EIA Report Chapter 2: Proposed Development and Design Evolution

Monan Repower

Client: Constantine Wind Energy (UK) Ltd
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2 Proposed Development and Design Evolution

2.1 Introduction

This chapter outlines the design process undertaken and provides a description of the Proposed Development and ancillary infrastructure and its geographical context. It also outlines the anticipated construction, operation and decommissioning activities connected with the Proposed Development.

This chapter should be read in conjunction with the following figures and planning application drawings:

- Figure 2.1 – Site Constraints Plan
- Figure 2.2 – Site Constraints with Layout
- C5507-GCR-WF-GA-DR-P-0001 – Site Location
- C5507-GCR-WF-GA-DR-P-0002 – Site Layout
- C5507-GCR-WF-GA-DR-P-0003– Drainage Concept
- C5507-GCR-WF-VS-DR-P-0001 – Visibility Splay
- C5507-GCR-WF-DE-DR-P-0001 – Typical Construction Detail Harstanding and Road Detail
- C5507-GCR-WF-DE-DR-P-0002 – Typical Foundation Details
- C5507-GCR-WF-DE-DR-P-0003 – Turbine Elevation
- C5507-GCR-WF-DE-DR-P-0004 – Drainage Details

2.1.1 Design Statement

This Chapter is considered to also constitute a Design Statement. The Proposed Development triggers the requirement for the provision of a Design Statement under Regulation 13 of The Town and Country Planning (Development Management Procedure) (Scotland) Regulations 2013 because it is in a sensitive location – sited within a National Scenic Area (Regulation 13.—(2), (c)). Table 2.1 explains the requirements for Design Statements and how these requirements have been met.

Table 2.1 - Design Statement Requirements

Design Statement Requirement	Addressed
The approach adopted and design principles utilised	The key design consideration for the Proposed Development from the perspective of the Design Statement is the National Scenic Area (NSA) designation. The NSA has been a key design consideration in terms of layout, siting and design of the Proposed Development. This is discussed in detail in **EIAR Chapter 6 – Landscape and Visual Impact Assessment.**
How the legislative and policy context has been considered	The legislative and policy context have been considered in detail in **EIAR Chapter 4 - Regulatory and Policy Context** and the **Planning Statement**.
The appraisal process for the spatial context and constraints of the site, and how these have been considered	This is outlined in **Section 2.2 Site Constraints and Design Evolution**.

The public engagement undertaken on the design and the resultant influence on the final design	The Applicant has conducted early engagement with the local community prior to planning application submission as outlined in **EIAR Chapter 3 – EIA Methodology.**
The approach adopted in terms of the policy for access to disabled people	The only areas of the Proposed Development that have floor space and the potential for physical restrictions for access for disabled people would be the Substation. However, the restrictions would apply to all users due to it being an operational electrical substation. The internal layout of the substation building is not considered to be "development" under the terms of the Town and Country Planning (Scotland) Act 1997 (as amended) and is not considered further in design terms.

2.2 Site Constraints and Design Evolution

2.2.1 Site Constraints

Constraints were identified through desk-based assessment, site surveys and the consultation process. Key constraints for the Site include:

- Landscape Designations- Harris-Uig Hills WLA and South Lewis, Harris and North Uist NSA;
- Class 1 and 2 Peat;
- Hydrological features; and
- Topographical features.

There are a number of features surrounding the Site that require appropriate separation distance requirements, namely:

- The Application Boundary;
- Water features on and in close proximity to the Site;
- Infrastructure in close proximity to the Site; and
- Residential properties in close proximity to the Site.

Appropriate separation distances from these features have been applied to the baseline constraints plan, making areas suitable for development easily identifiable from the offset.

These constraints and separations can be seen in **Figure 2.1.**

2.2.2 Design Evolution

The design process of the Proposed Development has had four key iterations. These iterations have taken into consideration environmental constraints, results from environmental baseline surveys, scoping responses from consultees, knowledge from the operational wind farm and input from turbine manufacturers for the new replacement turbines. These iterations are shown in **Image 2.1 - 2.4** and are described below.

2.2.2.1 Iteration 1

The initial layout proposed the turbines to be adjacent to the operational locations. This would minimise the requirement for new access tracks and would allow the utilisation of as much of the existing infrastructure as possible and thus minimising environmental impacts on the surrounding receptors. Illustrated in Image 2.1.

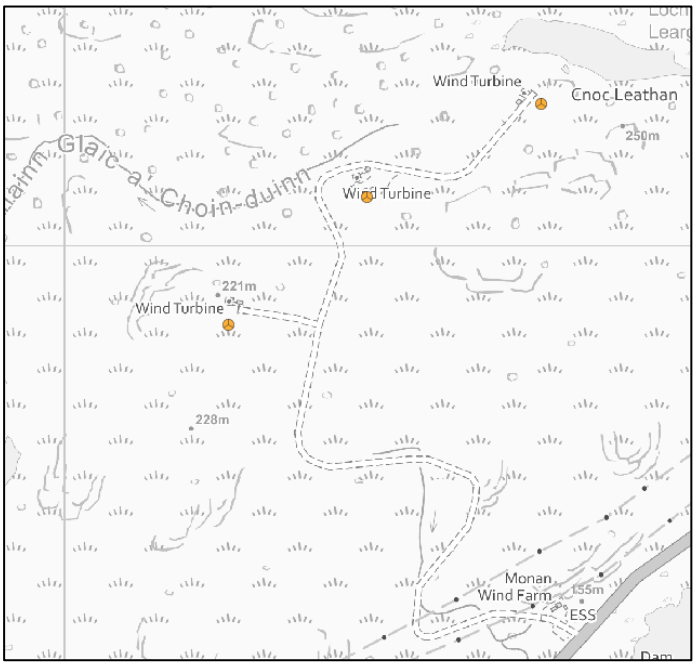

Image 2.1 – Iteration 1

2.2.2.2 Iteration 2

Following a review of the historic performance of the wind farm over the past 7 years it has been observed that the conditions experienced by the northern turbines have been very turbulent due to the higher elevation of the topography and the impact of surrounding topography to the east creating significant levels turbulence. This was particularly the case for the most northeasterly turbine. In consultation with the turbine manufacturer it was deemed necessary to move the northeastern turbine to the south-west to reduce these effects on the repowered

scheme. Further examination of the other turbines also resulted in micrositing of the proposal turbines, still adjacent to the existing, to maximise the use of existing infrastructure. This is illustrated in Image 2.2.

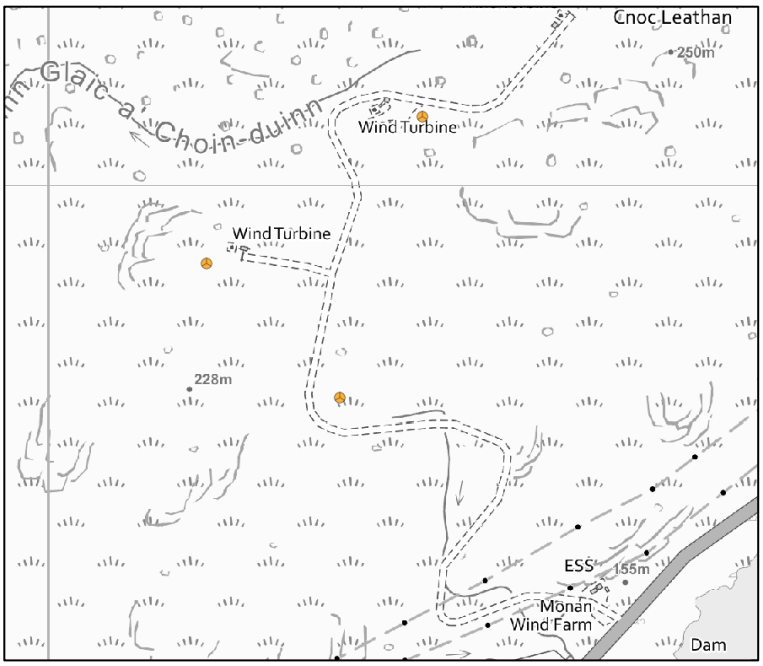

Image 2.2 - Iteration 2

2.2.2.3 Iteration 3

Upon further review and utilising computational fluid dynamics modelling, it was found that the conditions created by this triangular layout would not reduce the effects of turbulence to a significant degree. The newly placed southern turbine was moved west to move it further form the public road and recreate the existing linear layout but with improved siting taking into account turbulence and desired distances between wind turbines. This is illustrated in Image 2.3.

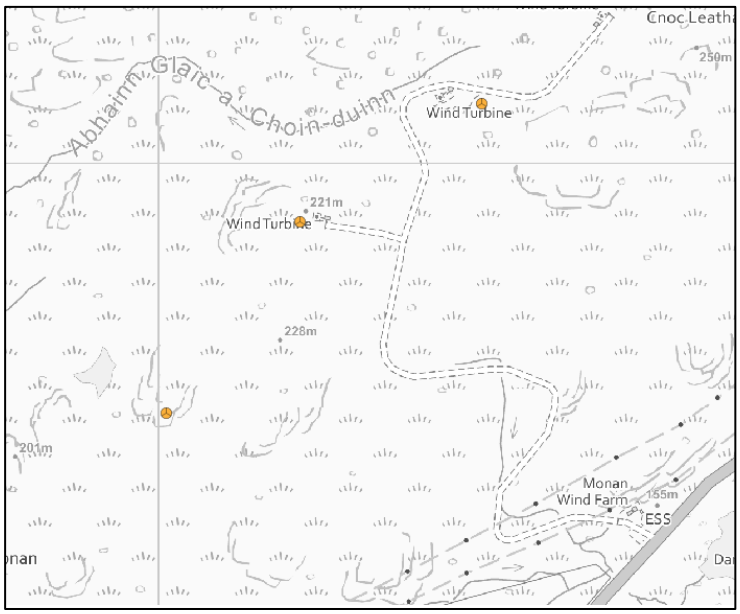

Image 2.3 - Iteration 3

This move has additional benefits in terms of the landscape and visual impact. This removes one of the turbines from the Harris -Uig Hill WLA, reducing the direct impact to the WLA. Additionally, the move of the most northerly turbine to the south-west of the Site brings the turbine onto lower elevation land and thus, reduces the prominence and visibility of the Proposed Development in the landscape. The Site would also retain its linear layout. LVIA considerations are discussed further in **EIAR Chapter 6 – Landscape and Visual Impact Assessment.**

2.2.2.4 Iteration 4

Refinement of the latest design took place subsequent to onsite peat survey results. Turbine locations have encountered minor micro-siting to account for changes in the wider design of the proposed infrastructure with the aim of mitigating impact on peat deposits. Peat considerations are discussed further in **EIA Chapter 7 – Hydrology** and it's associated appendices. This layout is illustrated in **Image 2.4** and **Planning Drawing C5507-GCR-WF-GA-DR-P-0002.**

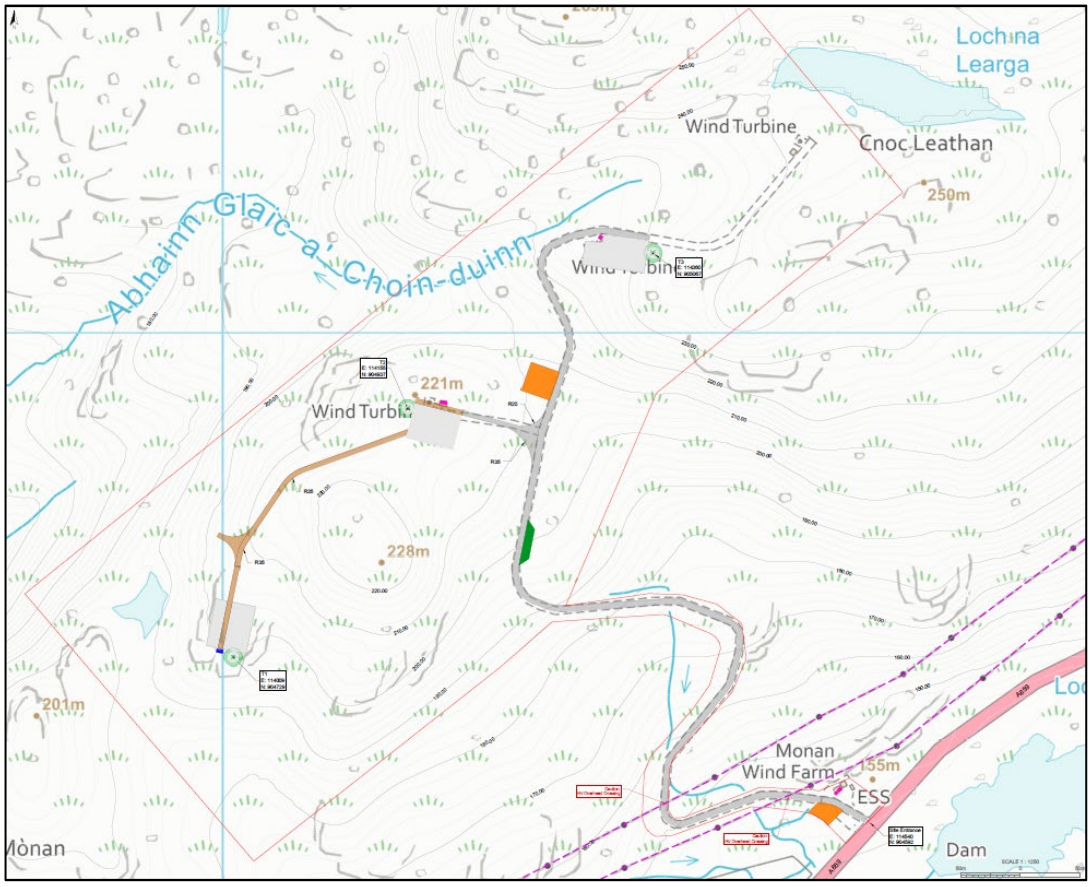

Image 2.4 - Iteration 4 (Planning Layout)

2.2.3 Design Summary

The repowering layout is the result of a thorough review of the current data available from the successful operation of three wind turbines at the Site, alongside diligent design and communication with key stakeholders, aimed at mitigating any likely significant effects through design.

The design principles behind the Proposed Development have taken into account potential environmental considerations such as, landscape and visual effects, physical constraints and engineering requirements. The design of the Proposed Development considered baseline data from various sources. A final layout was created

based on the design criteria, which have been assessed alongside the findings of the extensive site-specific assessment and survey work.

The final layout has been presented throughout the EIA Report as the Proposed Development and is described in detail in the following sections.

By following the adopted design process, the siting and design of the Proposed Development has been optimised to avoid significant environmental impacts while maximising the generation capacity of the Site and therefore the contribution to offsetting carbon emissions and supporting the ambitious renewable targets set by the Scottish Government.

2.3 The Site

The new turbines would be located in close proximity to the current turbine positions and will use the majority of the existing access tracks.

The Landscape Character Area (LCA) is titled as 'Prominent Hills and Mountains'. This LCA is characterised by individual peaks with pronounced summits, long ridges, and slopes, rising steadily from the surrounding terrain. Steep sided corries and short u-shaped glens form an integral part of this character type. The landcover is dominated by a mixture of low moorland, mixed windswept heather with damp rough grassland which gives a course texture surface.

The northern part of the Site where the Proposed Development is located is situated within the Harris – Uig hills Wild Land Area (WLA) which was designated after the operational Monan Wind Farm was granted consent. The WLA consist of many different landscape elements at a variety of scales, elevation, and pattern. These include open peatland; high rocky mountain ranges; isolated lone peaks; rocky cnocan; deeply carved fjords; open sea; islands; sea cliffs; lochs and lochans; and rivers and waterfalls. The landscape and scenic qualities attributed to the Sites location are recognised through its inclusion within the South Lewis, Harris and North Uist National Scenic Area. Approximately 9.0km east of the Site is the Eishken WLA.

The wider area is sparsely populated with the nearest residential properties situated 1.0km to the south-west in Bunavoneader. The settlement of Tarbert is approximately 4.6km south-east of the Site.

There are no heritage assets located within the Application Boundary and the nearest National Record of the Historic Environment (NRHE) site is located approximately 480m to the south-east of the Proposed Development. The Site is located entirely within a mixture of Class 1 and 2 Peat. The West Coast of the Outer Hebrides Special Protection Area (SPA) is located approximately 1.2km to the south-west of the Proposed Development and the North Harris Site of Special Scientific Interest (SSSI) and Special Areas of Conservation (SAC) is located approximately 875m to the north-west of the Proposed Development.

The A859 lies approximately 400m south-east of the Site and is a key route within the immediate area, running from Stornoway to Rode. The Abhainn Glaic a' Choin duinn partially runs through the northern section of the Site. The western edge of Loch Learga is situated within the Application Boundary.

2.4 Development Description

The repowering proposal will comprise three wind turbines up to 86m to tip. This is the same height of turbine as originally granted planning consent in 2008 (planning reference 06/00290). The proposed turbines would replace the three existing two-bladed turbines of 46m to tip and two of their locations would be in very close proximity to the current positions. The existing substation building and existing access tracks and turning/passing areas on the Site would be utilised. A short section of new access track will be required to access turbine one.

The extent of additional areas required will be kept to a minimum.

The Proposed Development will comprise:

- Three, three-bladed horizontal axis wind turbines measuring up to 86m tip height and up to 500kW export capacity each;
- Hardstanding areas for cranes at each turbine location;
- Turbine foundations;
- Drainage works;
- A temporary construction compound, including parking, and welfare facilities;
- Associated ancillary works; and
- 370m new access track and 930m of upgraded access track.

The Proposed Development would use the existing substation building and current access.

2.4.1 Access

2.4.1.1 Route to Site

It is proposed that the wind turbine components will be delivered to the Port of Arnish, as it is the most accessible for turbine delivery. The delivery will then connect to the A859 via Arnish Port Road and travel south along the A859 towards Bunavonaeder to the Site entrance which is located off the A859 approximately 260m north of Breedon Ceann an Ora Quarry. This route is outlined in detail in EIAR Chapter 11 – Traffic and Transport.

2.4.1.2 Access Tracks

Existing access tracks and turning/passing areas on the Site will be upgraded and utilised as far as possible. A short section of new access track will be required to access T1. Approximately 370m of new access tracks would be required for the Site.

New access tracks would be typically 4m wide on straight sections, up to 7m wide on corners where it is necessary to construct wider track to reflect the minimum bend-radii for the longest construction loads. All sections of track would have a 0.25m shoulder on each side and would consist of crushed stone to a depth dictated by ground conditions, approximately 500mm. Tracks would comprise of stone sourced from the quarry adjacent to the Site thus avoiding the need for use of the public highways.

All new access tracks have been designed to avoid sensitive environmental receptors and where possible, tracks will be floated to minimise peat disruption.

2.4.2 Grid Connection and Substation

The electrical power produced by the individual wind turbines would be fed to the existing substation located on the Monan Wind Farm Site via the underground cables.

2.4.3 Wind Turbines

The Proposed Development would involve the replacement of three existing 2-bladed wind turbines of 46m to tip at Monan Wind Farm, with three 3-bladed wind turbines with a tip height of up to 86m. The exact model of wind turbine to be installed will be selected through a competitive procurement process, however for the purposes of the assessments, currently available wind turbine models are being considered which fit this height parameter and which have a total electricity generating capacity of up to 500kW, giving a total generating capacity for the Site of up to 1.5MW. There are a number of potential wind turbine models which fit within the height parameter, but which differ in properties, in each instance a 'worst case' potential wind turbine has been used in the assessment as appropriate.

The Ordnance Survey National Grid References for the proposed final locations of the wind turbines are presented in Table 2.2 below.

Table 2.2 – Proposed Turbine Locations

Turbines	Grid Coordinates	
	Easting	Northing
T1	114009	904729
T2	114155	904937
T3	114360	905067

Each wind turbine will comprise the following components:

- Blades;
- Tower sections;
- Nacelle; and
- Hub.

The turbines will rotate in a clockwise direction. The computerised control system within the turbine continuously monitors the wind direction and instructs the turbine to turn (yaw) to face into the wind to maximise the amount of energy that is captured. The turbines will begin generating at a wind speed of 3-4 m/s and operate with a storm control feature that enables the turbine to continue to operate in very high wind speeds; this avoids the need for sudden shutdowns and the resulting energy yield losses.

In the event of extreme wind speeds, in excess of those that the turbines can operate at (typically 10minute averages of 25m/s or a gust of 34m/s), they would shut down until the wind speed has dropped to a level where they can safely start operating again.

2.4.4 Turbine Foundation

A typical turbine foundation is shown in Planning Drawing C5507-GCR-WF-DE-DR-P-0002. The foundation would typically have a diameter of approximately 15m, and a depth of 2.8m. When the foundations are excavated, a further metre around the foundation edge will be dug to allow working space during construction. A concrete blinding, 10cm thick, will be poured to provide a surface on which the foundation can be constructed.

The turbine foundations will be covered by consolidated backfill that will have a density of no less than 18kN/m³. It is anticipated that the excavated material will be used for this backfilling. A plinth of approximately 7m in diameter is left, just above the surface level, upon which the turbine is bolted.

2.4.5 Hardstandings

Crane hardstanding areas are required at each turbine location to facilitate the erection of the wind turbine. Where possible the existing crane hardstandings for the operational scheme will be used albeit with some additional widening to facilitate the larger turbine components. The indicative crane pad design measures 40mx20m Adjacent to the crane hardstanding would be laydown areas for the blades measuring approximately 40m long by 10m wide. The overall hardstanding area will measure approximately 40mx34m and a typical hardstanding is shown in Planning Drawing C5507-GCR-WF-DE-DR-P-0001.

The crane hardstanding and laydown areas would remain a permanent feature of the Proposed Development to facilitate maintenance.

2.4.6 Decommissioning of existing turbines

The decommissioning of the operational wind farm would involve the dismantling of the turbines and their removal from the Site. This would be in line with good practice guidance and the decommissioning plan of the operational wind farm. See EIAR Chapter 12 – Other Issues for further information.

2.4.7 Watercourse crossings

The Proposed Development would only have one water crossing. This would be on the existing area of access tracks and as such, is already in existence. No new water crossings are proposed as part of this application. See EIA Chapter 7 - Hydrology for all information relating to water crossings.

2.4.8 Quarry

There is an existing quarry located to the south-west of the Proposed Development by the A859. It is anticipated that this quarry may be used in place of a borrow pit or sourcing of stone elsewhere in the local area for construction material required for the new section of access tracks. The entrance to the quarry is located approximately 55m to the south-west of the entrance to the wind farm Site and is accessed off the A859. New access tracks will not be required to access the quarry.

2.5 Construction

The construction phase of the Proposed Development would last for approximately 4 to 6 months, subject to award of consent, award of construction contracts, time of year and weather conditions.

2.5.1 Construction Approach

Any site investigation and preconstruction surveys required to be undertaken will be done in order to inform detailed design in advance of construction.

Excavation would be undertaken by initially stripping back the soil from the area to be excavated. This soil would typically be stored separately in a designated area on Site for further use or reinstatement of temporary works areas. This soil could be used for restoration and should be stripped and stored carefully. The handling of soils would be undertaken in accordance with best practice techniques. Soil and peat storage is discussed in EIAR Chapter 7 – Hydrology.

Should surface water run-off or groundwater enter the excavation during construction of the wind turbine foundations, appropriate pumping measures away from watercourses would be implemented to ensure the works are safely carried out and the excavation is sufficiently dry to allow concrete placement. Once the concrete is cast, the excavated material would be used for backfill and compacted to the required design density. Once this backfill is completed, the crane hardstanding areas would be constructed.

2.5.2 Micrositing

A micrositing allowance from the proposed position of turbines, and associated infrastructure (up to 50m deviation from the indicative design) is requested via planning condition and will assist in reducing environmental impacts during construction. Micrositing of any of the turbines, track or associated infrastructure would be used to limit environmental impacts following a detailed site and ground investigation required as part of discharging the planning conditions and final locations of infrastructure would be agreed in writing with the planning authority prior to site commencement.

2.5.3 Construction Environmental Management Plan (CEMP)

A construction environmental management plan (CEMP) will be prepared and implemented ahead of the commencement of construction. The CEMP will detail the mitigation measures which would be applied during

construction of the Proposed Development. The CEMP will be prepared by the Principal Contractor, responsible for undertaking the construction works. It would be based on the mitigation measures outlined in EIA Chapter 13 - Summary of Mitigation.

The CEMP will be prepared and agreed with Comhairle nan Eilean Siar (CnES) and relevant consultees prior to the commencement of construction.

The CEMP will describe how the Principal Contractor will ensure suitable management of several environmental issues during construction. The Applicant would engage an Ecological Clerk of Works (ECoW) onsite during the construction phase. The services of other specialist environmental advisors would be procured as required.

The construction mitigation measures proposed by each of the environmental topics assessed in the EIA Reports are provided in the relevant EIA Report chapters.

2.5.4 Drainage

A preliminary drainage concept has been produced to manage all surface water and foul drainage in line with the CIRIA C697 'The SuDs Manual. The Site will utilise as much of the existing drainage as possible. This aspect is discussed further in EIA Chapter 7 – Hydrology and on drawing Planning Drawing C5507-GCR-WF-GA-DR-P-0003.

2.6 Operation and Maintenance

2.6.1 Operational Life

It is proposed that the operational lifetime of the Proposed Development will be 35 years. Therefore, the assessment considers the effects of the operational phase of the Proposed Development to be temporary.

Following the commissioning of the Proposed Development, the construction elements, such as cranes and other plant will be removed from the Site, and the Site will revert to a calmer overall appearance. Reinstatement works will be undertaken where appropriate and in line with planning conditions to improve the overall appearance of the Site.

2.6.2 Lighting

Turbines will be fitted with aviation obstacle lighting to meet the requirements of the Ministry of Defence (MOD). This will take form of Infra-red lighting to MOD specification as required.

2.6.3 Maintenance

During operation, the Site will be visited at regular intervals by approved technicians to undertake maintenance and to ensure safe operation throughout the lifetime of the development. The service team is made up of operation management, operations technicians, and support functions. During periods of scheduled maintenance, technicians who may be based in the local area would be required for up to several weeks per year. Although activity on the Site will be limited during the operational phase, the requirements of the CEMP will remain in place in the even that any maintenance works are required.

Additionally, the technicians would be required to undertake unscheduled maintenance throughout the year. This team would either be employed or contracted directly by the developer, by the wind turbine manufacturer or by the maintenance service provider. Management of the Proposed Development would typically include wind turbine maintenance, health and safety inspections and civil maintenance of tracks, drainage and buildings.

Maintenance activities could include but are not limited to:

- Civil maintenance of tracks and drainage;
- Scheduled routine maintenance and servicing;

- Unplanned maintenance or call outs;
- Electrical maintenance;
- Blade inspections;
- Fencing;
- Snow clearing; and
- Replacement of turbine components.

2.7 Reinstatement and Decommissioning

2.7.1 Reinstatement

Prompt completion of post-construction reinstatement works shall be undertaken where reasonably practicable. Early reinstatement reduces the temporary storage of materials, and the associated visual impact.

Excavated materials will be replaced in a sequence and to a depth similar to those recorded during excavation, or similar to the surrounding undisturbed ground at the point of reinstatement.

Any reinstatement and restoration proposals will consider, and mitigate against, all residual risks to environmental receptors. These proposals will be submitted and agreed with CnES pursuant to any planning conditions.

2.7.2 Decommissioning

At the end of their operational life it is assumed that the Proposed Development would be decommissioned. The decommissioning will be undertaken in accordance with good practice guidance available at the time. While details of the decommissioning stage for this development are not known at this time, it is assumed for the purpose of the EIA that decommissioning will involve the removal of all above ground infrastructure. On completion of the decommissioning works, all temporary facilities will be removed and areas of excavation disturbed will be reinstated.

It is proposed that a decommissioning, or indeed further repowering plan will be agreed with CnES and relevant consultees prior to the end of life of the Proposed Development in line with planning conditions.

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