Chapter 2: Project Description

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Chapter 2: Project Description

2.1 Introduction

This chapter describes the proposed development in more detail, addressing the physical characteristics of the wind farm, its components and design. It also provides a summary of methods and timescales for construction and operation of the proposal.

The exact process will depend upon the final details of the equipment to be installed, preferences of the construction contractor and availability of installation plant.

The descriptions provided here are based on current best industry practice, as well as using Community Windpower's experience gained during the construction of their previous onshore wind projects.

2.2 The Proposal

The proposed development will comprise of 3 wind turbines with a maximum tip height of 149m. In addition to the wind turbines, the proposed site will consist of the following associated infrastructure:

- Electrical Generating Equipment
- Turbine Foundations
- Crane Hardstands and laydown area at each turbine
- Substation Control Room and Compound
- Temporary Construction and Storage Compound
- Access tracks, including turning heads
- A borrow pit.

The proposed wind farm will generate electricity from a renewable source. This site has a viable wind speed, and from this, it is predicted that the wind farm will generate approximately 40,800 MWh annually, which is enough to power over 10,885 homes (see Appendix 2.1).

Herds Hill Wind Farm is within an area of operational wind farms; hence the proposed turbines have been sited so that they can be viewed in conjunction with the existing schemes. The area has been previously deemed appropriate for wind turbine development, evident through the council's acceptance of numerous schemes in the area including:

- Sanquhar Community Wind Farm, (9 x 130m to tip, producing 31.05MW annually) which was approved in February 2013 and commenced operation in March 2018.
- Sandy Knowe Wind Farm, (24 x 125m to tip, producing 81.60MW annually) which was approved in July 2020 and commenced operation in December 2022.
- Sanquhar II Community Wind Farm (42 x 200m to tip, 2 x 149m to tip, producing around 308MW annually) which was approved by the Scottish Ministers in August 2023.

2.3 Associated Infrastructure

The location of the site, as seen in Figure 2.1, shows the area in which the proposed development will be contained. Table 2.1 identifies the turbine coordinates. The three turbines will generate a capacity of round 10.35 MW and have a typical hub height of 93m.

Table 2.1: Turbine Locations.

Turbine ID	Easting	Northing
1	273008	608956
2	273118	608267
3	272266	608563

The proposed turbine tower is a conical multi-sectioned tower. The turbines are to be three-bladed horizontal axis machines. The asynchronous turbines are pitch regulated, upwind turbines with active yaw (a device which allows the machine to turn itself towards the prevailing wind). The turbine blades are typically airfoil shells bonded to supporting beams and constructed of fibreglass reinforced epoxy and carbon fibres, although different construction methods are employed by different manufacturers.

The tower, blades and nacelle will be a semi matt, light grey finish (International Colour Reference RAL 7035, RGB 230, 230, 230). This colour has been selected to blend into the skyline.

The three-bladed turbines will be variable speed, so the speed of their rotation will be dependent on wind conditions, however, a typical turbine will rotate between 6 and 16 revolutions per minute (rpm). Electricity will be generated at wind speeds above 3 to 4 m/s (the 'cut-in' speed). If the wind reaches a constant 25 m/s and above, equivalent to around 56 miles per hour (mph), the turbines will shut down in order to protect the components.

Each turbine has a lightning protection system providing a path of least resistance for any lightning strike to ground and preventing any likely damage to the turbine.

As the proposed turbines are under 150m in height, visible aviation lighting is not required.

The final choice of turbine specification and manufacturer will be decided following a tendering process and commercial and technical appraisal; however, the physical dimensions of the turbines will not exceed the maximum tip height of 149m. However, this is subject to gaining planning permission and the tendering process will occur post-consent.

2.4 Turbine Foundations

Turbine foundations typically consist of either a square, circular or octagonal reinforced concrete base approximately 20.5m in diameter and located approximately 3.5 m below ground surface. The base tower section of the turbine is connected to the foundation by either an embedded end-can that is cast into the foundation, or alternatively bolts that are cast into the upstanding section of the foundation. The weight of the foundation and the backfill material provides the stability required for the turbine.

Construction of the turbine foundations will require the excavation of surface organic soil/sub-soil and other soft overburden until either rock, or a firm stratum is found, with the excavation sides battered back to ensure stability. The excavated soil/sub-soil would be separated and stored near to the excavation in stockpiles not exceeding 2 m in height to minimise the risk of overheating and gravitation soil creep.

Once the foundations have been excavated, the formation is rolled and blinded with around 100-millimetre (mm) layer of blinding concrete and levelled. The steel reinforcement is placed within the construction area and external formwork will be used to contain the poured in-situ concrete.

The surrounding ground around the turbine base would be restored to tie in with the original and existing surface levels by using the previously stored overburden. Any surplus material would be used for additional landscaping and surfacing reinstatement. The final foundation design is confirmed at the detailed design stage of the project when results of geotechnical investigations are complete and the required loadings are confirmed by the turbine manufacturer.

2.5 Crane Hardstands

Each wind turbine requires areas of hardstand to be constructed adjacent to the actual turbine foundation area. These provide stable and suitable areas for the turbine components to be stored and lifted into position by the required cranes.

The construction of each turbine will require a primary large sized crane and a secondary small sized crane. These cranes will require areas of hardstand to provide a stable and firm base during the installation of the turbines. The crane hardstands will also remain in-situ for the lifetime of the wind farm, in case any cranes are required during the operational phase e.g., to change a blade, undertake any repairs.

Prior to the excavation of the crane hardstands, all vegetation and any underlying organic soil will be stripped. The turves and organic soils will be stored separately next to the crane hardstands for use in re-instatement works and banking around the area.

Underlying material will be excavated to a suitable level and then built up to form a firm platform with suitably graded stone taken from the borrow pits and/or turbine foundation excavations and follow exactly the same construction methodology as for the access tracks.

2.6 Borrow Pits

The stone required for the access tracks, turbine foundations, crane hardstands and other hardstand areas will be sourced from an already existing borrow pit, as seen in Figure 2.1. This approach will avoid transportation movements of stone to the site from offsite locations, thus reducing the overall project's carbon footprint.

2.7 Electrical Connection and Substation/Control Room Buildings

All wiring from Herds Hill Wind Farm will connect to a local business or businesses, via private underground power cables. Through a separate application by Scottish Power Energy Network (SPEN), likely cable routes will be identified and assessed, and best practise followed in order to avoid any ecological sensitivities.

The proposed development will require an on-site substation, a wind farm control building and outdoor electrical infrastructure. Including but not limited to 132kV switchgear and 132kV transformers.

The onsite substation/control room buildings and compound will house electrical switchgear and transformers which will connect the Herds Hill Wind Farm to the electrical network. Typical

dimensions for the substation/control room compound are 24m by 28m with a building height of around 5m.

The substation/control room buildings may be of a containerised type which would be easily removed and therefore more sustainable, or they may be of a traditional built block structure with rough cast render finish. The buildings would be painted a suitable colour to minimise its visual impact and also to resemble agricultural outbuildings. However, the exact configuration, layout and finish of the building and compound will be agreed prior to their construction and is subject to the input from SPEN and the advice they receive during the S37 process.

The location of the substation/control room buildings and compound are shown in Figure 2.1.

2.8 Construction and Storage Compounds

During the construction phase, a secure temporary construction/storage compound would be required to house the necessary welfare facilities and store construction equipment and machinery. The compound will also provide storage and a lay-down area for plant and materials and for the secure storage of turbine components and equipment. It will also be used as a suitable location for refuelling.

An already existing hardstanding will be used (see Plate 2.1), therefore, the dimensions are in the region of 30m x 40m. The existing compound area is located adjacent to existing access tracks and sited at a suitable distance to allow easy access to the areas of working for the construction teams.

Plate 2.1: Existing Hardstand Area circled in red [image taken from Bingmaps.com].

2.9 Land Take

Temporary land take is the area of land which is reinstated after the construction phase of the project is complete. Permanent land take relates to the infrastructure, for example, new access tracks, hardstands, substation/control room compound and turbine footprints which will exist on site throughout the lifetime of the wind farm, which is not already present on site.

The overall development area, shown bounded in red in Figure 2.1, is equivalent to approximately 287 hectares. Within this area, the permanent land take has been calculated as 1.75 hectares, which is equivalent to 0.3% of the overall area.

In addition, these areas of permanent land take will be restored at the end of the wind farms operational life, unless the landowner requests to keep the tracks for agricultural purposes.

2.10 Habitat and Land Management

Habitat management and enhancement measures will be undertaken, to improve the biodiversity of the site and to encourage and protect wildlife. A comprehensive series of surveys of flora and fauna have been undertaken by professional ecologists and ornithologists. The results of these extensive studies and surveys have been used to develop and inform the Ornithology and Ecology chapters for this application. Further development of habitat management and enhancements to be delivered, will be undertaken in discussion and agreement with NatureScot, RSPB, SEPA and Dumfries and Galloway Council.

2.11 Waste Management

Waste management will be an integral part of the proposed project and the Waste Management Strategy will have two principal objectives:

- To segregate waste that cannot be avoided and maximise recovery, reuse and recycling opportunities.
- To dispose of the waste in an environmentally sensitive manner off-site where recovery options are impractical.

The construction of the wind farm will lead to low volumes of construction waste being generated. Onsite segregation will assist in minimising the quantity of material that is sent for offsite disposal in landfills.

Storage of potentially polluting substances will be kept to a minimum, with only the necessary amount being kept onsite. When potentially polluting substances are onsite, they will be located in a sensible location where they are least likely to be interfered with and at a maximum distance away from watercourses and likely catchment areas.

Where it is necessary to store materials whilst the wind farm is in operation, polluting substances will be locked in an impermeable container. This will reduce the risk of vandalism and contamination.

Concrete will be ready-mixed offsite and then delivered to site by a local concrete supplier using their concrete delivery vehicles.

During operation, a commercially available wastewater treatment system (septic tanks) would be on site to deal with wastewater from the control room/substation building which would have integrated working toilets. The discharge volumes will be small however it will comply with the requirements of the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR).

Waste management details will be incorporated into a Construction Environmental Management Plan (CEMP) which will be agreed with SEPA, NatureScot and Dumfries and Galloway Council, prior to construction commencing.

2.12 Wind Farm Maintenance

Maintenance regimes begin shortly after commissioning with 'post-construction' checks performed, usually at 10 days and 3 months after commissioning.

After this, minor and major service regimes continue on a 6-monthly basis with both services being performed annually throughout the lifetime of the turbines.

These service regimes will be programmed so a minimum number of turbines are being serviced at any one time. This will ensure the electrical generated output from the wind farm is kept to a maximum.

In the case of major component maintenance being required, such as generator or blade replacement, large vehicles similar to those used during the installation phase may be required to return to the site. All maintenance on any equipment is performed according to the Original Equipment Manufacturers (OEM) stated schedules and procedures.

2.13 Project Phases

Construction Phase

The construction of the development will be carried out over a 12-month period. Details of this construction phase may be subject to modifications at a later point; however, this phase will involve the following stages:

- Extraction of locally won stone for the construction of access tracks, hardstands, construction compound and turbine bases from a temporary borrow pit located onsite.
- Construction of the new access tracks that will reach the turbines from the already existing Sanquhar Wind Farm access track.
- Construction of a temporary storage and construction compound.
- Construction of crane hardstands.
- Construction of turbine bases.
- Wind turbine delivery and installation.
- Cabling installation and electrical works including the construction of a substation and control room.
- Commissioning of site equipment.
- Site restoration works, as required.

The activities that take place during the construction phase, as outlined above, would occur in a logical order, or overlap accordingly, to ensure a smooth and efficient construction timeline. An indicative construction timeline/programme is included in Appendix 2.2.

Operational Phase

Once the turbines have been built and commissioned, the temporary works, including the construction and site storage compound, will be removed. The turbines will have an operational life of 40 years and therefore planning permission is sought for 40 years from the date of commissioning. The wind farm will be serviced and maintained by technicians and engineers, with specialist personnel contracted to cover specific aspects of the wind turbine maintenance work.

Decommissioning Phase

Once the operational phase has ended, the turbines will be decommissioned, and the site restored, typically within 12 to 24 months. This is in contrast to traditional fossil fuel fired power stations, and particularly nuclear power stations. The proposed wind farm should therefore be viewed as a sustainable development.

The decommissioning work would be the responsibility of the Developer and it is proposed that at least 12 months prior to decommissioning, a 'Decommissioning Method Statement' will be produced, and agreed with the Dumfries and Galloway Council, the landowner and other statutory stakeholders such as SEPA.

Alternatively, the Applicant may seek consent for the extension of its operational life, or they may apply to the Council to repower the wind farm site.

Appendices

Appendix 2.1: Energy and Carbon Calculations.

Predicted Energy Production:	**Calculation:**	**Total:**
Proposed 3 turbine development with a 3.45MW candidate turbine:	3 Turbines x 3.45 MW	10.35 MW
Maximum theoretical electrical generation per year, based on 8,760 hours per year (365 days x 24 hours):	10.35 MW x 8760 hours	90,666 MWh
It is accepted that although wind turbines operate for around 80% of the time, they do not produce the full installed capacity factor all the time. A capacity factor of 45% is used instead as it is a more conservative figure. The predicted energy production is:	0.45% x 90,666 MWh	40,799.7 MWh per year
Based on the above assumptions and average UK domestic consumption [(1),] this is equivalent to:	40,799.7 MWh / 3.748 MWh	10,885 Homes powered
Annual Emission Calculations (Carbon Dioxide (CO_2)):		
The energy produced displaces energy that would have to have been produced by traditional methods such as coal and gas power stations. Thus, the avoided CO_2 production is [(2)]:	40,799.7 MWh x 432 kg / 1000	17,625 Tonnes per annum
40 Year Emission Calculations (Carbon Dioxide (CO_2)):		

Over to 40 year operational life of Herds Hill Wind Farm, the CO_2 savings would equate to:	17,625 Tonnes x 40 years	705,018 Tonnes

The scheme at Herds Hill will use the latest technologically advanced wind turbines. Given the predicted wind regime obtained from data from the temporary on-site meteorological mast, the anticipated capacity factor is likely to be in the region of 50%. Nonetheless, although these are realistic assumptions, for the purpose of this ES and resulting calculations, a more conservative capacity factor of 45% has been used in the energy and emission calculations. The wind farm is therefore expected to generate **40,799.7 Megawatt-hours** of electricity per annum. Based on BEIS statistics, this would be enough electricity to power around 10,885 homes each year.

(1) Average domestic consumption will vary over time due to changing energy habits and variations in climate. However, the latest figures for average UK annual domestic electricity consumption per household static (calendar year 2021) is **3.748 MWh**. More information on these statistics can be found on the following document:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1126284/subnational_electricity_and_gas_consumption_summary_report_2021.pdf

(2) It is currently agreed that each kWh of electricity produced using the UK's average fuel mix results in the emission of **432g** of CO2 (or 432kg per MWh). Further details can be found at: page 53 of the following document:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1130501/DUKES_2022.pdf

Appendix 2.2: Indicative Construction Programme.

	Week Number																								
Task	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Mobilisation																										
Access & Site tracks																										
Foundations																										
On-site cabling																										
Crane Pads																										
	Week Number																								
	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Substation - Electrical																										
Turbine Delivery																										
Turbine Erection																										
Commissioning and Testing																										
Site Reinstatement																										

397 Herds Hill

Legend

- Site Boundary
- Wind Turbine (149m to Tip)
- Existing Access Tracks
- Cable Route
- New Access Tracks
- Substation & Control Room
- Temporary Construction Compound
- Existing Borrow Pit

Notes: N/A
Revisions: N/A
Layout: 397-220905-9005-C

0 150 300 600 m
Scale: 1:15,000 @ A3
N

Figure 2.1 - Site Layout

Date: 31/10/2023 Ref: 397-220928-7025-J
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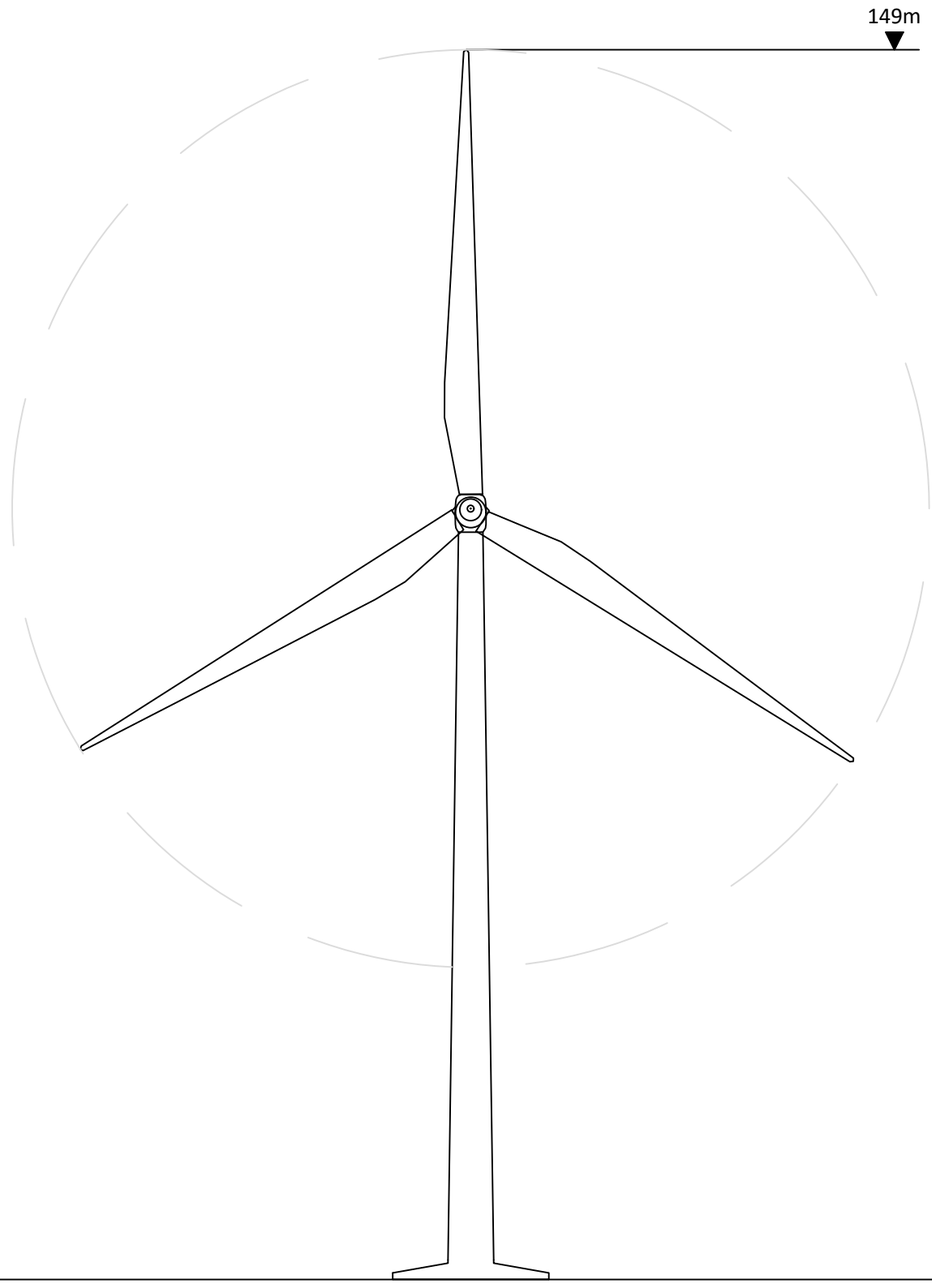
Scale: 1:1,250 @A3



397 Herds Hill

Recommended Turbine Colour

International Colour Reference:
RAL 7035 RGB: 230,230,230

Notes: Maximum Hub Height 93m
Revisions:

Figure 2.2 - Typical Wind Turbine Specification
(149m Tip Height)

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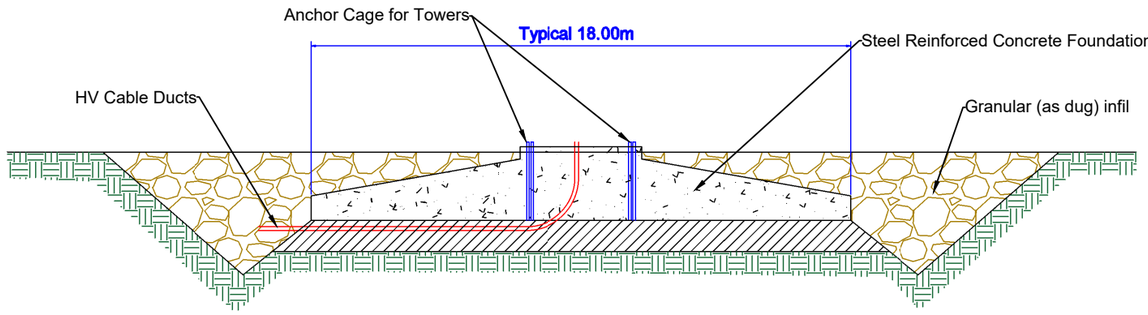
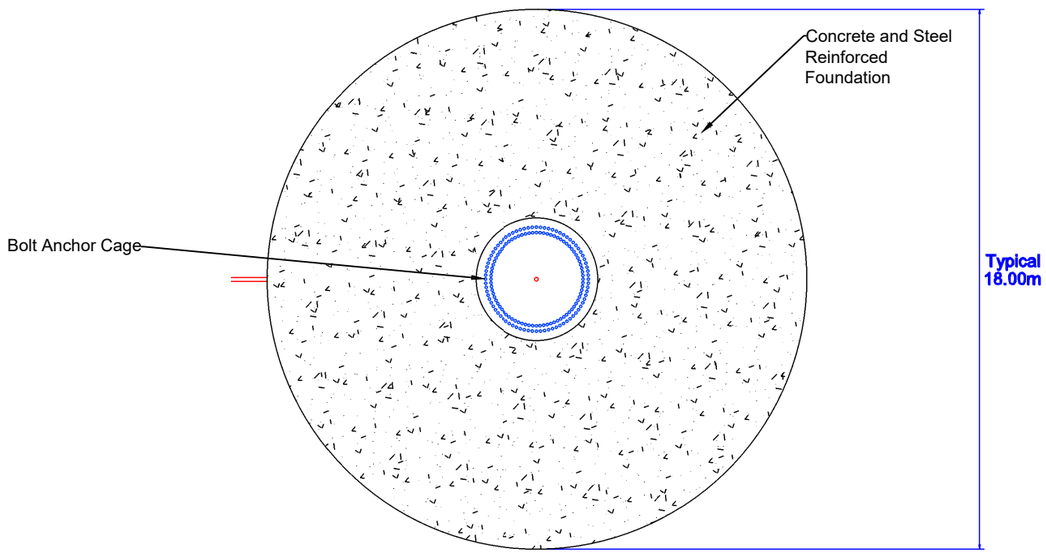
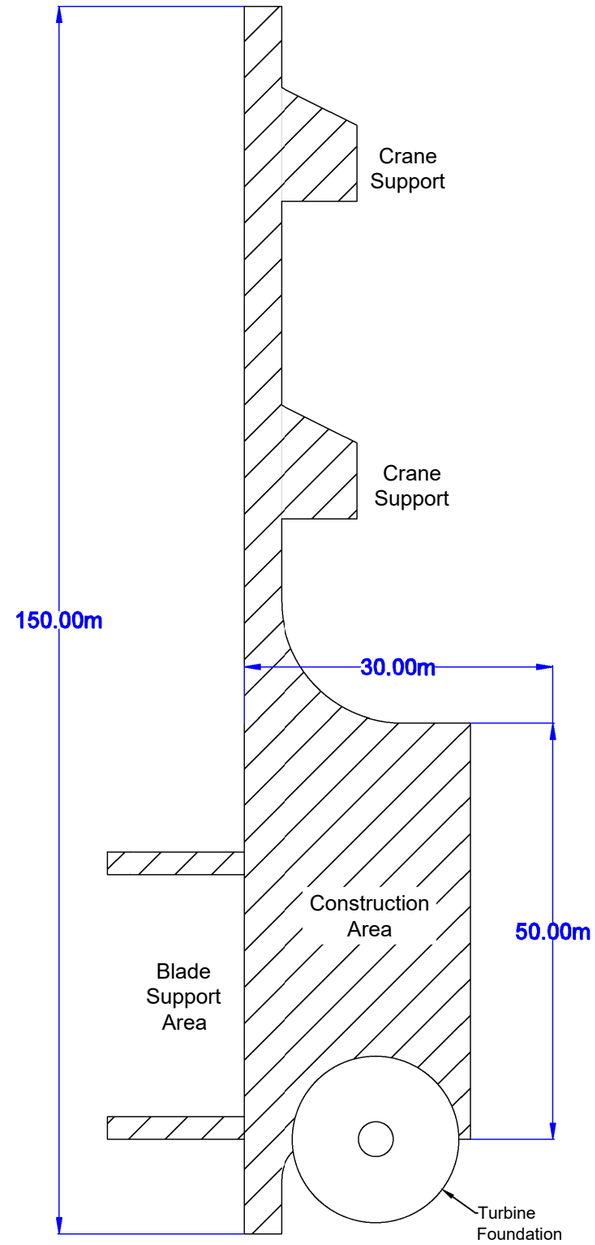


Section View of Typical Turbine Foundation



Plan View of Typical Turbine Foundation

Scale: NTS



Typical Crane Hardstand Area

Scale: NTS

397 Herds Hill

Notes:
All foundations and crane hardstands to be built to the turbine suppliers Site Specific Requirements.

Depth of stone used in constructing hardstand may vary depending on ground conditions encountered. Stone depth will be to a suitable formation strata.

The foundation design has assumed a suitable formation layer is beneath the engineering stone fill.

Revisions: N/A

Figure 2.3 - Typical Foundation & Crane Hardstand Design

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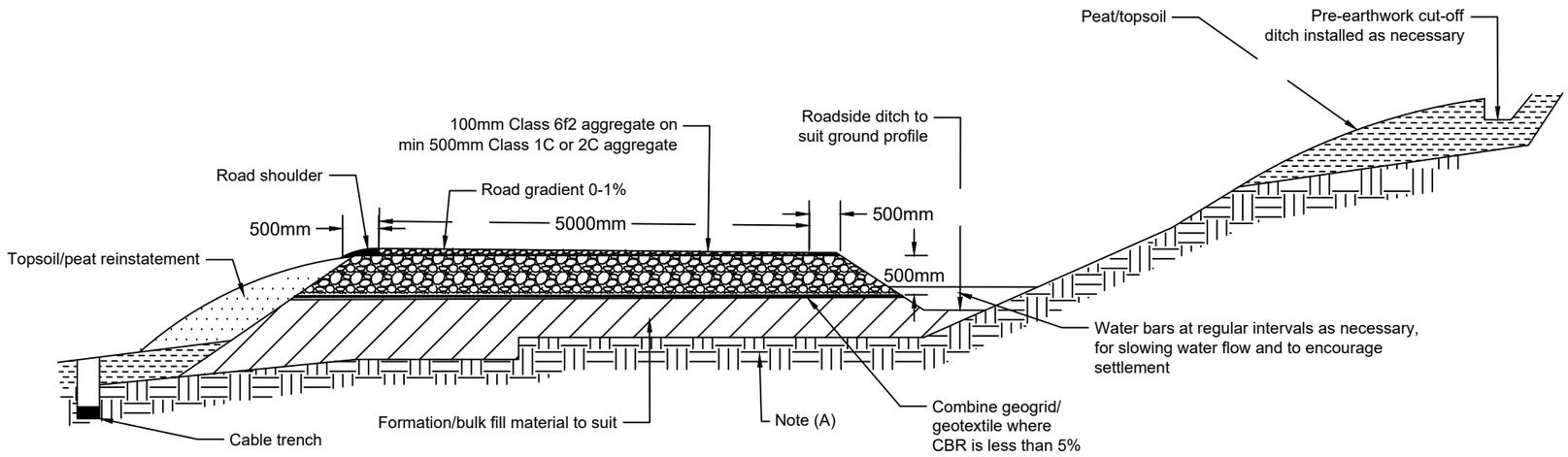
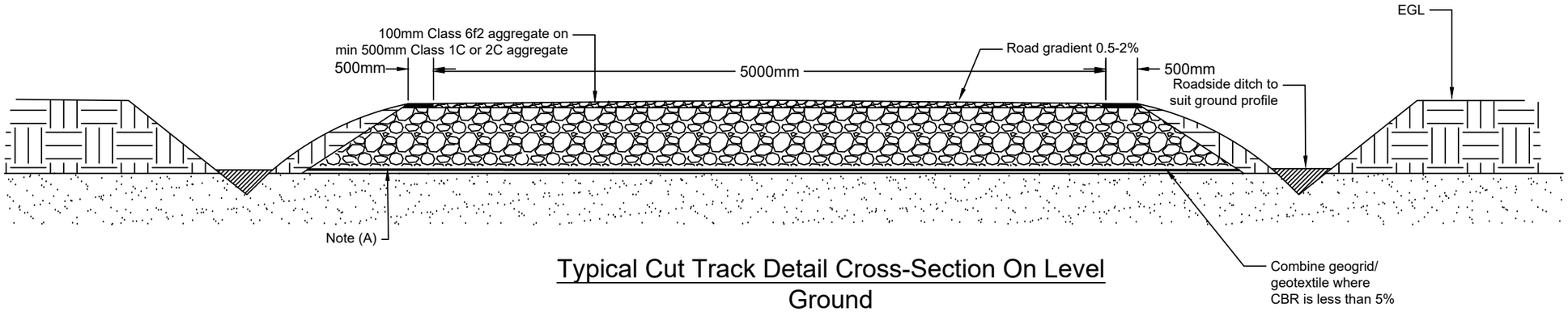
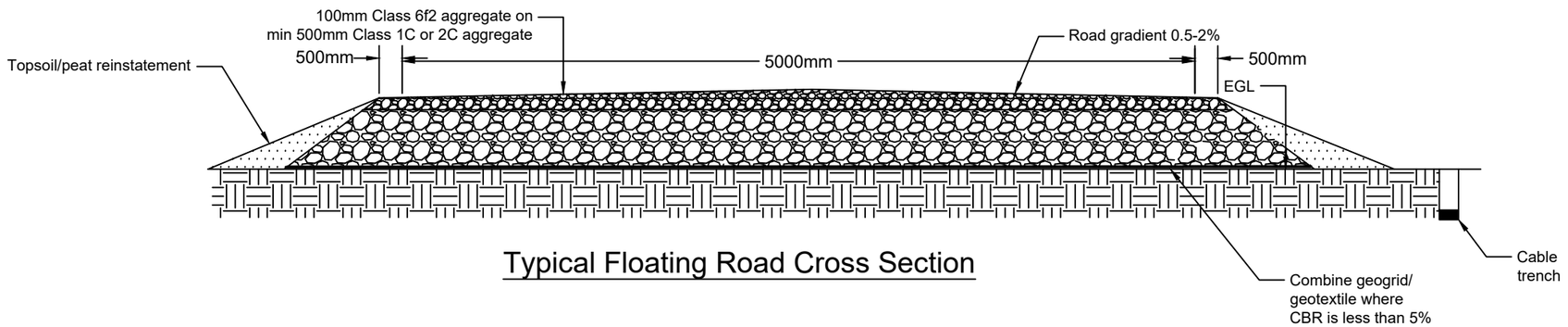


Typical Cut Track Detail Cross-Section On Slightly Sloping Ground



Typical Cut Track Detail Cross-Section On Level Ground



Typical Floating Road Cross Section

397 Herds Hill

Notes: (A) All organic soft material to be excavated to achieve formation level.
Revisions: N/A

Figure 2.4a - Typical Access Track Design

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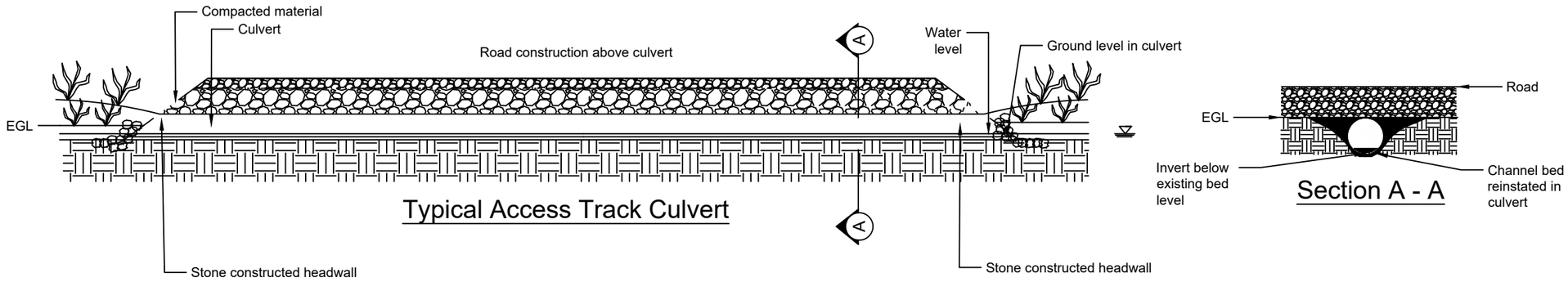
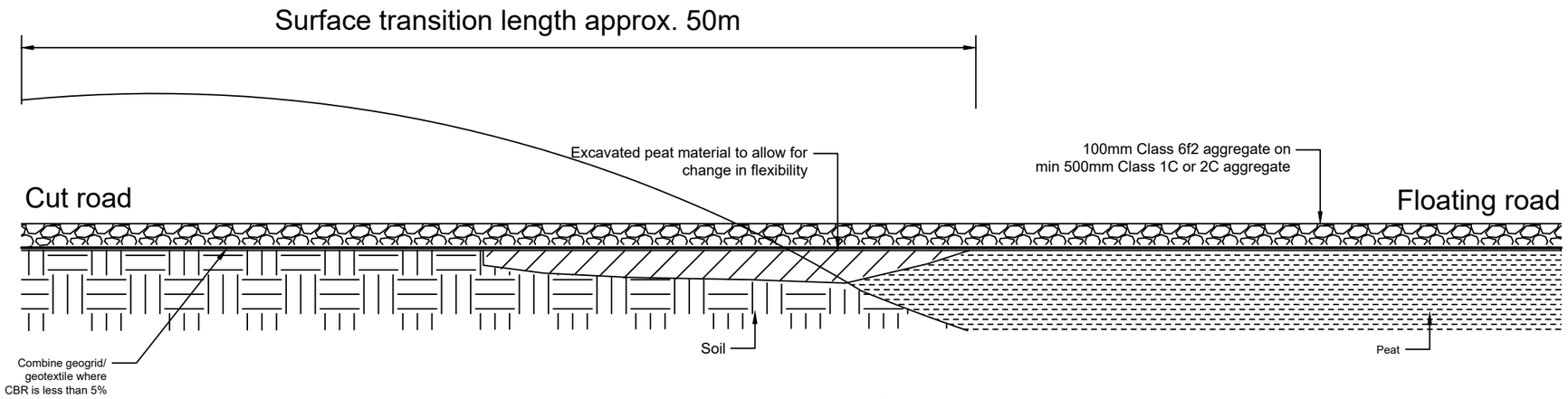


Typical Access Track Culvert

Section A - A



Typical Transition From Floating Road To Cut Track Construction Detail

397 Herds Hill

Notes: NTS
Revisions:

Figure 2.4b - Typical Access Track, Track Methodology And Culvert Design

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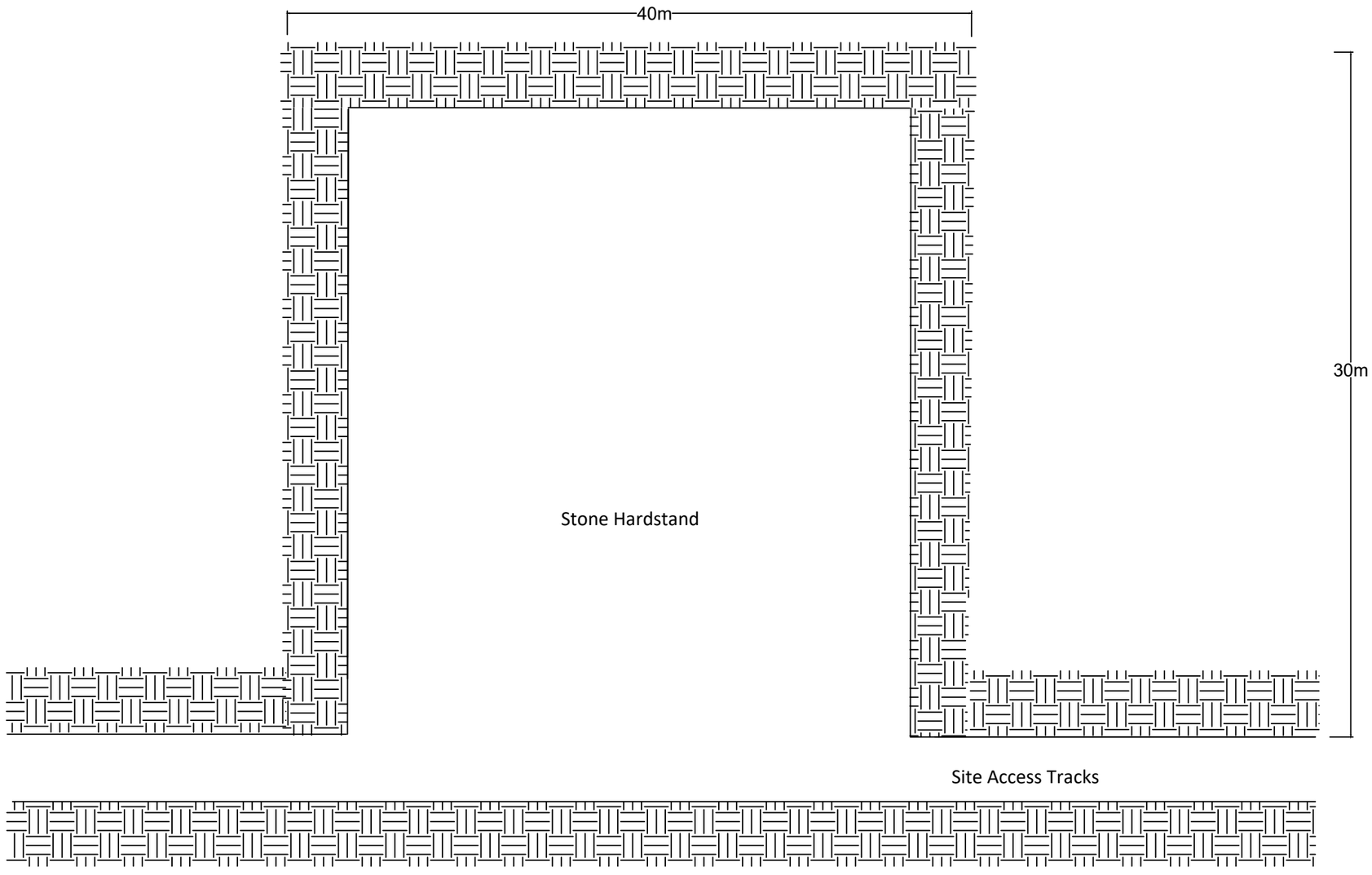

397 Herds Hill

Figure 2.5- Typical Temporary Construction Compound Layout

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