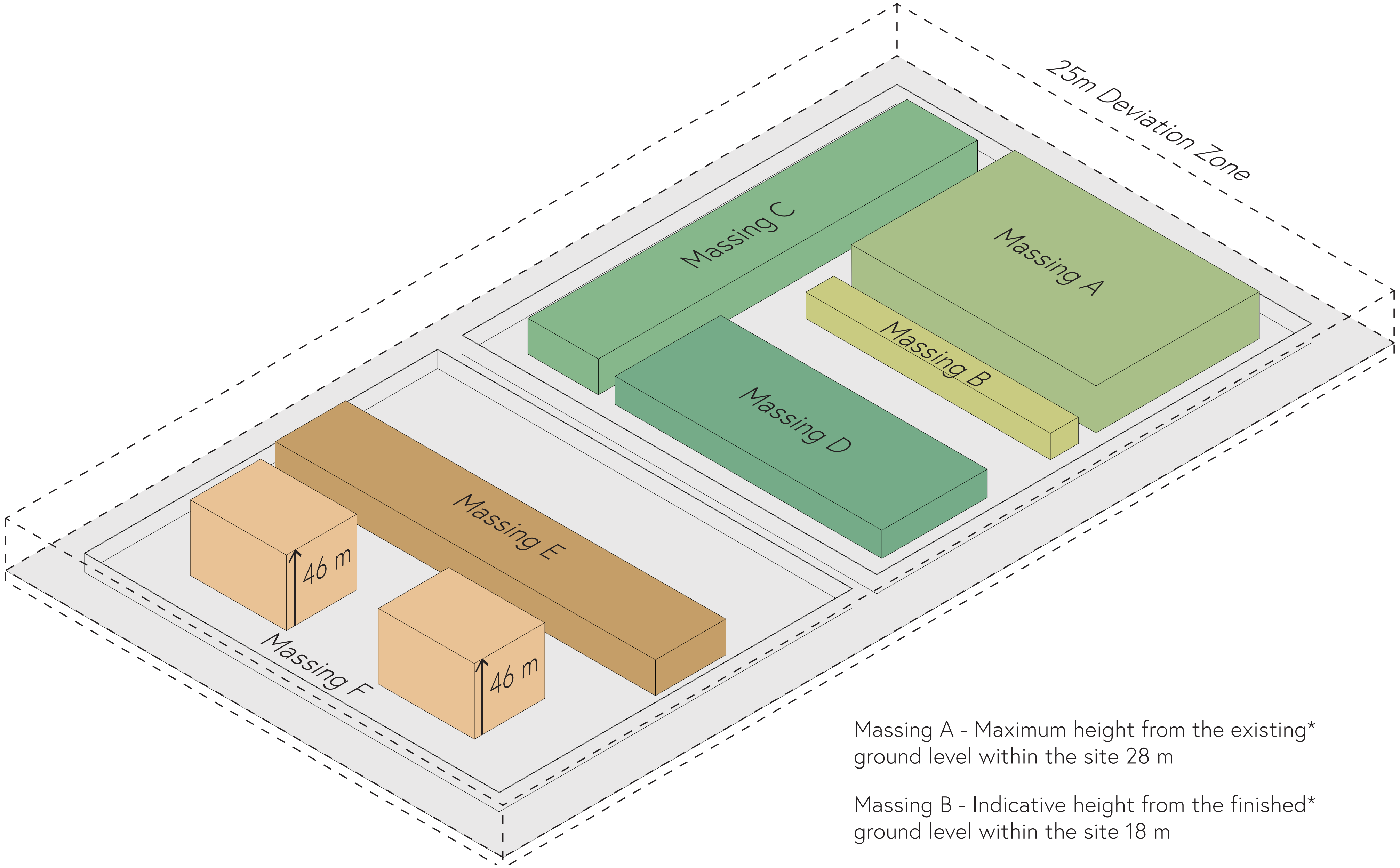
Heights

The overall scale and arrangement of the buildings are determined by the site's technical requirements. The challenge is to design the buildings in a way that minimises their visual impact on the local area.

Unless restricted by ground conditions, drainage, flood risk, or other technical constraints, the converter station and substation development plateau should be kept as low as possible*. This is to mitigate visual impact by keeping the project's overall height above ordnance datum (AOD) as low as possible. This principle needs to be addressed in conjunction with those relating to the Nature and Built Form sections of the Converter Station Design Principles in Table 3.1 and Substation Design Principles in Table 4.1 of **Application Document 7.12.2 Design Principles - Kent**.

Within the technical limits of the function and design of the buildings, it should be demonstrated that the overall height has been kept to a minimum, while also considering the articulation of the buildings.

* The current engineering assumption is that the ground may need to be built up by approximately 2 m and the illustrative renders are based on this scenario. The stated maximum heights are taken from the Table of Parameters in **Application Document 3.1 draft Development Control Order** and are measured from the existing ground level. Hence the Rochdale Envelope being assessed for the converter station incorporates an allowance for land raising.



Massing A - Maximum height from the existing* ground level within the site 28 m

Massing B - Indicative height from the finished* ground level within the site 18 m

Massing C - Indicative height from the finished* ground level within the site 15 m

Massing D - Indicative height from the finished* ground level within the site 14 m

Massing E - Maximum height from the existing* ground level within the site 20 m

25 m lateral Limits of Deviation (LoD) Zone

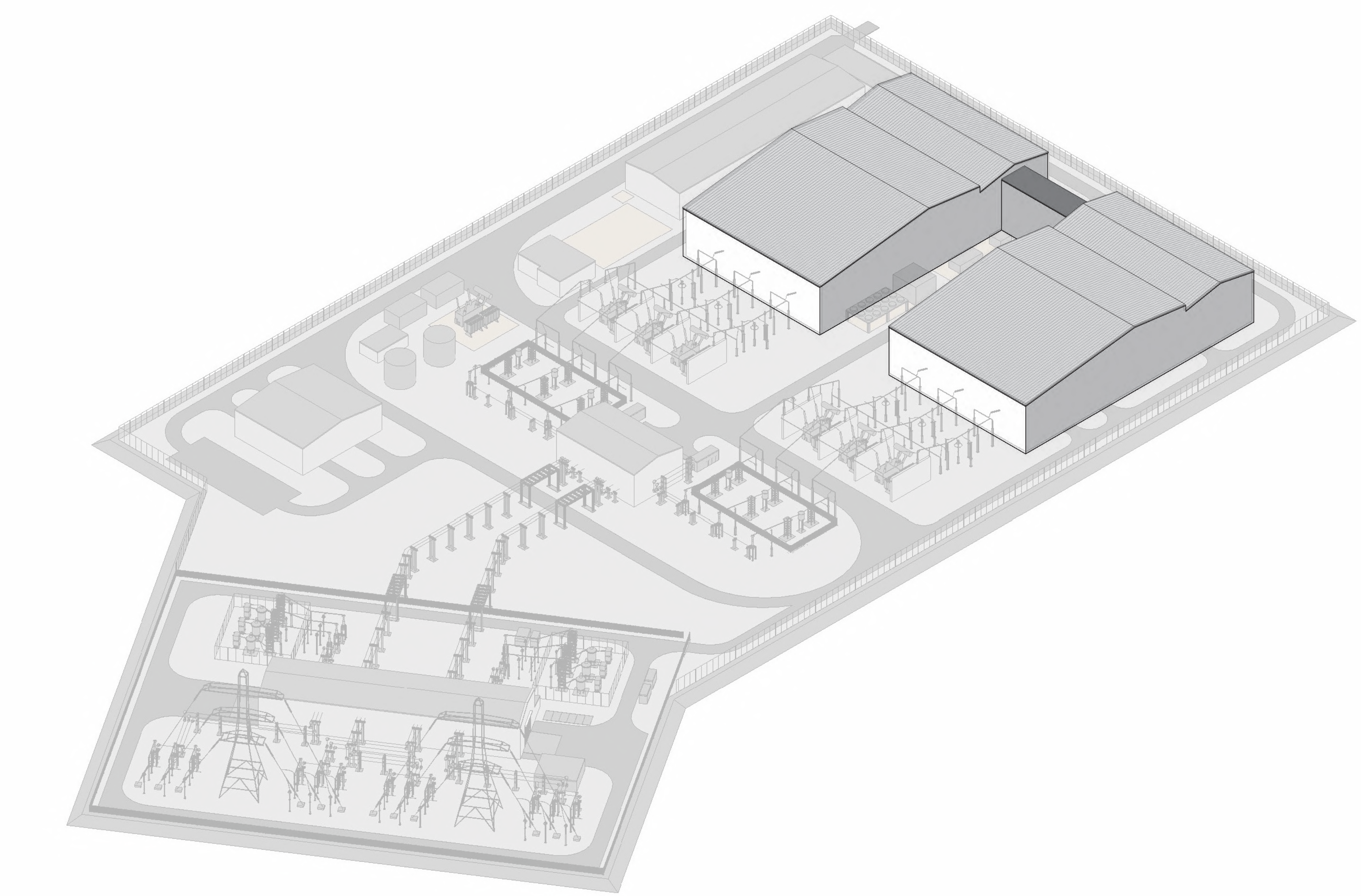
46 m Indicative height of towers (pylons)

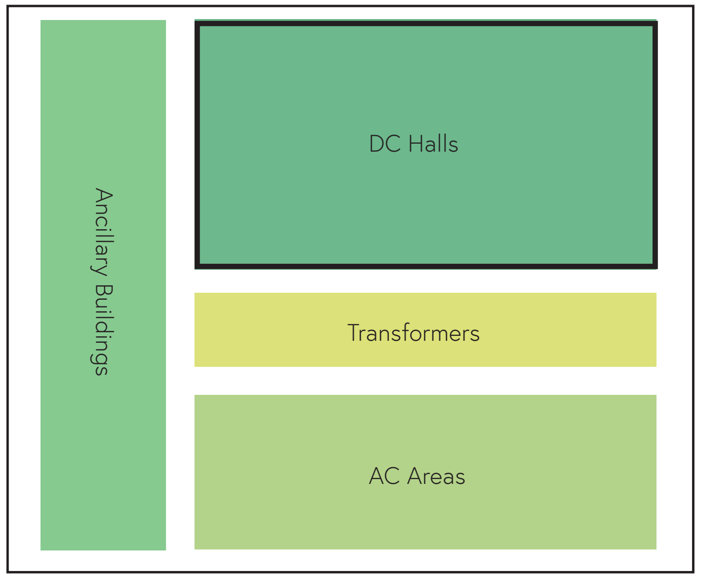
3.1 Converter Station

DC Halls

The DC equipment requires a controlled environment hence the need to be located inside buildings. There are two sets of identical halls, one for each pole. A high voltage direct current (HVDC) cable enters into each DC Hall, adjacent to which is a Valve Hall, and adjacent to that is a Reactor Hall from which three-phase high voltage alternating current (HVAC) goes out/in (as the process is reversible).

These are the largest footprint and tallest buildings within the converter station. They tend to be symmetrical as each pole requires the same sequence of adjoined halls. They tend to be located at one end of the site and have outward facing elevations and inward facing elevations between the two sets of halls. These buildings require areas of outdoor mechanical plant to maintain the internal environment. The design should aim to locate this equipment between the two sets of halls, using the buildings to screen it from view.





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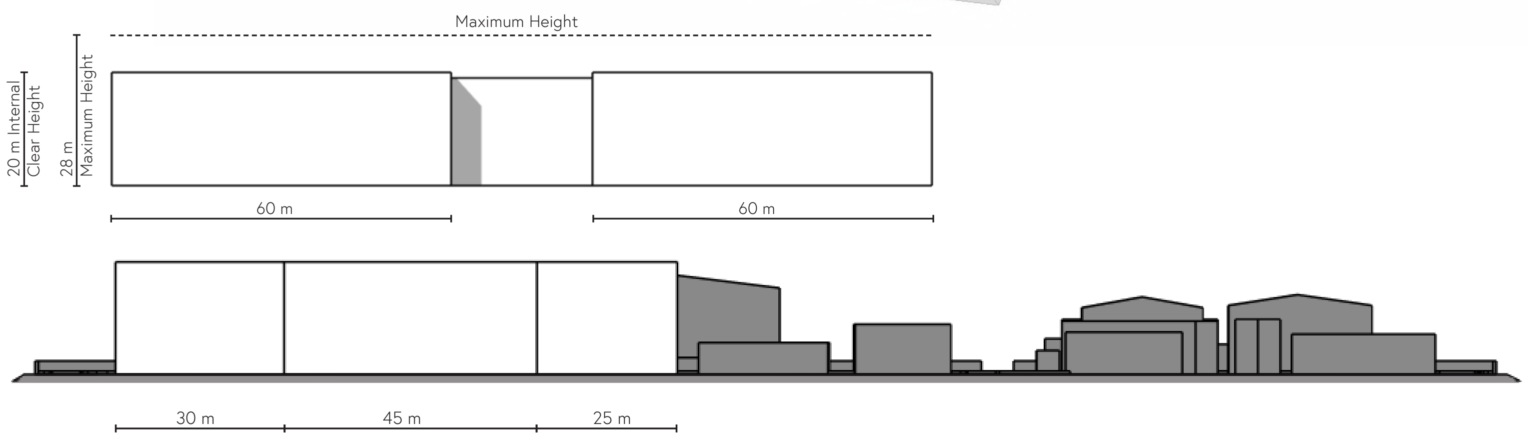


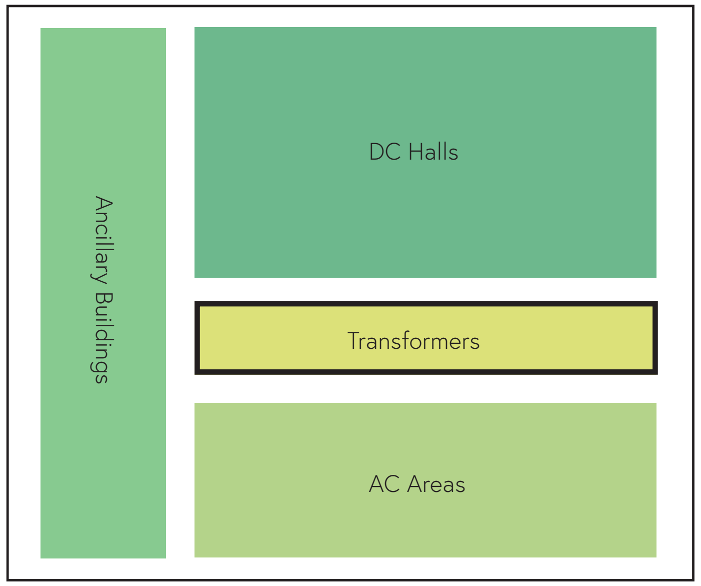
Enclosed DC equipment with outdoor mechanical plant

3.1 Converter Station

Transformers

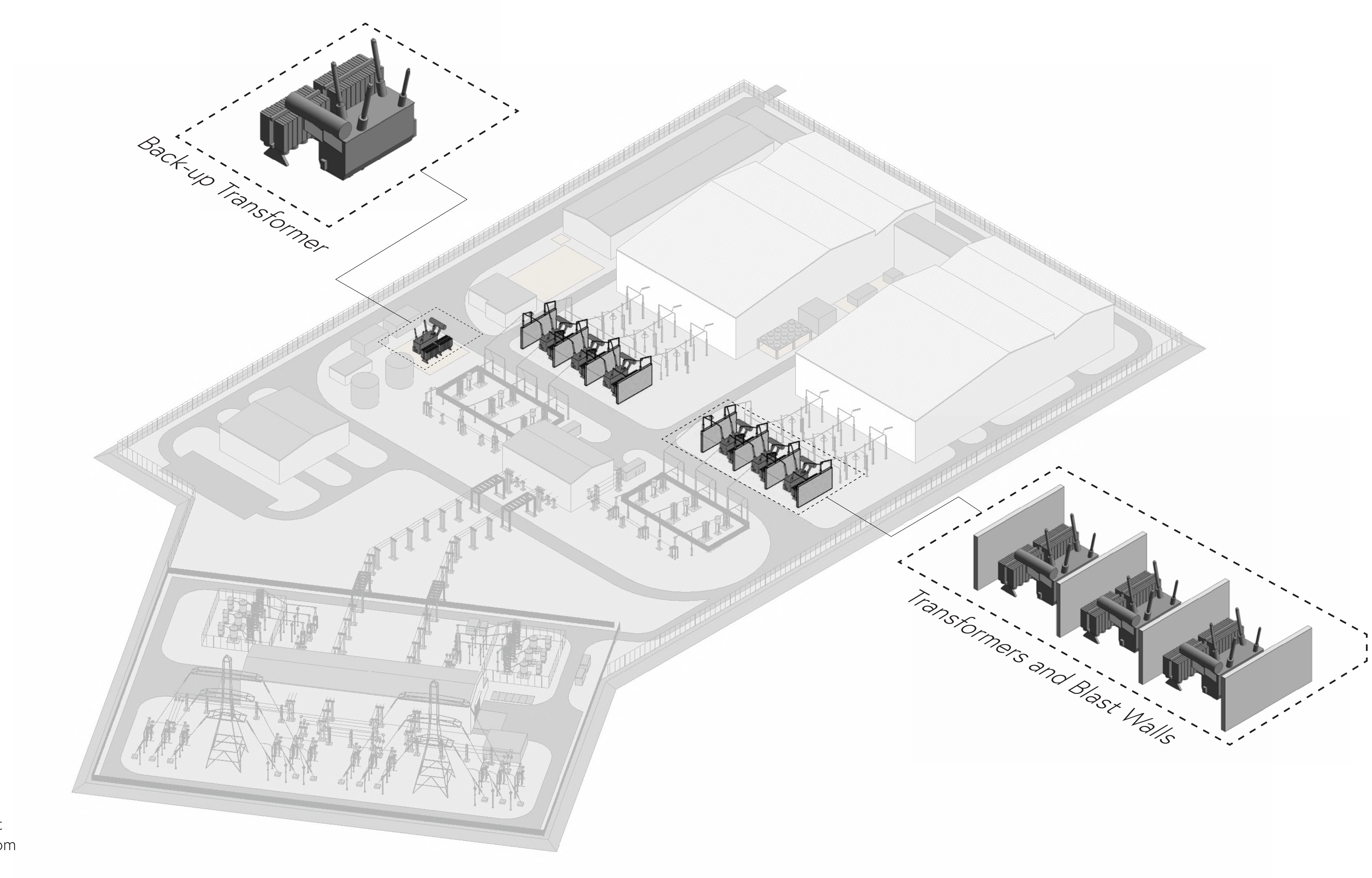
The HVAC current from the Reactor Hall is stepped down to the voltage required to feed into the substation. There is a transformer for each AC cable, two sets of three-phase making six, plus a spare. The transformers have particular needs in terms of blast protection and noise that sets them apart from the rest of the AC equipment.

These are positioned between the DC Halls and the AC Areas. The current design convention is to position them away from the DC Halls to reduce the risk of damage in the event one fails. They are arranged in a set of three for each pole, with six in total plus, a spare that is not connected. Protective concrete blast walls are needed between each of the transformers, and these define the effective building height in this area. Subject to noise mitigation requirements there may be a need to enclose the six connected transformers in an acoustic attenuation enclosure. In this case, the detailed design should consider how the external envelop fits in with the scheme of the rest of the buildings.



(Not to scale)

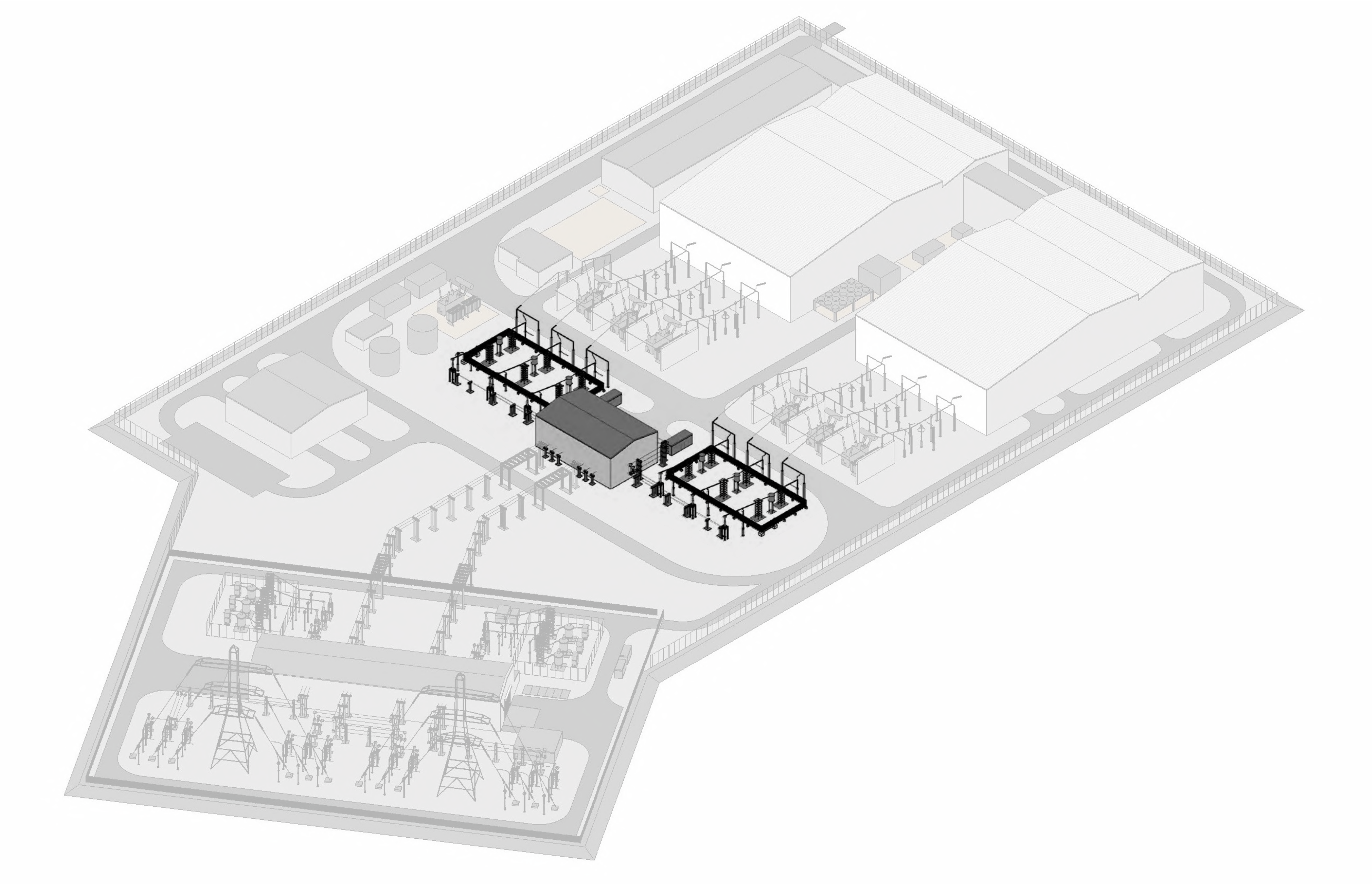
Equipment left open, away from the DC Halls.



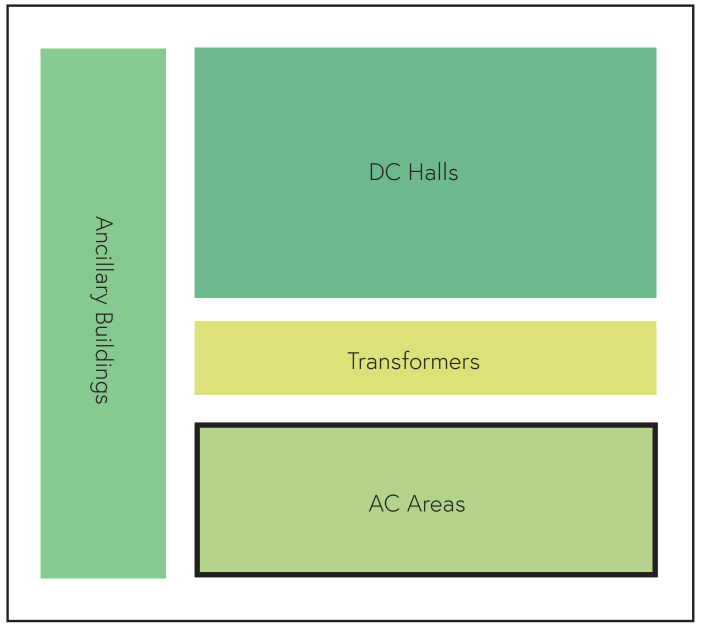
3.1 Converter Station

AC Equipment and Buildings

Most of the AC equipment can be located outside with a limited number of buildings. This equipment is mostly for cleaning up the current from the transformers and making sure it is ready to be put back into the wider grid. As most of the equipment is external there is limited architectural scope for this area.



Equipment left partially open, AC buildings is the only area enclosed.

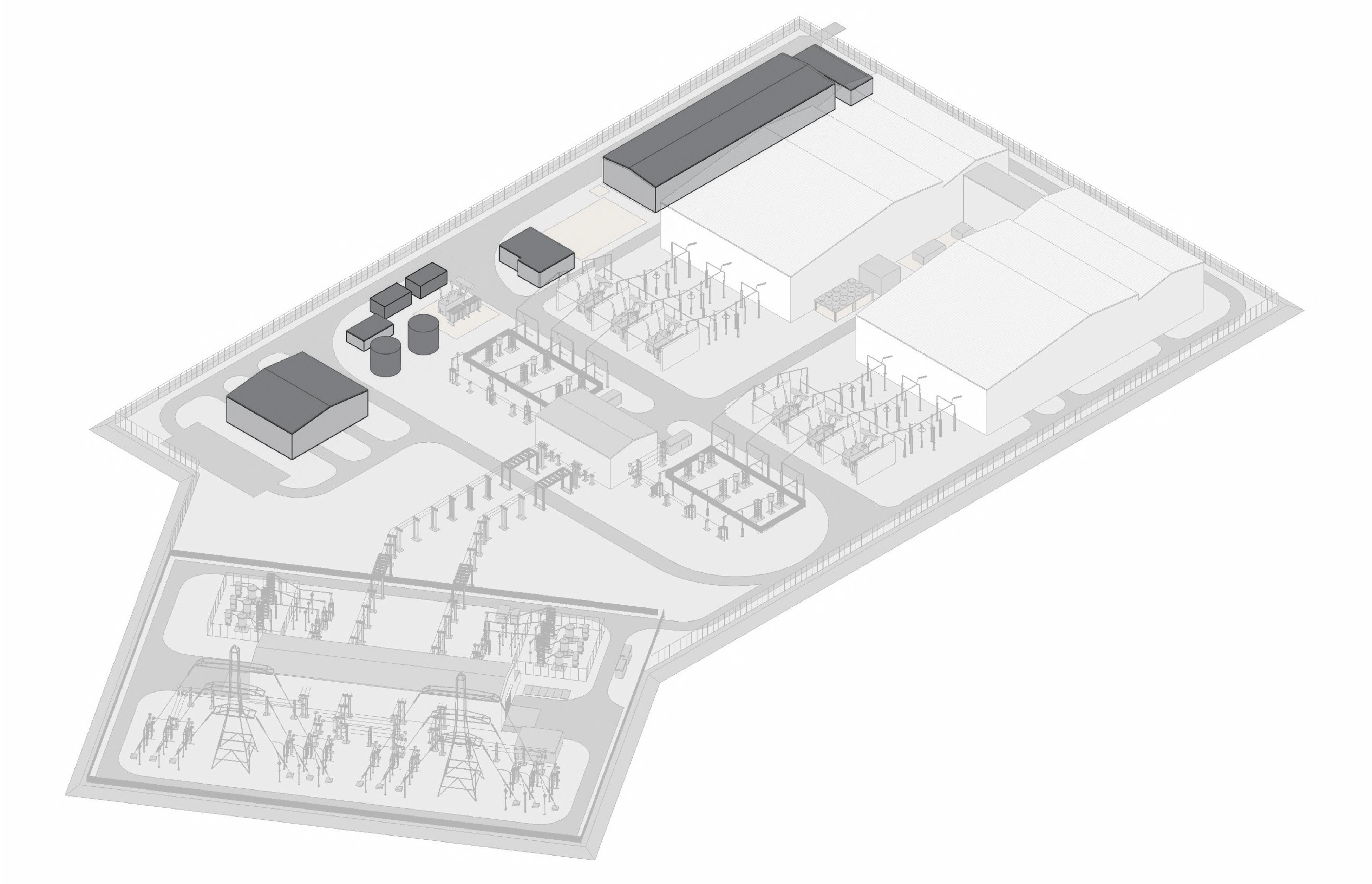


(Not to scale)

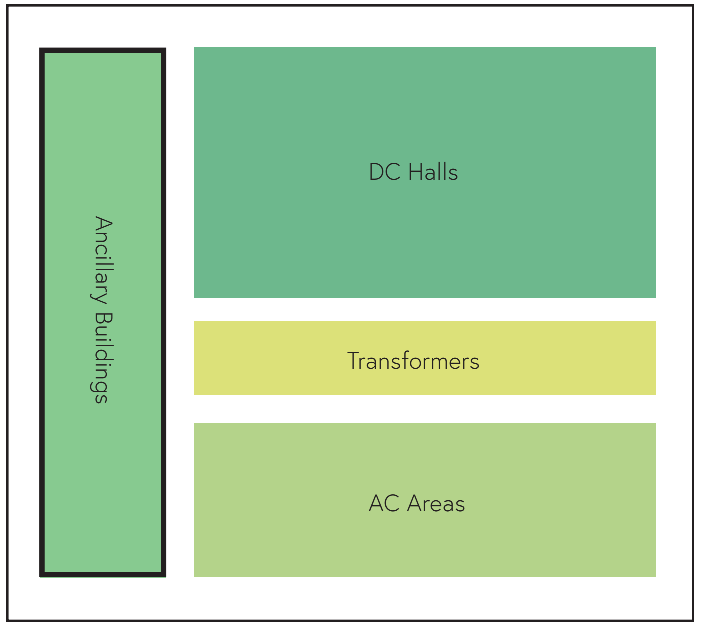
3.1 Converter Station

Ancillary Buildings and Equipment

There is a functional sequence to the other three area types that determines how they need to be arranged. However, within reason there is more flexibility of where the ancillary buildings such as the Spare Parts, Control, Security Office, etc can go to suit the design intent for the site. There is also fire safety equipment such as water tanks and emergency generators which can be located to suit.



Enclosed buildings, with fire handling units scattered across site.



(Not to scale)

3.1 Converter Station

Vehicular Circulation

Within the converter stations fence line there will be a requirement for a perimeter road providing safe access for maintenance, equipment replacement and firefighting. This will set the buildings back from the perimeter. Within the site road access there is a requirement for a loop with larger radii. This is to allow the abnormal long load vehicles, primarily for replacing transformers, to circuit.

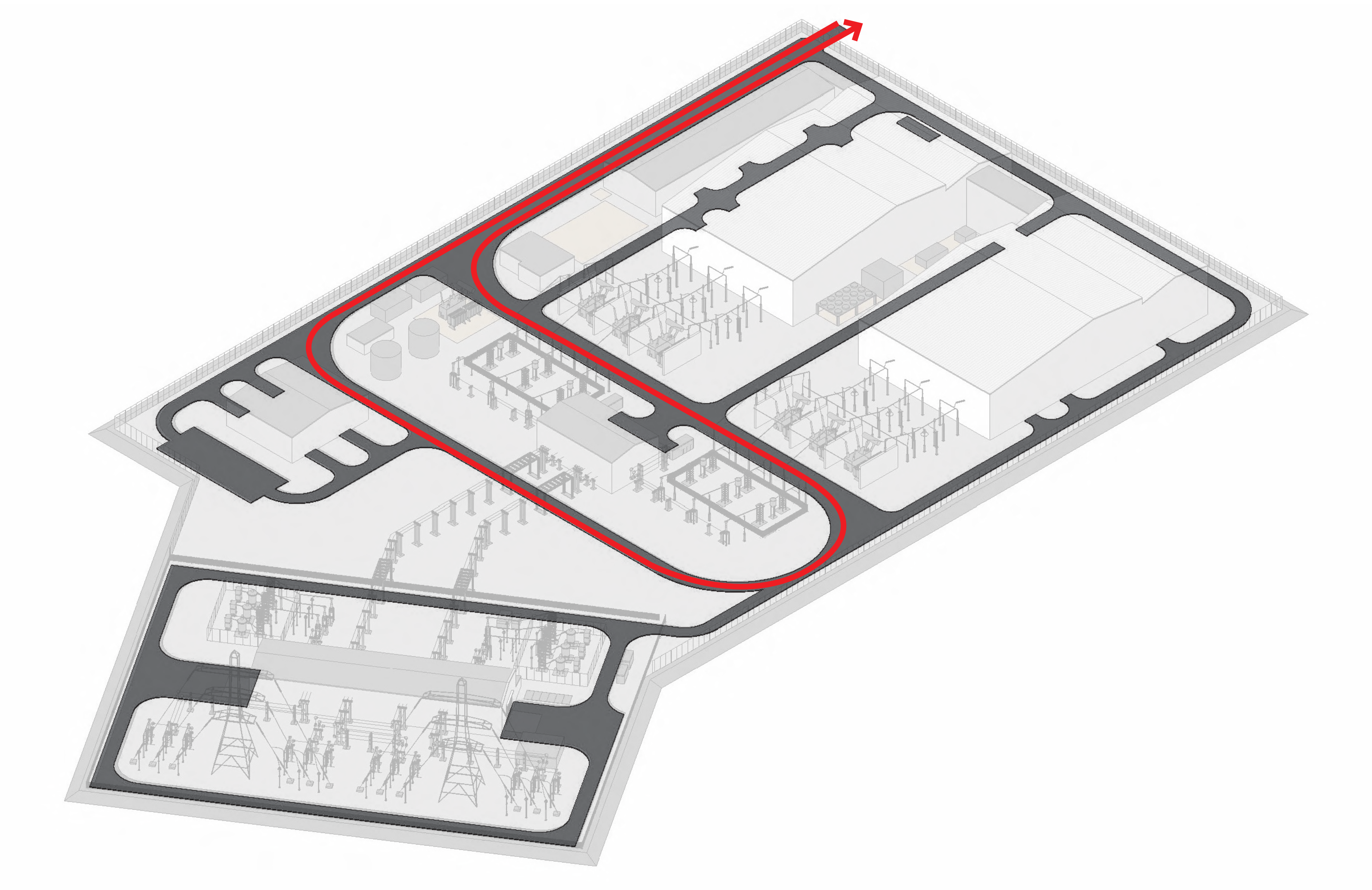


Image of a transformer being delivered to site on the abnormal indivisible load (AIL) vehicle.

nationalgrid.com/new-electricity-transformer-worcestershire-substation

3.2 Substation

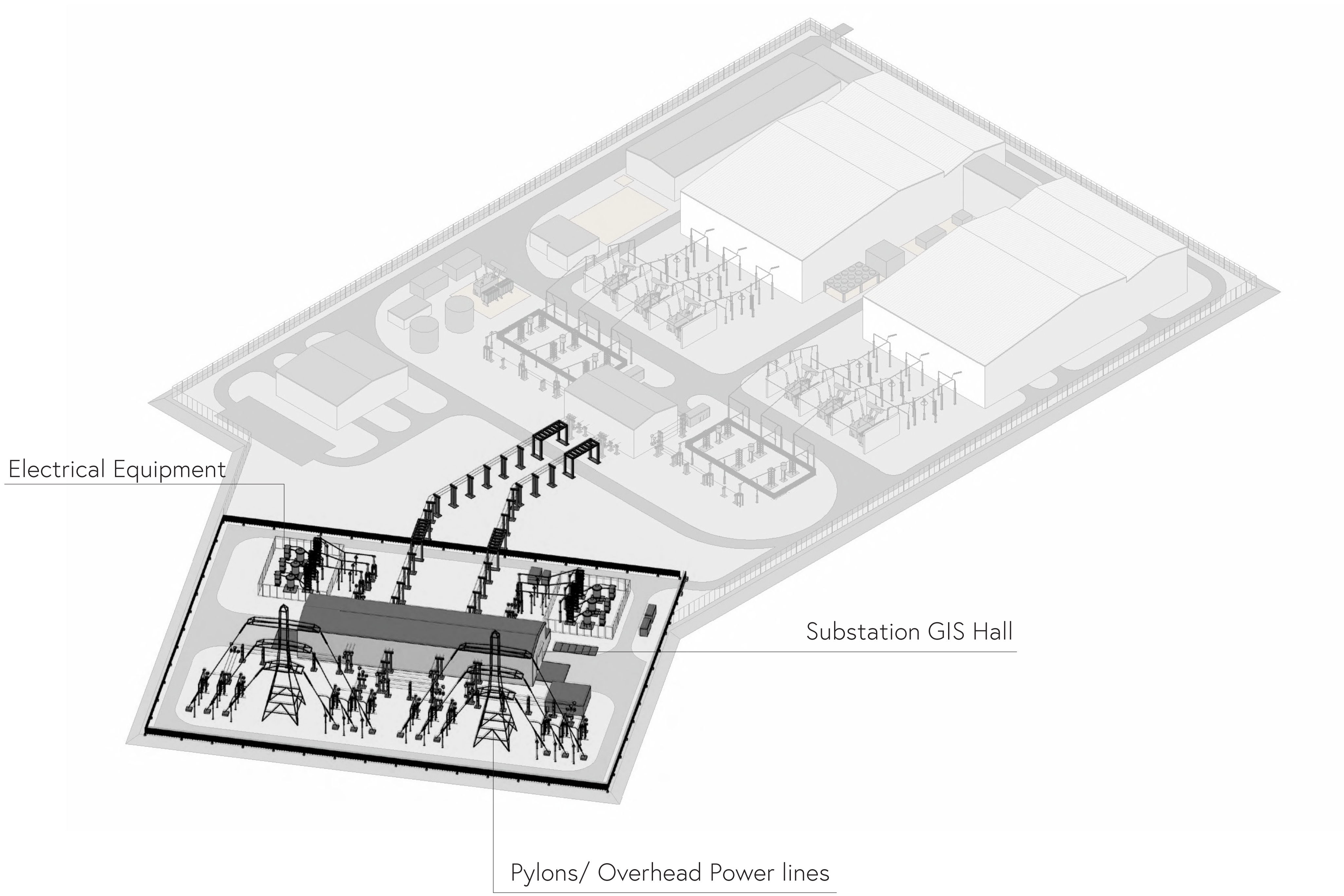
Buildings and Equipment

The substation is required to connect the power from the converter station, that has been inverted back to HVAC at 400kV, to the rest of the transmission network. At Minster the distance between the converter station and the power lines to which the HVAC connection is to be made is relatively short. The river is also a constraint that has resulted in an overhead line (OHL) connection with two terminal towers (pylons) within the substation which are circa 46 m tall.

The majority of the substation is filled with outdoor equipment such as BUS bar and Harmonic Filters that ranges in height from circa 9 m to 12m and this has very limited opportunity for design.

The substation also contains a building that includes a Gas Insulated Switchgear (GIS)Hall and a 400kV Annex Building. This building is likely to have a footprint of approximately 83 m in length, 30 m in width and circa 15 m tall.

Access to the substation is intended to be from the internal roadway within the converter station compound, i.e. the access would be shared.



DESIGN EVOLUTION

4.0

4.0 Design Evolution

4.1 Statutory Consultation

Engagement

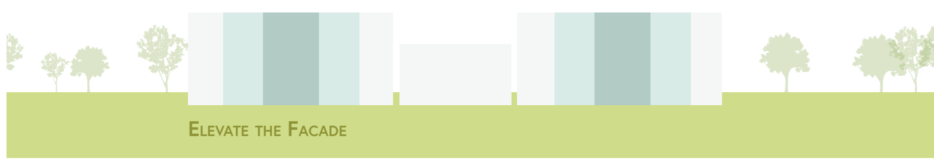
Sessions have been held with the Local Planning Authorities (LPAs) to discuss the structure and content of the design principles, design approaches and masterplan. Where feedback from the LPAs has relevance to the wider approach, and not just the local geographical area, this has been applied to the design documents for both the Suffolk and Kent Onshore Schemes.

Feedback from the non-statutory and statutory consultation exercises is summarised in **Application Document 7.3 Design Development Report**, with detailed feedback provided in **Application Document 5.1 Consultation Report**. Where this feedback relates to converter station design, it has been considered in the development of the design principles and the design approach.

Six Architectural Approach options were prepared for use in the Statutory Consultation to help gather LPA and public opinion on what would be considered most appropriate for the site and locality. This included simple sectional/elevational diagrams that were prepared for the event banners, and a supplementary document available online, Converter station design – background to potential architectural approaches, which includes further information about the design approaches and illustrative Computer-Generated Imagery (CGIs) of how they might look.

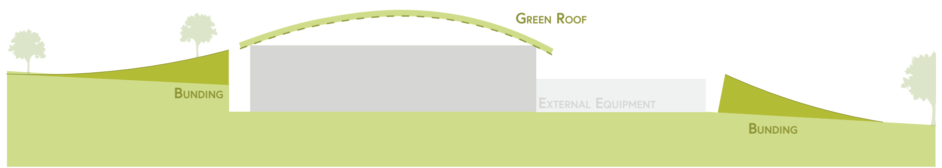
There have also been thematic meetings with LPAs that cover the converter station design principles and the colocation masterplan for Saxmundham. It is suggested that these are continued through the development of detailed designs ahead of the submission of statements and drawings for demonstration of compliance with the design principles.

Enhanced Elevations

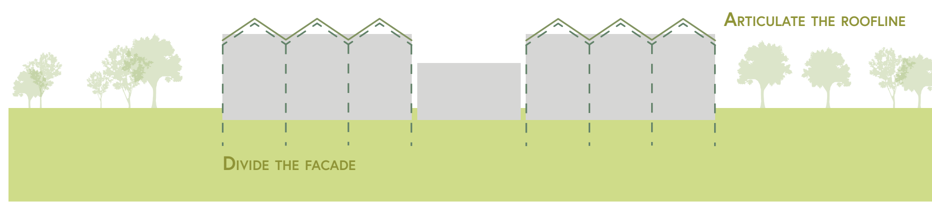


Colour

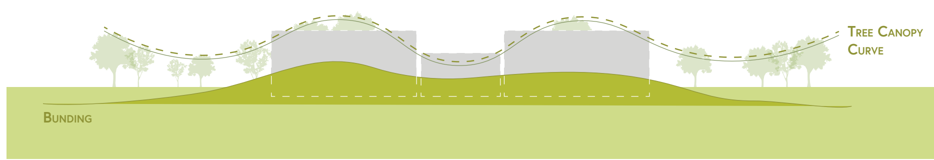
Green Roof



Agricultural Barns



Colour & Curve



Kinetic

4.1 Statutory Consultation

Six Design Approaches

Vertical Banding

This approach uses vertical bands of differing shades and colours to visually divide the building form into smaller parts reducing the impact of the mass. The colour palette can be drawn from context to help blend into the background. This would take green/brown hues from the marsh and farmland in different seasons, and pale blues and greys from the wide skies of the open countryside.

Precedent

This approach has been used on a previous converter station project in Hunterston, western Scotland (image below). The cladding concept relates to the existing nuclear power station which is closer than the NEMO Link converter station to the Kent Onshore Scheme. The context also means the building is mostly seen against the sky and not the landscape hence the paler grey colour palette.

Design Development

The visual (right) shows this cladding treatment applied to a form derived from the simplest structural solution with ridges, gables and eaves lines. It could equally be applied to other building forms with different roof profiles. The cladding in the image is flat however profiles could be applied to add texture.

A plinth section could be added to help connect the building to the ground. This could have darker colours allowing the upper section to be paler to relate more to the sky. As such features of the different approaches could be combined for best effect.

copyright Virtual Hunterston

6 different architectural design approaches were presented during the statutory consultation in October 2023 for feedback.

It included the images below. The location of the CGI is not related to a specific key view.

Strengths

- Clean simple and established detailing and does not add to the building mass;
- Reduces the apparent length of facade; and
- Orientation works with viewing from different heights with varying relationship to the horizon.

Weaknesses

- Doesn't offer a means of transition between a connection with the ground and the sky unless combined with other techniques; and
- When viewed obliquely from the north, sheen on the flat cladding can override the colours.

4.1 Statutory Consultation

6 different architectural design approaches were presented during the statutory consultation in October 2023 for feedback.

It included the images below. The location of the CGI is not related to a specific key view.

Horizontal Banding

This approach uses horizontal bands of colour in a gradient that transitions between the darker green/brown colours of the ground and tree line, to the paler greys and blues of the wide open skies of the marsh. It is a common strategy for tall buildings in the landscape that break the horizon line.

Precedent

The recently constructed Viking Link converter station at Bicker Fen in Lincolnshire uses three bands of green, fading from dark at the base to light at the top. This is effective in the context as the site is so remote it is generally seen from very long distances and blends into the background of flat fenland and big skies. The green colour also works well with the style of agricultural buildings found in the area.

Design Development

The visual (right) shows this cladding treatment applied to a simplified form with parapets, which on reflection is not the most appropriate solution. It could equally be applied to other massing solutions which would probably do more to add articulation and reduce the apparent building form. Consideration needs to be given to how other features could stand out against flat areas of cladding, and whether a more contextual approach is required given the more complex setting.

Copyright Siemens Bickerfen

Strengths

- Can effectively transition between the colours of the ground, middle distance, and sky; and
- Common infrastructure cladding strategy (NEMO Link, Viking Link, consented Hornsea 4 substation).

Weaknesses

- The colour gradient works best where there is a consistent relationship with the horizon which is not the case in this location;
- Does not divide up the length of the massing; and
- Can look flat in the landscape.

4.1 Statutory Consultation

6 different architectural design approaches were presented during the statutory consultation in October 2023 for feedback.

It included the images below. The location of the CGI is not related to a specific key view.

Green Roof

This approach aims to fold the roof down over the walls to reduce the height and impact of the elevations. The intention would be to combine this with a green roof and bunding of the landscape to give the impression of an artificial hill. There would be less reliance on selecting cladding colours as the planting would do the job of blending into the landscape.

Precedent

Green roofs have been applied to Energy from Waste facilities (notably CopenHill) and a substation near Ghent, but to do so on a converter station is unprecedented at this point in time. Therefore further technical assessment is required to determine suitability and flush out risks.

As the ground needs to be built up for the engineering solution the potential for bunding without importing large quantities of material is very limited. As such it will be very hard to achieve the effect suggested in the CGI, with the roof plane being more detached from the ground plane.

Design Development

In this location there is an opportunity for cut and fill however not as extreme as the CGI to the right. (This is a visual representation of the impact of green roofs on the landscape). The roofs of the DC Halls are likely too tall to offer visual amenity unless the roof is sloped into view.

Green roofs can have other benefits, such as habitat creation, even if not visible. Blue roofs (which don't have to be green) need to be flat to retain water for attenuation so would not work for the hill form.

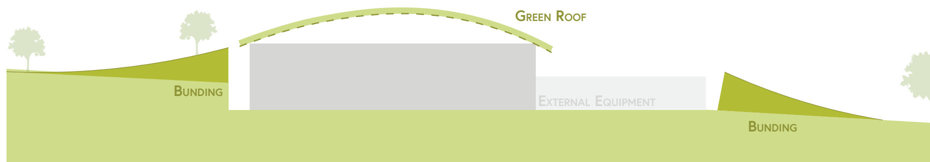
Other technical concerns include irrigation to prevent die-back in dry weather and creating a fire spread risk. Typically green roofs need to be accessed (potentially mown) twice a year.

Strengths

- Green roofs could be used to provide habitats;
- Green/blue roofs could be used to provide additional attenuation of surface water run-off; and
- Green roofs could potentially protect the roof covering and reduce solar gains in the building.

Weaknesses

- Untested as a solution for a converter station and requires detailed design to demonstrate viability;
- Concern over regular access for maintenance; and
- Would add to the roof loading on long spans and add thickness (height) to the roof.



4.1 Statutory Consultation

6 different architectural design approaches were presented during the statutory consultation in October 2023 for feedback.

It included the images below. The location of the CGI is not related to a specific key view.

Vernacular / Gables

To break up the form of the building by articulating a collection of gable forms giving the impression of a cluster of barns.

Precedent

The area has examples of farm courtyards with large clusters of barns and outbuildings. The roofs have an organic composition that is hard to replicate in a single facility without contrivance, especially when the clear height and internal layouts need to retain flexibility.

Design Development

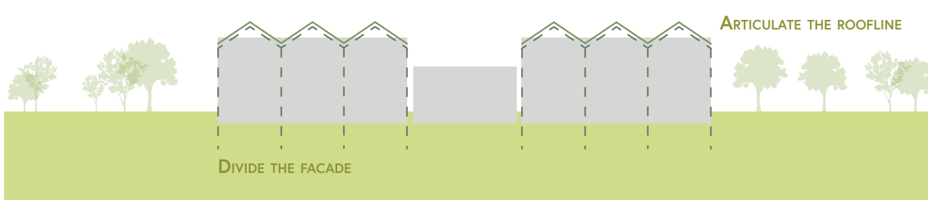
The visual shows the apparent height of the buildings reduced by placing an earth bund in front. This is unlikely to be viable without importing a lot of material to site (adding traffic and CO_2 impacts). Without this it is hard to relate the mass to agricultural buildings which are only half as tall.

However the use of sinusoidal and half-round cladding profiles could be applied to the plinth level of the buildings to create a base more connected to the ground and a background to screen planting.

Given the height of the DC Halls, having the gables formed in dark material would create a more impactful silhouette on the skyline. This would be counter to the preference for forming background development that blends into the landscape.

Strengths

- Breaks up the form into smaller parts that are easier to relate to vernacular buildings such as barns.



Weaknesses

- Clear internal height requirements limit the range of the roof pitch without ridge heights exceeding the maximum;
- Valley gutters are unsuitable for this type of building limiting the scope of the form;
- Natural materials are not suitable for a building of this height, would need to be metal; and
- Very dark cladding runs the risk of fading over time and attracting heat gains requiring more cooling.

4.1 Statutory Consultation

6 different architectural design approaches were presented during the statutory consultation in October 2023 for feedback.

It included the images below. The location of the CGI is not related to a specific key view.

Curved Profile

This approach uses curvature of the roof and the top edge of the elevations to soften the form of the building and help the profile blend in with the context.

The elevations also feature a pattern and texture which could be adapted to blend in and break up the flat surfaces.

Precedent

Curved forms are more associated with Energy from Waste facilities, such as the Ardley ERF in Oxfordshire (picture below). This is because the taller elements can be gathered towards the centre of the mass. This is more difficult with the DC Halls in a converter station. This type of expression tends to making landmarks which draw attention, something we are trying to avoid in this instance.

Design Development

The visual (right) shows the curving forms alongside rolling tops of earth bunds. It is unlikely that bunds of this scale will be viable in this location. The cladding shows a means by which the vertical and horizontal banding can combined to create a more textural surface that could transition between the ground and sky as well as creating variation along the length of the building. This would reduce the visual impact of items like RWPs and louvres.

Depending on how this cladding surface was constructed, the top edge could be feathered as shown to make a lighter connection to the sky and hide the roof plane.

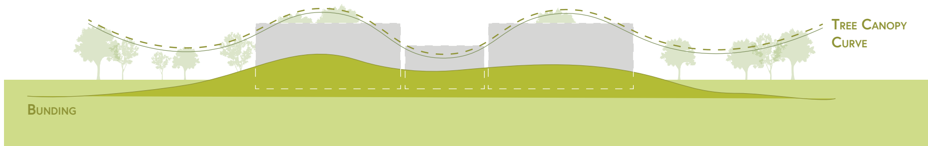
Copyright University of Oxford

Strengths

- Opportunity for a softer, more natural edge where the building meets the sky;
- Cladding design provides a more organic pattern breaking up the form; and
- Could be combined with a green roof

Weaknesses

- Clear internal height requirements limit the range of roof curvature without exceeding the maximum height; and
- Barrel vaults tend to create large gable elevations, whereas 3D curves complicate the large space structure.



4.1 Statutory Consultation

6 different architectural design approaches were presented during the statutory consultation in October 2023 for feedback.

It included the images below. The location of the CGI is not related to a specific key view.

Overcladding

This approach uses a separation of the underlying technical box from the decorative cladding to allow more freedom in how the building is articulated without compromising performance. Gaps or perforations in the top layer could add depth and variation reducing the flatness of the form.

Precedent

On the coast east of Saxmundham there are plans for a nuclear power plant on the Sizewell site. Early plans for Sizewell C project includes multiple ways of overcladding. This concept comprises prefabricated panels that expresses geometric shapes that are pressed into it and contains various colours to create a complex facade. The design is a sensitive response to the surrounding landscape by creating variations in relief, tone, colour and texture.

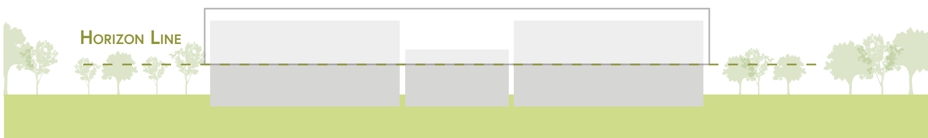
Design Development

The visual (right) shows the overcladding wrapping around to simplify the building form. This may work better with the pattern but risks adding bulk to the massing.

The pattern shown features loosely fitted metallic tiles that can flutter in the wind. This kinetic pattern would add natural moving shadows and highlights on the surface. The intention being that the movement replicate clouds in the sky and the rustling of leaves on trees in the wind. The reflectiveness of the surface would need to be considered in respect of glare with a less polished coating being in more keeping with the context.

Strengths

- More choice of cladding colours, profiles and textures compared to standard cladding systems;
- Can create depth in the envelope with shading reducing the flatness of standard cladding; and
- Can be used to hide gutters, pipes, and louvres.



Weaknesses

- More complex cladding system, need to consider a hanging system that doesn't compromise the weather/air tightness of the envelope; and
- Introduction of kinetic or reflective elements would require bespoke analysis and testing for glare, degradation, noise based on previous experience.

4.2 Design Review Panel Presentation

Design Review Panels

The use of an independent design review panel (DRP) is recommended on several levels:

- It is encouraged in NPS EN-1;
- It is suggested in the NIC Design Group's handbook on project level design principles as a means of providing 'evidence how design principles have directly informed decision making';
- It is recommended by the ICE as part of the design governance structure; and
- And is supported by the host LPAs.

The usual process is for the LPA to refer applicants for significant projects, in terms of scale and impact, to arrange a voluntary DRP. East Suffolk Council (ESC) did so in the period after Statutory Consultation, and in the interest of ensuring both ends of the Proposed Project get equal treatment National Grid suggested to Thanet District Council (TDC) that the same be done for the Kent converter station as well.

Both ESC and TDC have affiliations with Frame Projects, an independent design review body operating across England. This was advantageous as by working with Frame it was possible to organize an overlap in the panel members for both reviews for consistency.

Each DRP was undertaken over the course of a day, using an established Formal structure from Frame but with additional time allowed for:

- A longer site visit (morning session), given the wide area covered by key views; and
- A longer briefing session, for both LPA and National Grid, to allow the DCO process to be explained and set the scope for discussion.

For Kent the LPA briefing session was led by the case officer from TDC with technical officers from Kent County Council (KCC) and Dover District Council (DDC) in attendance as observers.

The DRP presentations made use of work in progress on the design approaches as a means of guiding discussion of how the design principles could be applied. The design principles themselves were not included in the discussion directly, as the preparation and panel discussion time allocated would not cover going into such detail.

The DRP days were two weeks apart (23 October 2024 and 5 November 2024) with Kent first and Suffolk second. The presentation and responses to the Kent panel report are included in section 4.2.

It has been recommended that further DRPs be undertaken for both Suffolk and Kent at a point to be confirmed when a preferred design approach addressing the selected equipment supplier's arrangements and building sizes. It was suggested that these could be done as a shorter Chair's Review, a format with just the Chair and no other panel members, given a Formal Review, with the Chair and a panel of four further experts, has already taken place.

4.2 Design Review Panel Presentation

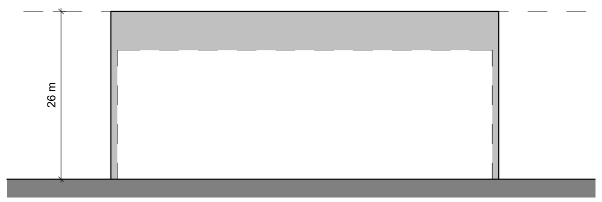
Panel Presentation

Reducing Apparent Height (Conventional Roof Forms)

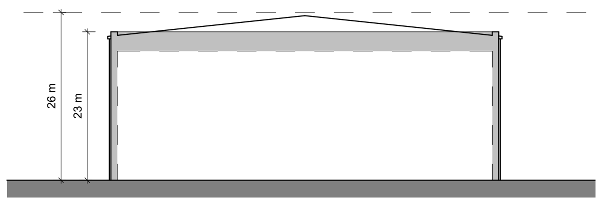
- The massing and locations of buildings within the LoD of the converter station compound will be determined by the supplier with very limited scope for this to be adapted to reduce impact as there are restrictive criteria for the function of the facility.
- These design explorations have focused on the opportunities to adapt the cladding of the elevations to create patterns of colour and texture which could help blend into the background.
- Opportunities are being explored, to take the function of the facility and use it as inspiration for the cladding design.
- This design exploration is not for the purposes of creating a concept design. It is intended to inform the Site Specific Design Principles so they can define the design requirements for the post-consent designers.

The Design Review Panel was held on 23 November 2024 in the Radford House in Ramsgate following a site visit taking in a selection of the representative views used in the LVIA and also used to demonstrate the design approaches.

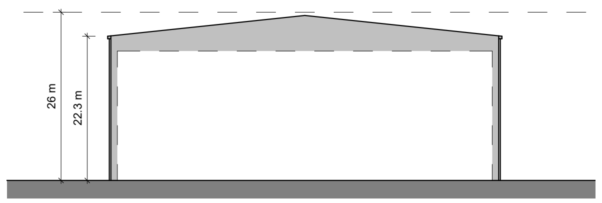
Baseline (Maximum)



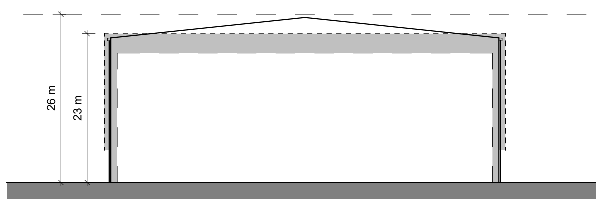
Hipped with Low Parapets



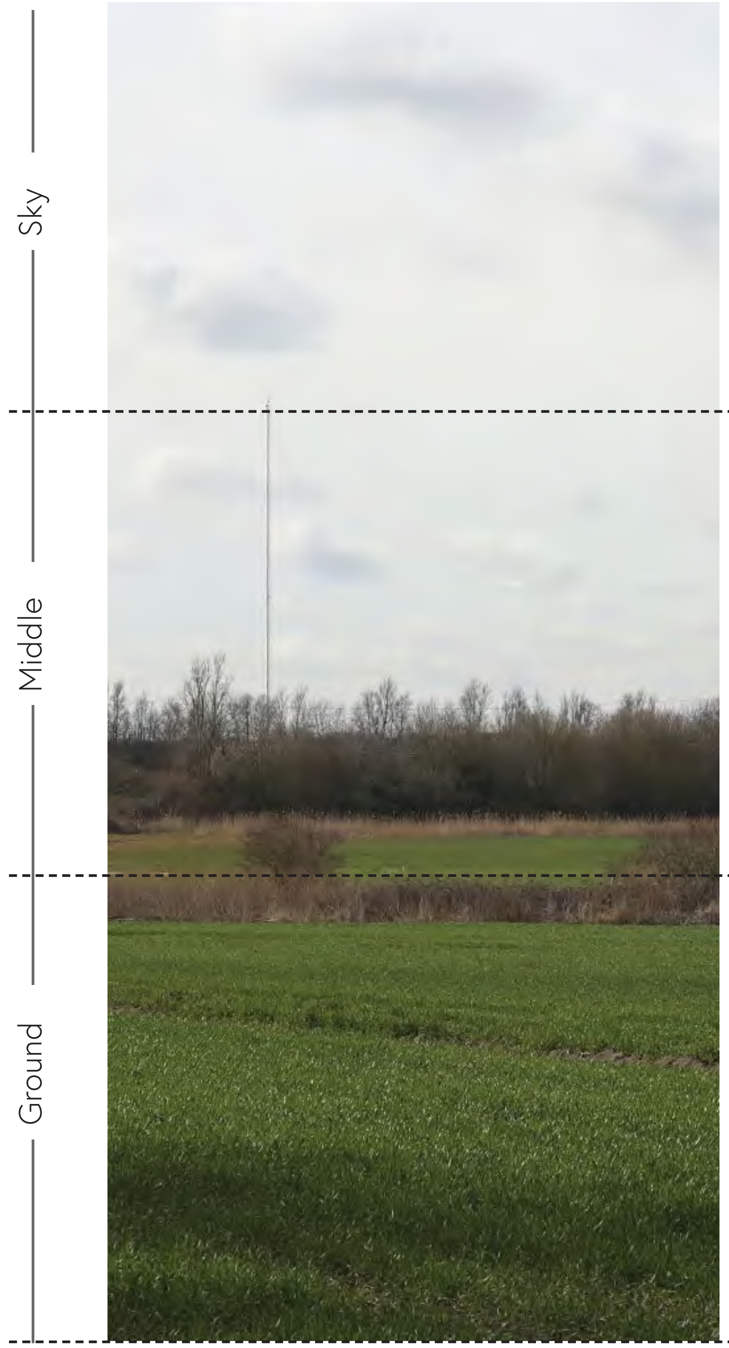
Typical Gable (6 degree roof)



Hipped with Eaves and Overcladding



Landscape / Context



Elevation Treatment

- Sky tends to change in colour and texture throughout the year.
- Clear skies would have more lighter blue tones.
- Grey skies during the colder and wet seasons.
- Clouds add texture and shadows, adding white and grey tones to this section.

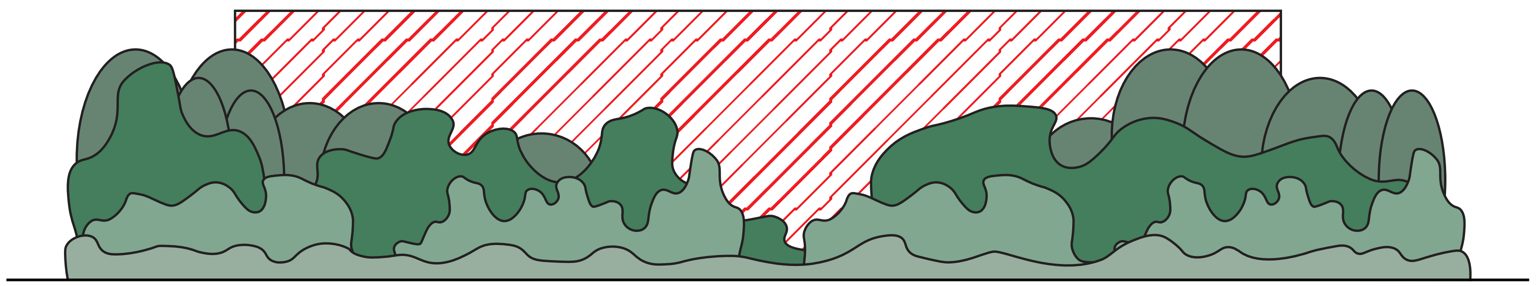
- In this section you will find trees, greenery and other existing infrastructure
- There are varying colours and textures from leaves, branches, flowers etc.
- The way the sun hits these elements will cause more variation in the shades and colours.
- These natural elements cause varying depths and textures.

- The ground has more solid earthier tones.
- Colours vary throughout the year, however stay shaded with darker tones.
- When stood looking at this angle shadows are most prominent in this area.
- A solid base with earthy tones would represent the Ground most appropriately.

4.2 Design Review Panel Presentation

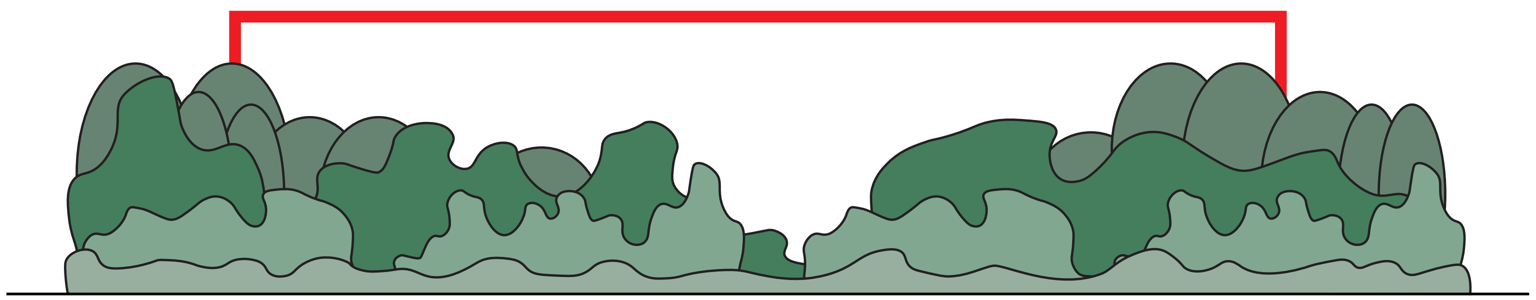
Scale and Massing

The scale and massing is driven by the space requirements of the equipment. This will be determined by the selected supplier and there is limited opportunity for the design team to influence this. The design principles require that opportunities get taken with a view to reducing height, and positioning the mass in a way that reduces impact. This should be demonstrated through rendering the proposal in the key views. This would happen after the DCO submission through engagement with the request for proposal (RfP) process. Assumptions cannot be taken on what can be achieved therefore the Rochdale Envelope has to be what is consented.



Hard, Straight Edges

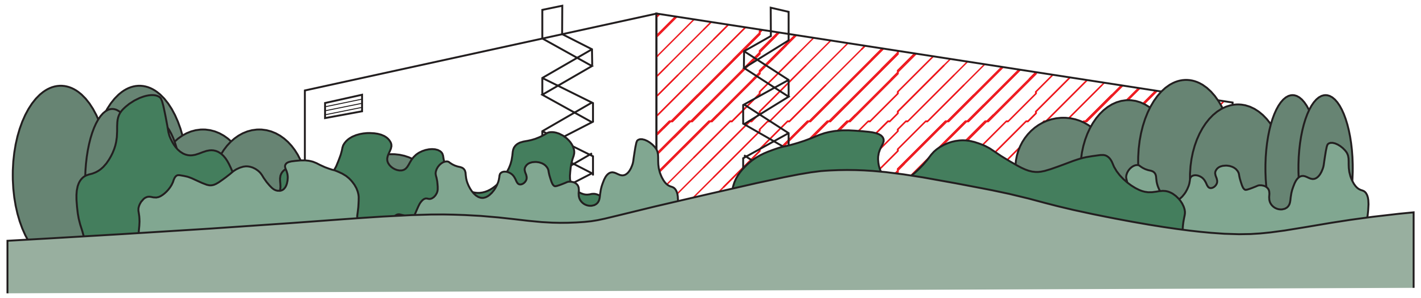
The large internal clearances, and stringent requirements for weather and air-tightness tend towards very simple volumes that do not describe the complexity of the equipment within. The selected suppliers will not accept untested forms and articulation that differ from their standards. This is due to the sensitivities of electrical equipment to layout and spacing. The design principles require that opportunities are sought to soften the edges without compromising the technical box. There may be limited opportunities regarding roof pitches, arrangement of ancillary buildings and articulation of a decorative outer layer of cladding whilst the inner part remains very simple.



4.2 Design Review Panel Presentation

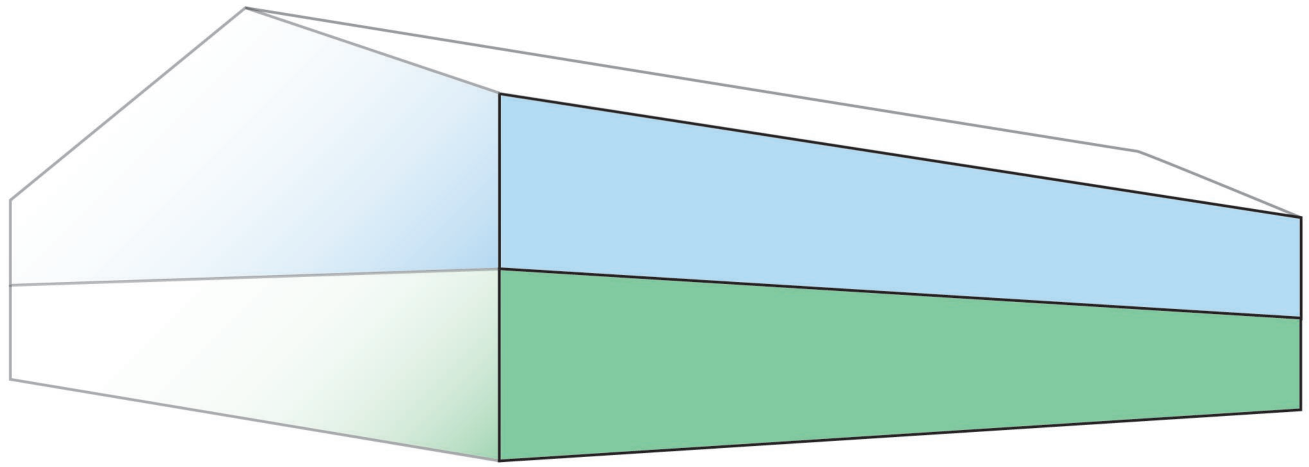
Flat Surfaces

Conventional cladding for this type of building is trapezoidal built-up or composite systems with powder coated steel. At distance these profiles tend to look flat which makes them stand out against the softer textures of the landscape setting. However these systems are tested and offer the performance guarantees required for a sensitive facility where asset protection is a consideration in addition to the Building Regulations focus on protection of life. There are carrier panel systems that, in theory, would allow the inner technical envelope to remain standard whilst a more bespoke outer layer can be designed to address visual impact. The design principles should set out a requirement to design a more textured surface using this strategy. The other issue with these flat surfaces is that they make other features like louvres or access ladders conspicuous.



Sheen on Powder Coated Finishes

Conventional cladding systems tend to be powder coated steel. Even if avoiding the glossiest coatings the sheen on this cladding can result in unintended consequences for visual impact in relation to the apparent colour of envelope. Oblique surfaces will tend to pick up sheen which masks colour variations and makes the cladding appear a single coloured surface. Visible low pitch roofs can be appear very bright as they catch the sunlight, especially when a viewed form the north side which puts the elevation in silhouette. The lesson here is that showing colour compositions in elevation alone, without showing them with real world lighting is insufficient. Design strategies that reduce the sheen on the surfaces need to be employed and mandated through the design principles. Perforation of the top coat is one method of reducing the sheen by reducing the reflective surface area. It should be used over a dark technical box to avoid moire interference patterns from shadows in direct sunlight. The other is to use sheen to create shading by angling the top layer of the cladding. Used together these techniques can be a proxy for how the tree canopy creates a softer texture within the landscape. Apart from Autumn leaf colours are fairly consistent and are similarly glossy to cladding panels. The variation comes from the gaps between them and the changing angles.



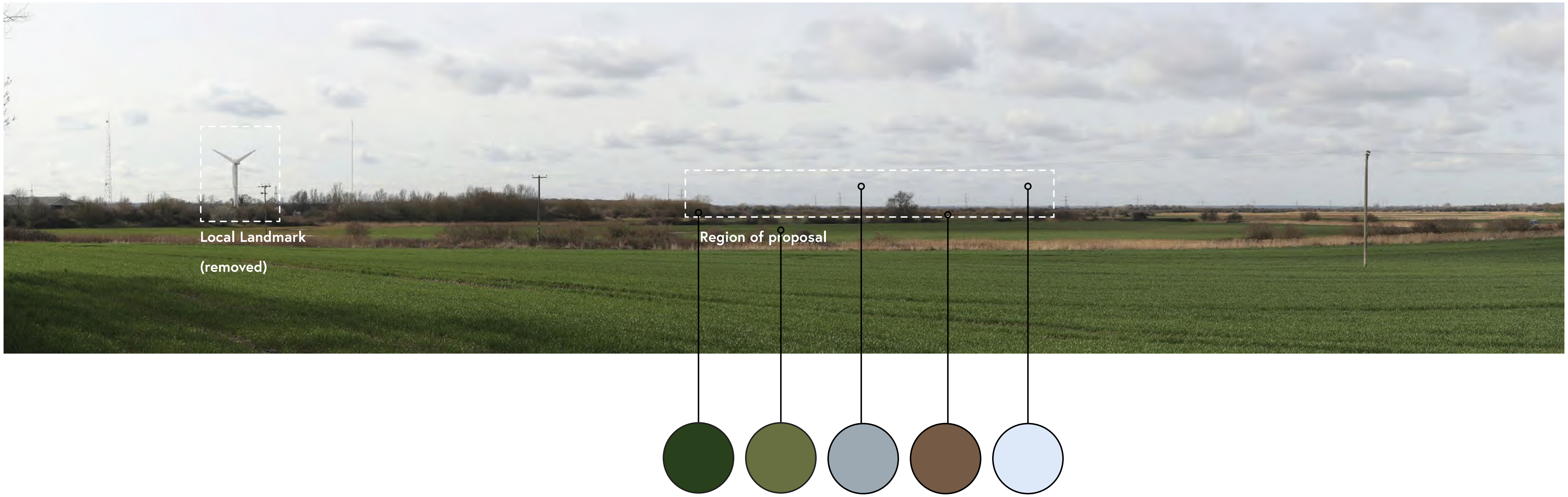
4.2 Design Review Panel Presentation

Note that the wind turbine and one of the masts have been removed since the baseline photography was taken.

Landscape Character: Viewpoint H3

Key View H3. This is the closest Key view (heritage) and is located near to a public right of way just off Jutes Lane.

The view is from a similar level to the site looking towards the marsh in the background. Most of the horizon is low with a slightly raised area of Weatherlees Hill on the left hand side that gives additional height to the trees.

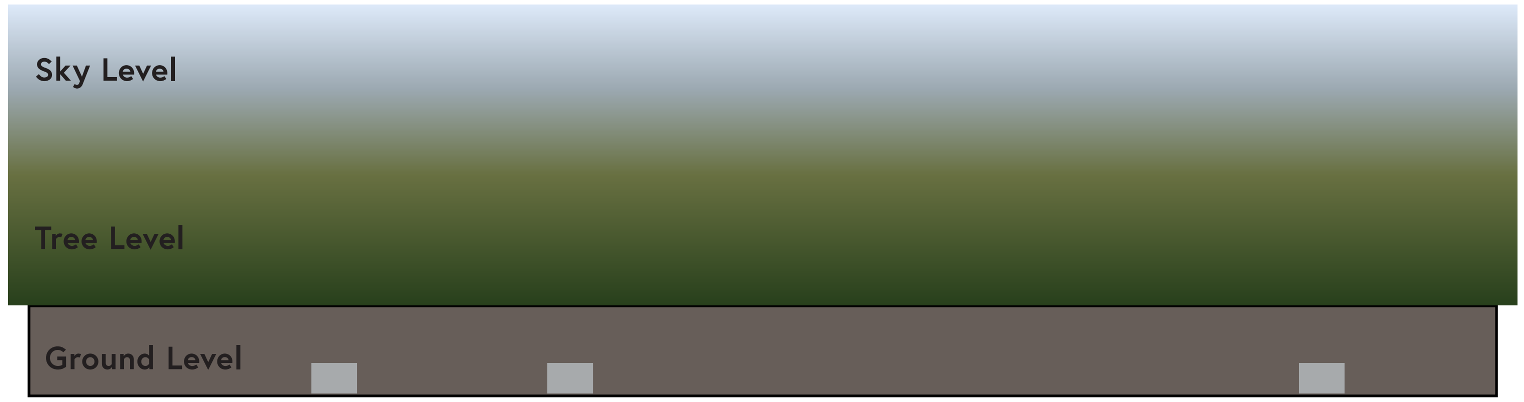


4.2 Design Review Panel Presentation

Gradient of colours from the context

Based on the colour research from the baseline analysis, we can use these site-specific colours to design a facade that harmonises with the surrounding environment. This will be further tested in the context of the proposed planting in winter and summer.

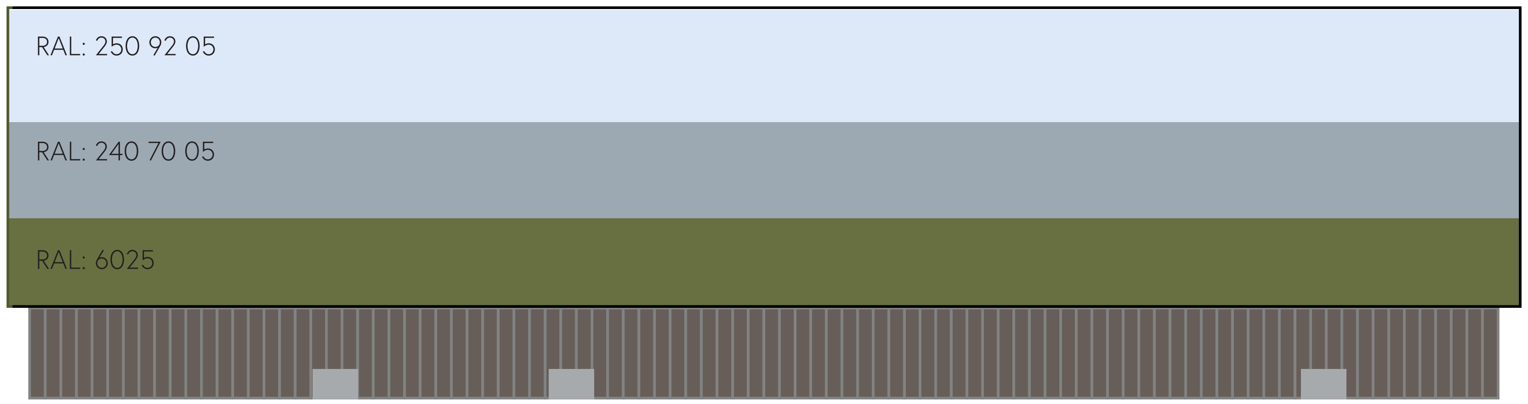
The gradient of the facade will visually break up the building as it merges into the horizon, creating a softer transition between the structure and its natural backdrop. By using a blend of hues that reflect the changing colours of the landscape, such as the earthy tones of the ground, the greens of the woodland, and the subtle shifts of the sky, the facade will reduce the visual impact of the building.



Simplifying the colour gradient (Cladding)

The number of bands, colours and transition heights would be adapted to the context. However this strategy can be less effective where the horizon and background varies.

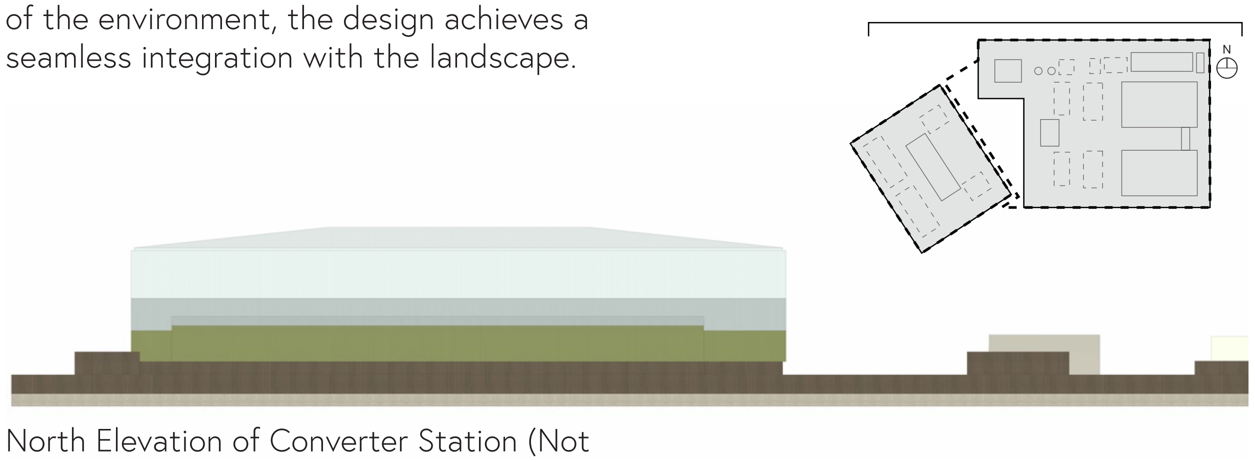
Vertical Cladding



4.2 Design Review Panel Presentation

Facade Development: Horizontal Articulation

This colour banding facade method reflects the natural tones of the site, harmonising with its surroundings. By following the existing colours of the environment, the design achieves a seamless integration with the landscape.



North Elevation of Converter Station (Not to Scale)

These are proposed views without the planting.

Note that the wind turbine and one of the masts have been removed since the baseline photography was taken.

Viewpoint 8

Viewpoint 4

4.2 Design Review Panel Presentation

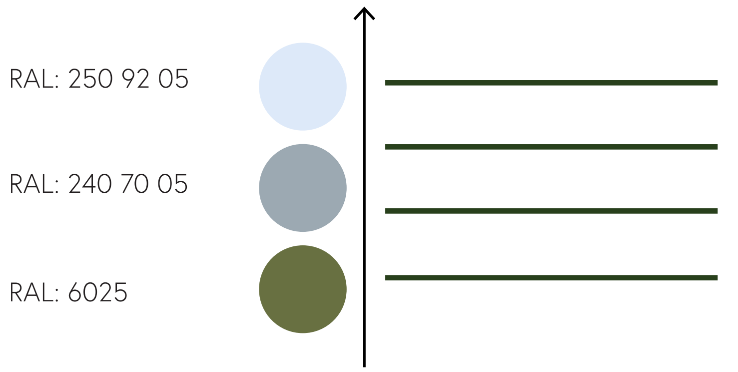
Note that the wind turbine and one of the masts have been removed since the baseline photography was taken.

Viewpoint 10

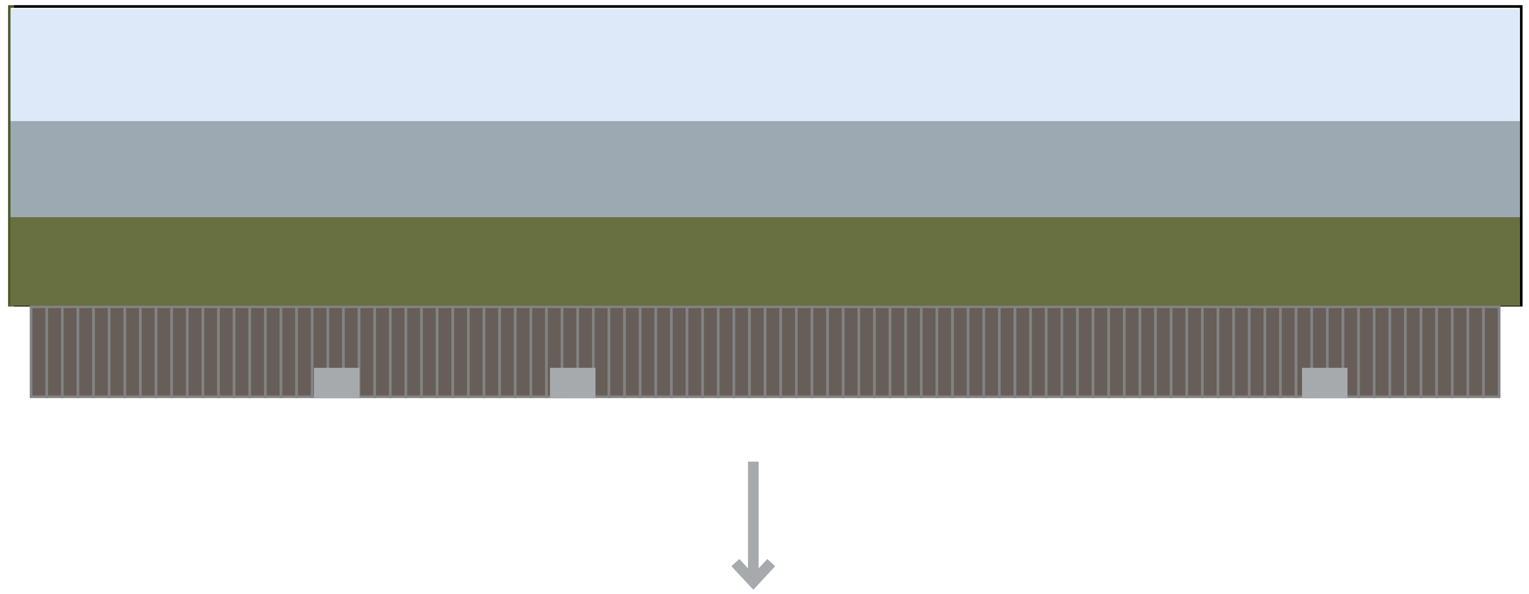
Viewpoint H3

4.2 Design Review Panel Presentation

Facade Development: Horizontal and Vertical Articulation

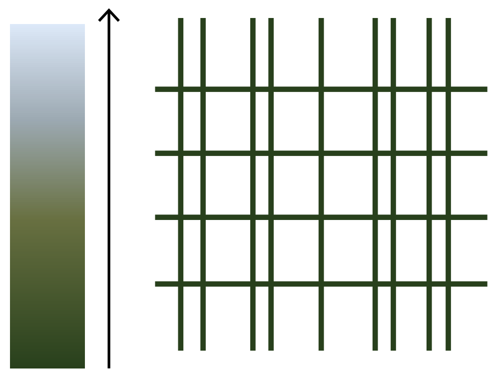


Horizontal Articulation

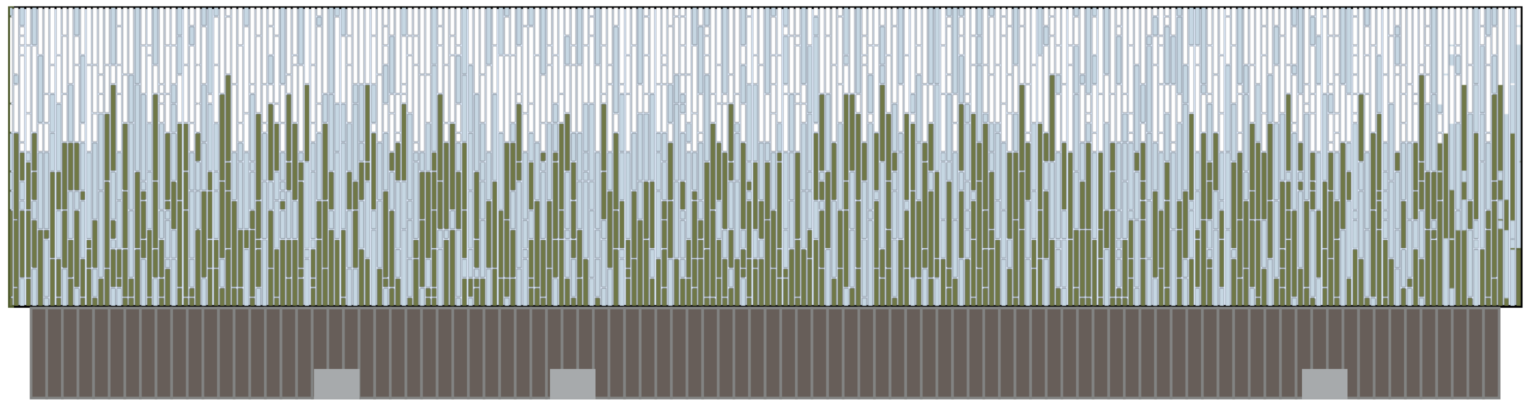


The horizontal articulation facade alone has distinctive colour bands. In the closer-up views, the colours do not blend as much.

When you introduce vertical articulation, it creates more complexity, blending the colours into the varying tree scape. The dynamic play with the panels mimic the tree lines rhythm.



Combining Horizontal and Veritical Articulation



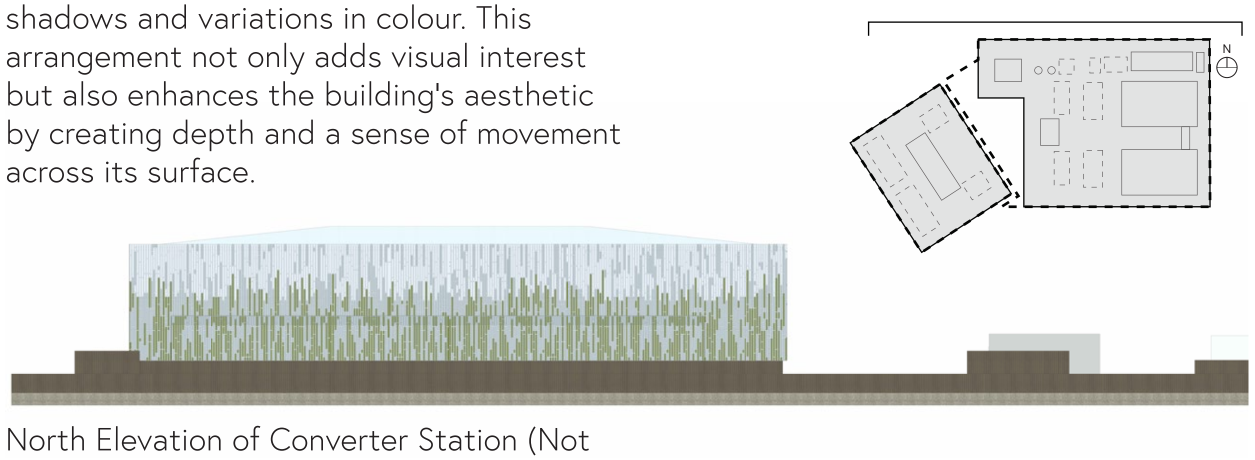
4.2 Design Review Panel Presentation

These are proposed views without the planting.

Note that the wind turbine and one of the masts have been removed since the baseline photography was taken.

Facade Development: Horizontal and Vertical Articulation

A staggered panel placement can introduce a higher level of complexity to the facade, resulting in a more dynamic interplay of shadows and variations in colour. This arrangement not only adds visual interest but also enhances the building's aesthetic by creating depth and a sense of movement across its surface.



North Elevation of Converter Station (Not to Scale)

Viewpoint 8

Viewpoint 4

4.2 Design Review Panel Presentation

These are proposed views without the planting.

Note that the wind turbine and one of the masts have been removed since the baseline photography was taken.

Viewpoint 10

Viewpoint H3

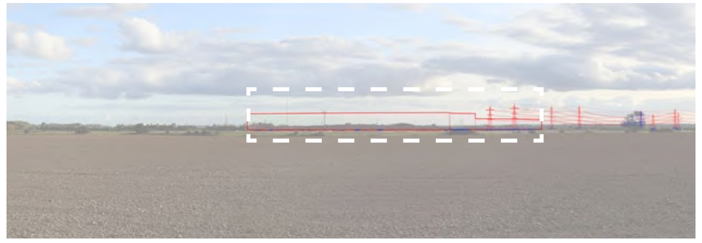
4.2 Design Review Panel Presentation

Facade Development: Enhanced Panels

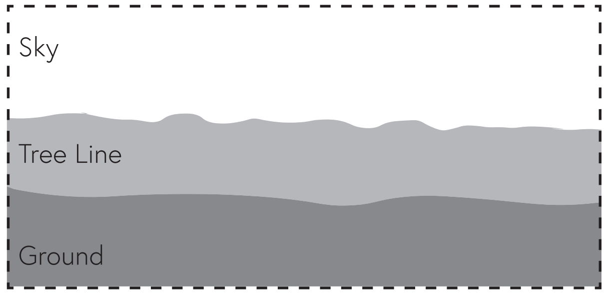
The enhanced facade design will incorporate a more site specific design, where important site views are used to distinguish a pattern gradient on the face. Using panels of a exterior facade, we can start to play with colours and reflections to see how this affects the visual impact of the converter station.

VP 4, 8, 10 and H3 are important viewpoints that need to be considered when looking at the facade.

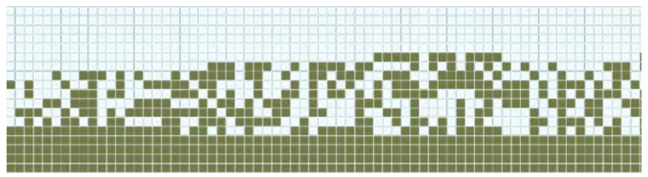
Viewpoint 4



Above the Horizon. The blend of the colours in this view need to flow from the ground to the sky effortlessly. There is a prominent tree line that could be translated into the facade.

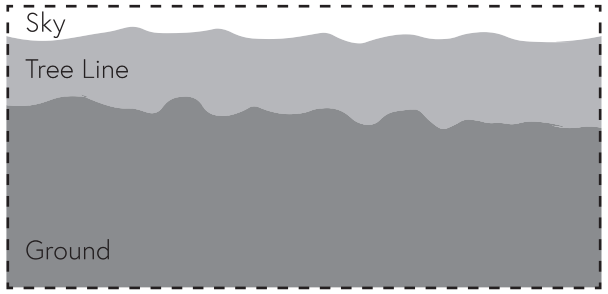


Indicative Facade Pattern

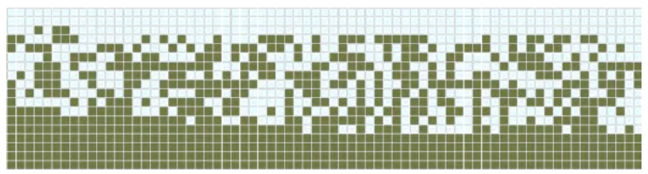


Viewpoint 8

Below the Horizon. Ground and Tree colours in this view need to be more prominent.

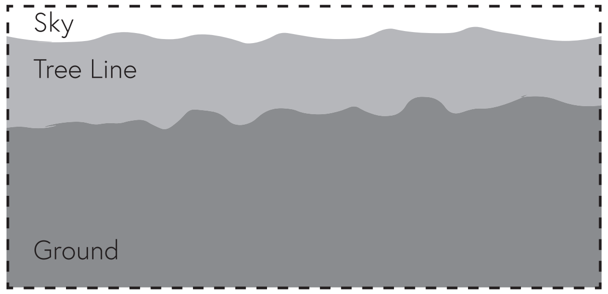


Indicative Facade Pattern

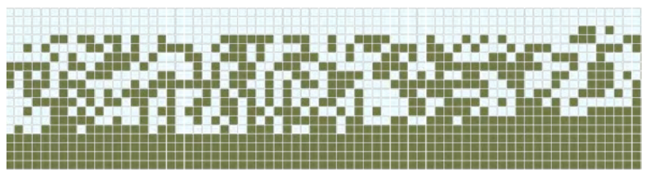


Viewpoint 10

Above the Horizon, but behind trees and other greenery. Could have more sky or tree colours.

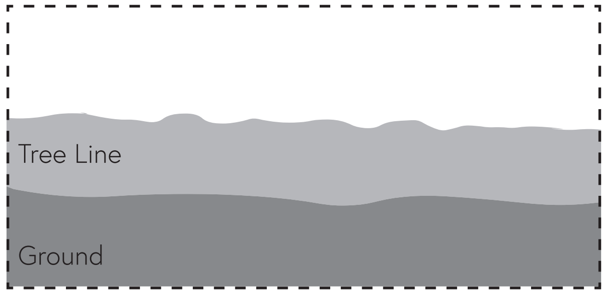


Indicative Facade Pattern

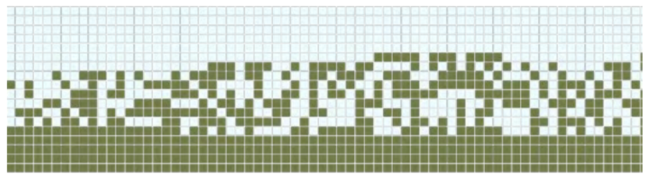


Viewpoint H3

Above the horizon line, predominantly sky tones.



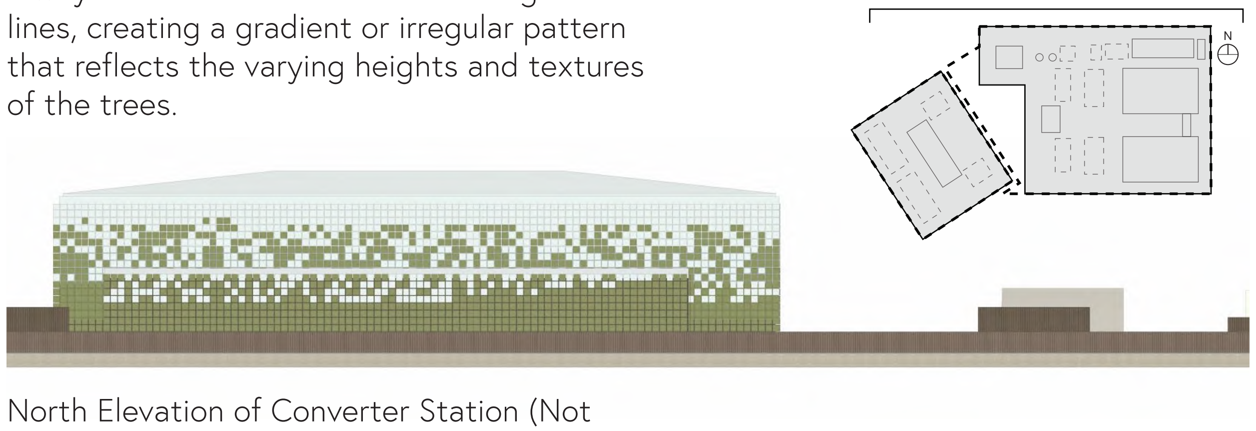
Indicative Facade Pattern



4.2 Design Review Panel Presentation

Facade Development: Enhanced Panels

The building is adjacent to woodland. A method that could be used to blend the facade into the surroundings is to distribute panels in a way that mimics the natural and organic tree lines, creating a gradient or irregular pattern that reflects the varying heights and textures of the trees.



North Elevation of Converter Station (Not to Scale)

These are proposed views without the planting.

Note that the wind turbine and one of the masts have been removed since the baseline photography was taken.

Viewpoint 8

Viewpoint 4

4.2 Design Review Panel Presentation

These are proposed views without the planting.

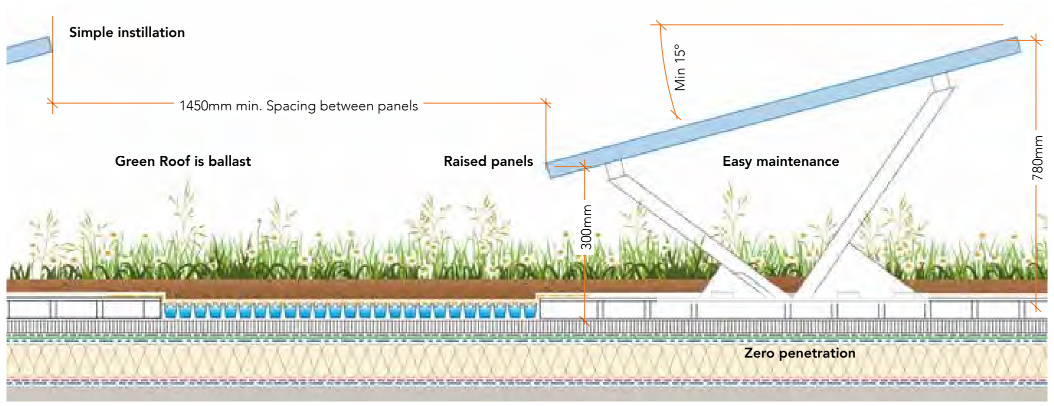
Note that the wind turbine and one of the masts have been removed since the baseline photography was taken.

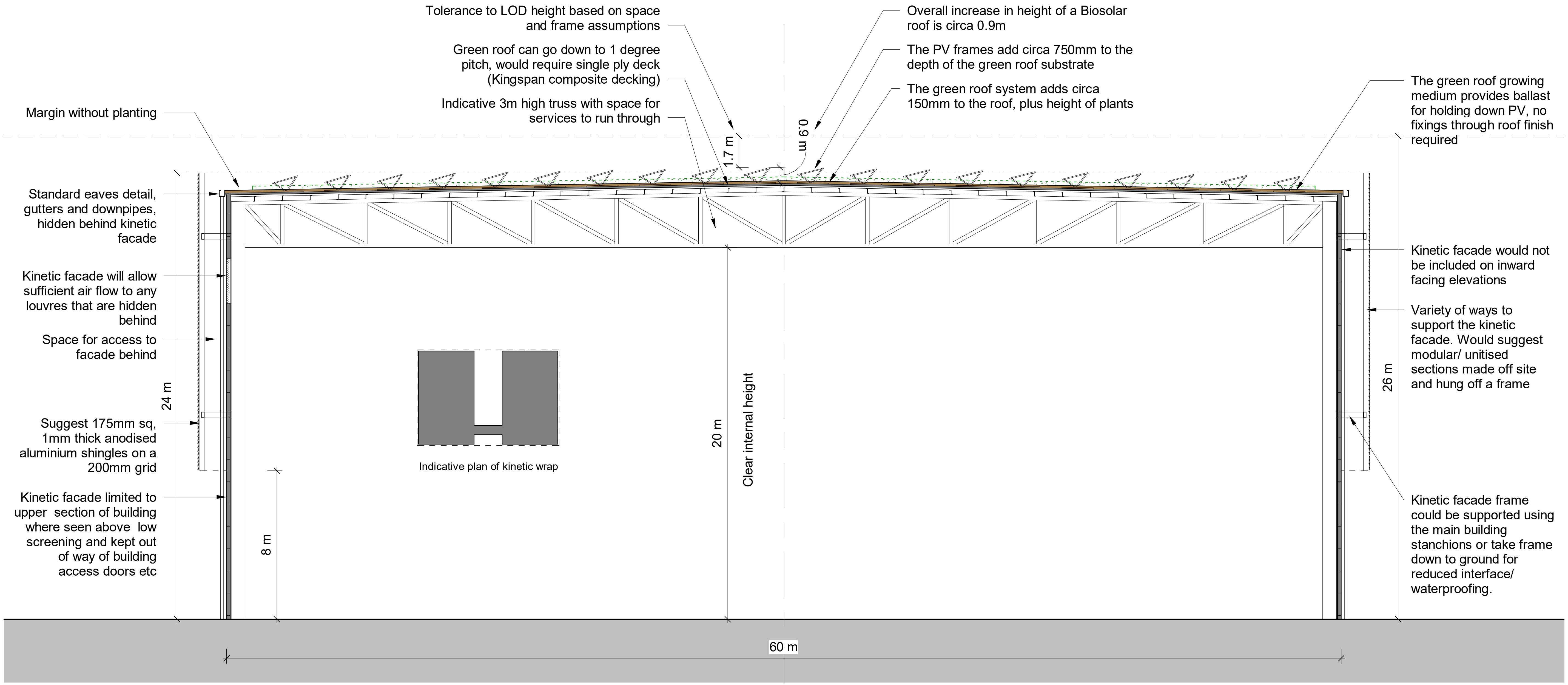
Viewpoint 10

Viewpoint H3

4.2 Design Review Panel Presentation

This illustrative cross section shows how the overcladding concept could be used to shroud a very simple building. It is also an exploration of how renewables and habitats can co-existing on a roof. These details would be subject to technical development post-consent.





4.3 Design Review Panel Report and Responses

The DRP Report was issued two weeks after the panel was held. It covers a wide range of topics that relate to matters covered in other application documents, such as the landscape mitigation proposals. The report has been shared with the rest of the design team and where required the response refers to which application document addresses the comment.

ID	DRP Report	Response
Strategic Approach		
D.1	This is a complex project, not least because the DCO process places constraints on where design advice can be most effective.	Noted
D.2	Once a delivery partner has been appointed, and the optimal envelope is fully understood, the panel feels that there should be a further opportunity to consider the design and visual impact of the buildings. Mechanisms to allow for this should be built into the DCO.	**Application document 7.12.2 Design Principles - Kent** identifies a commitment to undertaking a further DRP a point in time when a preferred design approach has been developed to suit the selected supplier's layout and design. The suggestion is to use the same organisation for continuity.
D.3	The panel feels that it will be important to novate (if that is appropriate to the procurement route) the design team to the successful delivery partner, to provide a degree of continuity between the proposals and what is delivered. If this is not possible the design team should be retained in an advisory role to National Grid to review technical and design proposals from the chosen delivery partner on parts of the design that will technically fall within their remit once the contract is let.	As per OA.7 in Table 2.1 of Overarching Design Principles in **Application document 7.12.2 Design Principles - Kent**. The design champion will establish a structure for National Grid to monitor compliance with the design principles through the delivery of the project to completion.
D.4	To facilitate this, the panel would also like to see contractual mechanisms explored, outside the DCO process, to secure a commitment to design quality from the contractor through specific requirements in the National Grid specifications or Employers Requirements requiring the contractor to submit for approval elements of the design that were not fully resolved at the point of contract.	As per OA.7 in Table 2.1 of Overarching Design Principles in **Application document 7.12.2 Design Principles - Kent**. The design champion will establish a structure for National Grid to monitor compliance with the design principles through the delivery of the project to completion.
D.5	The panel notes that no wider masterplan, showing a coherent overview of the proposals within the area as a whole, was presented. It feels that this is a bigger priority for understanding the wider impacts of the scheme and design development and in giving the panel and planning authorities confidence that the impact of the scheme is being addressed effectively.	A wider coordinated site plan is included alongside the OLEMP. This is **Application Document Figure 7.5.7.2.1 Minster Converter Station and Substation Outline Landscape Mitigation**.

4.2 Design Review Panel Report and Responses

ID	DRP Report	Response
Design principles		
D.6	The design principles document is essentially a design code and could be the only control mechanism over what is delivered, once the delivery partner is appointed. The design principles should allow for some flexibility, but its language needs to be specific and unambiguous for important elements.	The Key Design Principles in Table 3.1 and Table 4.1 of the **Application document 7.12.2 Design Principles - Kent** have been developed to allow any of the design approaches explored in section 6 to be applied, whichever suits the detailed design layout and massing best. Through consultation with the LPAs they have also been written in a way that defines the intention of the design and focus on the key features, following guidance from the National Design Guide and National Model Design Code, that define the requirements for good design.
D.7	The design principles should set out clear targets and requirements for important design elements of the proposals, to give the planning authorities confidence that what is presented will be delivered.	The Key Design Principles in Table 3.1 and Table 4.1 of the **Application document 7.12.2 Design Principles - Kent** have been developed in consultation with the LPAs to get to the point of having a clear and concise set of design principles that cover the converter station and substation designs. It uses the characteristic headings in the National Design Guide to ensure this.
D.8	The design principles should specify the qualities of materials, rather than colours and patterns, to ensure that these are high quality, durable, amendable and sustainable.	**Application document 7.12.2 Design Principles - Kent** has several entries that relate to this. In table 2.2 of the Project Level Design Principles V.2 relates to the design life and V.3 relates to sustainable construction and the circular economy. The Identity section of Table 3.1 of the Converter Station Design Principles describes the material qualities required to be considered, particularly how coatings are seen in different lighting conditions.
D.9	In particular, the panel would like to see a worked-up example of how the design principles could be applied to building form and layouts, to provide reassurance that sufficient specificity can be contained within this important document that can anticipate the technical demands of any given delivery partner.	Section 6 of this document shows design approaches developed in response to the comments from LPAs and the DRP report, and alongside the Key Design Principles in Tables 3.1 and 4.1 of **Application document 7.12.2 Design Principles - Kent** in order to test them.
Visual impact		
D.10	The very large structures of the scheme will be located within a sensitive landscape and will need to sit comfortably in that context. The panel would like to see more evidence that an analysis of the character of Stour Marsh has informed the proposed design work.	Extensive context analysis is included in section 2 of this document, a small section of this was made available at the panel presentation due to limited time.
D.11	The key consideration should be how the buildings are perceived in this sensitive landscape. Attempts to camouflage the buildings appear overly complex and will not be able obscure entirely their intrusion into the landscape.	The design development leading up to and included in the DRP presentation (section 4.2 of this presentation) and further development since the DRP (covered in sections 5 and 6) addresses the limitations of what can be achieved through facade treatments, and sets out a range of design approaches based on relevant case studies focusing on what cladding techniques are appropriate.
D.12	While the panel understands the rationale for presenting the Rochdale Envelope views, which illustrate the greatest possible extent of the proposed structures, it feels that the white blocks are jarring and therefore unhelpful. More realistic visualisations, showing possible structures in the landscape, would be more useful in assessing the converter's actual visual impact.	The Rochdale Envelope is an established means of assessing the worst case in terms of the three dimensional limits of deviation (LoD) for the proposed development. This flexibility is required as it is not possible at this stage to determine the exact location of buildings within the LoD. Further illustrative images, based on a generic converter station layout, have been provided to demonstrate the different design approaches in the same key views as the Rochdale Envelope for a more realistic assessment.
D.13	The visualisations appear to reflect conditions at the same time of day and in the same weather conditions. It would be helpful if a range of views were provided, showing how the buildings will appear in different conditions. The panel notes that, in the hazy conditions of the site visit, the roofs of existing structures were much more visible that the flank walls. This would also be useful to the design development of the scheme to select the most appropriate and discrete design.	CO.3 - Responding to strategic views - The Key Design Principles in Table 3.1 and Table 4.1 in **Application document 7.12.2 Design Principles - Kent** require a subset of the representative views used in the LVIA be shown at different times of day and in different lighting conditions to show how the proposals respond to these scenarios.

4.2 Design Review Panel Report and Responses

ID	DRP Report	Response
Layout and building form		
D.14	The panel feels that the Environmental Statement should be used to inform the layout of the scheme, not simply to identify measures to mitigate harms.	The rationale for the wider layout of the scheme is covered in **Application document 7.5.7.2 Outline Landscape and Ecological Management Plan** (OLEMP). The layout is largely driven by technical requirements and the detailed proposals will develop from the OLEMP. The EIA process was key in the design and evolution of the projec. with siting principles covered in **Application document 7.3 Design Development Report** which explains where design choices have sought to reduce the environmental effects of the Proposed Project**.**
D.15	The site is at a point of transition between open land and a more wooded landscape. While National Grid plans to introduce new trees to screen the structure, these will take time to establish themselves, while existing mature trees exist on the periphery of the site. National Grid should explore options for reorientating the buildings to sit more closely within the existing trees near the sewage works.	The site has been located as close to this existing woodland as possible whilst making use of and limiting disruption of the existing field boundaries and perimeter drainage network.
D.16	The landscape visual impact assessment should be used not simply to test different façade treatments, but to sculpt the form of the buildings themselves, in so far as the technical requirements of the buildings allow.	As per answer to D.12 the Rochdale Envelope has to be evaluated to cover the worst case and give the required flexibility to the consent. Section 6 of this document tests a design approach that makes use of more fragmented forms. However, exactly how this works can only be determined once the internal space requirements of the buildings are known.
Architecture and materials		
D.17	The panel feels that the darker, simpler façade options are more convincing than the brighter patterns presented.	This is noted and has been taken on board in the more recent design approach development in section 6 of this document.
D.18	However, the panel does not think that the project should be seen as an exercise in cladding options but should address more directly the unavoidable impact of the buildings in the landscape.	The design approaches have been developed through analysis of converter station projects that have been delivered or taken to planning in the UK and Europe. This gives assurance that the techniques being proposed are likely to be suitable and can address the critical design constraints of this type of facility.
D.19	The panel feels that the gable end, fronting onto the attenuation pond, represents an opportunity for a genuine architectural response.	This is noted, however the nature of that gable to pond relationship is likely to be different in the final layout. How much of an opportunity this is will become apparent when addressing the representative view from the nearest public vantage point where the cycle route crosses the access road.
D.20	The work done to make the building façade as attractive as possible is welcome, but the panel notes that mitigation will largely be through landscape interventions and public benefits, which can be a lot more specific.	The scope for public benefits within the DCO is limited. The DAD and design principles are focused on how the architecture relates to the landscape and the areas which are beyond tree screening due to height.
Landscape design		
D.21	The landscape proposals currently appear to be too rigid, and the panel would like to see a softer, more layered approach adopted.	**Application Document 7.5.7.2.1 Minster Converter Station Outline Landscape Mitigation** shows an update to the illustration of the landscape proposals addressing this point.
D.22	The panel notes that only the rights of way within the red line are shown of the site plan, and it would like to see consideration given to views from the wider network of paths, with screening located near these viewpoints, rather than within the red line itself, as this is likely to be more effective in reducing the buildings' visual impact.	The plan has been updated to show the wider PRoW network. However the area of the site is not very accessible with the Saxon Shore Way along the river, and Ebbsfleet Lane North being closest.

4.2 Design Review Panel Report and Responses

ID	DRP Report	Response
Public benefits		
D.23	The project will inevitably represent an intrusion into the landscape, no matter what mitigation is put in place, and consequently National Grid should seek to justify this through the creation of public benefit. Alongside socio-economic interventions, this could include exploring opportunities to use the project for public engagement and education.	The provision of community benefits sits outside the planning process. National Grid are exploring other ways in which this can be achieved and can then be agreed with LPAs and community groups outside the DCO where appropriate.
D.24	The scheme offers an opportunity to celebrate the contribution the facility will make to an important national mission and to engage people in understanding more about the technology involved. To support public engagement with the purpose of the scheme, National Grid could explore ways of connecting the buildings' function with their architectural expression.	This has been incorporated into the narrative of the guidance in the Identity part of Section 3.2 in **Application document 7.12.2 Design Principles - Kent**. The enhanced facades design approach in section 6 of this document explores opportunities for doing so whilst avoiding making the buildings more conspicuous.
D.25	National Grid should develop a more compelling strategy for deploying the waste heat generated by the operation of the facility. This should form part of a wider narrative around community benefits from the scheme.	This has been captured in the Table 3.1 of **Application document 7.12.2 Design Principles - Kent**, Key Design Principle R.1 - On-site renewable energy generation. This could include submission of an energy strategy statement that explores opportunities for reuse of waste heat. A concern raised by the project engineer is that the supply of heat may not be constant as the converter station poles (two, one for each DC Hall) may be switched off to regulate supply or for maintenance.
Access		
D.26	The details of the access road require clarification, in terms of its alignment, construction, and its visual and carbon impact. It will be a significant piece of civil engineering in its own right, and should be delivered as efficiently and sensitively as possible.	The design of the road does not fall in the scope of this document or the Key Design Principles in **Application document 7.12.2 Design Principles - Kent**. It is addressed in the OLEMP in relation to the landscape proposals and **Application Document 2.7 Access and Public Right of Way Plans**.
D.27	Careful thought should be given to how the right of way crosses the access road, both in terms of the ease of use and of visual impact.	The design of the road does not fall in the scope of this document or the Key Design Principles in **Application document 7.12.2 Design Principles - Kent**. It is addressed in the OLEMP in relation to the landscape proposals and **Application Document 2.7 Access and Public Right of Way Plans**.
Sustainability and biodiversity		
D.28	The panel recognises that this project is part of the national strategy for decarbonising the UK and feels that the buildings themselves should be exemplars in their environmental performance, despite the operational constraints of the scheme.	This has been captured in **Application document 7.12.2 Design Principles - Kent**, at project level in CL.1 - Approach to net zero, and in Table 3.1 Key Design Principle R.1 - On-site renewable energy generation. It could be subject to submitting an assessment of how suitable PVs are for meeting the power needs of the converter station, or the substation (see Table. 4.1) and what areas of roof are suitable for use.
D.29	While the constraints on material choices are understood, National Grid should fully account for and seek to minimise the embodied carbon of the concrete volumes to be used. In particular, it questions whether alternative, more sustainable materials could be used for the smaller buildings with less stringent technical requirements.	This has been captured in **Application document 7.12.2 Design Principles - Kent**, at project level in V.3 - Sustainable construction and the circular economy - in Table 2.2.

4.2 Design Review Panel Report and Responses

ID	DRP Report	Response
Sustainability and biodiversity		
D.30	The two-metre build-up for the stone platform will have significant implications for material movement and embodied carbon, and these need to be specified and accounted for in assessments of environmental impact. The panel urges the design team to interrogate further the technical specification for the build-up and then to explore local sources for the material required.	The build-up of the development platform is driven by engineering requirements dealt with in other areas of the DCO application documents. The procurement team at National Grid are in discussions regarding ways to partner with other local developments to source fill material.
D.31	The panel is pleased that a circular economy approach is to be pursued, but it would like to see the detail of how this will be realised in practice, particularly with regard to the reuse of materials and the replacement of elements during the facility's operation.	This has been captured in **Application document 7.12.2 Design Principles - Kent**, at project level in V.3 - Sustainable construction and the circular economy - in Table 2.2. Many of the building framing and cladding systems available can be repurposed at end of project life.
D.32	In the absence of a requirement to meet building regulations, the panel would like to understand the mechanisms that will be in place to ensure that the scheme performs well in terms of operational energy use.	This has been captured in the **Application document 7.12.2 Design Principles - Kent**, at project level in CL.1 - Approach to net zero, and Key Design Principle R.1 - On-site renewable energy generation - in Table 3.1. It could be subject to submitting an assessment of how the energy demand of the converter station is managed.
D.33	The team should explore the potential to include PVs in the scheme, although it notes that reflective materials on the roofs of the buildings could be very visible from distance. This should be balanced against the benefits of their inclusion.	This has been captured in the **Application document 7.12.2 Design Principles - Kent**, at project level in CL.1 - Approach to net zero, and Key Design Principle R.1 - On-site renewable energy generation - in Table 3.1. It will be subject to submitting an assessment of how suitable PVs are for meeting the power needs of the converter station (for substation see Table 4.1) and what areas of roof are suitable for use.
D.34	The panel urges the team to maximise the permeability of the site, recognising the technical constraints of the equipment and the need for the stone platform.	**Application Document 6.8 Flood Risk Assessment** sets out how surface water would be managed during construction and operation of the Proposed Project using suitable SuDS
D.35	The panel encourages National Grid to work with the Kent Wildlife Trust to identify opportunities for off-site mitigation measures to enhance the scheme's biodiversity performance.	National Grid is committed to playing its part in halting and reversing the decline of biodiversity in the UK and to achieving 10% biodiversity net gain (BNG) on major projects. National Grid has made this commitment on a voluntary basis in advance of the requirement being mandatory for Nationally Significant Infrastructure Projects. The initial approach taken to BNG on the Proposed Project is explored in **Application Document 6.12 Biodiversity Net Gain Feasibility Report** submitted with the application. National Grid will explore how this can be delivered through a combination of on-site measures, off-site measures and credits will be determined when the detailed design of design is complete and the final effects and potential for delivering BNG on site is clear. Discussions and engagement have been held with stakeholders and the wildlife trusts throughout the project. National Grid will continue to engage with Kent Wildlife Trust for opportunities to progress any potential collaborative off-site projects.

CASE STUDIES AND REFINED DESIGN APPROACHES

5.0

5.0 Case Studies and Refined Design Approaches

5.1 Design Approach Themes

Throughout the design development process case studies have been gathered to provide references for the design approaches that could be developed and applied to the Project. The focus has mostly been on completed converter stations in the UK and in Europe, as the techniques should be reasonably transferable excepting for differences in national standards. As the pool of converter station references is fairly limited, a few examples of similar building types have been included where a particular feature may be relevant to the design approaches being considered.

Feedback on the six design approaches included at statutory consultation, and from the DRP and LPA engagement since, has been filtered through the prism of these case studies to consolidate into four design approach themes:

- Conventional industrial/agricultural (Baseline);
- Enhanced cladding;
- Enhanced roof forms; and
- Fragmented forms.

The following pages explore the case studies that relate to these different approaches and the lessons that can be taken and adapted to a suit of design approaches for the converter station.

These are arranged in three different categories, with different lessons drawn from each in terms of;

1. Other Converter Stations, examples from UK and Europe showing comparable schemes addressing similar functional and technical constraints;
2. Relevant Local Development, whether comparable in scale or demonstrating a response to context; and
3. Design Inspiration, from a broader set of project types and locations that may translate to a converter station.

The converter station precedents have been instructive when defining the design principles. The onerous functional constraints have tended to lead to the delivery of conventional industrial type designs, particularly in the UK. Any move away from this needs to be done with caution to avoid untested design strategies conflicting with the Critical Design Constraints set out in Table 1.1 of **Application Document 7.12.2 Design Principles - Kent**.

Some of these case studies have been referred to the design team through the consultation process, including the DRPs. Further precedents within these categories may come to light and it would be worth updating this set of references as the design progresses.

Conventional industrial/ agricultural (Baseline)

Enhanced Cladding

Enhanced Roof Forms

Fragmented Forms

5.2 Conventional Industrial/ Agricultural (Baseline)

All completed UK converter stations in the UK fall into this category, with most projects across Europe taking a similar approach.

It uses the most efficient building forms and cladding systems for this type and scale of building and as such will tend to be the approach with the smallest built form.

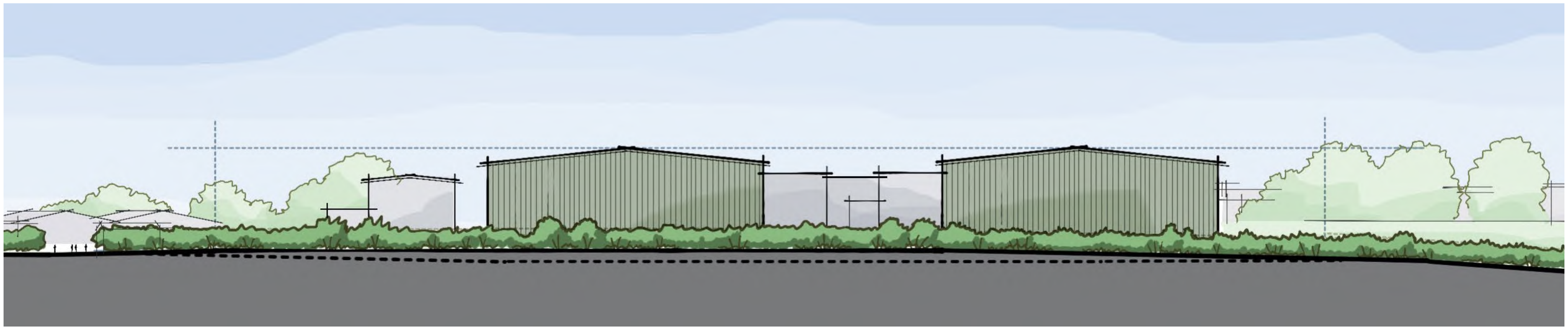
This type of approach is commonly associated with powder coated trapezoidal cladding and roofing systems. The colour options for these systems can be limited and as has been noted in feedback, the reliance on varying colours, whether in bands or other patterns, can be of limited effectiveness in terms of mitigating visual impact.

This type of approach has been included as a baseline by which the other enhanced design approaches can be compared to see if they are reducing the visual impact.

The green colour shown has been taken from the Tata Steel Standard Cladding Colours, based on the Kent colour analysis. A single green colour has been used based on feedback preferring this to the use of colour bands or patterns.

Svelete Grey (RAL 080 50 20)

From the Tata Steel Standard Cladding Colours.
tatasteeluk.com/construction/key-products/colorcoat

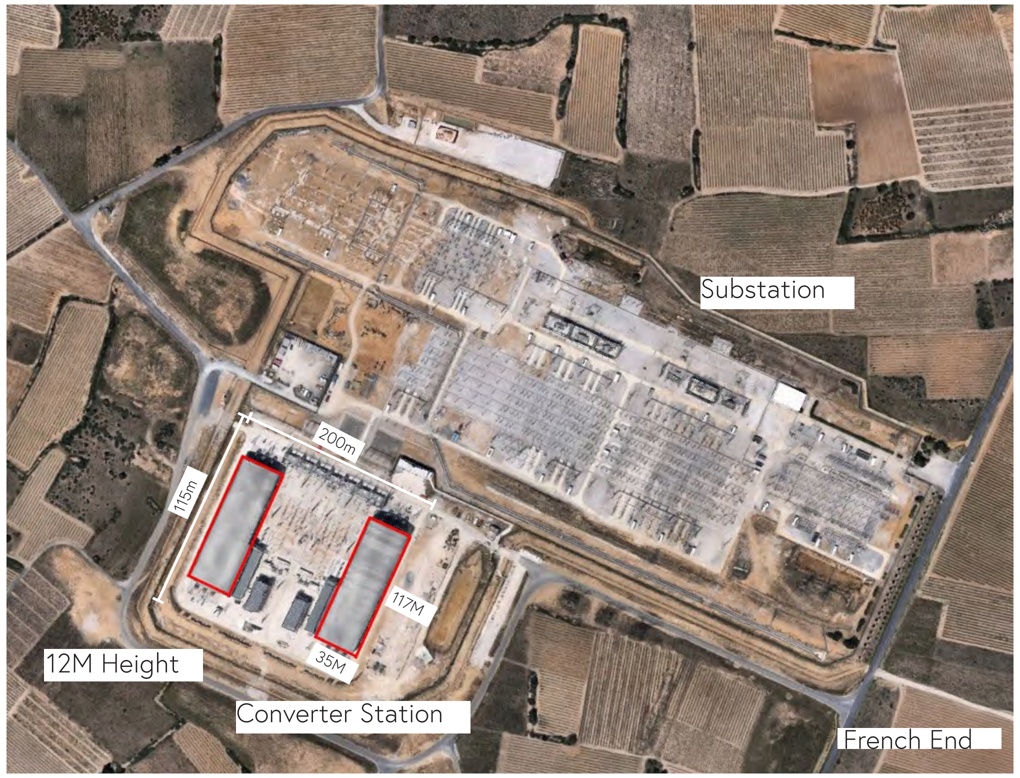


5.2 Conventional Industrial/ Agricultural (Baseline)

France to Spain INELFE Link, Baixas end

INELFE link plays a vital role in strengthening the power grid interconnection between France and Spain, facilitating energy exchange, and supporting the integration of renewable energy into both countries' grids.

The converter station in Baixas encompasses a curved form that softens the typical industrial box style.



Lessons Learned

2.0 GW (bi-pole). 320kV HVDC. Supplier Siemens. System activated 2015.

- Baixas (french) converter station site is 200 m by 115 m with a large substation on the periphery;
- The Baixas DC Halls are long and slender and relatively low height (17m after consultation) making them more recessive in the landscape;
- The shade of green combined with the curved roof form blends with the landscape, softening the industrial look;
- The DC Halls are spaced far apart with equipment located between;
- Distance from Coast is around 11.8 Miles; and
- Green Facade changes colour depending on the intensity and direction of the sun.

global.toshiba/ww/company/energy/topics/transmission/italy-power-transmission.html

briv.me/index.php/projects/15-projects/special-purpose-buildings/50-toshiba

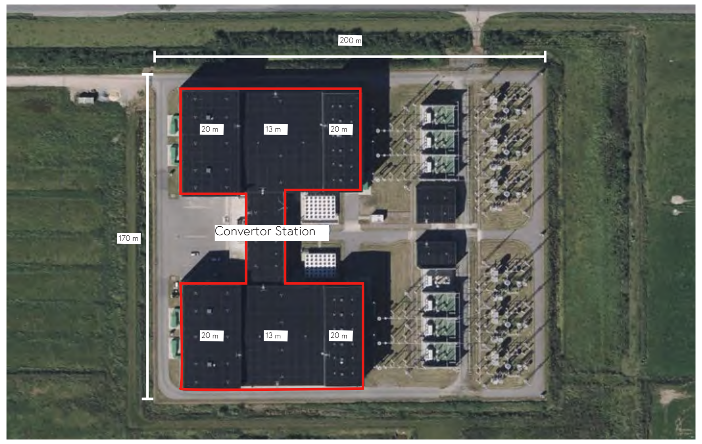
5.2 Conventional Industrial/ Agricultural (Baseline)

Nordlink, Tonstad to Wilster, Germany

NordLink is the first interconnector to provide a direct link between the Norwegian and German energy markets.

NordLink is a HVDC transmission system connecting Germany and Norway, spanning a total distance of 623 km, with 516 km of it as a submarine cable. Given the extensive length, DC is utilised for electricity transmission through both cables (positive and negative poles), linked to converter stations at each terminus. DC is particularly suitable for long-distance and large-scale power transmissions.

NordLink has a capacity of 1,400 MW, enough to supply renewable energy to over 3.6 million German households. This capacity is comparable to the power generated by 466 wind turbines, each producing 3 MW. Therefore, the interconnector's capacity slightly exceeds that of a large conventional power station.



Lessons Learned

The design of the NordLink converter station incorporates a green façade to blend with the landscape and employs a compact spatial strategy for efficient site navigation.

- The converter station's capacity is 1.4 Gigawatts. The whole site is only 170 m by 200 m;
- The Green facade mimics the colour of the landscape that it's on, however no colour variation is used, so could be quite invasive to the area when seasons change;
- No screening is used on site, with the converter station situated directly next to the main road. This may be because the country views converter stations as essential infrastructure and has accepted their presence without the need for additional concealment;
- Facade seems to have a reflective surface; and
- Black roof is unusual due to it potentially prone to over heating, with black being a high conductor of heat.

arcsom.com/en/cases/alegro

tennet.eu/de/projekte/nordlink

lincolnshirelive.co.uk/news/local-news/bicker-fen-siemens-electricity-power-4757306

lincsonline.co.uk/spalding/news/key-pieces-of-major-viking-link-project-in-place-9286084/

eifo.dk/en/knowledge/news/765-km-long-electricity-link-enables-more-effective-use-of-renewable-energy-in-denmark-and-the-uk/

5.2 Conventional Industrial/ Agricultural (Baseline)

Viking Link, Bicker Fen, UK

Viking Link is a new HVDC electricity interconnector between the substation Revsing in southern Jutland, Denmark, and Bicker Fen in Lincolnshire, Great Britain

This is the UK side of the connector located in Bicker Fen in Lincolnshire. The facade of the building uses a green colour scheme that matches the surrounding area. The change in colour from green up to the light colour, blends the building in the landscape from ground to sky.

Viking Link Trailer video:

youtube.com/embed/QncH6IILB2c?autoplay=1&start=0&rel=0&enablejsapi=1&mute=1&version=3

It is interesting to note that different technical standards have been applied than at the UK end. With the concrete bund walls on the Transformer side stopping below the metal parapet and not having external gutters and down pipes.

Lessons Learned

The design of this converter station has informed the colour bands design approach.

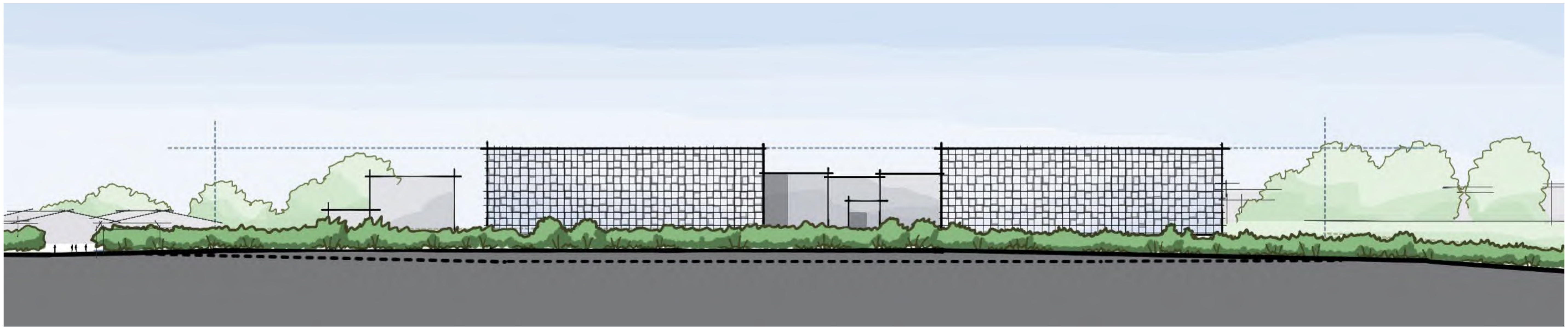
- The colour banding is relatively successful at blending in with the landscape as the building is generally seen at a long distance, (for example from the A17 where is off to one side and hard to pick out even when aware of it), with the location being very sparsely populated;
- The green bands relate well to the prevalent colour of agricultural buildings in the local area;
- The strategy and design is best suited to long distances and lacks sophistication when seen close up;
- With the transformers tight up to the Reactor Halls the resultant concrete blast wall leaves no scope for architectural treatment;
- The transformers being tightly placed next to the reactor halls means a smaller area of the site is occupied;
- Control buildings are not scattered around the site, could be found in the main control centre between the DC Halls;
- Viking Link is a 1.4 GW high voltage direct current electricity link; and
- Situated northwest from a residential development, it is vital that the building is screened or blends in with the landscape to lessen the visual and acoustic impact.

5.3 Enhanced Cladding

This design approach is focused on how the appearance of the walls can be enhanced to reduce the visual impact compared to conventional cladding systems.
It typically uses a decorative overcladding layer applied on top of a technical background cladding layer to add depth and give more flexibility for design options. It can also be used to hide features such as rainwater goods and louvres that might otherwise detract from the design.

It is also common for this approach to use a parapet detail with a flatter roof type so the roof can be hidden. This allows roof based equipment and access safety systems to be hidden as well.

This approach creates scope for the cladding design to incorporate decorative themes that include local cultural references or relate to the function of the facility.
Generally the enhanced cladding is focused on those areas with greatest visual impact, i.e. The taller parts of buildings which can be seen from key viewpoints, with more conventional cladding applied to lower levels and inward facing elevations.



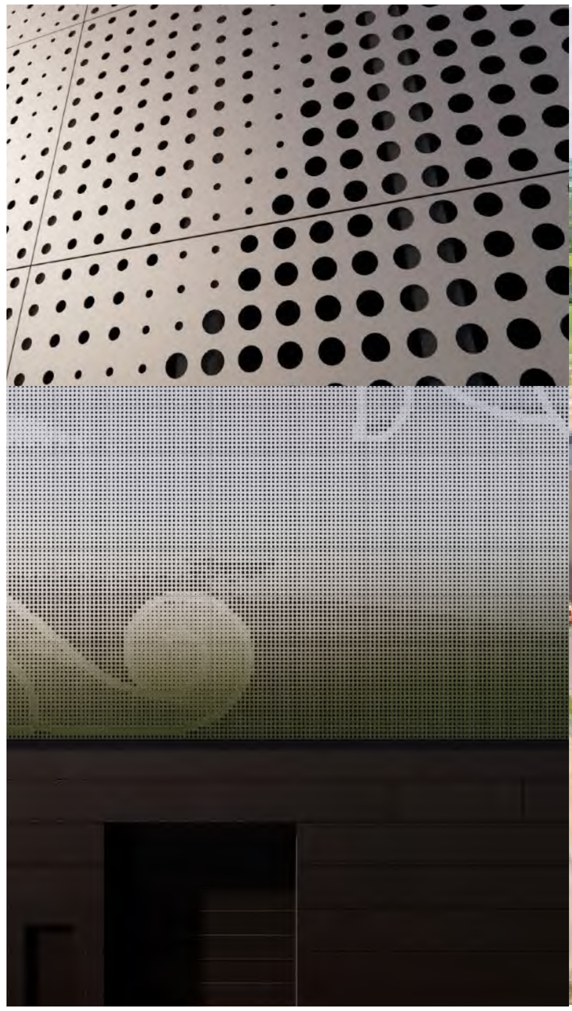
5.3 Enhanced Cladding

Viking Link, Revsing, Denmark

This is the Danish end of the Viking Link to the UK. The DC Halls are clean volumes with wrap around parapets and all rainwater goods hidden behind the rain-screen.

The metal cladding features perforated patterns with the designs inspired by traditional Viking knot patterns.

It is interesting to note that different technical and design standards have been applied than at the UK end, which is a more conventional building.



Lessons Learned

1.4 GW (bi-pole). The HVDC is 525 kV. Supplier Siemens. System activated 2023.

- The DC Halls are split into two sections. The lower part (crica 7-8 m) has simple dark brown cladding, (which also wraps the transformers), and the upper part (14-16 m) has metallic rainscreen cladding;
- The rainscreen cladding features perforation designs depicting local traditional knot work. It is fixed over a simple technical box using vertical cladding rails (see image below of removed panels);
- The use of a rain screen has allowed a very clean building volume with parapets, low pitch single ply roofing, and hidden rainwater goods. It would be challenging to replicate this in England and Wales without derogations to the NG Technical Standards. The effect is slightly spoilt by the transformer bund walls; and
- Bunding is used to screen the buildings from the farm houses situated near by.

eifo.dk/en/knowledge/news/765-km-long-electricity-link-enables-more-effective-use-of-renewable-energy-in-denmark-and-the-uk/

viking-link.com/cables/

5.3 Enhanced Cladding

Sizewell C - Turbine Halls

Lessons Learned

- The rainscreen cladding features a slight fold that expresses a geometric shape. The sun bounces of the panel creating shadows and varying shades; and
- These panels are then rotated to create variations on the flat facade, adding a complex elevation that encompasses varying shades breaking up the large facade, and fading it into the environment.

7.11 Conventional island concept

7.11.1 One of the driving concepts for Sizewell C is expressed through the bold simplified geometry of the turbine halls in combination with the operational service centre and the linking skybridge elements which together will comprise a formal set-piece.

7.11.2 This group of 'focal' structures would be constructed as pure orthogonal elements, which relate to the existing Sizewell A and B platonic built forms. Parallels with Sizewell A and B power stations can also be drawn in terms of the use of detailing to manipulate the perceived scale of certain elements, as described in Chapter 6 of this statement. The structures will also be treated with a consistent material approach which would have a high-quality durable finish and behave sensitively to complement the surrounding landscape of the area.

7.11.3 In order to achieve the required high-quality finish within a marine environment, anodised aluminium has been selected for the external cladding panels. This lightweight, easily formed material is corrosion resistant and will retain its finish. The electrochemical process of oxidising the surface of the metal creates an integral layer, which is chemically stable, tough, brittle and acts as an electrical insulator. It is possible to colour the surface of the aluminium by combining metal salts within the anodic skin of the panels, the colour is created by light absorption and reflection from the surface as an optical effect. The selected colour will be from a fade free range.

DETAILED BUILT DEVELOPMENT PRINCIPLE WITHIN MAIN PLATFORM 55.

The turbine halls and operational service centre will comprise a formal set-piece with a consistent material **finish. The silhouette of these structures would be identifiable as a clean simple profile from coastal views.**

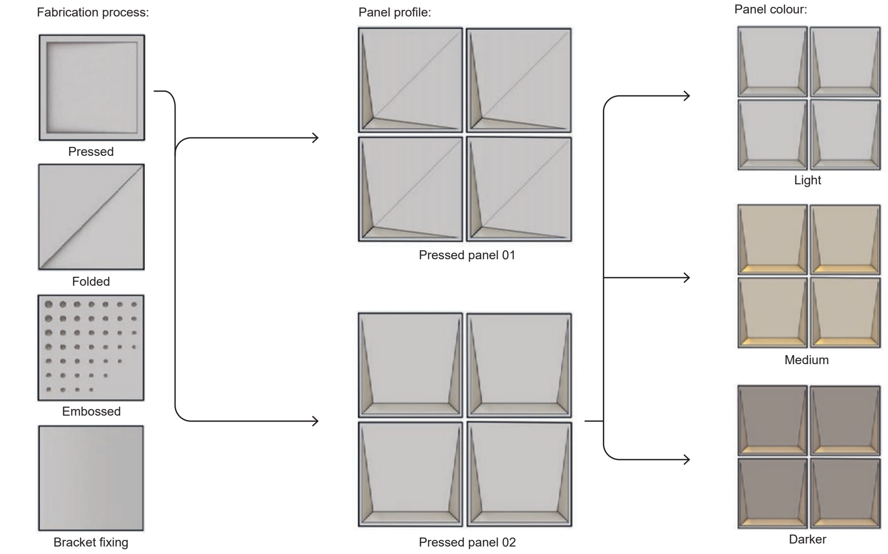


Figure 7.28: Cladding panel profile development

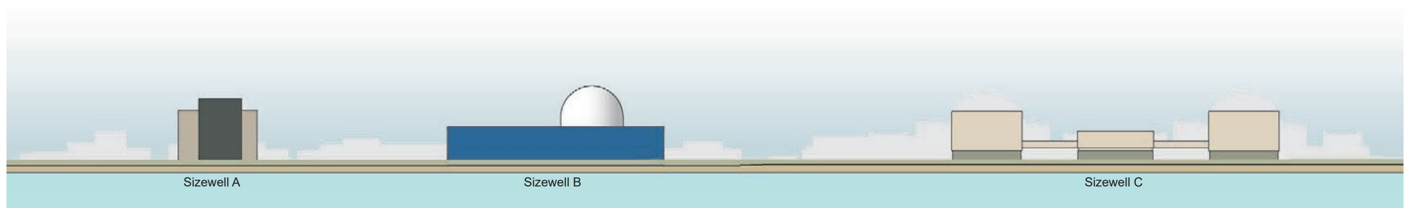


Figure 7.29: Coastal elevation illustrating sequence of contrasting Sizewell A, Sizewell B and Sizewell C forms

7.11.4 The panelised facade treatment of the turbine halls would perform as the external expression of the power station. It is designed to provide a sensitive response to the surrounding landscape by using a regular cladding module in different orientations across the facade to create graduated variations in relief, tone, colour and texture. This system will also deliver a maintainable facade with a layered skin to allow for panel replacement and will meet rigorous acoustic and safety requirements in accordance with the UK EPR™ generic design technical requirements. A dark recessed shadow gap will be visible between panels to define the framework and modularity of the facade.

7.11.5 The cladding panels would be applied to a 1.5m facade grid and would be profiled to accentuate variation across the turbine hall facades. The profiles explored have included etched, embossed, folded and pressed surfaces, several of the design options explored are illustrated within Figure 7.28, each of the profiles offers the opportunity to rotate the panels through four alternative orientations. The pressed profile has resulted the greatest variation in surface colour and tone, providing the greatest visual effect when orientated in different directions. Currently two different pressed panel variants are being considered, one of these is pressed in on the corner and the other is pressed into the side as illustrated by Figure 7.28 and Figures 7.30 - 7.35.

7.11.6 The resulting variation across the surface of the turbine halls could be applied randomly or modified to create gradients and patterning to the façade. Each individual panel would become like a pixel forming part of a broader picture in conjunction with the context the buildings sit within. This has been explored to create a subtle gradation from the base of the building towards the top edge where panels will be angled up in greater numbers to reflect the sky and dissipate into the light beyond. Similarly, towards the bottom of the façade grid panels are angled down towards the ground in greater numbers in order to reflect the ground conditions. Centrally located panels are randomly placed with the largest numbers orientated east and west. The overall effect is a gradation from darker colour tones at the base to lighter at the top creating the appearance of a dynamic skin which is responsive to its surroundings.

DETAILED BUILT DEVELOPMENT PRINCIPLE WITHIN MAIN PLATFORM 56.

The turbine halls cladding (material above the base plinth) will **seek to provide a responsive surface treatment which changes** in colour and tone, subject to surrounding lighting and climatic **conditions and will be made of a material and panel profile/s agreed with East Suffolk Council. The colour palette, material and panel profile will be discussed and agreed with East Suffolk Council in** consultation with the AONB Partnership and the National Trust as part of pre submission discussion/ design review and align with the colour information and study outcomes recorded in the Design and **Access Statement Section 7:11 and within a range of light to darker** bronze. The information will include details of the manufacturer's **maintenance specification for external facing cladding.**

Figure 7.30: Geometric form visible beyond the site: Option 01

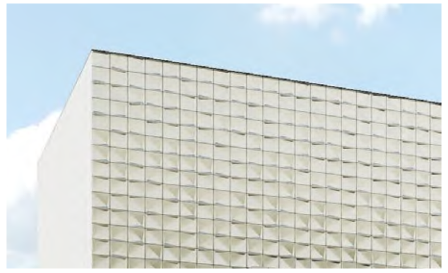


Figure 7.31: Cladding modules at mid-distance views: Option 01

Figure 7.32: Panel detail perceptible at close range: Option 01

Figure 7.33: Geometric form visible beyond the site: Option 02

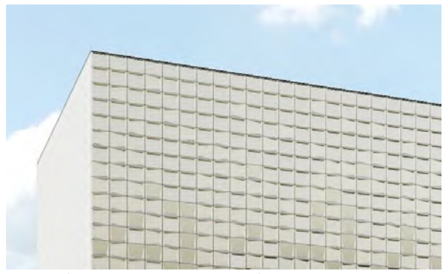


Figure 7.34: Cladding modules at mid-distance views: Option 02

Figure 7.35: Panel detail perceptible at close range: Option 02

5.3 Enhanced Cladding

Brent Cross Substation

Largest permanent public artwork in the UK. The substation is wrapped in a 52 m long and 21 m high artwork designed by London- based artist Lakwena and IF_DO Architects.

This installation sits in a prominent location, within a busy junction of the M1 and can be seen from the North Circular Road.

arup.com/projects/brent-cross-town-substation/

Lessons Learned

- Scale of the panels will have a significant effect on the further viewpoints. Smaller panels tend to be washed away in the distance;
- Various folds and angles of the panels could be used to vary the colour and shades when light hits the surface;
- Spacing between the panels is significant enough so that the effect of the panels is not lost; and
- Shape of the curve soften the square substation by creating a wrap around the substation.

5.4 Enhanced Roof Forms

This design approach is focused on using the roof form as a means of softening the profile of the buildings in the landscape compared to the conventional pitched roof and gable forms.

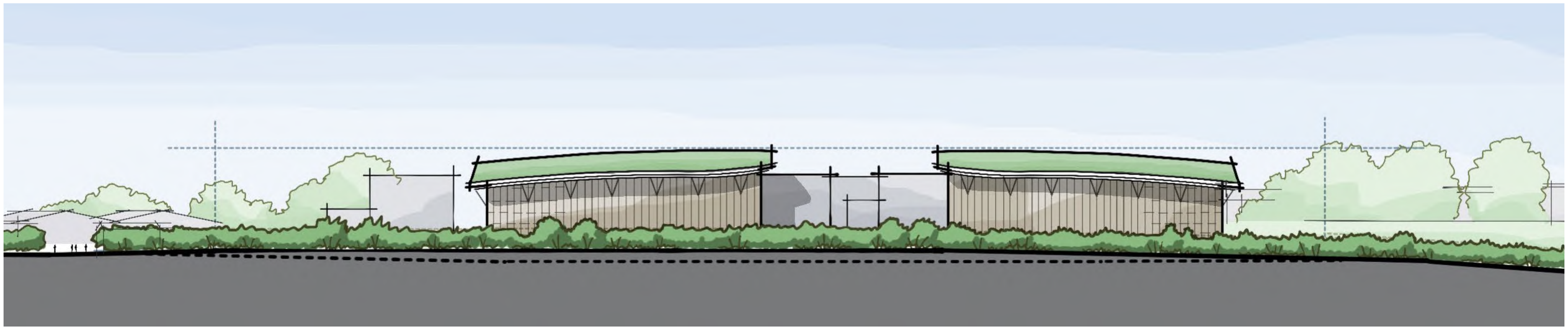
It typically uses a curving profile with deep oversailing eaves to reduce the apparent height of the walls and push the wall cladding into the background as a secondary feature.

The way the roof forms are articulated depends on the preferred elevations for gables or eaves, for simpler 2D curves, with more complex 3D curves allowing all sides to have lower eaves.

Roofs of smaller buildings can be tilted to face outwards and screen the elevations of taller buildings.

As the intention is for the roof to be more prominent, the choice of finishing material is critical. This form and approach would be well suited to applying a planted green roof.

However it is noted that the only converter station case study that has been found, which includes a green roof, was cancelled after planning stage. So this part of the approach remains untested.

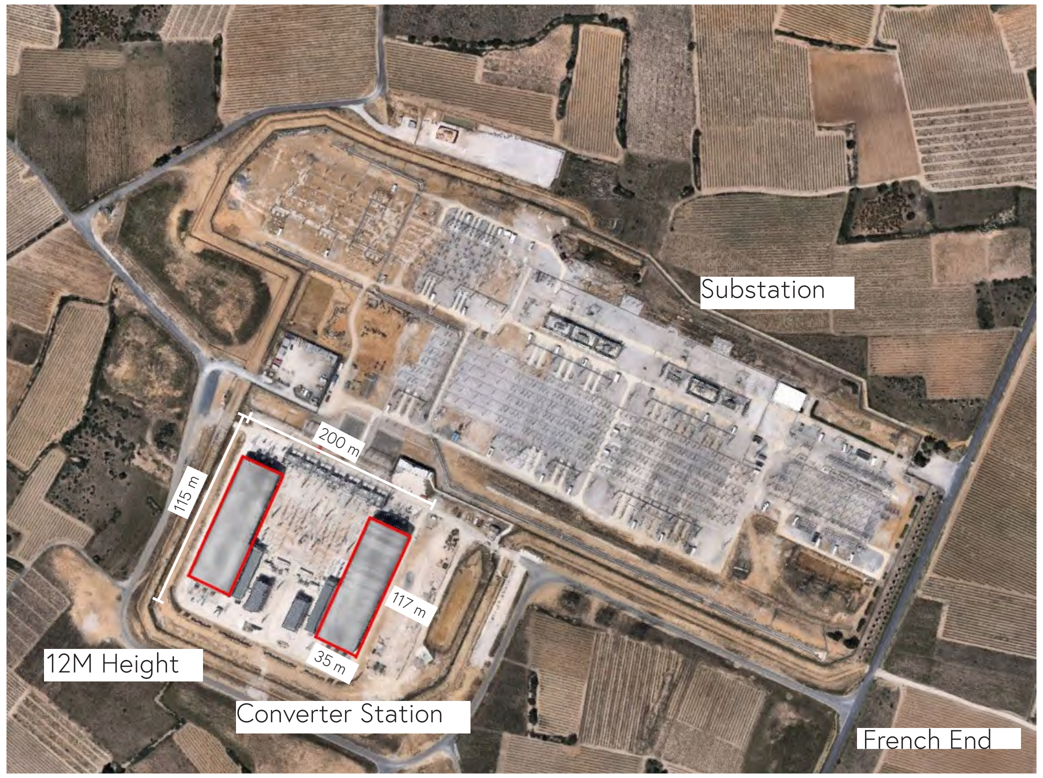


5.4 Enhanced Roof Forms

France to Spain INELFE, Baixas end

INELFE link plays a vital role in strengthening the power grid interconnection between France and Spain, facilitating energy exchange, and supporting the integration of renewable energy into both countries' grids.

The converter station in Baixas encompasses a curved form that softens the typical industrial box style.



Lessons Learned

2.0 GW (bi-pole). 320 kV HVDC. Supplier Siemens. System activated 2015.

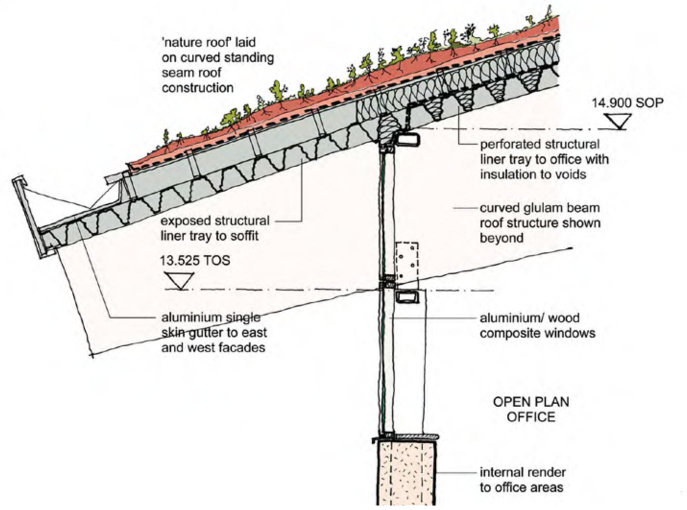
- Baixas (French end) converter station site is 200 m by 115 m with a large substation on the periphery;
- The Baixas DC Halls are long and slender and relatively low height (17 m after consultation) making them more recessive in the landscape;
- The curved form reduces material usage and distributes loads efficiently. Increases durability by minimising stress points;
- The shade of green combined with the curved roof form blends with the landscape, softening the industrial look; and
- The DC Halls are spaced far apart with equipment located between.

global.toshiba/ww/company/energy/topics/transmission/italy-power-transmission.html

briv.me/index.php/projects/15-projects/special-purpose-buildings/50-toshiba

5.4 Enhanced Roof Forms

Adnams Distribution Centre - Southwold, Suffolk

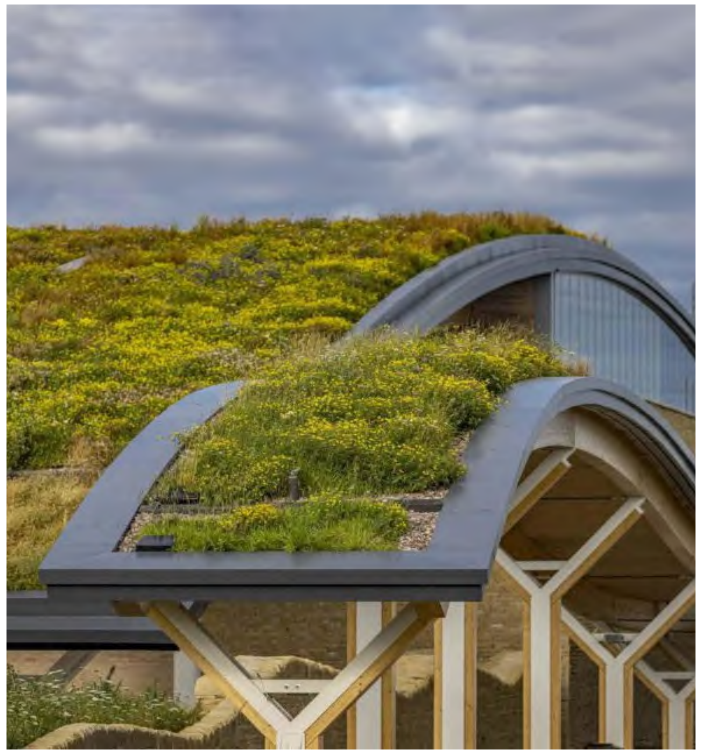


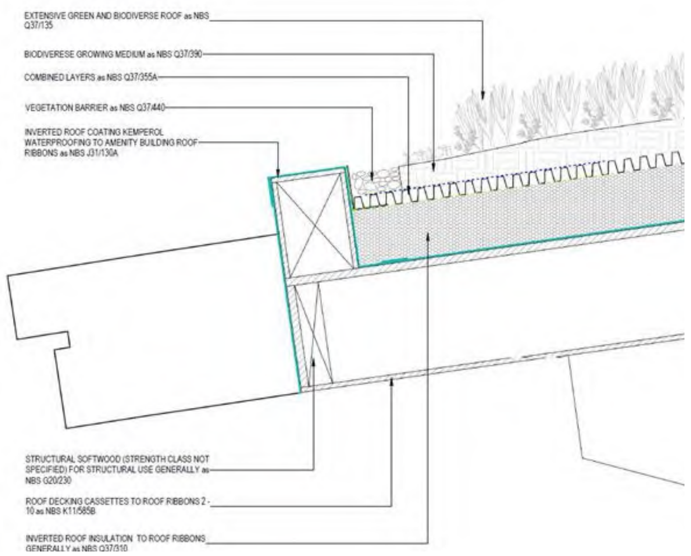
Lessons Learned

- Curved Green roof minimises the visual intrusion of the large development.
- "Softens the mass into the landscape"
- The sedum green roof adds insulation for the building and enhances the natural habitat for local green species.

aukettswanke.com/projects/adnams-distribution-centre/

Skelton Lakes, Leeds





Lessons Learned

- Rural locations can benefit from the introduction of green roofs and cladding as it helps the building to blend into it's surroundings;
- Key considerations are watering and maintenance access, Skelton Lakes features a meadow mix tailored to the local ecosystem. This could be adapted to either of the Suffolk or Kent sites. It needs to be mown twice a year so consideration should be made for safe access and disposal;
- An integral irrigation system will be required. In order to establish the planting it will need to be watered heavily. The roof will naturally tend to reduce the run-off from the building so it contributes to the overall site SUDs. Rainwater harvesting could be used for irrigation; and
- Drought resistant planting would be selected and the intention would not be to have this roof lush and green when surrounding fields have turned yellow/brown. However some background irrigation will be required to prevent die-back. A dead dried out green roof or wall can pose a fire spread risk.

5.4 Enhanced Roof Forms

Rabobank Datacenter, Boxtel, Utrecht

Lessons Learned

- Surface area of the building is 6500 m^2 and a sloping green roof was added over the entire building;
- The green roof slopes above the roof's plant to cover the buildings services;
- Building is split into 3 different sections, but the green roof is connected through the lowest point where the building touches the landscape; and
- The landscape is connected to the sloping roof.

Imagery: Google Maps. 2024 (not to scale).

5.4 Enhanced Roof Forms

North Connect, Peterhead

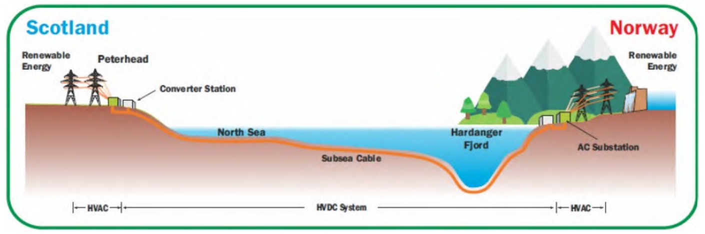
This is a 1.4 GW proposed interconnector between Scotland's electricity network and Norway.

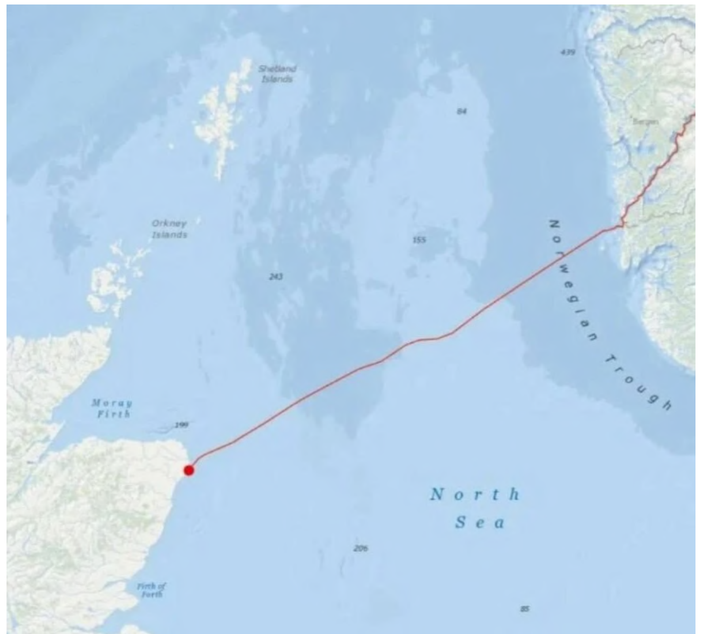
The Scottish side's converter station was to be located in Peterhead, an example of a converter station design incorporating a curved massing with a green roof.

This gained full planning permission, unfortunately the license application was refused by the Norwegian Ministry of Petroluem and Energy in 2022.

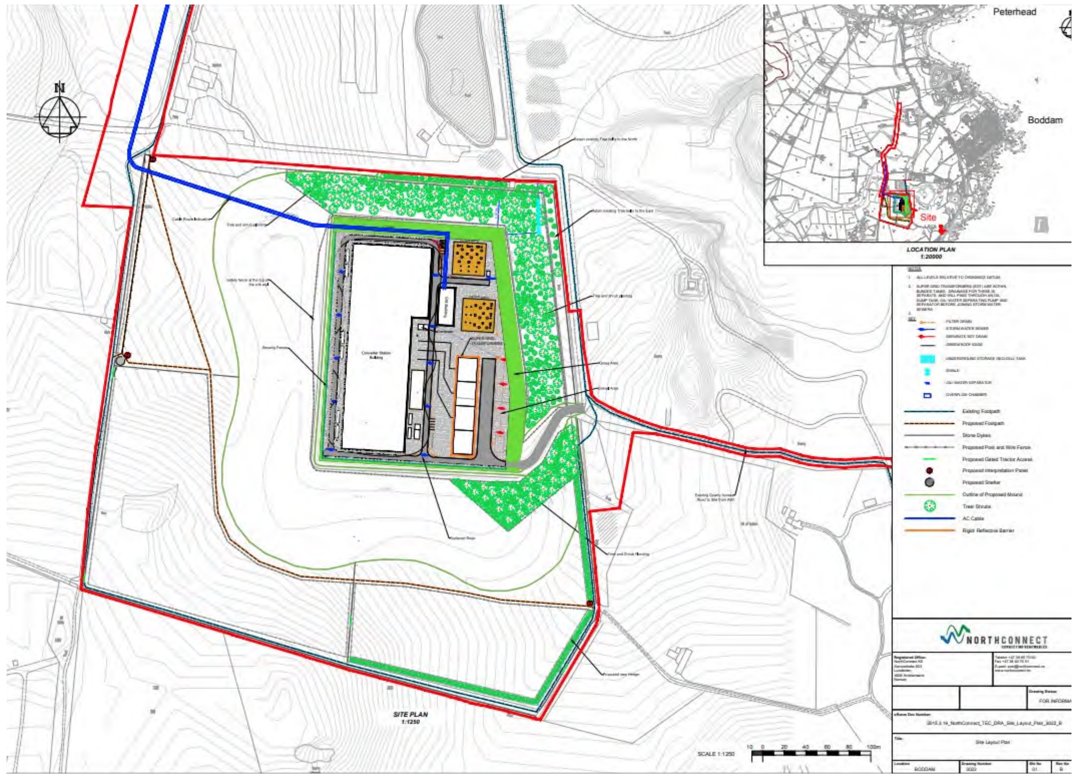
Lessons Learned

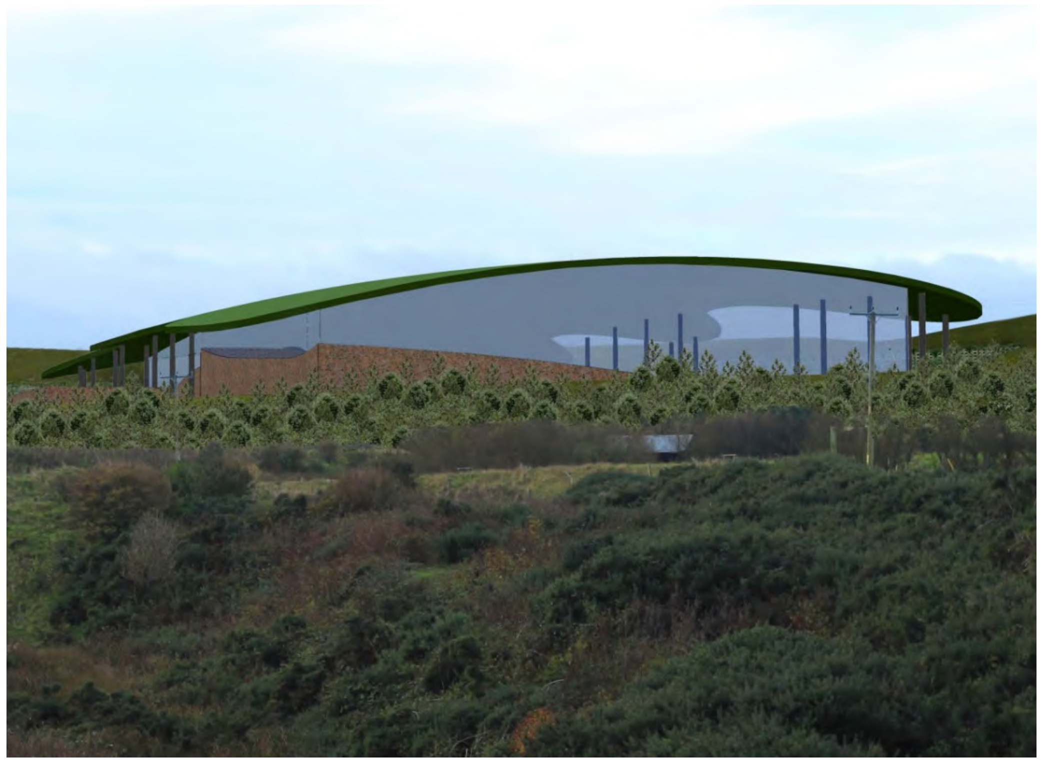
- 1.4 GW HVDC;
- Converter Station site is sloping gently from southwest to northeast between approximately 63 m to 82 m above sea level;
- Green Roof with Sloping Eaves to reduce the visual impact;
- Bunding is brought up to follow the curve of the green roof;
- Unknown as to why glazing was used for the design; and
- Can learn through their planning process as permission was granted for the proposal.





current-news.co.uk/1-4th-scotland-norway-interconnector-refused-license-by-norwegian-government/



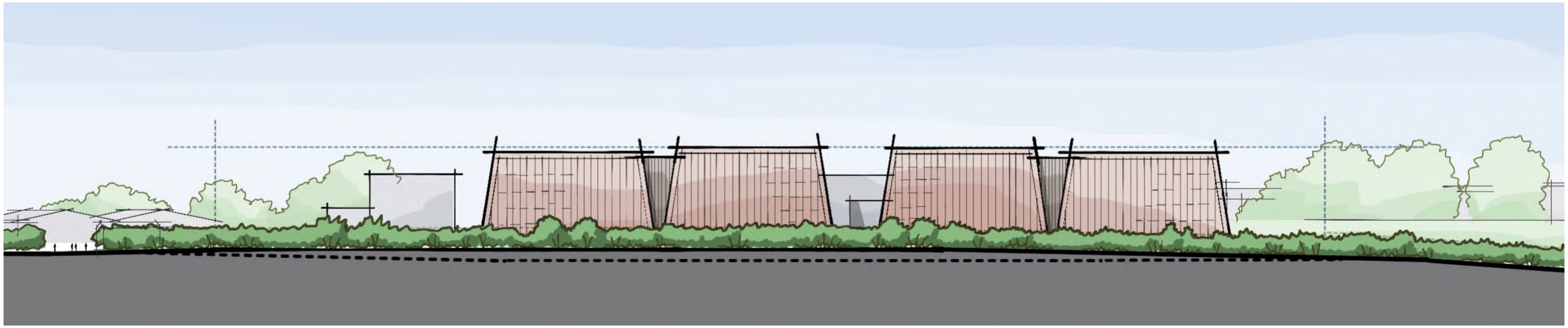


5.5 Fragmented Forms

This design approach is focused on breaking up the mass of the large buildings into segments and articulating them as a series of smaller forms.

The intention is that the forms can step up and down in scale to suit the internal space requirements instead of an overall simpler flexible envelope. A key challenge in developing this approach is that the internal height requirements are at present unknown, whereas the case studies have the benefit of working to a known equipment design.

By breaking up the forms into smaller parts there is less reliance on using colour and pattern to break up large flat surfaces. Part of the strategy can use smaller buildings to form a composition of layered massing to break up the height of taller elevations



5.5 Fragmented Forms

South-West Link (SydVastlanken) Hurva (Sweden)

SydVästlänken (English: South–West Link) is a project aimed at strengthening the power grids in Southern Sweden and the Oslo region in Norway. The project is to be carried out by the national grid operators Svenska kraftnät of Sweden and Statnett of Norway.

The unique architectural design of the SydVästlänken converter stations showcases a combination of modern industrial architecture and thoughtful environmental integration. The structures are characterised by their strong, utilitarian forms, strategic verticality, and use of durable materials, while incorporating aesthetic measures to harmonise with their surroundings.

Lessons Learned

1.2 GW (bi-pole). 300 kV HVDC. Supplier Alstom. System activated 2021.

- The design of this converter station features a stepped structure, creating an articulated vertical form breaking up the mass of the building. It is unclear how these steps in height relate to or are driven by the internal clearance requirements;
- The natural variations in the Corten cladding panels and staggered pattern aids in blending the building with the surrounding environment, breaking the large facade up;
- The whole site is about 6.82 hectares including the AC Equipment located North of the site;
- Required additional acoustic measures post-completion after complaints about noise. (note external transformers in photographs); and
- It appears that a significant amount of the equipment (possibly including the HVDC Reactors) is outdoor. This reduces the mass of building.

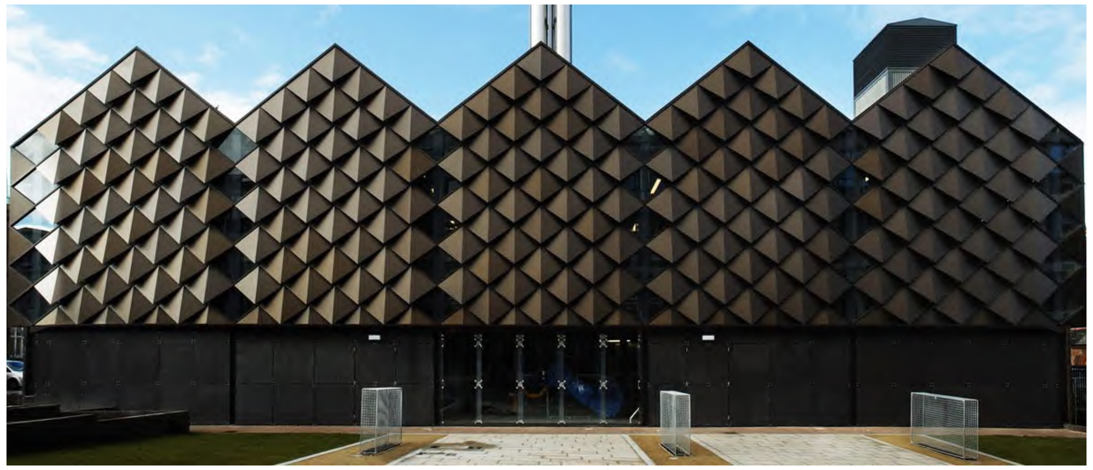
hd.se/artikel/sydvastlanken-forsenas-annu-en-gang/

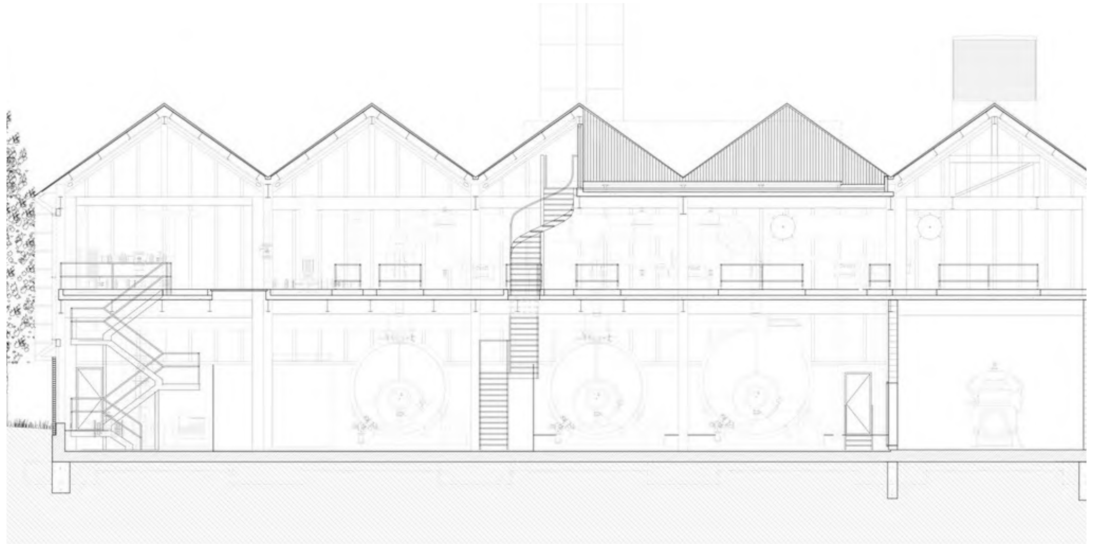
5.5 Fragmented Forms

Heating Infrastructure Building, Liverpool

An infrastructure building which has a formal arrangement achieving symmetry where the texture of the cladding corresponds to the roof form and pattern of the building.

Designed by Levitt Bernstein Architects





Lessons Learned

- A strong definition of simple dark plinth and articulated upper form;
- Use of texture in the cladding to use varying shading instead of mixing colours to add interest to the surface;
- The very geometric and regimented form would make it stand out in the landscape whereas a less repetitive format would be better at blending into the landscape pattern; and
- The creation of valley gutters would be considered a risk of future leaks into the DC Halls.

archdaily.com/53867/heating-infrastructure-building-levitt-bernstein-associates

5.5 Fragmented Forms

Biomass Plant, Sheffield, BDP

The dark cladding responds to the historic industrial landscape. The visually striking orange colour creates a landmark beacon, illuminated from the interior in the evenings.

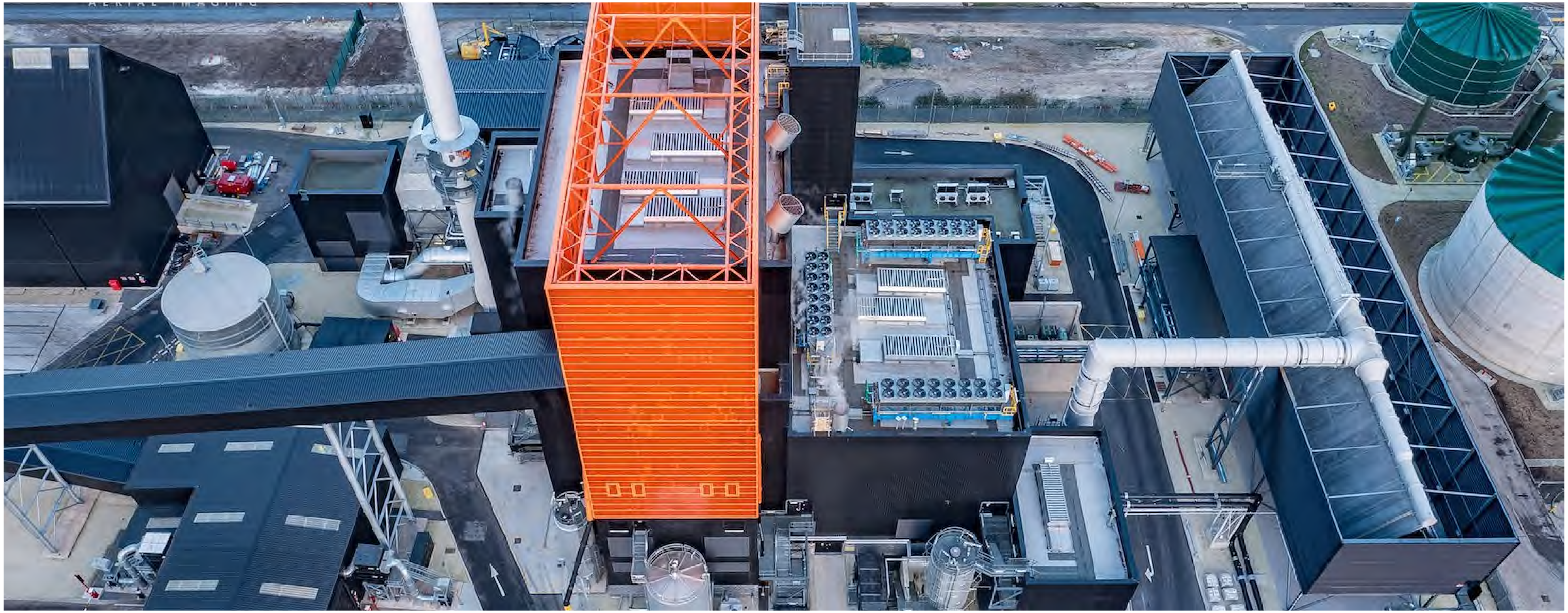
The technical equipment inside could be wrapped with a translucent weather proof material obscuring it's form and allowing for architectural design of the exterior.

The translucency can be used to blend into the skyline reducing the impact of the building.

bdp.com/en/projects/a-e/blackburn-meadows-biomass-plant/

Lessons Learned

- The overall massing has been reduced by designing the form around the function in different areas; and
- The facility replaces a previous landmark pair of cooling towers so there was an appetite to create a new landmark. That is not the case for Kent.



DESIGN RESPONSES TO DESIGN PRINCIPLES

6.0

6.0 Design Responses to Design Principles

6.1 Development of the Design Approaches

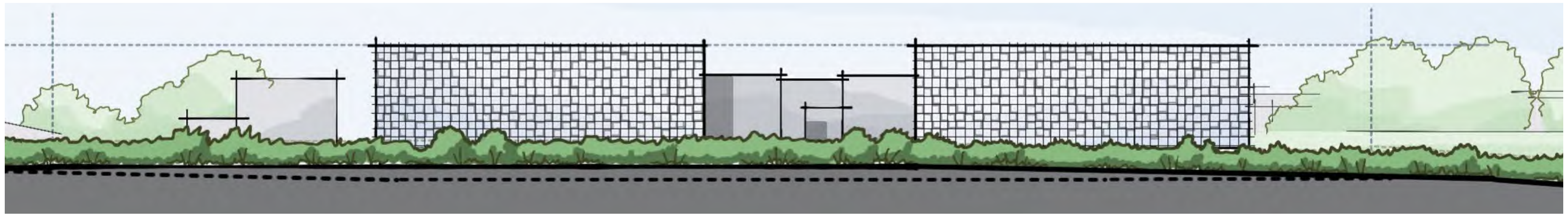
This section shows how the four different design approaches have been developed in tandem with the design principles in **Application document 7.12.2 Design Principles - Kent**, taking on board lessons learned from the case studies and the feedback on previous LPA and DRP engagement. The site-specific design principles in section 3.2, and in particular Table 3.1, of the design principles document have been written in such a way that any of these design approaches (or a combination of them) can be used. This allows the most appropriate to be selected to suit the designs put forward once a supplier has been selected.

Correspondingly these design approaches have been developed as a means of testing how these design principles work and of demonstrating how they might be applied. These are not intended to show design solutions and are for illustration purposes only.

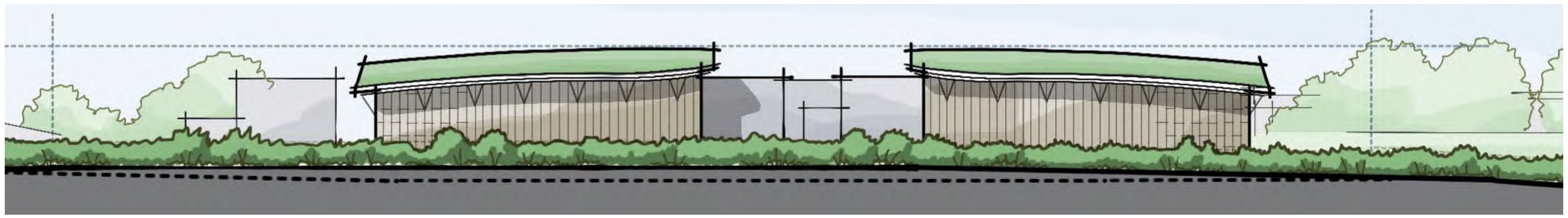
Each design approach is accompanied by a set of diagrams explaining what the strategy is addressing and the methodology of how they might be applied to the generic converter station massing. At the end of each design approach section there are some illustrative renders of the design approach applied in a selection of the representative views. These are not verified in terms of position or lighting and are intended as a means of assessing the relative merits of the design approach.

Conventional Industrial/Agricultural (Baseline)

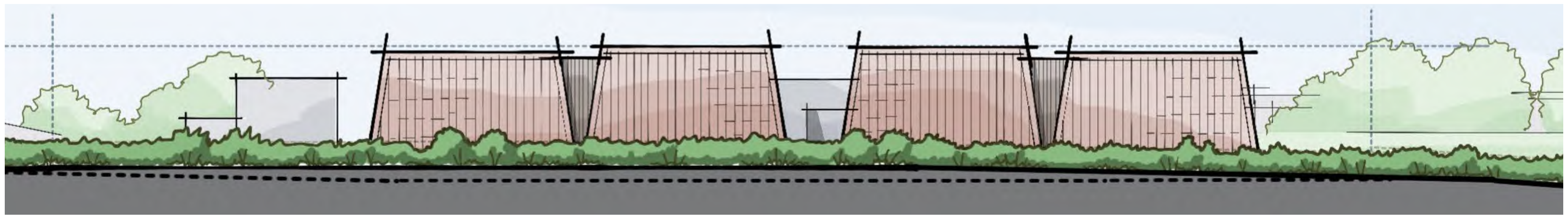
Enhanced Cladding



Enhanced Roof Forms



Fragmented Form



6.2 Conventional Industrial/Agricultural (Baseline)

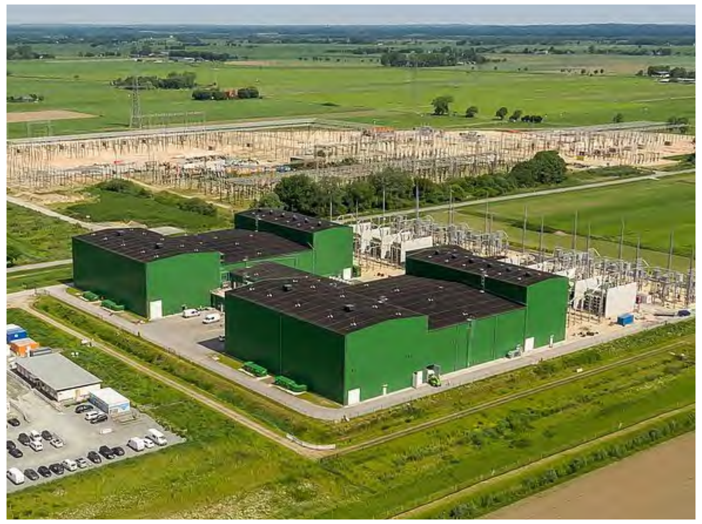
Design Approach Premise

The building forms have been taken directly from the generic converter station layout massing and elevations included in the DCO drawings. It is based on 6 degree roof pitches which are standard for conventional sheet roofing.

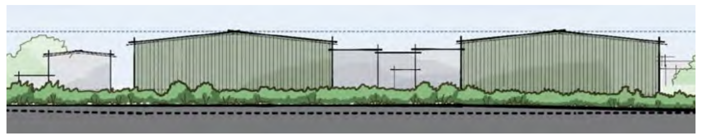
Revision B of this document includes updated illustrations of the baseline design approach (using Olive Green cladding) for viewpoints 4, 8 and 11. These include two versions alongside indicative tree planting:

- Winter Year 1
- Summer Year 15

These have replaced the images included in revision A.



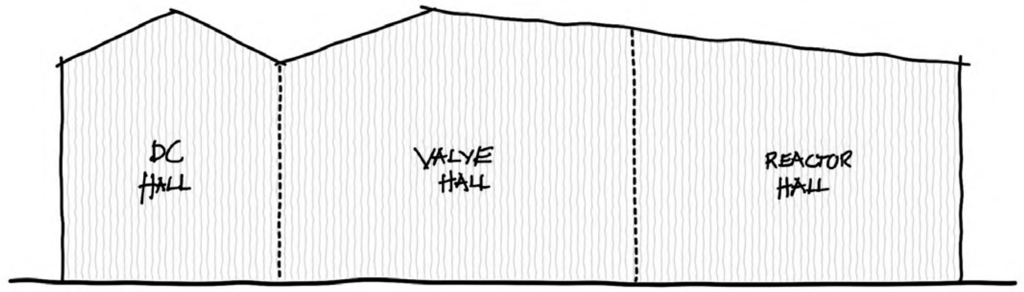
NordLink Converter Station
tennet.eu/de/projekte/nordlink



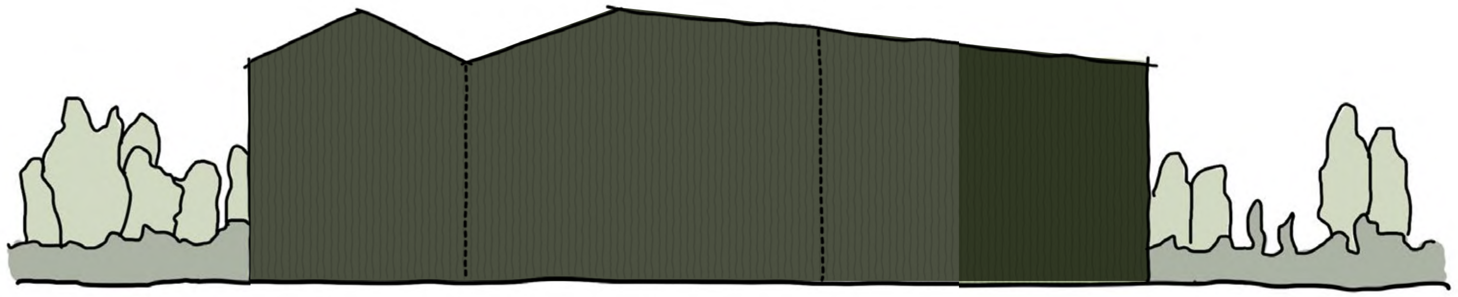
Conventional Industrial/Agricultural (Baseline)

DC Halls Heights

Max Height (from existing ground) 28 m



DC Halls Colour Scheme



Svelete Grey (RAL 080 50 20)

From the Tata Steel Standard Cladding Colours.
tatasteeluk.com/construction/key-products/colorcoat

Olive Green (RAL 140 30 10)

6.2 Conventional Industrial/Agricultural (Baseline)

These are proposed views without the planting.

Note that the wind turbine and one of the masts have been removed since the baseline photography was taken.

Viewpoint 4 - Winter (Year 1)

- The colour of the massing helps to situate the form into the landscape, and due to its position on the North Facade, it will be less susceptible to seasonal changes.
- The massing is prominent in the foreground but subtly mirrors the rhythm of the distant tree line, creating a sense of continuity with the natural surroundings.
- Being viewed from the north, the cladding will appear darker and 'browner' due to shading, enhancing the connection with the deeper tones of the distant tree line.

Viewpoint 4 - Summer (Year 15)

- Due to the increased growth in vegetation, the massing would be better situated within the landscape.
- The dark green/olive colour would help the massing blend/transition between the freshly cultivated fields and the think green horizon line.
- The massing from this viewpoint would still be prominent and clearly visible, but mitigation and colour choice helps to lower the overall impact.

6.2 Conventional Industrial/Agricultural (Baseline)

Viewpoint 8 - Winter (Year 1)

- Looking north, sunlight from the south will significantly affect the facing facade, potentially highlighting the sharper edges of the design.
- The building's verticality and straight lines could stand out in the landscape, making the structure identifiable within this view.
- The colour of the facade is well-suited to this viewpoint, as it shares a similar hue with the surrounding tree line. However, the angle of sunlight throughout different seasons could cause the façade to appear brighter, contrasting more sharply against the darker browns of the landscape.

Viewpoint 8 - Summer (Year 15)

- Looking north, with high sunlight from the south, the roof of the design may be highlighted within the landscape.
- The colour is more successful in summer months, due to the increase in growth of trees, meaning there is large amounts of dark green layered within the landscape.

6.2 Conventional Industrial/Agricultural (Baseline)

Viewpoint 11 - Winter (Year 1)

- This viewpoint is situated on higher ground, meaning the massing of the buildings sits below the horizon line, helping to naturally mitigate it within the view.
- The green cladding helps to blend the foreground of the landscape from deeper browns into the surrounding and distant greens.

Viewpoint 11 - Summer (Year 15)

- In the summer, the greens become thicker and darker, meaning when the sunlight hits the verticality of the structure, it can highlight it within the landscape.
- The colour is well suited to this viewpoint as it sits in between the thicker greens and the lighter greens of the landscape where the sun is hitting a flatter surface.

6.2 Conventional Industrial/Agricultural (Baseline)

These are proposed views without the planting.

Note that the wind turbine and one of the masts have been removed since the baseline photography was taken.

Viewpoint 10

- The vertical form of the building is especially noticeable in this view, as it stands out against the foreground vegetation, which is closer to the viewer.
- The darker façade colour, while distinct, contrasts with the natural landscape and the river, but is framed against the sky, which may accentuate the building's form even further.
- The sharp corners of the design are highly visible and draw attention within the landscape.

Viewpoint H3

- From this viewpoint, as with others, the building's form remains highly prominent in the landscape, but here it is particularly unsuccessful, as it is starkly outlined against the sky.
- The colour of the form somewhat blends with the landscape, continuing the tree line to the left; however, a more fragmented or softer approach would improve its integration.
- With the right adjustments to the colour and form, such as combining the massing with bunding or an enhanced façade, the design could be more successful, especially since this viewpoint offers a closer-up view where the building's details would become more evident.

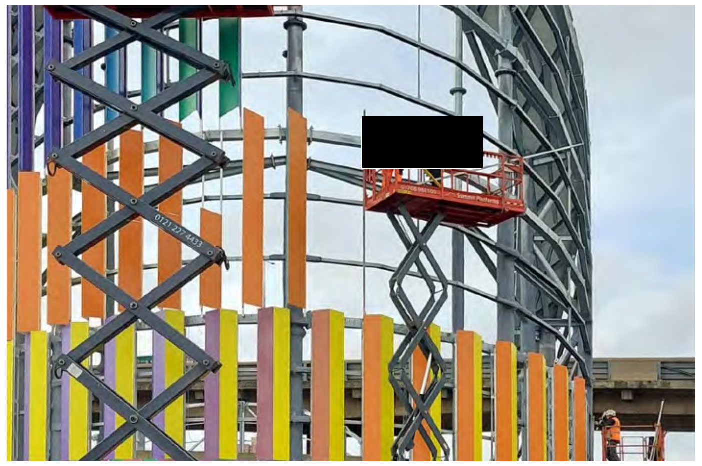
6.3 Enhanced Cladding

Design Approach Premise

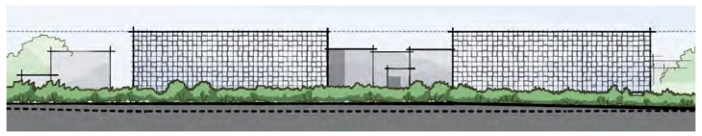
Using enhanced cladding can provide a way to enclose the technical box, creating a decorative facade that sensitively responds to the surrounding area. This approach allows for variations in texture, colour, and tone, offering an expression of depth that complements the environment.

As this is a secondary skin for the technical box of the converter station, it can effectively conceal gutters, pipes, and louvres.

The design approach has been developed in line with the Limits of Deviation and within the Rochdale Envelope (28 m).

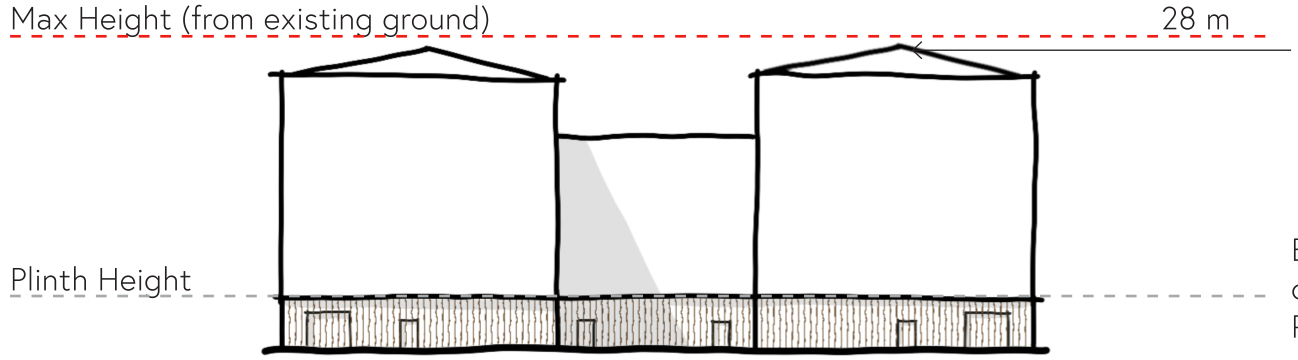


Brent Cross Substation
arup.com/projects/brent-cross-town-substation/

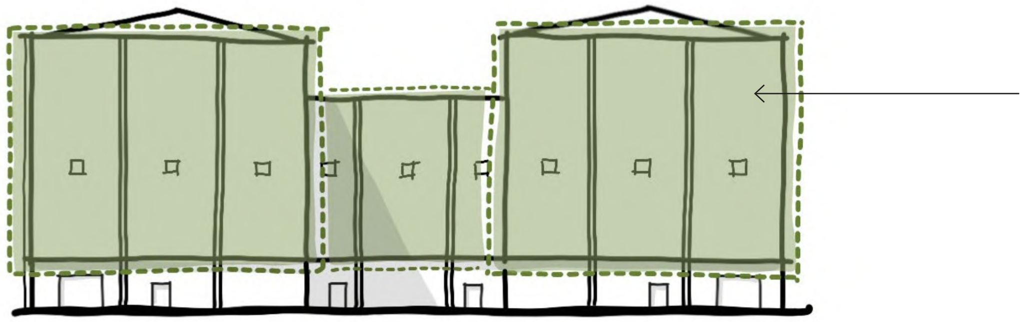


Enhanced Cladding

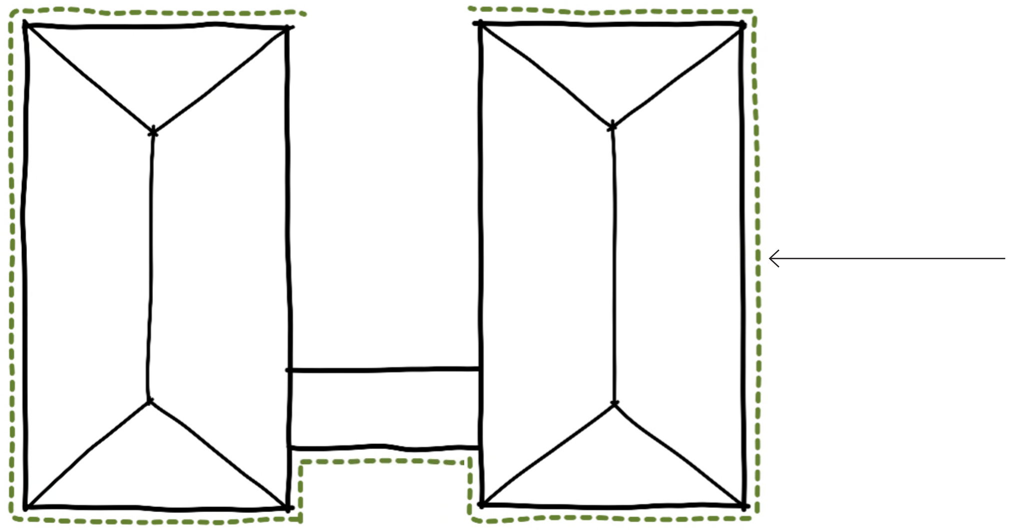
DC Halls Heights



Secondary Skin Elevation



Secondary Skin Plan



6.3 Enhanced Cladding

Key Elements

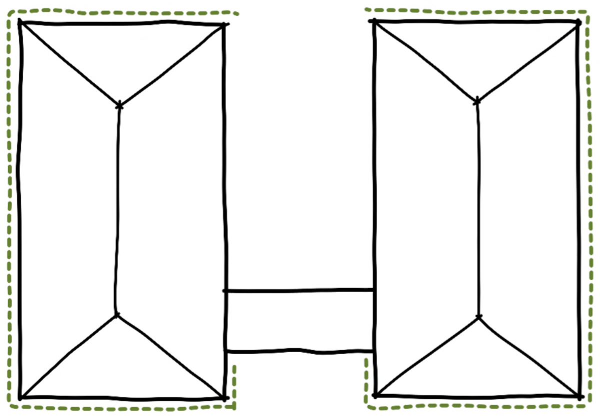
This integrates three key strategies: Softening Edges, Stepping Corners, and Panelisation.

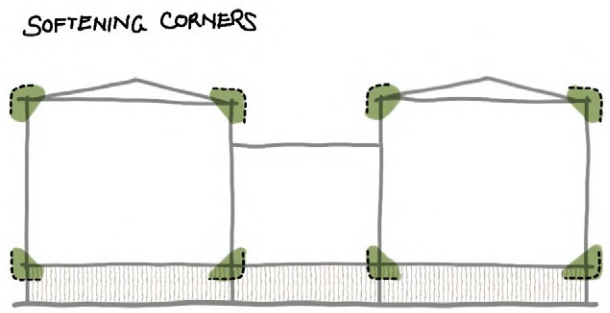
Softening Edges: The cladding curves over the roofline, blending with the landscape by mimicking natural contours. This reduces visual impact and creates a seamless transition between the structure and its surroundings.

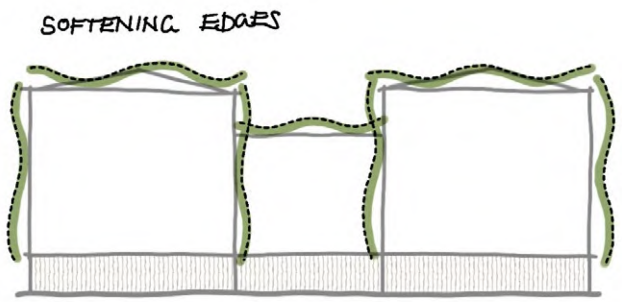
Stepping Corners: A freeform mesh wraps the building, with varying cladding density to create depth and texture. This interplay of light and shadow enhances the organic feel, echoing patterns found in nature.

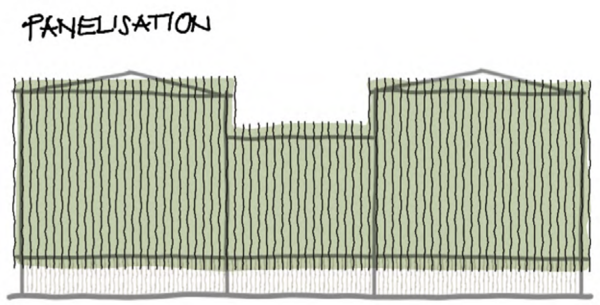
Panelisation: Varying the cladding height along the facade reflects the rhythm of the treeline, breaking down scale and adding an organic, dynamic quality to the elevation.

Perimeter covered by panels on the DC Buildings







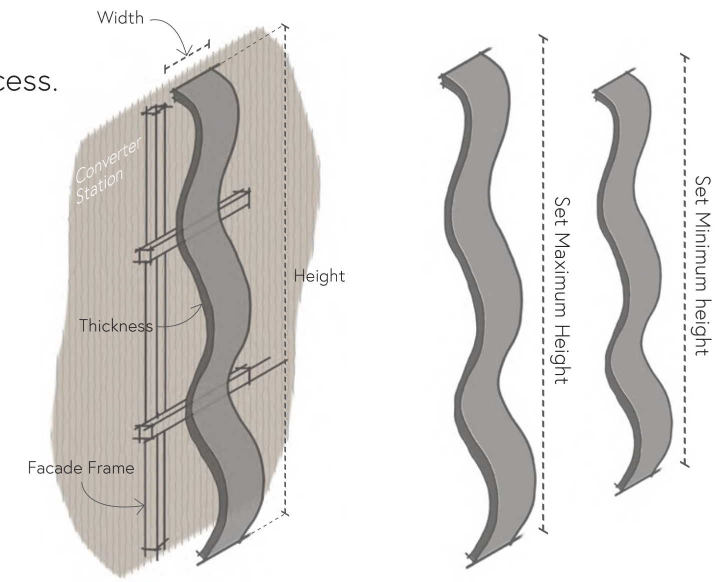


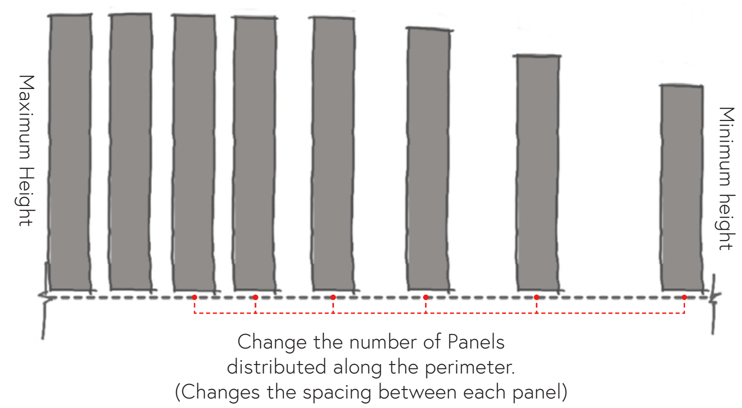
Organic curve along the face of the technical box.

Using parametric modelling, the facade is generated through a set of adjustable parameters, enabling an iterative design process. The enhanced facade adapts to individual design changes and site conditions through these parameters.

Individual parameters that can be changed:

- Height / Width / Thickness of the panel.
- The curvature of the panel.
- Set the number of panels along the perimeter of the technical box. (Changes the spacing between the panels)
- The maximum and minimum heights of the panels when distributed along the perimeter.





6.3 Enhanced Cladding

These are proposed views without the planting.

Note that the wind turbine and one of the masts have been removed since the baseline photography was taken.

Viewpoint 4

- This approach enhances the facade to reduce its visual impact compared to conventional cladding systems.
- A decorative overcladding layer adds depth and flexibility, allowing for a more refined integration with the surroundings while concealing technical elements.
- The detailed design will require far greater refinement and respond to the final engineering layout in order to capture the intended design benefits of this strategy.

Viewpoint 8

- Colour of the technical box is important as it blends into the enhanced facade, in this case a brown earth tone becomes more prominent.
- In this view the tallest buildings are below the horizon line. The building blends into the fields behind (much more so than NEMO Link that can be seen on the right hand side).

6.3 Enhanced Cladding

These are proposed views without the planting.

Note that the wind turbine and one of the masts have been removed since the baseline photography was taken.

Viewpoint 10

- In this view, the DC building is seen through the break in the trees.
- At this scale the shape of the building remains very sharp despite the curving of the edges through the enhanced cladding.

Viewpoint H3

- The building remains a dominant presence. The softening of the edges through the curved panels is more prominent.
- There is a contrast between the straight edges of the technical boxes to the organic "wave" the panels create through its curvature.

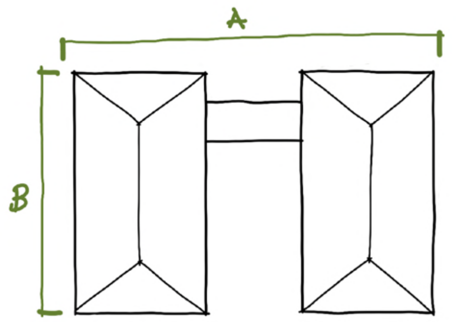
6.4 Fragmented Form

Design Approach Premise

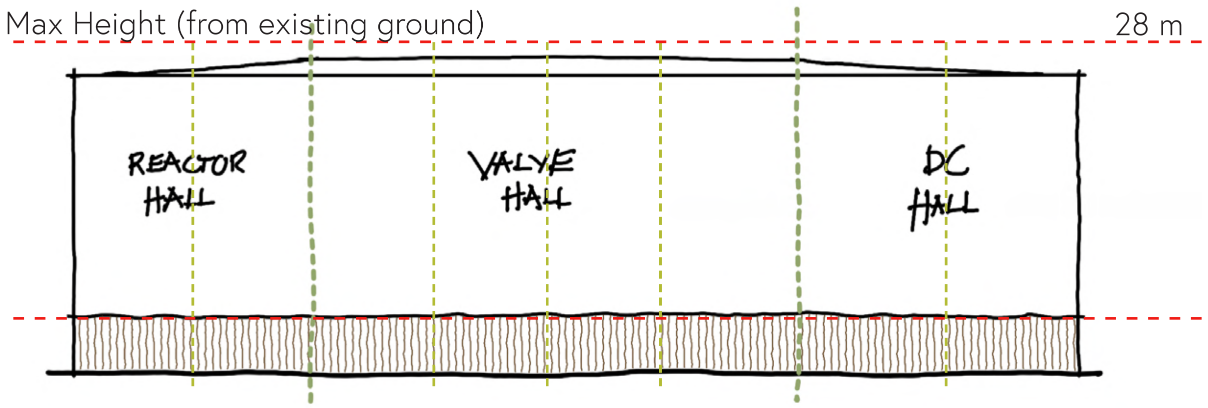
The Rochdale Envelope allows for a maximum height of 28 m, the views are obstructed by a large, imposing block. Fragmenting the form and facade of the converter station can mitigate this issue by breaking the lengthy facade into smaller, more manageable sections.

Dividing the facade into three main blocks highlights the three primary areas of the DC block: the DC Hall, Valve Hall, and Reactor Hall. This approach not only enhances the architectural design but also visually represents the flow of electricity through the DC Halls.

DC Halls Plan View



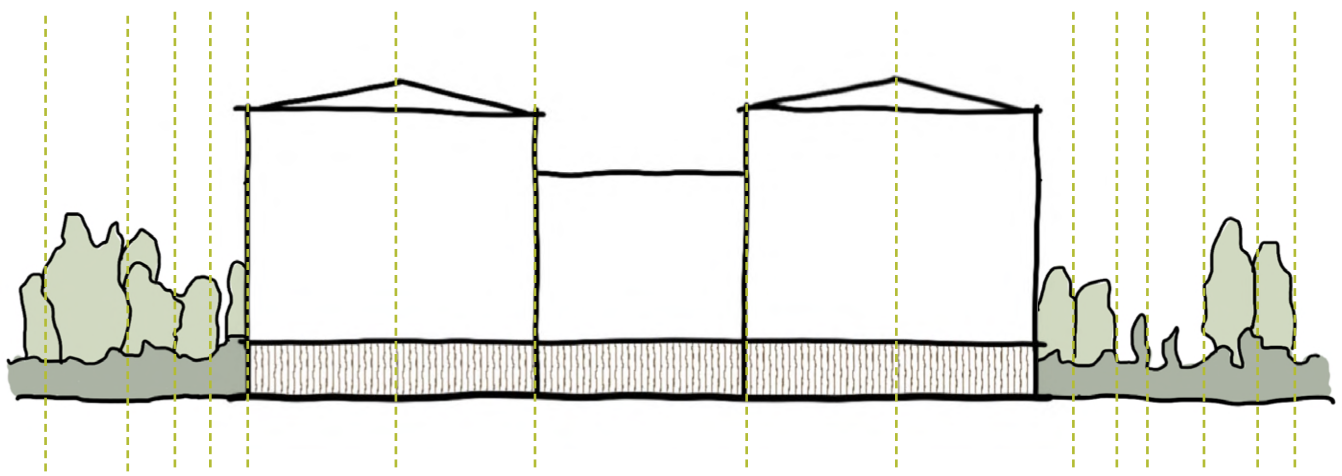
DC Halls Elevation A



Entrances are concealed within the Plinth Level

DC Hall Elevation B

Fragmenting Sections



South- West Link (SydVastLanken Hurva Sweden.
hd.se/artikel/sydvastlanken-forsenas-annu-en-gang/

Fragmented Form

6.2 Fragmented Form

Key Elements

Fragmented Form 1

Taking the principle of breaking up the facade into 3 main blocks. The elevation is broken up into bigger and smaller blocks with a shadow gap emphasising the lines that break the facade up. This creates an irregular rhythm, symbolising the irregularity of the tree line and topography.

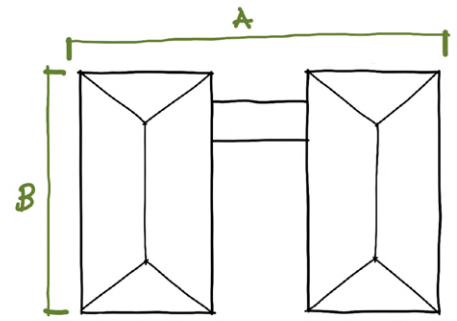
Fragmented Form 2

This takes fragmented form 1 further by softening the sharp edges of the articulated mass by cutting away the corners, with the adjustments tailored to the equipment inside each block. The angle at which the block is cut depends on the height of the mass. For the lower blocks, a larger angle is used, resulting in less material being removed to ensure sufficient clear height for the equipment inside. The variation in height breaks up the mass's skyline, reflecting the irregularity of the treeline

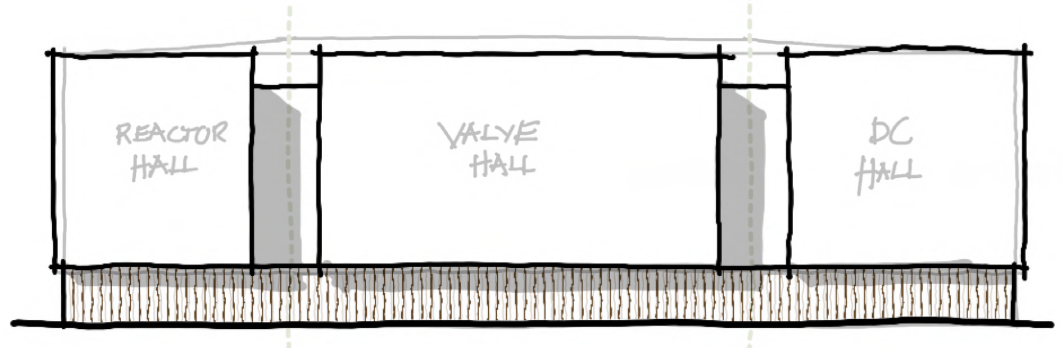
Fragmented Form 3

This form further fragments the mass while maintaining the concept of dividing the facade into three main blocks to represent the primary areas of the DC block. These three blocks are then further subdivided into secondary fragments, breaking up the flat facade even more to better integrate with the organic landscape. Each block features a sloped roof, creating a staggered elevation for added visual interest.

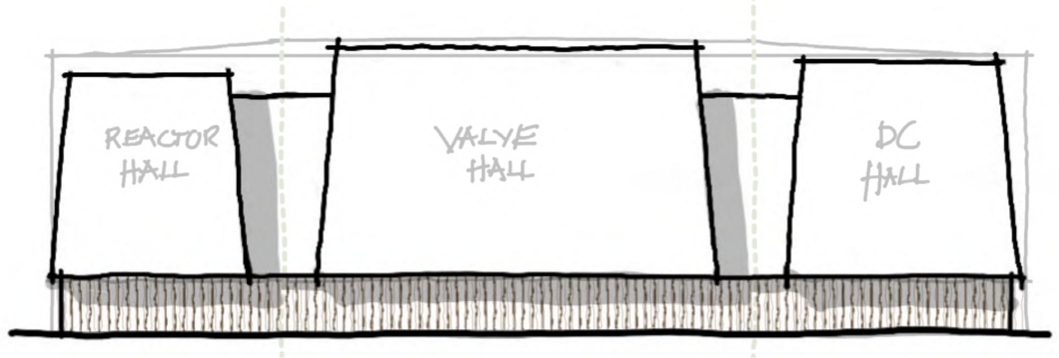
DC Halls Plan View



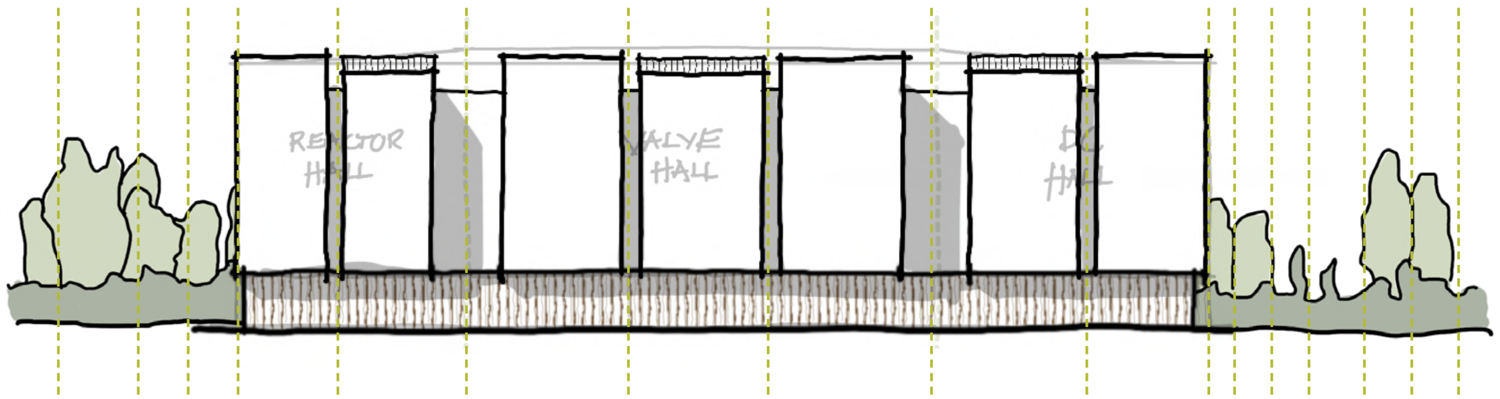
Fragmented Form 1 Elevation B



Fragmented Form 2 Elevation B



Fragmented Form 3 Elevation B



6.2 Fragmented Form

These are proposed views without the planting.

Note that the wind turbine and one of the masts have been removed since the baseline photography was taken.

Viewpoint 4

- Sharp edges are cut away through the sloping edges- softening the profile.
- Shadow gaps accentuate the articulation, breaking up the long facade
- Depending on the clear heights of the equipment, the various heights of the blocks could be taken further, elaborating the stepping up and down from the ground, and following the tree line behind.

Viewpoint 8

- This view displays all parts of the converter station including the AC areas.
- The fragmentation of multiple buildings reduces the visual impact of large, imposing blocks in the distance.
- Positioned below the horizon line, the building blends with the surrounding trees and planting in the background.
- The articulated roof enhances the organic quality of the design, further integrating it with the landscape.

6.2 Fragmented Form

These are proposed views without the planting.

Note that the wind turbine and one of the masts have been removed since the baseline photography was taken.

Viewpoint 10

- The facade should be further fragmented to reduce the block-like appearance in this view.
- The flat roof creates a distinct line against the sky and could be refined to blend more seamlessly.
- Exploring different colours could help minimise the visual impact in this perspective.

Viewpoint H3

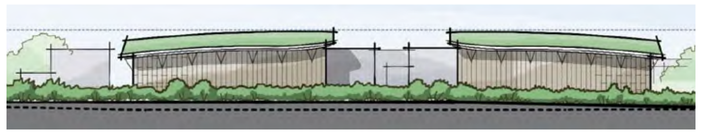
- In this angle the facade could be further fragmented to reduce the block-like appearance in this view.
- Exploring different colours could help minimise the visual impact in this perspective.

6.5 Enhanced Roof Forms

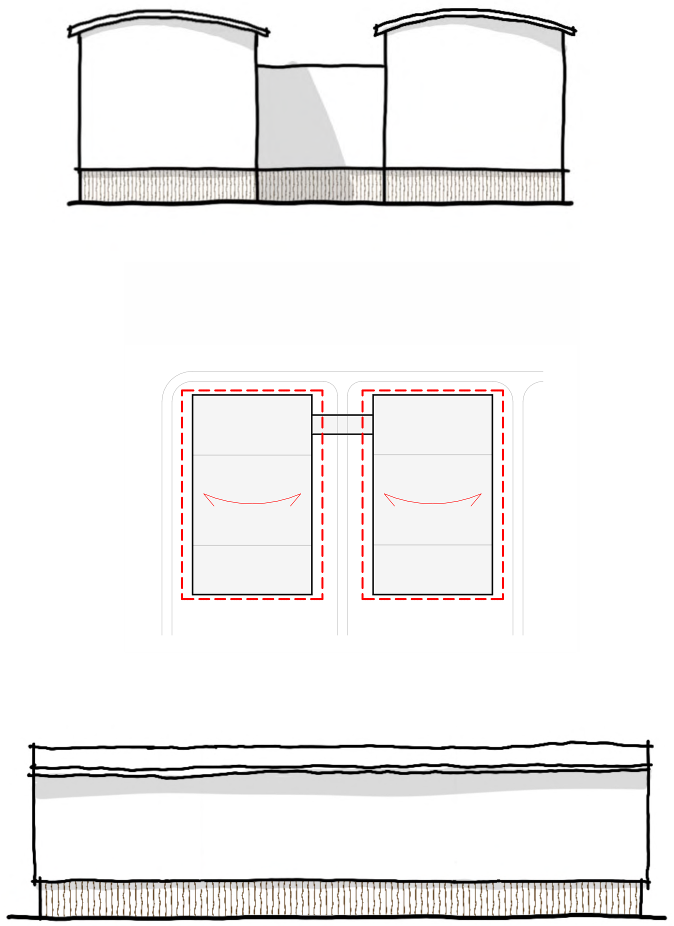
Design Approach Principles

A curved roof on a converter station significantly reduces its visual impact by softening the sharp edges typically associated with industrial buildings. This smoother, flowing form creates a more organic silhouette, helping the structure blend more seamlessly into its surroundings. Compared to angular or flat-roofed designs, the curved roof reduces the perception of bulk, making the building appear less imposing from a distance.

Adnams Distribution Centre - Southwold, Suffolk
aukettswanke.com/projects/adnams-distribution-centre/

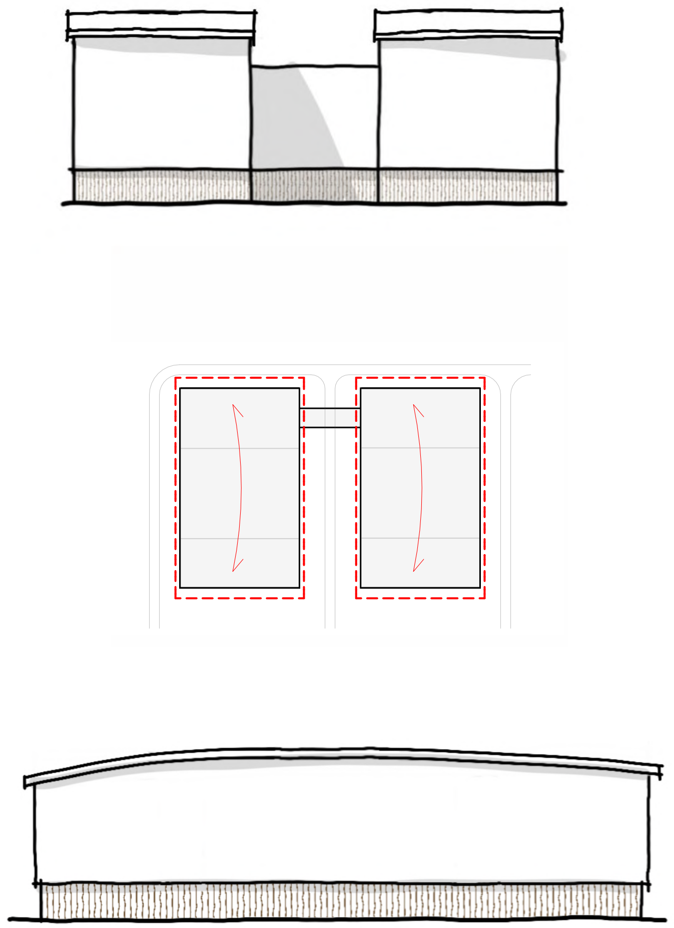


Enhanced Roof



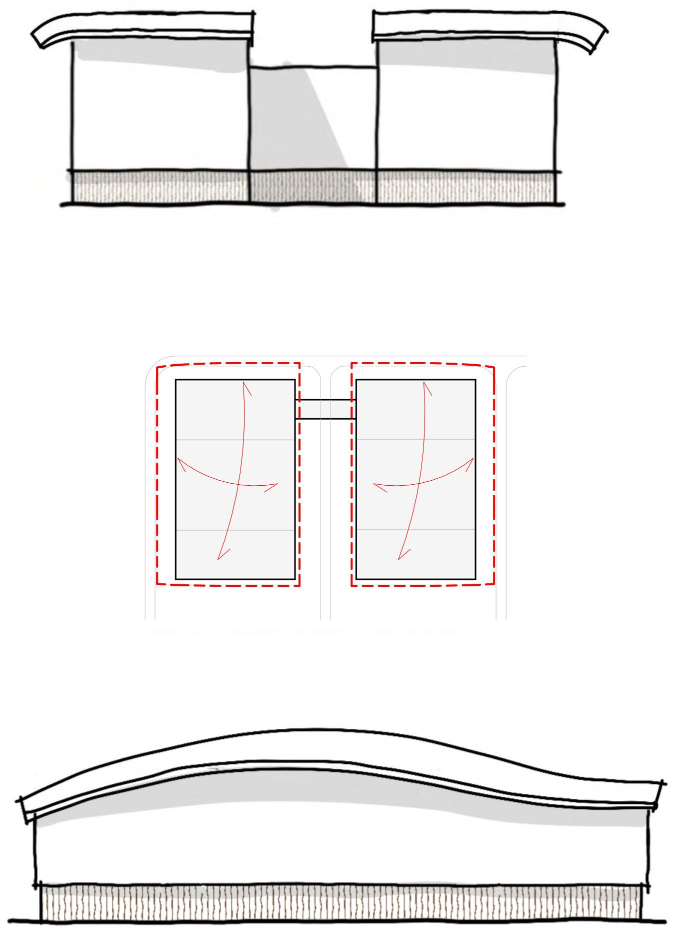
Single Curve (Y)

One option is a single curve in the Y direction, which spans the shorter side of the converter station. This is a conventional approach that maintains the same height across all three parts of the building. While simple and efficient, this design creates a uniform profile that softens the overall form without differentiating between the internal spaces.



Single Curve (X)

Another approach is a single curve in the X direction, spanning the longer side of the station. This method introduces varied heights across the DC Hall, Valve Hall, and Reactor Hall, reflecting their differing functional requirements. By emphasising these variations, the design gains a more dynamic and layered appearance while maintaining a conventional approach.



Asymmetrical Double Curve

For a more expressive and context-sensitive design, an asymmetric double curve offers a profile that spans in all directions. This option introduces an irregular, flowing form with varying heights for each part of the building. The asymmetric profile is complemented by extended eaves, which help integrate the roof's curves into the natural context. This approach creates a visually striking and organic design that further softens the edges and reduces the building's impact on its surroundings.

6.5 Enhanced Roof Forms

Key Elements

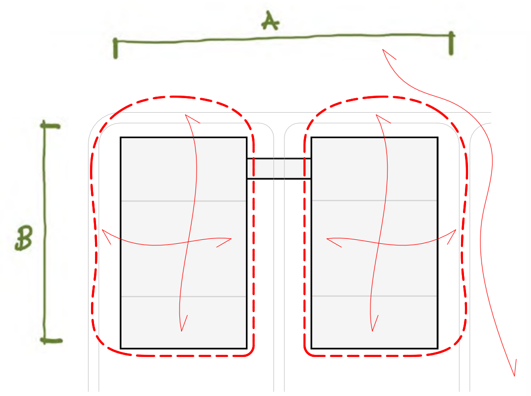
Freeform Double Curve

A curved roof on a converter station significantly reduces its visual impact by softening the sharp edges typically associated with industrial buildings. With a free-form profile across all directions, the roof introduces an organic irregularity, creating a flowing form that feels more in harmony with its surroundings. This reduces the perception of bulk, making the building appear less imposing and more visually integrated into the landscape.

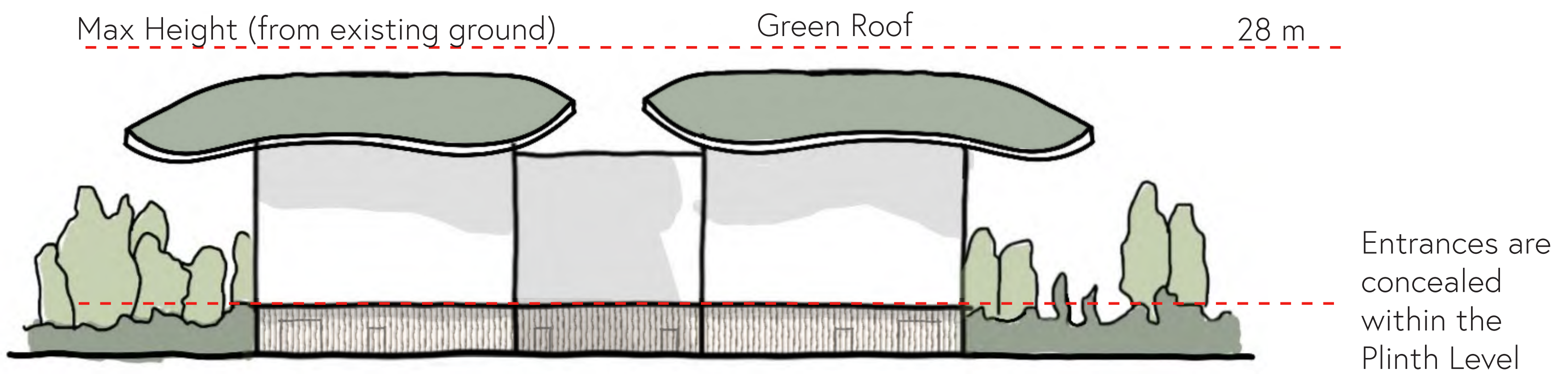
In the context of a green area, the curved roof's significant outer eaves cantilever over the bunding, helping the structure blend with the natural contours of the site. Dynamic roof edges and an exaggerated roof expression add architectural interest while enhancing the overall silhouette. By incorporating a green roof, the building further mirrors the colours and textures of the surrounding vegetation, reducing its prominence and promoting biodiversity by providing habitat opportunities for plants and wildlife.

Note that the opportunity for bunding in the Minster site will be more limited reducing the impression that the roof is an extension of the ground plane.

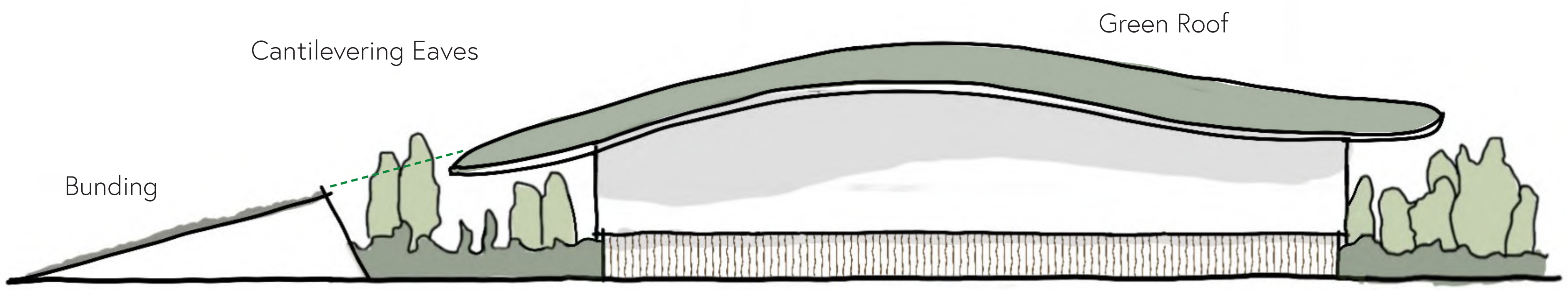
DC Halls Plan View



Freeform Double Curve Elevation A



Freeform Double Curve Elevation B



6.5 Enhanced Roof Forms

Viewpoint 4

- The 'stepped' curves in this design help integrate the surrounding greenery with the rooflines of the DC blocks, softening the otherwise bleak verticality of the facade.
- The deliberate 'split' between the two roofs, coupled with the large overhanging eaves, mirrors the rhythm of the distant tree line, casting a continuous line of shadow that flows through both the landscape and the buildings.
- The main roof of the DC block extends the natural landscape across the rooftops, gently mitigating the harsh angles typically found in standard building designs. While the large scale of the roofs might initially seem imposing within the landscape, they effectively 'rescale' the DC building, making it appear more proportionate and visually comfortable within its environment.

Viewpoint 8

- The curve of the roof serves to minimize the impact of a typical 'boxy' structure within the landscape, softening the harsh edges that become more pronounced in distant views.
- The expansive overhanging eaves not only draw the tree line over the building, but also cast dynamic shadows on the vertical walls below. These shadows, shaped by the eaves, could blend into the larger landscape, enhancing the organic feel of the environment.
- Depending on the season, a green roof may stand out prominently in the landscape, particularly during times when the surrounding vegetation shifts—such as in winter, when the landscape transitions to more muted browns and fewer greens

6.5 Enhanced Roof Forms

Viewpoint 10

- The substantial overhangs cast shadows on the brown facade of the building, working with the surrounding vegetation.
- The green roofs introduce a 'grass canopy' that fills the visual gap in the existing vegetation, helping to combine with the natural environment.
- There is potential for the curved roofs to evolve in form (maintaining the same core principles), to better mirror and complement the surrounding landscape.

Viewpoint H3

- While any structure might seem imposing from this viewpoint, the expansive roofs give the impression that the DC building is smaller than it is.
- The oversized eaves, however, can amplify the building's scale. To mitigate this effect, bunding could be strategically introduced to soften the visual impact of the large eaves.
- The curved roofs over the otherwise boxy structure serve to soften harsh edges, while also creating a continuous line across the distant landscape. To further minimise the dominance of this curve, breaking it into multiple sections that respond to the landscape differently can help introduce a sense of fragmentation, making the form feel more dynamic and less overwhelming.

7.0 Summary & Conclusions

This document has been developed in stages as the design approach has evolved. It addresses key milestones in the development of the design approaches, such as the statutory consultation and the Design Review Panel. At each stage the design approach has been refined as more information and feedback has become available. The last step of development has resulted in four potential design approaches that could be applied individually or in combination in accordance with the design principles.

The four potential design approaches are as follows:

Conventional Industrial/Agricultural (Baseline) - This design approach has the advantage of simplicity but is more limited in terms of how the design could be adapted to address visual impact. The potential weaknesses are the scale of flat facades and the hard edges against a rural landscape setting. The suggestion in response to feedback on the versions included at statutory consultation is that the use of colour bands and patterns is not the preferred solution and this is validated by our analysis that shows reliance on colour for breaking up the massing has limited effectiveness in this situation, particularly where elevated views result in the tops of the buildings appearing below the horizon. This design approach has been referred to in the design principles as a baseline, required to be presented alongside any preferred design approach when submitting for compliance, as a means of checking that the preferred design approach shows the intended reduction in visual impact.

Enhanced Cladding - This design approach has the advantage of not being reliant on complicating the building forms or structures with the decorative layer added over the top of a more conventional envelope. The emphasis is on using parapets to hide the roofs, and this has the potential benefits of hiding any roof based equipment or glancing sun reflecting off roofs and the associated visual impact. The layering of the façade can be used to soften the edges and add depth to the surface, but care will be required to avoid adding bulk to the massing. The intention is for the enhancement to be limited to the taller parts of outward facing elevations where it will have the most benefit. Separate design principles cover the manner in which the buildings should meet the ground. The design approach explores options for how the fabrication and patterns of the decorative outer layer could be developed to make reference to the purpose of the Project and create the types of shading and texture which would relate to the tree belts in the background. These are purely illustrative and how this detail is articulated would be for the post-consent design team to develop in line with the technical and fabrication requirements.

Enhanced Roof Forms - This design approach has the advantage of softening the profile of the building against the sky. The early version of this approach included at statutory consultation included an assumption of large scale bunding which the site constraints and further topographical surveys have demonstrated to not be achievable. However by bringing the roof eaves down closer to the screening can reduce the apparent height of the buildings. The exploration includes different versions of curves, with simpler two-dimensional curves creating a hierarchy of eaves and gables, and more complex three-dimensional curves allowing the eaves to drop lower on each side. By projecting the eaves outwards the roof can be pulled down the walls but this may be limited by structural constraints. The form of the roof may also be constrained by the requirements of lifting beams, etc, within the DC Halls. By placing more emphasis on the roof the finish will be of greater importance. The suitability of materials will relate to the maximum and minimum slopes and also the complexity of the form, for example a standing seam roof finish is better suited to two-dimensional curves. This design approach would lend itself to having a green planted roof applied to the curved forms if that were to prove to be technically feasible. This design approach appears to be more successful when viewing the buildings from high level but from the marsh the large gap between the screening planting and the eaves risk the approach appearing disjointed and top heavy.

Fragmented Forms - This design approach has the advantage of breaking up the large forms of the DC Halls into smaller parts, avoiding the large flat surfaces and straight edges that can make the buildings stand out against the rural landscape setting. The form of the buildings would require close coordination with the internal space requirements and this may limit the effectiveness and ability to step the massing down where height requirements prove to be less. To reduce the bulkiness of the DC Halls recessed shadow gaps have been introduced between the pattern of forms. Care will be required to avoid complicating the roof form, especially avoiding valley gutters over the clear space spaces. The version of this design approach included at statutory consultation was based on a regular rhythm of barn gables. The feedback suggested a preference for avoiding regular patterns and black cladding as it made the building more prominent in the landscape. The illustrations included in this section show a less formal arrangement that is better suited to the context.

It is anticipated that these design approaches could be applied in combination, for example the enhanced cladding approach could be applied to the taller DC Halls, with the enhanced roof form approach being used to help integrate the lower buildings with the landscape proposals and provide a setting for the larger buildings. The Key Design Principles in Table 3.1 and Table 4.1 of **Application Document 7.12.2 Design Principles - Kent** cater for this so the post-consent design team has a toolkit by which an architectural design can be developed to suit the detailed engineering solution. The design principles have been developed in response to the analysis presented in this document but the ways in which they are interpreted are not limited to the illustrations included in section 6 of this document. It would be for the post-consent design team to develop their own response using this document as guidance.

Glossary

For a full list refer to **Application Document 1.6 Glossary and Acronyms.**

References

Anon., 2010. Arch Daily. [Online] Available at: https://www.archdaily.com/53867/heating-infrastructure-building-levitt-bernstein-associates [Accessed 6 February 2025].

Anon., 2017. Toshiba. [Online] Available at: https://www.global.toshiba/ww/company/energy/topics/transmission/italy-power-transmission.html [Accessed 6 February 2025].

Anon., 2023. Eifo. [Online] Available at: https://www.eifo.dk/en/knowledge/news/765-km-long-electricity-link-enables-more-effective-use-of-renewable-energy-in-denmark-and-the-uk/ [Accessed 6 February 2025].

Anon., 2024. Goggle Earth. [Online] Available at: https://earth.google.com/web/@51.34002914,1.22854292,0.98669519a,3093.95326299d,35y,356.00469777h,14.39971629t,359.97986224r/data=CgRCAggBMikKJwolCiExRTlIOXpXNGhCZGUyZjZLUkIyQUZiUUtYTVRmMi1MYVYgAToDCgEwQgIIAEoHCLXHuRAQAQ [Accessed 6 February 2024].

Anon., 2024. Youtube. [Online] Available at: https://www.youtube.com/embed/QncH6IILB2c?autoplay=1&start=0&rel=0&enablejsapi=1&mute=1&version=3 [Accessed 6 February 2025].

Anon., n.d. Arcsom. [Online] Available at: https://arcsom.com/en/cases/alegro [Accessed 6 February 2025].

Anon., n.d. Aukett Swanke. [Online] Available at: https://www.aukettswanke.com/projects/adnams-distribution-centre/ [Accessed 6 February 2025].

Anon., n.d. Briv Construction. [Online] Available at: https://www.briv.me/index.php/projects/15-projects/special-purpose-buildings/50-toshiba [Accessed 6 February 2025].

Anon., n.d. Hitachi Energy. [Online] Available at: https://www.hitachienergy.com/uk-ie/en/news-and-events/customer-success-stories/nordlink [Accessed 6 February 2024].

Anon., n.d. National Grid. [Online] Available at: https://www.nationalgrid.com/new-electricity-transformer-worcestershire-substation [Accessed 6 February 2024].

Anon., n.d. Tennet. [Online] Available at: https://www.tennet.eu/de/projekte/nordlink [Accessed 6 February 2025].

Anon., n.d. Toshiba. [Online] Available at: https://www.global.toshiba/ww/company/energy/topics/transmission/italy-power-transmission.html [Accessed 6 February 2025].

Anon., n.d. Viking Link. [Online] Available at: https://www.viking-link.com/cables [Accessed 6 February 2025].

BDP, n.d. BDP. [Online] Available at: https://www.bdp.com/en/projects/a-e/blackburn-meadows-biomass-plant/ [Accessed 6 February 2025].

Fear, V., 2022. Lincs Online. [Online] Available at: https://www.lincsonline.co.uk/spalding/news/key-pieces-of-major-viking-link-project-in-place-9286084/ [Accessed 2026 February 2025].

Heynes, G., 2023. Current News. [Online] Available at: https://www.current-news.co.uk/1-4gw-scotland-norway-interconnector-refused-license-by-norwegian-government/ [Accessed 6 February 2025].

Magnusson, E., 2020. Helsingborgs Dagblad. [Online] Available at: https://www.hd.se/artikel/sydvastlanken-forsenas-annu-en-gang/ [Accessed 6 February 2025].

Ott, C., 2024. Archdaily. [Online] Available at: https://www.archdaily.com/1013310/kalyon-karapinar-50-mwp-spp-central-control-building-bilgin-architects?ad_source=search&ad_medium=projects_tab [Accessed 6 February 2025].

Waygood Colour, 2018. Suffolk Coast & Heaths Area of Outstanding Natural Beauty: Guidance on the selection and use of colour in development. Suffolk Coast & Heaths AONB. Available at: https://coastandheaths-nl.org.uk/wp-content/uploads/2021/01/SCH-Use-of-Colour-Guidance-v7.pdf [Accessed: 10 February 2025]

Whitelam, P., 2020. Lincolnshire Live. [Online] Available at: https://www.lincolnshirelive.co.uk/news/local-news/bicker-fen-siemens-electricity-power-4757306 [Accessed 6 February 2025].

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