Chapter 2: Design Evolution, Alternatives and the Proposed Development

INTRODUCTION

2.1 This chapter of the ES summarises the surrounding context of the site including environmental opportunities and constraints that have influenced the design; discusses the alternatives analysis undertaken with regards to due consideration of a Do Nothing / No Development alternative, alternative sites and alternative design; provides a summary of the consultation undertaken to date with regards to the Proposed Development; describes the design evolution of the Proposed Development, focusing on key design modifications that were made during the design process; and discusses some of the environmental considerations which have influenced the design evolution process where relevant.

2.2 A description of the Proposed Development that is sought for approval by the planning application is also included in this ES chapter. It provides sufficient information on the Proposed Development to aid the identification and assessment of potential environmental impacts and likely environmental effects across the environmental topic areas addressed by the EIA. Additionally, a description of the enabling and construction works for the Proposed Development is also included for the purposes of assessment.

2.3 Further details on the Proposed Development can be found within the Planning Design & Access Statement (PDAS), detailed plans and the Planning Statement submitted in support of the planning application.

SITE AND LOCAL ENVIRONMENTAL CONTEXT

Site Description and Context

2.4 The site is located in the district of South Oxfordshire, located to the north-west of Culham Science Centre and approximately 2.5km south-east of the town of Abingdon (see Figure 2.1).

2.5 The site comprises areas of open fields and is crossed by a tarmac track (Thame Lane, a non-public highway) as well as an existing farm track.

2.6 As per the South Oxfordshire Local Plan[1], the site lies within the Oxford Green Belt (Policy STRAT6), an area that offers protection to the historic setting of Oxford and to areas surrounding the city. Furthermore, part of the site is located within the Nuneham Courtenay Grade 1 Registered Park and Garden (covered by Policy ENV10) and lies adjacent to the Nuneham Courtenay Conservation Area (ENV8). The Culham Science Centre lies to the immediate south-east of the site (STRAT8 - Culham Science Centre), with the proposed extension to the substation partially within this STRAT8 site, and an urban expansion area lies immediately to the west of the site (STRAT9 – Strategic Allocation), as discussed in **ES Volume 1, Chapter 1: Introduction and EIA Methodology**.

Local Environmental Context

2.7 The following environmental considerations were reviewed as part of the design evolution of the Proposed Development with regards to establishing site environmental constraints and opportunities. Figure 2.1 summarises the site's content.

Land Use and Soils

2.8 The site comprises areas of open fields (currently harvested for hay and silage). Soils within the site are a mixture of loamy sand, sandy loam and sandy clay loam with a range of gravel content in the subsoil. They are all well drained.

2.9 The agricultural land at the site has been classified as mostly Grade 2 (19.1ha) with smaller areas of Subgrade 3a (2.3ha) where the land is more gravelly at depth. There is also a small area of Subgrade 3b (0.3ha) next to the existing woodland at the north-eastern extent of the site where the subsoil is slowly permeable clay. The Grade 2 and Subgrade 3a agricultural land on site is considered to be Best and Most Versatile (BMV) land. For further information, see **ES Volume 3, Appendix: Land Take and Soils – Annex 1**.

Air Quality

2.10 There are no designated Air Quality Management Areas (AQMAs) in the vicinity of the site. The SODC has three designated AQMAs (Henley, Wallinford and Watlington), all of which are located in urban areas more than 10km away from the site.

Archaeology and Heritage

2.11 The site is not located in an Archaeological Priority Area, nor there are any areas designated for archaeological protection within 1km of the site boundary. However, a geophysical survey undertaken in 2022 and 2023 (**ES Volume 3, Appendix: Cultural Heritage – Annexes 2** and **3**) determined an area of archaeological activity within the southern part of the site. The anomalies identified are indicative of rectilinear enclosures and a drove way. Other potential ditches indicative of field systems were also noted, along with areas of magnetic disturbance likely associated with modern and historic land use.

2.12 These anomalies were interpreted as being the continuation of Romano-British field systems identified immediately to the west of the site. Furthermore, there is the potential for Early Prehistoric (Palaeolithic & Mesolithic), Neolithic, Bronze Age & Iron Age, Roman, Early Medieval, Medieval and Post Medieval & Modern remains at the site.

2.13 Previous developments within the site, mostly notably the use of the site during the Second World War, are likely to have negatively impacted the survival of archaeological remains and deposits. However, this development appears to have been limited to the northern and eastern parts of the site. This suggests there is a higher potential for undisturbed archaeological deposits to be present in the south and west.

2.14 The following heritage assets are located within 1km of the site boundary:

- Nuneham Courtenay Registered Park and Garden: NHLE 1000122 (Grade I);
- Nuneham Courtenay Conservation Area;
- Culham Station Ticket Office: NHLE 1059789 (Grade II*) listed building;
- Thame Lane Bridge: NHLE 1409238 (Grade II) listed building;
- Fullamoor Farmhouse: NHLE 1449039 (Grade II) listed building; and
- Station House: a locally listed building.

2.15 Further information regarding the built heritage baseline conditions can be found in the Desk Based Assessment (**ES Volume 3, Appendix: Cultural Heritage – Annex 1**).

Ecology and Biodiversity

2.16 The site is not located within any local, national or international designated sites for nature conservation. Two internationally designated sites of nature conservation importance are located within 7km of the site; Little Wittenham Special Area of Conservation (SAC) and SSSI located approximately 4.7km to the south-west of the site and Cothill fen SAC located approximately 7km to the north-west of the site. Culham Brake SSSI is the closest national designation to the site, located approximately 1.8km to the west of the site. Lastly, there are three local non-statutory sites within 2km of the site; Furze Brake Local Wildlife Site (LWS) located approximately 760m to the north-east, Radley Gravel Pits LWS located approximately 850m to the north-west and Abbey Fishponds Local Nature Reserve located approximately 1.65km to the north-west of the site.

2.17 Habitats identified within the site are considered to be of negligible intrinsic ecological interest and includes four fields and a portion of a fifth field containing modified grassland, two areas and margins of other neutral grassland, bare ground, hardstanding, scattered trees and scattered scrub. No ponds or waterbodies were identified within the site or within 500m of the site (aside from north of the River Thames which is located approximately 130m north of the site).

2.18 An ecological site survey, as detailed within **ES Volume 3, Appendix: Ecology and Biodiversity – Annex 1**, identified the following protected and priority species as present or potentially present within and in the vicinity of the site:

[1] *South Oxfordshire District Council. (2020). The South Oxfordshire Local Plan 2011-2035. Available at: https://www.southoxon.gov.uk/south-oxfordshire-district-council/planning-and-development/local-plan-and-planning-policies/local-plan-2035/adopted-local-plan-2035/*

- Badger setts at five or six locations and four latrines;
- Brown hare within the grassland habitats;
- Potential for common species of reptiles on the site boundaries and within the other neutral grassland habitat;
- Potential for foraging and commuting bats on the site boundaries with no opportunities for roosting within the site;
- Opportunities for nesting birds within the scattered trees and scrub; and
- Negligible opportunities for other protected or priority species.

2.19 The site is considered to have a biodiversity baseline value of 64.75 habitat units in line with Natural England Defra Biodiversity Metric 4.0, as detailed within **ES Volume 3, Appendix: Ecology and Biodiversity – Annex 2.**

2.20 An arboricultural survey has been undertaken of the site and its immediate surrounds as reported in the Arboricultural Impact Assessment which supports the planning application. Many of the existing trees on-site are located on the boundary of the site running around the perimeter of the fields. Some of the groups of trees are woodland plantings with arboriculturally valuable tree species. The profile of trees observed on-site during the survey is predominantly *Quercus robur* (English Oak), *Quercus cerris* (Turkey Oak), and some *Fraxinus excelsior* (Ash). The new plantings comprise of predominantly native tree species.

Ground Conditions

2.21 The site is currently undeveloped agricultural land. According to the British Geological Survey (BGS) online viewer[2], the site is entirely underlain by the bedrock geology of the Lower Greensand Group. There are no records of superficial deposits at the site.

2.22 There are no extant mineral operations, areas safeguarded for minerals or areas designated for geological interest on-site.

Noise and Vibration

2.23 The prevailing noise climate on-site and within the surrounding areas are dominated by road traffic noise on Abingdon Road (A415) and Oxford Road (B4015) to the south and south-east of the site respectively, railway noise related to the Great Western Railway (GWR) trains operating on the railway line to the west of the site and operational noise from the Culham Science Centre located to the south of the site.

Transport and Access

2.24 The site is accessed from the east, south-east and south by the Thame Lane, which connects to Abingdon Road (A415) to the south. A railway line servicing GWR runs along the site's western boundary, and the National Railways Culham Station is located approximately 1km south of the centre of the site.

Water Resources and Flood Risk

2.25 A section of the River Thames, also known locally as River Isis, is located approximately 130m to the north of the site. A further branch of the River Thames is located approximately 2km to the south of the site. Located approximately 1.3km to the west of the site is Swift Ditch which is an artificial channel which feeds into the River Thames.

2.26 The site is not tidally influenced and there appears to be no culverted watercourses within the vicinity of the site. No other significant artificial features such as canals and reservoirs have been identified within 1km of the site.

2.27 The site is entirely located within Flood Zone 1 (low risk of flooding). The site is not considered to be at risk from tidal sources due to its distance in-land.

2.28 The site is not located in a Flood Warning Area. The majority of the site is at a very low risk of surface water flooding with areas of low risk within the north-west of the site along the railway line and to the southern extent of the site adjacent to the Thame Lane.

2.29 The site is not at risk of reservoir flooding. Furthermore, the site is situated on Lower Greensand Group, comprising sandstone which is classified as a Secondary A aquifer.

2.30 The site is not located in a groundwater Source Protection Zone.

2.31 There are no records of drainage for the site and it has been assumed that no artificial drainage system will be present within the area as the land is currently agricultural land. The overall risk of flooding via artificial drainage system to the site is considered as low.

Landscape and Visual Amenity

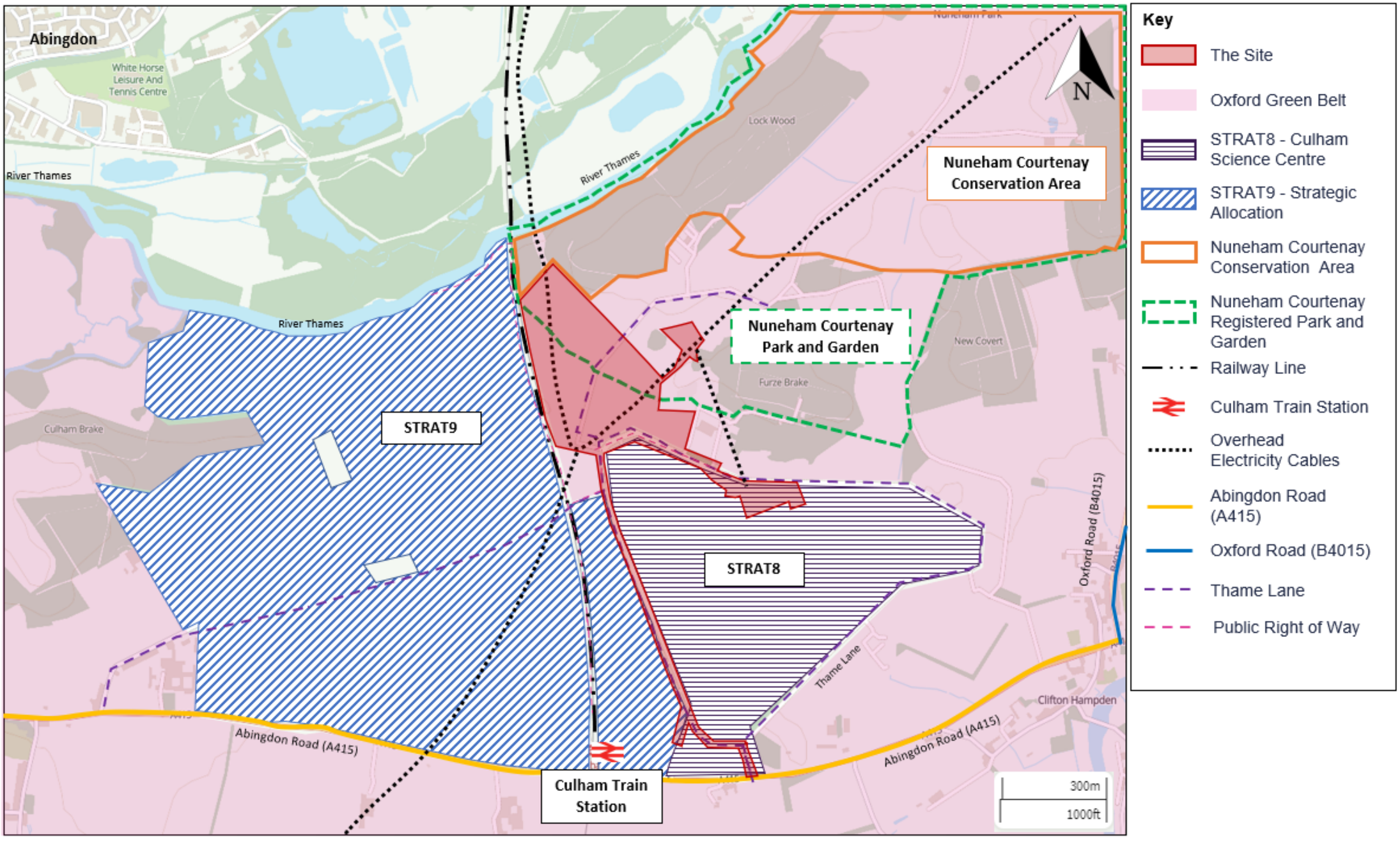
2.32 The site lies within the Oxford Green Belt, with part of the site located within the Nuneham Courtenay Registered Park and Garden, with Nuneham Courtenay Conservation Area to the north of the site.

2.33 The site is visible from a short section of the Oxford Green Belt Way footpath, whereby to the north and east the site benefits from visual enclosure provided by Lock Wood and rising ground. The site is not visible from within the Thames valley.

2.34 The railway to the west passes the site in a cutting and so the site is not visible to rail users. No dwellings overlook the site apart from Warren Farm to the west which lies in the centre of a proposed urban expansion area (STRAT9 – Strategic Allocation of the South Oxfordshire Local Plan).

[2] *https://www.bgs.ac.uk/map-viewers/geology-of-britain-viewer/*

Figure 2.1 **Site and Surrounding Context**[3]



[3] *The site boundary shown is indicative.*

ALTERNATIVES AND DESIGN EVOLUTION

2.35 The following sections review the alternatives to the Proposed Development that have been considered by the Applicant (as relevant), including:

- The Do-Nothing / No Development Alternative;
- Alternative Sites; and
- Alternative Designs and Design Evolution.

Do Nothing / No Development Alternative

2.36 The Do-Nothing / No Development Alternative refers to the option of leaving the site in its current state.

2.37 The site is undeveloped, predominantly comprising areas of open fields, currently harvested for hay and silage.

2.38 BESS facilities provide a means of allowing electricity from the grid to be imported and stored at times of low demand/high generation, which can then be exported back into the grid at times of higher demand / system stress.

2.39 System frequency is also a continuously changing variable that is determined and controlled by the second-by-second (real time) balance between system demand and total generation. If demand is greater than generation, the frequency falls while if generation is greater than demand, the frequency rises. If the transmission system is not maintained within the required frequency tolerance system stress can result in widespread power supply issues and damage to network infrastructure.

2.40 Battery storage is a key part of the National Grid energy strategy and provides balancing services to help accommodate the increasing level of renewable energy generation.

2.41 By importing excess renewable energy from the grid and storing it, batteries can capture energy that would otherwise be lost / unutilised. In respect of their storage ability, batteries offer opportunities to support the intermittent nature of renewables by storing the excess energy they produce and importing it back into the grid when demand requires.

2.42 During situations when primary power sources (e.g., traditional power stations) are interrupted, BESSs can bridge the gap in production, thus avoiding potential blackouts. It should be noted that the UK electricity network is wholly interconnected and issues in one geographic location can have far reaching implications on the network. Accordingly, BESSs offer additional capacity to deal with system stress and any variations in grid frequency at both a local and national level.

2.43 As has been recognised by National Grid's 2016 System Operability Framework (SOF): "*Faster response is more effective and so less response is needed if speed can be increased.*" BESSs can respond more rapidly than other types of balancing services, as they have no start-up delays. As such, BESSs can balance the real-time requirements of the national grid more efficiently. The Department for Business, Energy and Industrial Strategy (BEIS) review of electricity market arrangements (REMA) in 2022 found that "*frequency response markets have helped to deploy new batteries*".

2.44 The Proposed Development has come forward following the Government's reform of the Nationally Significant Infrastructure Project ("NSIP") process through the Infrastructure Planning (Electricity Storage Facilities) Order 2020 (the "Storage Order") aimed at reducing barriers to investment and delivery of large BESS over a 50MW capacity.

2.45 The Government considers that larger capacity BESS developments are crucial to meeting the country's overall net zero 2050 target, as well as its target to decarbonise the power system by 2035, which will require a substantial growth in renewable energy generation, along with electricity storage to balance the intermittent generation from renewables, and stability services to keep the national grid stable.

2.46 National Grid's Future Energy Scenarios document (July 2022) states "*we expect battery storage to make up the largest share of storage power capacity in all scenarios by 2050 to help with shifting demand within the day and managing network constraints as battery costs fall*". As such, the Future Energy Scenarios document forsees battery use rising "*from 1.6GW in 2021 to as much as 20GW by 2030 and 35GW by 2050*".

2.47 To be most effective in contributing to the country's targets, the proposals need to be of a large capacity (i.e., over 50MW) and located in an area where there is a significant need for new capacity to support renewable energy generation.

2.48 The proposal also supports renewable planning policy in the National Planning Policy Framework and would help meet National Grid's requirement for ancillary services.

2.49 These factors have also driven the site selection process and the scale and types of technology proposed, as set out below in the '*Alternative Sites'* section.

2.50 Furthermore, the Applicant has been in communication with United Kingdom Atomic Energy Authority (UKAEA) since 2021 regarding a project at this site and both parties agree a battery energy storage system (BESS) facility at this site would offer UKAEA a number of direct and indirect benefits, including:

- Resilience: An alternative cable route to supply electricity will reduce 400kV (kilovolt) outages so these would only be very short term if at all. It is also possible that the Culham Science Centre campus could be simultaneously fed from both points of supply and therefore would have a very high degree of resilience;
- Stability: The response of the National Grid at UKAEA's connection point will be substantially stabilised by the Proposed Development so indirectly helping gain approval for facilities which have fast changes and large power requirements;
- Financial benefits: Annual electrical connection costs that are currently met by UKAEA will be reduced as these costs for the reconfigured substation will be shared nationwide by National Grid as part of its transmission network costs;
- Supports the Culham Science Centre's ambition for the campus to continue to be a world leading fusion facility, driving growth and employment in the region;
- Attractiveness: The Culham Science Centre is a unique science and technology park with high-power National Grid connectivity. Increasing the resilience of this high-power connection will help Culham Science Centre attract tenants, future fusion facilities and create the opportunity to locate facilities such as high-power advanced computing, thus attracting new businesses to Culham; and
- Opportunity: The Proposed Development would increase UKAEA's ability to deploy assets such as the JET flywheel generators or consider new large scale generator R&D opportunities.

2.51 As such, a letter support for the project was issued by the CFO and Director of Property and Commercial Services at UKAEA in June 2022. This letter of support is included within the PDAS submitted in support of the planning application.

2.52 The 'No Development' option would therefore not result in the benefits that could be realised by the Proposed Development with regards to the import, storage and export at electricity, and the benefits this offers the grid and the viability of lower carbon energy. Furthermore, as set out above, the 'No Development' option would not result in the benefits afforded to UKAEA. The Do-Nothing option on the site has therefore not been considered in further detail within this ES.

Alternative Sites

2.53 To meet the primary objectives of the scheme, the following key site selection criteria were applied by the Applicant:

- Located in a region where there is a need for voltage and power flow support – this is important to replace generation from traditional coal and gas plants and manage voltage issues arising from the increasing generation from renewable energy sources;
- Connection to the National Grid transmission networks 275/400kV – in order to deliver the greatest benefit, connection to the transmission system is required. The 275/400kV network is generally used to transmit energy from its source to areas of demand. To maximise the benefits of the Proposed Development, it is important to connect large scale BESS to a 275/400kV grid substation. The 275/400kV transmission network often suffers from voltage and stability issues whereby BESS help to address these issues;
- Available grid connection by 2030 – to enable the Government to reach its 2035 net zero carbon electricity target; and

- Located within a heavily constrained transmission area – to provide the greatest level of support to the national grid, the project should be located within an area of the national grid transmission network which is heavily constrained due to high loaded circuits.

2.54 The Applicant has identified that the site fulfils this key site selection criteria, whereby it is located within an area that requires additional backup capabilities to meet peak demand and can provide critical ancillary services at a strategic substation and important area of the grid network.

2.55 The size of the site offers the potential for a large capacity BESS, the need for which is set out above, whilst also offering the potential to deliver significant Biodiversity Net Gain (BNG).

2.56 The Applicant holds an agreement with National Grid Electricity Transmission (NGET) to connect its BESS to Culham substation, located to the south-east of the site, which critically enables export and import for a battery system. The site location next to Culham substation presents the opportunity to precisely secure the right sort of grid connection offer allowing import and export for the battery system. The need for this type of facility is a direct consequence of the amount of renewable and intermittent generation that is now installed in the UK. The site location also provides direct and indirect benefit to UKAEA with regards to improved power security and resilience for their research facilities at Culham Science Centre.

2.57 Furthermore, the site offers benefits with regards to the presence of a suitable access to/from the site, with its location away from main settlements and noise sensitive receptors. The existing condition and use of the site also offer benefits with regards to the lack of habitats with the potential to support protected species (see **ES Volume 3, Appendix: Ecology and Biodiversity – Annex 1**) and given that the land is currently not used for intensive agricultural purposes.

2.58 Additionally, the Government has set a target of achieving a 100% reduction in greenhouse gas emissions by 2050, known as "net zero." (The Climate Change Act 2008 (2050 Target Amendment) Order 2019)[4]. As a result, the government has adopted a series of renewable and low carbon energy targets and strategies that have created a more positive policy environment for energy storage and management. BESS are considered to be a key element in helping balance energy supply and demand and supporting efficient electricity markets as part of the net zero strategy. They are also necessary to reduce the costs of the electricity system and increase reliability by storing surplus electricity in times of low demand to provide electricity when demand is higher. The government has committed to decarbonize the power system by 2035, and electrical energy storage and stabilization is urgently needed to support the growth in renewable energy generation to meet these targets. Around 30GW of total low carbon flexible capacity may be needed in 2030, and 60GW in 2050, to maintain energy security and cost-effectively integrate high levels of renewable generation. BESS is expected to provide this capacity.

2.59 The **Site Selection Process Report** submitted with the planning application provides further detail with regards to why the site was selected by the Applicant.

2.60 As such, no alternative sites or locations have been considered by the Applicant for the Proposed Development.

Alternative Designs and Design Evolution

2.61 During the process of the designing the Proposed Development, no reasonable alternative schemes or designs (as a whole) were identified or considered by the Applicant and project team, which would warrant a comparison of environmental effects. Instead, the design of the Proposed Development has evolved to reflect the site constraints and opportunities, including key environmental considerations, and the outcomes following pre-application consultation. The design has also been guided by the Applicant's practical experience in developing and delivering BESS sites.

2.62 The project team have worked extensively together to ensure that '*mitigation by design*' principles have been incorporated into the evolving scheme, and so the evolution of the design has included, where relevant, consideration of environmental effects and issues. Where relevant, this has been set out below.

Key Design Considerations

2.63 Following analysis of the site and the surrounding context, initial design options were explored to test the site layout and design in order to assist in determining the most appropriate design for the site.

2.64 The key constraining factors considered during the design evolution of the scheme are presented below and include:

- Existing overhead lines that run through the site;
- The site's location within the Nuneham Courtenay Registered Park and Garden, and the site's proximity to the Nuneham Courtenay Conservation Area;
- The BMV quality of the site; and
- Existing arboriculturally valuable trees on the site.

2.65 Key objectives and opportunities for the site and the proposals were established as follows:

- Opportunity for significant BNG on-site, including the planting of native species and a number of targeted ecological enhancements within the site (as discussed further within this ES chapter);
- Provision of extensive landscaping, affording an enhancement to the setting of the Nuneham Courtenay Registered Park and Garden that will remain, and visual screening through targeted planting within the site from the Nuneham Courtenay Conservation Area to the north of the site;
- Creation of suitable drainage features (SuDS) to accommodate the increase in surface water runoff as a result of increased impermeable surfaces at the site;
- Provision of a new permissive path to allow access to a newly landscaped area; and
- Safe and optimal access to the site from the adjacent road network allowing access for heavy goods vehicles (HGVs) and emergency vehicles.

Consultation

2.66 Pre-application advice was sought from SODC (Reference: P22/S2503/PEJ), with a meeting held with the SODC in September 2022. Written feedback was subsequently received from the SODC (dated 13th September 2022), including responses from the Landscape Officer, Conservation and Design Officer, Oxford County Council (including the Transport Development Control Lead Officer, Flood Risk Engineer on behalf of the Lead Local Flood Authority, and Archaeologist), Forestry Officer and the Countryside Access Officer.

2.67 The feedback received recognised a number of constraints associated with the initial site layout and design (refer to Figure 2.2 which illustrates the designs issued to the SODC by the Applicant at the time of requesting pre-application feedback). Of note, principal matters raised by the SODC within the feedback included:

- The principle of development within the Oxford Green Belt area;
- The potential landscape and heritage impacts associated with the Proposed Development; and
- The potential loss of BMV agricultural land.

2.68 The Applicant has also undertaken thorough consultation with CEG (the promoter of a potential future housing development within the STRAT 9 allocated land to the west of the site). This engagement has focused around the operational noise of the facility and ensuring the facility can operate at an acceptable noise level in relation to the new proposed receptors.

Proposed Development Layout and Design Evolution

2.69 The Proposed Development's layout has evolved in response to the key opportunities and constraints, and pre-application consultation as set out above. Furthermore, considerations with regards to functional requirements to ensure safe operation and optimum output and contractor specifications have also influenced the design evolution.

2.70 The fire and drainage design for the site has been influenced by other live applications where the Environment Agency and fire and rescue services have been consulted. As such, the Proposed Development design seeks to adhere to the latest guidance.

[4] *The Climate Change Act 2008 (2050 Target Amendment) Order 2019 (legislation.gov.uk)*

2.71 The key layout changes have been captured in Figure 2.2, Figure 2.3, and Figure 2.4 below, and a description of how the layout has evolved between iterations of design is provided below. The final Proposed Development layout is illustrated in Figure 2.5.

Iteration 1

2.72 The initial layout for the Proposed Development shown on Figure 2.2 was used to identify the broad shape and size of the Proposed Development elements and how theses would fit and be functional within the defined boundary of the site. This design iteration included 625 battery units with the layout focussing on locating the battery containers across the majority of the site. This was driven by maximising the potential output of the BESS.

2.73 A number of spatial constraints were addressed in this initial design iteration, including:

- Avoiding electrical equipment under the overhead power lines;
- Maintaining an exclusion zone around the transmission towers for their stability and maintenance;
- Avoiding development over a water main which passes through the site from a Thames Water reservoir to the north;
- Avoiding development within an exclusion zone alongside the railway line; and
- Avoiding development adjacent to the existing concrete perimeter track to maintain access for large vehicles/loads

2.74 Woodland planting was limited to the north and north-eastern extent of the site, with a single attenuation pond at the southern extent of the site. The BESS substation within this design iteration was located within the southern extent of the site.

Iteration 2

2.75 Iteration 2 (Figure 2.3) built upon the initial concept design and included refinement of battery storage and inverter/transformer container locations across the site. This design iteration included a reduction of battery units to 432 units. This allowed for a greater extent of new woodland planning to the north, east and west of the containers. This was driven by the progressive landscape and visual impact assessment, which recognised the requirements for greater screening of the Proposed Development from local receptors, particularly the Nuneham Courtenay Conservation Area to the north of the site.

2.76 This iteration includes the provision of an earth bund along the western extent of the site in order to screen the Proposed Development.

2.77 This design iteration also diverts the existing farm access within the site to the north of the existing group of trees at the north-eastern extent of the site. The location of the proposed substation and attenuation ponds were largely unchanged.

Iteration 3

2.78 Refinements were undertaken in Iteration 3 regarding the location of the battery storage and inverter/transformer container locations (see Figure 2.4), focussing on locating these elements within a smaller area at the southern extent of the site. This allows for a significantly greater area of new woodland and habitat provision at the northern and western extents of the site, affording the Proposed Development greater screening to local sensitive receptors, but also creating a much greater BNG. This site layout also removed all battery storage and inverter/transformer container within the Nuneham Courtenay Registered Park and Garden, with works within this area associated with the Proposed Development only comprising landscaping and the upgrading of the existing farm track.

2.79 The number of battery units was decreased to 296, with a more sympathetic design to the surroundings of the site. Despite the decrease, the system still offers a substantial generation asset to the grid. The southern attenuation pond has been re-sited following further drainage design to accommodate site surface water run-off and also to locate the pond next to new planting to enhance the ecological and biodiversity value of the waterbody. A second attenuation pond was added within the south-eastern extent of the site.

2.80 Inverters and transformers have been housed in sound insulated buildings to mitigate against potential noise spill. The inverter houses were designed to represent small agricultural buildings – 37 inverter houses are included, each housing 16 transformer / inverter units.

2.81 The substation has been relocated to the east of the BESS, off of Thame Lane to site the customer substation as close to the Culham substation as possible to reduce the cable run and transmission losses. The existing farm access is maintained in its existing location within the final layout, with the Proposed Development proposing to upgrade this existing farm track to a 4.5m wide macadam surface.

2.82 The proposed earth bund along the western extent of the site was refined, screening the Proposed Development from the allocated urban expansion area (STRAT9 – Strategic Allocation of the South Oxfordshire Local Plan) and the section of the Oxford Green Belt Way footpath on the west side of the railway.

2.83 Furthermore, a number of permissible paths have been included within the final design iteration to allow for greater access to the site and new areas of habitat provision. Additionally, a 4m high acoustic fence was added to the western boundary of the site in response to futureproofing the site with regards to noise emissions and the potential for future development to the west of the site associated with the STRAT9 – Strategic Allocation.

Iteration 4 (Final Layout)

2.84 Further refinements have been made to the layout of the battery storage and inverter/transformer container locations (see Figure 2.5) to reflect additional fire safety measures, including additional and the re-location of fire water tanks for fire engine access across the site in the case of a fire and amendments to the internal routing to allow fire vehicles access around the outside perimeter of all units.

2.85 The attenuation pond within the south-eastern extent of the site has been removed as the western attenuation pond design has been established to meet the requirements of the Proposed Development with regards to site drainage. Drainage attenuation is also provided within a 500ml gravel layer in the site compound (see the **Flood Risk Assessment and supporting Conceptual Drainage Strategy** report submitted alongside the planning application).

2.86 The key difference between Iteration 3 and the final layout is the provision of a new tower within the north-eastern extent of the site. This tower will provide a cable easement to allow the connection of a second 400kV Didcot/Cowley circuit to the Culham Jet Substation. This will provide improved energy security and resilience, and will reduce 400kV outages as the new cable will mean that the substation will be fed from two separate points of supply. The tower will be screened by strategic planting to reduce visual intrusion.

2.87 This final layout also includes an additional area of land to the west of the Culham substation to accommodate National Grid's new cable, which will be undergrounded connecting into the NGET substation.

2.88 The site has also been designed with an impermeable membrane underneath the compound area to deal in response to the Environment Agency's concern over contaminated run off in the event of a fire and water being used to cool the neighbouring containers.

2.89 National Grid have also influenced the final design of the site with the addition of their plant.

Figure 2.2 **Proposed Development Layout – Iteration 1**

Figure 2.3 **Proposed Development Layout – Iteration 2**

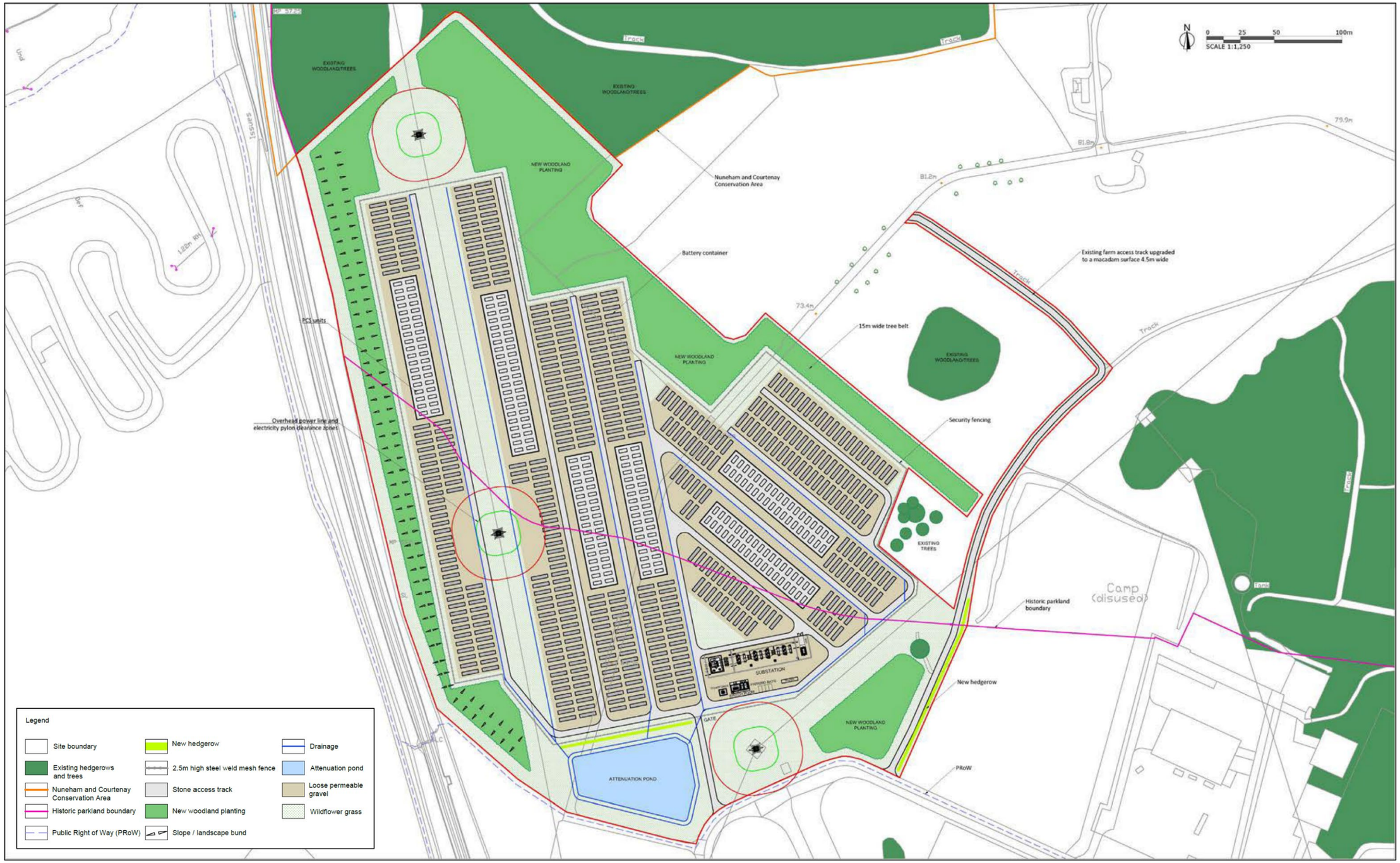
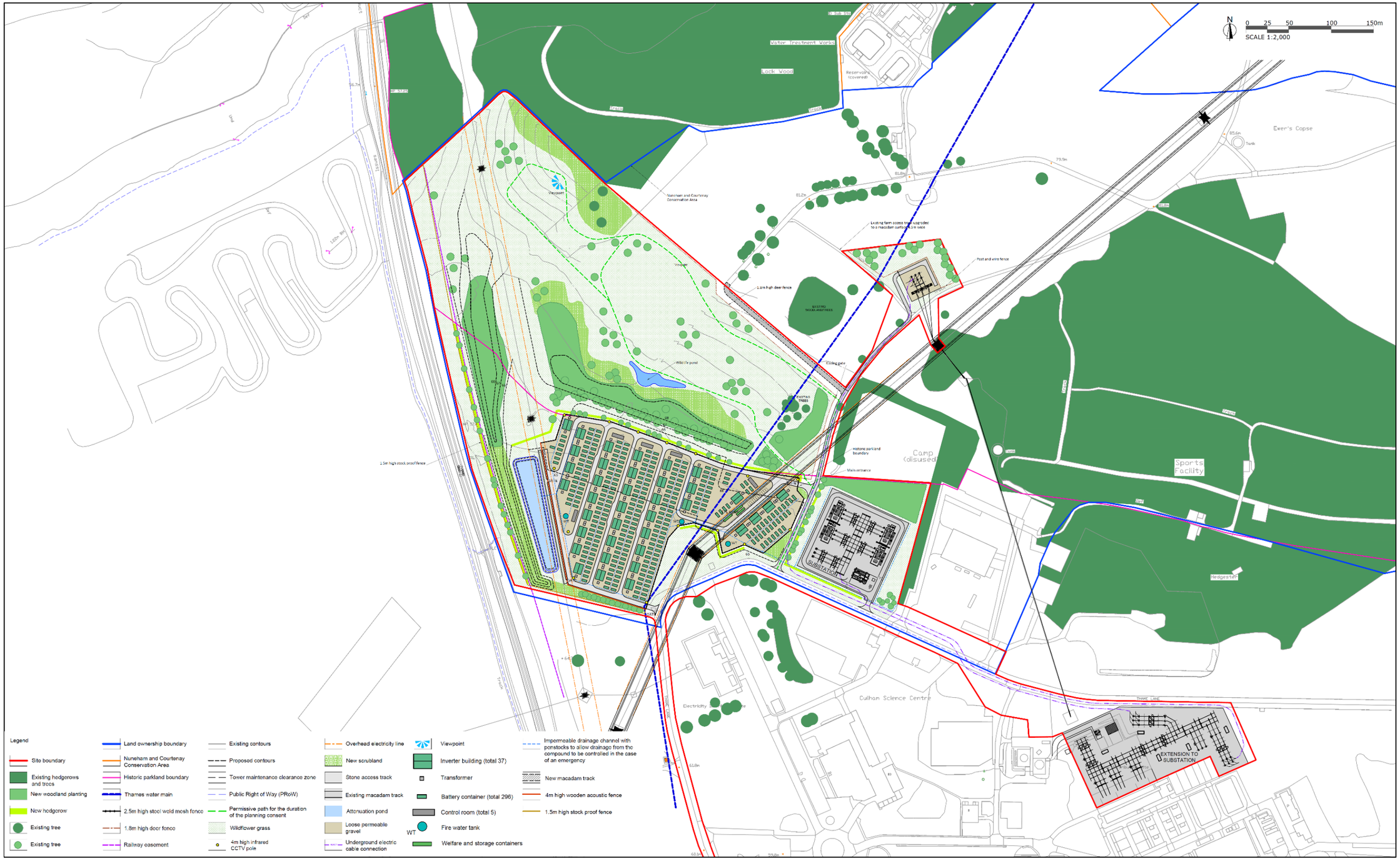


Figure 2.4 **Proposed Development Layout – Iteration 3**

Figure 2.5 **Proposed Development – Final Layout**



DESCRIPTION OF THE PROPOSED DEVELOPMENT

2.90 The Proposed Development comprises a 500 megawatt (MW) battery storage facility, with 296 sound insulated lithium ion battery units housed within standard shipping containers (6.3m x2.4m x 2.8m) and 37 larger (12m x 9.5m x 4.05m) noise insulated inverter houses to accommodate the inverters and transformers.

2.91 Furthermore, the Proposed Development will comprise the following components:

- Vehicle tracks 4.5m wide and vehicle hardstanding areas;
- Loose permeable gravel around the battery units and buildings, with an impermeable membrane layer lining the compound areas;
- Erection of 2.4m high weldmesh fencing around the compounds (steel palisade around the customer substation) and 4m high wooden acoustic fence. CCTV security cameras will be mounted on 4m high posts;
- Three water storage tanks;
- An electricity substation compound with a seven 33 Kilovolt (kV) switch house/control room (13m x 5.5m x 3.5m), comprising transformers, busbars and other equipment of up to 10m in height;
- One storm water attenuation lagoon;
- A new permissive path within a landscaped area at the northern extent of the site;
- A 4m high acoustic fence that runs along the west and south side of the BESS compound;
- An earth bund along the western boundary of the site;
- Removal of the non-public highway track (Thame Lane) within the site, and the upgrading of the existing farm track to a 4.5m wide macadam surface;
- Works to be undertaken by NGET as the statutory undertaker for electricity transmission in England and Wales.
  - a new drawn down tower,
  - cable easement, and
  - substation extension.
- Extensive landscaping in the form of hedge and woodland planting, and provision of a wildlife pond.

2.92 The grid connection for the Proposed Development would be via high voltage underground cable from the National Grid Substation on Thame Lane to the south of the site.

2.93 Works to be undertaken by NGET includes an extension to one of the existing substations within the Culham Science Centre as part of a wider upgrade of its electrical infrastructure. The extension will be on the east side of the northern substation. A high voltage underground cable will run from this extension to a proposed connection tower, which will be situated within the Registered Park and Garden, north of the BESS. The tower will allow the underground cable to connect aerially across to the existing overhead line. In terms of functionality, this is the only practical point of connection. The connection tower will be set within a compound protected by palisade fencing with proposed scrub and tree planting to reduce its visibility within the landscape.

Layout

2.94 Figure 2.5 shows the layout plan of the Proposed Development. Containers within the Proposed Development will be arranged in several parallel blocks to fit the shape of the site, considering the presence of the existing hedgerows and overhead power lines crossing the site.

2.95 Figure 2.6, Figure 2.7 and Figure 2.8 illustrate the battery container, inverter building and control room dimensions and appearance respectively, with Figure 2.9 illustrating the acoustic fence design.

Figure 2.6 Battery Container Plan

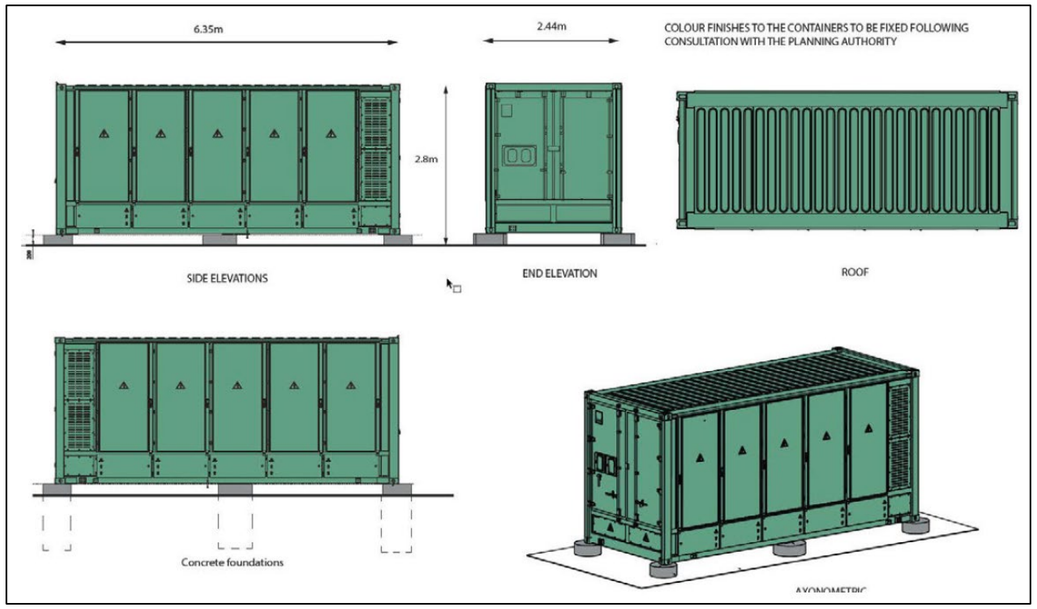


Figure 2.7 Inverter Building Plan

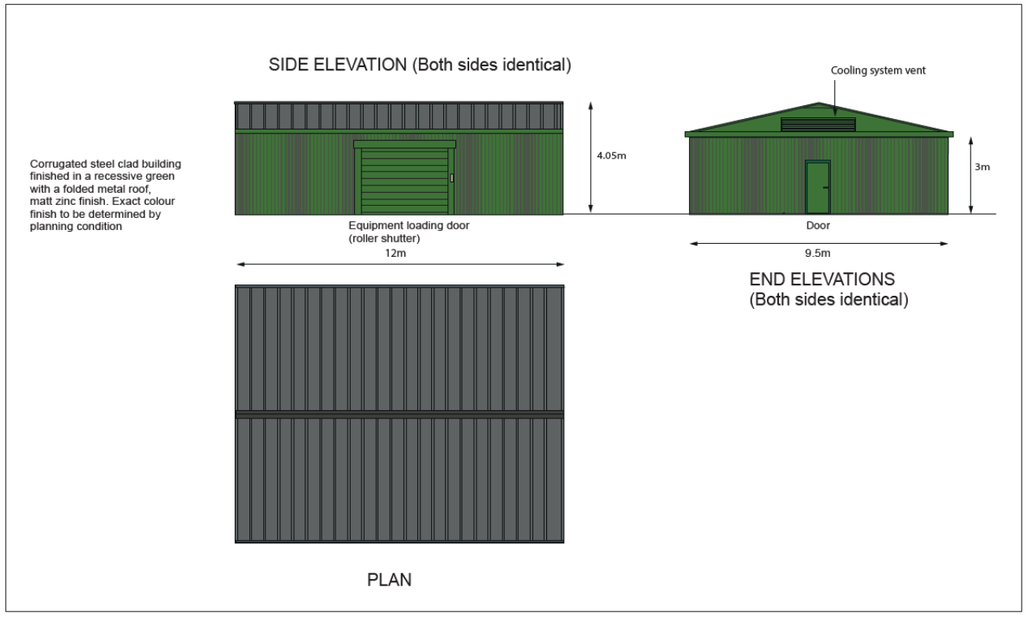


Figure 2.8 Control Room Plan

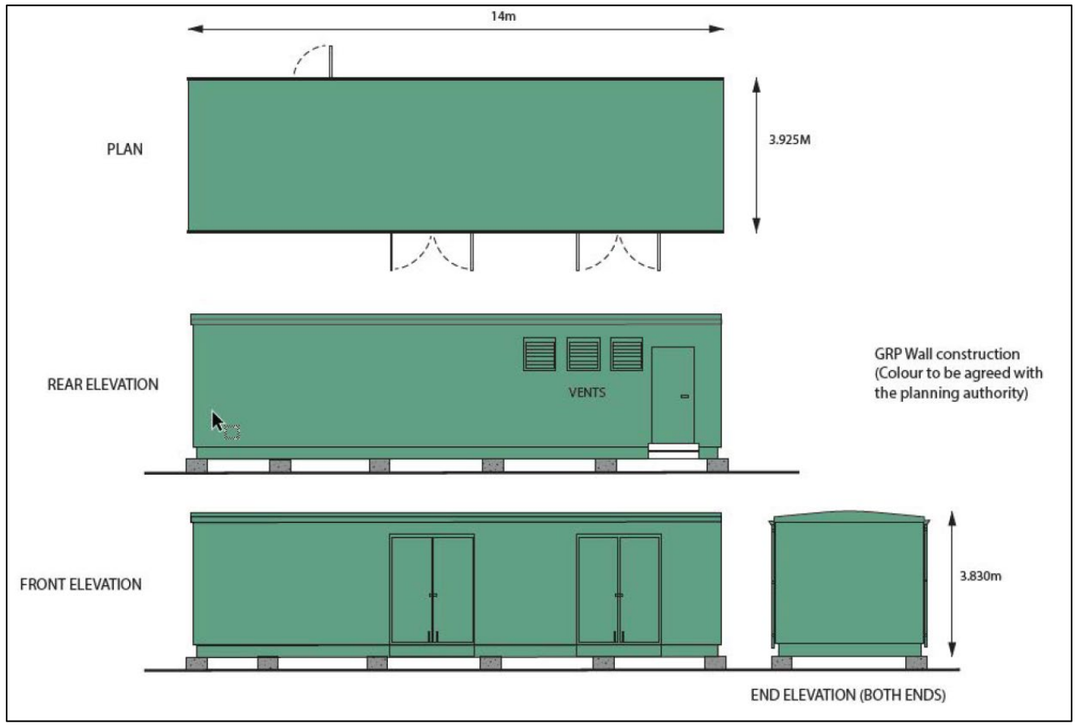
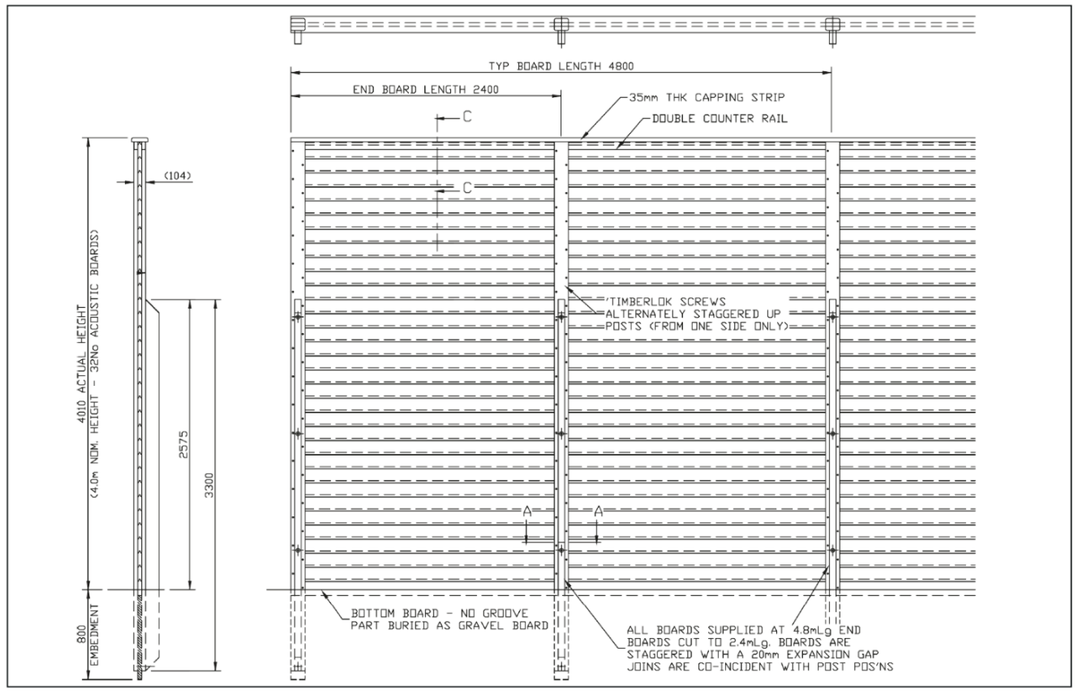


Figure 2.9 Acoustic Fence



Appearance

2.96 The containers proposed have been selected to reduce impact in terms of scale and visibility. The colour of the containers are proposed to be a dark green colour to better blend them into their surroundings.

Access and Parking

2.97 The Proposed Development, when operational, will be operated automatically, with limited need for personnel on site. Development traffic will likely comprise occasional maintenance vehicle access for security checks and routine maintenance, primarily by car and van as and when required, from the public road Thame Lane via the retained construction access. Operational visits are unlikely to involve more than three to four visits per week. A small number of parking spaces are available for occasions on-site for when personnel attend the site.

2.98 Within the site, internal access roads are also provided, as shown in Figure 2.5.

Operation and Maintenance

2.99 Due to the nature of the ancillary services provided by the Proposed Development, unlike a traditional power station, the facility needs to respond very rapidly to calls of frequency voltage and reactive power support and peaks in energy demand. It is therefore not possible to forecast any standard hours of operation or operational staff numbers. However, even when in operation, there is minimal on-site activity required during the plant lifecycle. The facility will be unmanned and be remotely controlled / monitored, with activity limited to occasional visits to undertake security checks and routine maintenance. It is unlikely to involve more than 3 or 4 visits by car or small van over a typical week with vehicle access being from Thame Lane via the retained construction access.

Construction Phase Logistics

Programme

2.100 The Applicant holds an agreement with NGET to connect its BESS to Culham GPS substation. This agreement states a connection date in 2027. For NGET to facilitate the connection, it is required to expand the existing substation which is subject to its own consenting and land optioning requirements.

2.101 Construction of the Proposed Development is anticipated to be undertaken over an 18-months construction programme, with approximately 8 to 10 months for civil works and 8 months for commissioning.

Construction Works Overview

2.102 The construction activities will comprise the following phases:

- Enabling works;
- Ground civil works;
- Main civil works;
- Electrical connection works; and
- Commissioning.

2.103 Up to approximately 70 construction workers are forecast to be on site each day during the busiest months, although the number will vary month to month depending on the work activities. Approximately 40 to 50 construction workers on site each day is considered a more typical number. Car sharing will be encouraged on site during construction phase. Where the workforce will travel from is currently unknown as it will depend on the appointed contractor and the personnel assigned to the site. However, it is anticipated that many of the non-local workforce will stay at local accommodation and be transported to and from the site by minibus and/or van, minimising the impact on the highway network. The number of car trips to and from the site will therefore be limited primarily to those associated with site management staff and visitors.

2.104 Typical construction plant and equipment to be used will include excavators, drilling rigs, graders and haulage vehicles, mobile and tower cranes, heavy and light goods vehicles.

2.105 A temporary construction compound will be created on site, this will be used for lorry turning and as a set down area during construction. This area will be reinstated post project completion.

2.106 All shuttle vehicles will be able to enter the site and unload within the compound area. There will be no queuing, parking or unloading on the public highway.

2.107 The cabins and containers are manufactured off site, delivered by Heavy Goods Vehicles (HGV) in modules and are rapidly craned into position onto pile foundations, resulting in an efficient build period.

2.108 The areas within the BESS facility will be fenced off and clear of the PRoWs, with no impacts in their usage during both construction or once operational. Furthermore, during construction phase, warning signs will be provided to inform pedestrians using the PRoWs about the construction work in progress. 'No Entry to Construction Traffic' signage will also be provided on the PRoWs to avoid their accidental use by construction vehicles.

2.109 Gates will be provided where the site access tracks pass through the fenced areas. Gates will be closed by default and will be open only when vehicles need to pass, ensuring that vehicles speeds will be low providing enough time and space for drivers and users of the PRoWs to avoid each other while crossing. At times of heavy vehicle usage, the gates will be manned by a Banksman who will hold back vehicles on the access tracks and/or advise pedestrians to wait while vehicles are manoeuvring.

2.110 Normal construction working hours will be Monday to Friday 07:00–18:00 and Saturday 07:00–13:00 during winter months (October to March) and Monday to Friday 07:00-20:00 and Saturday 07:00-13:00 during summer months. Construction work and construction traffic movements shall not take place on Sundays, bank holidays or after 13.00 on a Saturday unless such work is associated with an emergency or with the prior written consent of the Local Planning Authority. Construction laydown areas would be located within the site boundary.

Construction Access

2.111 It is anticipated that all construction traffic will route via the M4 or M40 before utilising local routes to access the site, as illustrated in Figure 2.10. All construction vehicles will approach the site via Abingdon Road (A415) and use the eastern junction with Station Road. Abingdon Road (A415) is a high standard 7.3m carriageway with a broadly straight alignment where it passes the Station Road junction. It is subject to the national 60mph speed limit.

2.112 The access route between Abingdon Road (A415) and the site serves to minimise the impact on the existing highway network and the businesses within the adjacent Industrial Estate and the Culham Science Centre, and therefore represents an appropriate arrangement as it facilitates large vehicle access during the construction of the Proposed Development.

2.113 The existing road to the west of the Culham No.1 Industrial Estate is currently used as an agricultural access track off Abingdon Road (A415) and vehicles will use it before joining on to Thame Lane. Access through the Culham Science Centre will also be required for the electrical connection of the site to the Culham National Grid substation. Construction vehicles will depart via the same route as illustrated in Figure 2.10.

2.114 The on-site layout of the Proposed Development is such that most construction vehicles will be unloaded within a temporary construction compound area next to the site access and not be required to enter the site itself. The compound will be arranged to ensure that large articulated vehicles can turn appropriately thereby ensuring all vehicles enter and depart the site in a forward gear.

2.115 Tracks 5m to 6mm wide will be provided within the site to enable vehicle access to the various areas of the BESS installation. These will be of a sufficient standard for the construction activities and will be retained post construction to allow occasional access for maintenance purposes during the operational stage. Topsoil will be removed before 500mm of 75mm crushed stone is laid and compacted on an appropriate geotextile membrane.

2.116 To manage access to the site, advanced 'Works Access', 'Slow' and 'Large Vehicles Turning' signage will be provided in both directions to warn of the presence of the site access and the potential for increased turning movements. This signage will be managed throughout the construction works by an accredited traffic management signage sub-contractor. The signage arrangements will be discussed and agreed with the Highway Authority prior to their implementation.

2.117 As part of the substation extension works, planned outages at Culham Jet Substation will be required. This is necessary for NGET (who occupy the substation) to carry out the work. NGET will take reasonable steps to minimise disturbance to UKAEA.

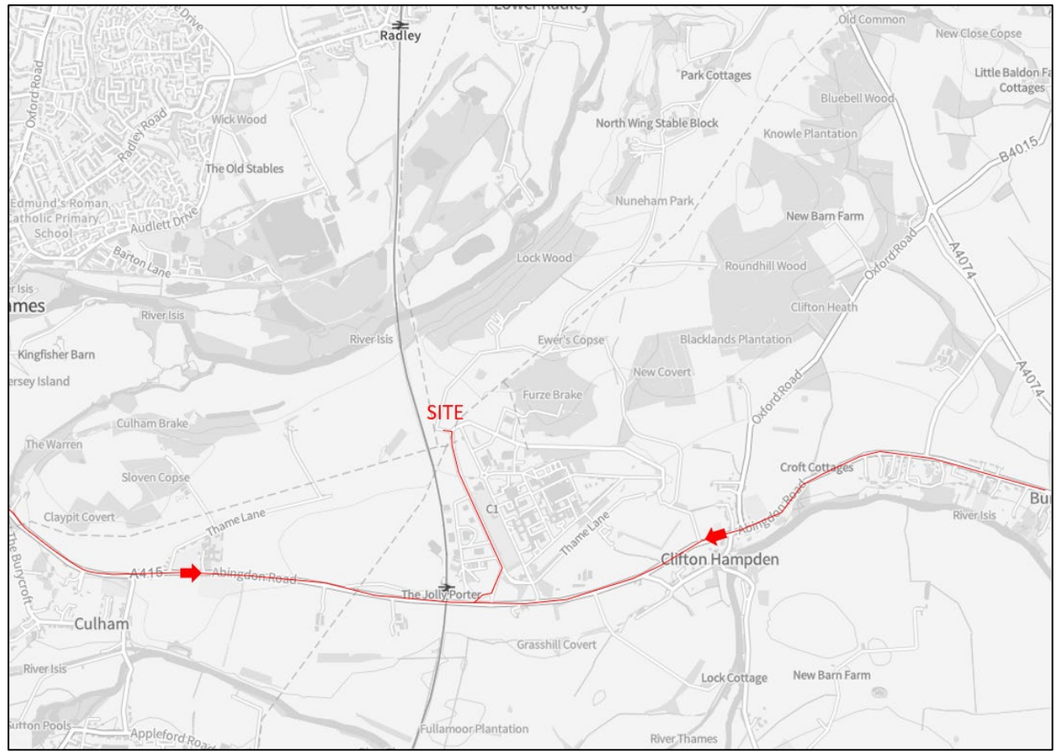
2.118 Height Restriction Barriers (Goal Posts) will be installed where there is a potential for accidental contact with overhead infrastructure in line with National Grid GS6 requirements. Similarly restricted access areas will be identified and barriered.

2.119 The Proposed Development will be accessed via a Site Security Checkpoint located at the entrance to the construction site. Visitors will need to undertake a Site-Specific Induction, Assessment and Approval, in its absence visitors will always be escorted by a site member.

2.120 Further information regarding construction access can be found within the **Access Note** and the **Construction Traffic Management Plan (CTMP)** submitted as a standalone report with the planning application.

2.121 Figure 2.10 shows a plan of the construction access route for HGVs.

Figure 2.10 Construction Access Route for HGVs



Construction Traffic

2.122 Material quantities have been calculated for the stone required for the on-site access tracks and the concrete / steel materials required for the concrete bases. These quantities have been used to identify the likely number of delivery vehicle movements required with this totalling approximately 825 loads by 8-wheel tippers (stone), flatbed rigid delivery lorries (steel reinforcement) and 6m^3 ready mix concrete lorries. It is likely that these materials will be delivered relatively evenly over an approximately 10-month period with typically 20 to 30 loads per week (40 to 60 two-way Heavy Duty Vehicles (HDVs)) or approximately 4 to 6 loads per day (8 to 12 two-way HGVs).

2.123 The deliveries (and staff) will be directed to the construction compound. Equipment will be stored in the construction laydown area until it is required within the construction site, however much of the equipment will arrive pre-assembled and be installed directly on arrival.

2.124 Based on previous experience from other similar sites it has been considered that the development of a BESS facility requires 1 HGV per modified battery container. The 500MW battery storage facility will therefore likely require approximately 296 HGV loads (containers on 16.5m articulated lorries) to deliver the battery containers and associated electrical equipment. These deliveries will take place evenly over an approximately 8-week

period which equates to approximately 37 loads per week (74 two-way HGVs) or approximately 6 loads per day (12 two-way HGVs).

2.125 HGV movements across the programme as a whole are forecast to peak at approximately 35 per week (70 two-way) or approximately 7 per day (two-way).

2.126 It should be noted that construction of the BESS facility will require some equipment to be delivered as an Abnormal Indivisible Load (or similar) - please refer to **Abnormal Indivisible Load Report** submitted alongside the planning application for detail.

2.127 Traffic will be managed through traffic management principles, programming and coordination of all construction works and associated traffic to the site.

2.128 Further information regarding construction traffic can be found within the **Construction Traffic Management Plan.**

Parking

2.129 During construction, a large contractor's compound will be provided within the site with this intended to accommodate all contractor parking, material storage and the majority of turning movements associated with the large delivery vehicles. For instance, the battery units themselves will likely be delivered to, unloaded, and temporarily stored within the compound before being transported individually to their final positions by on-site vehicles as and when required. Most delivery vehicles will not therefore be required to enter the main body of the site itself or to turn within.

2.130 A temporary car parking area (including spaces for minibuses and vans) will be provided within the contractor's compound with enough capacity to accommodate within the site the workforce, management and visitor parking demand, ensuring that no parking takes place on the local highway network.

Construction Drainage

2.131 During construction of the Proposed Development, the building contractor will be responsible for management and disposal of rainwater runoff generated from the site in its temporary condition.

2.132 The contractor shall develop a formal site management plan, which will address pollution management and control in relation to site plant and vehicles, raw materials storage and waste generation, to ensure that all surface water runoff generated in the temporary condition will be free of contamination.

2.133 The site will be subject to topsoil strip and bulk earthworks to prepare the site to the correct level for development. The contractor shall provide temporary drainage measures to contain runoff within the Proposed Development's site boundary ensuring that this is sized appropriately, and that means to remove excess surface water are available for use at all times.

Construction Waste

2.134 Waste generated during the construction of the Proposed Development will be re-used and recycled where possible. The overall objective will be to reduce the amount of waste generated during construction works and to sustainably manage any waste that is generated using waste management facilities in closest proximity to the site where possible.

2.135 Measures will be implemented to reduce the quantity of materials used during the construction of the Proposed Development, including avoiding the stockpiling of construction materials; preventing the overordering of construction materials by carrying out upfront cost analysis works; and storing the construction materials in an appropriate location that will minimise damage to materials.

2.136 Appropriate waste handling, storage and disposal measures, will be set out within the Construction Environmental Management Plan (CEMP) to be secured by the SODC via a planning condition. This includes measures such as careful handling of material and waste such as lowering rather than dropping items, storing waste materials in appropriate contains to be collected by a waste carrier to a registered waste transfer station and re-using materials where possible , as set out in **ES Volume 1, Chapter 7: Environmental Management, Mitigation and Monitoring**.

Landscaping

2.137 The landscape design aims to mitigate the loss of rural character of the site resulting from the construction of the Proposed Development. In addition, it seeks to enhance the setting of the higher quality Park and Garden.

2.138 The extensive landscape scheme includes the provision of woodland planting at the northern and eastern extents of the site, new scrubland, scattered tree planting, and hedge planting along the western, southern and north-eastern boundaries of the developed site area, as shown in Figure 2.11. The on-site attenuation basin will also be landscaped and managed to enhance biodiversity.

2.139 It is also proposed to erect an earth bund between the railway line and the overhead power lines, and also to the north of the battery infrastructure, which will typically crest at 67m Above Ordnance Datum (AOD) but rise to the north to 68m AOD, representing a crest height above existing levels of between 3m and 5m. The aim of this earth bund is to screen the Proposed Development from the allocated urban expansion area (STRAT9 – Strategic Allocation of the South Oxfordshire Local Plan) and the section of the Oxford Green Belt Way footpath on the west side of the railway to the east, and also the Registered Park and Garden and Conservation Area to the north. While the bunding may be perceived as an artificial feature, it will be seen in the context of the engineered railway cutting and the overhead power lines. The bunding also assists acoustically and will also reduce views of the STRAT9 allocated site from higher ground within the Registered Park and Garden, particularly once the tree and hedge planting has established.

2.140 The Proposed Development's landscape design also includes the retention of scattered trees in the north-east of the site, the enhancement of retained modified grassland habitats, and the inclusion of native species-rich hedgerow around the boundaries of the compound with some standard trees within the western hedgerow.

2.141 Furthermore, in line with guidance from the National Fire Chiefs Council (NFCC)[5] areas within 10m of BESS units will be cleared of combustible vegetation and any other vegetation on site will be kept in a condition such that it does not increase the risk of fire on site.

Ecological and Biodiversity Enhancements

Ecological Enhancements

2.142 A number of ecological enhancements, as set out within **ES Volume 3, Appendix: Ecology and Biodiversity – Annex 1**, have been embedded within the design of the Proposed Development, including:

- The creation of 10.7ha of other neutral grassland in moderate condition will represent a significant improvement for reptiles;
- Two log piles 2m length and width and 1.5m height will be installed on the north of the site, alongside the existing neutral grassland habitat (on the edges of the modified grassland habitat which will be subject to enhancement);
- Three woodcrete / woodstone bat boxes (e.g., 2F Schwegler Bat Box) suitable for crevice-dwelling species will be installed on the scattered trees in the north-east of the site; and
- Three woodcrete / woodstone bird boxes suitable for starlings, woodpeckers and nuthatches (e.g., 3S Schwegler Starling Nest Box) or similar will be installed on the scattered trees in the north-east of the site.

2.143 More information regarding ecological enhancements can be found within the Ecological Impact Assessment (EcIA) (**ES Volume 3, Appendix: Ecology and Biodiversity – Annex 1**).

Biodiversity Enhancements

2.144 A Biodiversity Net Gain calculation was undertaken using Natural England's 'Biodiversity Metric 3.0 – calculation tool'.

2.145 A number of principles and assumptions were made when undertaking the calculation. More information relating to these and the methods applied can be found within the EcIA and the Biological Impact Assessment (BIA) located in **ES Volume 3, Appendix: Ecology and Biodiversity – Annex 1** and **Annex 2.**

[5] *NFCC (2022) Grid Scale Battery Energy Storage System planning – Guidance for FRS*

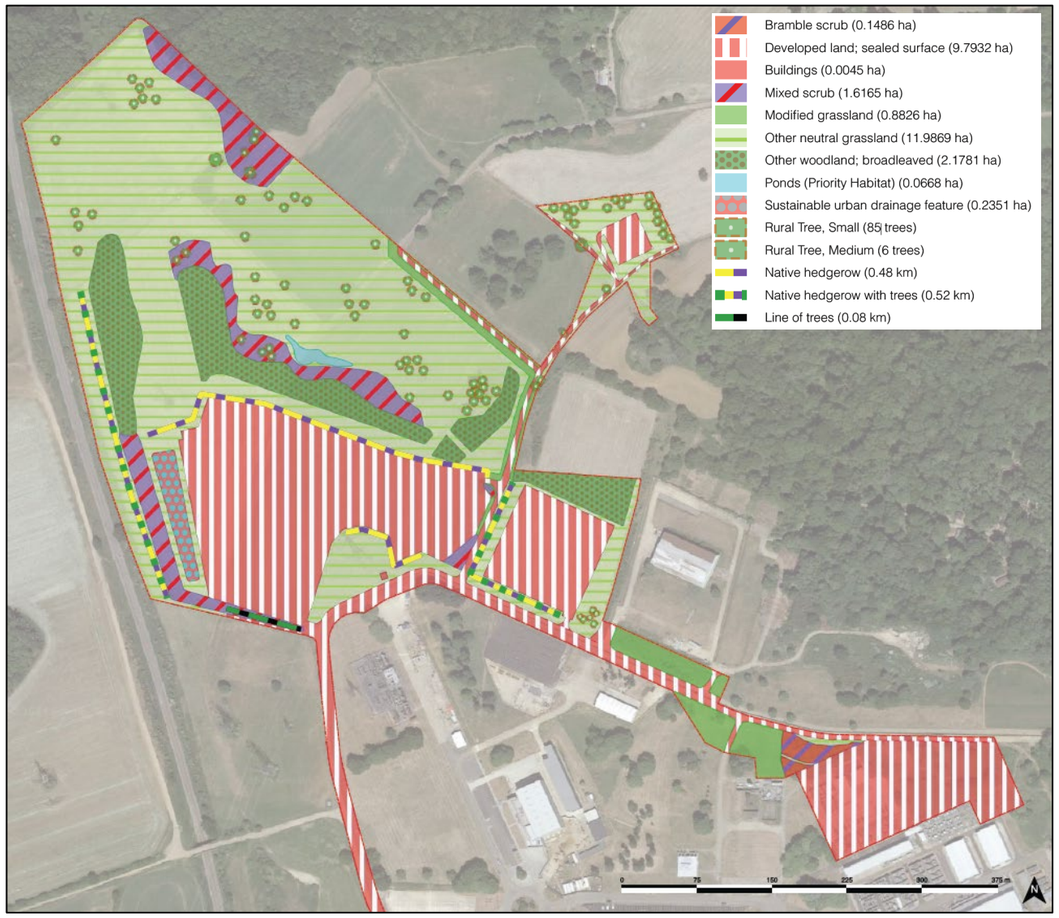
2.146 As demonstrated in Table 2.1 below, the BNG assessment predicts that with the on-site habitat enhancement measures implemented, the Proposed Development will deliver a significant biodiversity net gain.

Table 2.1 Summary of BNG Metric Assessment

Unit Type	On-site Baseline Units	On-site Post-development Units	Net Unit Change	% Change
Habitat	64.75	109.11	+ 44.36	+ 68.51%
Hedgerow	0.00	5.10	+ 5.10	N/A
River	0.00	0.00	0.00	0.00%

2.147 The Proposed Development results in a net gain of 44.36 habitat units (i.e., a 68.51% increase from the baseline). The native species-rich hedgerow being created on-site will deliver 5.10 hedgerow units. Therefore, the Proposed Development ensures an achievement in biodiversity net gain at the site, satisfying the mandatory 10% net gain requirement under the Environment Act 2021 and Policy ENV3 of the South Oxfordshire District Council Local Plan, by improving biodiversity through the design of the new development. Figure 2.11 shows a plan of the different habitats included within the Proposed Development design.

Figure 2.11 Habitats Plan



Drainage and Flood Risk

Operational Drainage

2.148 The Proposed Development will increase the low permeability area on-site. The battery and substation infrastructure will sit on a porous gravel surface. The layout plan, as shown in Figure 2.5, includes an on-site attenuation basin at the western extent of the site for drainage attenuation. Drainage attenuation is also provided within a 500ml gravel layer in the site compound. Surface run off will be controlled at an agreed runoff rate.

2.149 More information regarding drainage can be found within the **Flood Risk Assessment and supporting Conceptual Drainage Strategy** report which is being submitted as a standalone report with the planning application.

Crime and Lighting

2.150 The facility will be enclosed by new 2.5m high fencing to offer site security and ensure that the equipment is protected from vandalism. CCTV units will include infrared capability for use at night-time.

2.151 As the facility is unmanned, only limited operational lighting is required.

Waste

2.152 BESS facilities do not generate significant volumes of waste material during construction or operational phase. The materials anticipated to be required during the operational phase are expected to be limited to maintenance only.

2.153 The site will be controlled by a Site Waste Management Plan (SWMP) which will be submitted to the SODC prior construction phase. A SWMP will assist with the management of any construction waste.

2.154 An agreement is in place between the Applicant and the lithium-ion battery provider to ensure that at the end of the life of the batteries, as part of any future decommissioning works, the batteries will be recycled in line with appropriate industry standards by the manufacturer.

Fire Risk Management

2.155 Efforts to minimise and mitigate fire risk include (although are not limited to) the following of aspects, including following appropriate guidance from the NFCC and other best practice industry guidance:

- **BESS planning & design**: this includes the overall design of the site and specifically the separation of battery containers and other major equipment, i.e., transformers, inverters and sub stations. The spacing of containers is based on National Fire Protection Association standard NFPA855 (standard for the installation of stationary energy storage systems) which requires a 3m separation between containers. NFPA855 is a commonly applied and well-respected standard for batteries in the UK. The likely battery technologies have also been tested to UL9540A to rack level and the Lithium Iron Phosphate chemistry does not exhibit thermal runaway until temperatures are in the region of 150-200 degrees C, which is well above all thermal cut outs, and almost certainly never to be seen in operation. The batteries themselves also have overtemperature protection and fire suppression initiation. Suitable facilities for safely accessing and egressing the site are also provided, including
  - Two separate access points to the site to account for opposite wind conditions/direction;
  - Roads/hard standing capable of accommodating fire service vehicles in all weather conditions;
  - A perimeter road or roads with passing places suitable for fire service vehicles; and
  - Road networks on sites enabling unobstructed access to all areas of the facility.
- **BESS construction**: the Engineering, Procurement, and Construction (EPC) contractor will have experience and familiarity with BESS technology, whereby causes for BESS fires can result from poor workmanship and the EPC contractor's lack of experience in the sector. Other important construction factors include the use of non-combustible materials within the insulation of the battery containers and the chosen ventilation and suppression systems for the site.

- **BESS fire protection systems**: the BESS operator will ensure an adequate water supply is available for firefighters and that the local fire brigade have visited the site to familiarise themselves with the site. The fire brigade will have a plan devised to prevent any reignition scenarios and thermal runaway, and will be aware of Site Specific Risk Information (SSRI), including ensuring that the manufacturers' operational risk information is available for responding crews and the hazards associated with BESS are fully understood. The SSRI will inform an effective Emergency Response Plan. Remote and continuous online monitoring, early detection sensors, appropriate venting to avoid the build-up of gas and automatic fire suppression systems to NFPA855 standard will also be in place. The BESS will be built according to established fire standards such as NFPA855 and/or IFC 2018/20, which address issues such as fire protection, spacing and ventilation; using battery technology tested to UL9540a (Large Scale Fire testing). Should thermal runaway conditions be detected, there will be a facility in place for the early alerting of emergency services. Detection systems will also be in place for alerting to other fires that do not involve thermal runaway (for example, fires involving electrical wiring). Continuous combustible gas monitoring within units will also be provided. External audible and visual warning devices, as well as addressable identification at control and indicating equipment, will be utilised - this will enable first responders to understand what the warning is in relation to and aid in their decision-making. Suitable fixed suppression systems will be installed in units in order to help prevent or limit propagation between modules.
- **BESS maintenance**: the site will have a dedicated maintenance schedule including monthly preventive checks, and thermographic testing. Site maintenance will include ensuring that combustibles are not stored adjacent to units and access is clear and maintained. Areas within 10m of BESS units will be cleared of combustible vegetation and any other vegetation on site will be kept in a condition such that they do not increase the risk of fire on site.
- **Signage**: signage will be installed in a suitable and visible location on the outside of BESS units identifying the presence of a BESS system. Signage will also include details of:
  - Relevant hazards posed;
  - The type of technology associated with the BESS;
  - Any suppression system fitted; and
  - 24/7 Emergency Contact Information.
- **Emergency plans**: site operators will develop emergency plans and share these with the Fire and Rescue Service. These include:
  - A Risk Management Plan - developed by the operator, which provides advice in relation to potential emergency response implications including:
    - The hazards and risks at and to the facility and their proposed management;
    - Any safety issues for firefighters responding to emergencies at the facility;
    - Safe access to and within the facility for emergency vehicles and responders, including to key site infrastructure and fire protection systems;
    - The adequacy of proposed fire detection and suppression systems (e.g., water supply) on-site; and
    - Natural and built infrastructure and on-site processes that may impact or delay effective emergency response.
  - An Emergency Response Plan - developed to facilitate an effective and safe emergency response, including:
    - How the fire service will be alerted;
    - A facility description, including infrastructure details, operations, number of personnel, and operating hours;
    - A site plan depicting key infrastructure: site access points and internal roads, firefighting facilities (water tanks, pumps, booster systems, fire hydrants, fire hose reels etc), drainage and neighbouring properties;
    - Details of emergency resources, including fire detection and suppression systems and equipment, gas detection, emergency eye-wash and shower facilities, spill containment systems and equipment, emergency warning systems, communication systems, personal protective equipment and first aid;
    - Up-to-date contact details for facility personnel, and any relevant off-site personnel that could provide technical support during an emergency;
    - A list of dangerous goods stored on site;
    - Site evacuation procedures; and
    - Emergency procedures for all credible hazards and risks, including building, infrastructure and vehicle fire, grassfire and bushfire.

2.156 Whilst the Fire and Rescue Service is not a statutory consultee in relation to BESS projects at the planning stage, in England, the primary legislation for which Fire and Rescue Services (FRS) have direct statutory responsibilities are as follows:

- The Fire and Rescue Services Act 2004 (sets out the responsibilities of Fire and Rescue Authorities (FRAs));
- The Building Safety Act 2022;
- Regulatory Reform (Fire Safety) Order 2005;
- Fire Safety Act 2021 and Fire Safety Regulations (England) 2022;
- Civil Contingencies Act 2004;
- Policing and Crime Act 2017; and
- Crime and Disorder Act 1998.

2.157 In England, the FRS is also a statutory consultee of the Local Authority Building Control and will generally consider the guidance contained within Approved Document Part B (Fire Safety) from The Building Regulations.

2.158 The Fire and Rescue Services Act 2004 gives the Government responsibility for producing the Fire and Rescue National Framework which outlines the Government's high-level priorities and objectives for Fire and Rescue Authorities in England. The National Framework's priorities for Fire and Rescue Authorities are to:

- Identify and assess the full range of foreseeable fire and rescue related risks their areas face, make provision for prevention and protection activities and respond to incidents appropriately; and
- Work in partnership with their communities and a wide range of partners locally and nationally to deliver their service.

2.159 The Fire Liaison Framework (FLF) submitted in support of the planning application sets out the principles which underpin the FLF, as well as the long-term approach with regards to fire and rescue liaison throughout the planning, commissioning and operational delivery phases of the BESS scheme. Consultation will be undertaken with the local fire service and stakeholders throughout these phases as appropriate, as set out within the FLF.

Decommissioning Phase

2.160 The Proposed Development is intended to function for a maximum of 40 years. Following this 40-year lifespan, the battery storage infrastructure will be dismantled and the existing agricultural land will be returned to its original state for agricultural purposes. It is expected that a similar number of vehicle movements as per the construction phase would be required to clear the site, with vehicles following the same construction routing. It should be noted that the substation extension, connection tower and landscaping will be permanent features of the Proposed Development and not decommissioned/removed.

2.161 Once the Proposed Development is no longer in use, the lithium-ion batteries and other infrastructure contained within their containers will be extracted. An outstanding portion of the materials can currently be recycled. As the site will mainly consist of grassland, with minimal foundations, hard surfacing, and heavy infrastructure, restoring the land will be relatively easier to restore compared to a more intrusive developments that require more extensive foundations.