Section 2
DETAILED PROJECT DESCRIPTION

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Glossary

Term	Definition
Abnormal Load	An 'abnormal load' is a vehicle that exceeds standard vehicle dimensions and weights.
Capacity factor	The capacity factor of any power plant is the percentage of generation of its actual generation against its theoretical maximum generation.
Carbon Payback	The time taken for the loss of carbon from the development to generate carbon savings achieved by the wind farm in displacing electricity generated from coal fired capacity, grid mix or fossil fuel mix.
Cumulative impacts	The state in which a series of repeated actions have an impact greater than the sum of their individual impacts.
Environmental Impact Assessment	The process by which information about the environmental effects of a project is evaluated and mitigation measures are identified.
Environmental Impact Assessment Report	Statutory obligation to provide environmental impact assessments for certain projects or developments. The Environmental Impact Assessment Report (EIAR) is the collation of these assessments.
Meteorological Mast	Mast used for housing meteorological measuring equipment to measure wind speed, direction and other atmospheric conditions.
Mitigation	Term used to indicate avoidance, remediation or alleviation of adverse impacts.
Sustainable	Avoidance of the depletion of natural resources in order to maintain an ecological balance
Tip height	The distance measured from the surface of the wind turbine tower foundation to the maximum height the turbine tip reaches when the turbine blade is in a vertical position.
Wind Turbine	The structure comprising the tower, nacelle and blades that generate power from the wind by the rotation of the blades.

Abbreviations

Abbreviation	Description
AOD	Above Ordnance Datum
CCC	Committee on Climate Change
CO_2	Carbon Dioxide
CWL	Community Windpower Limited
DECC	Department of Energy and Climate Change
ECoW	Environmental Clerk of Works
HMP	Habitat Management Plan
ECU	Energy Consents Unit
EIAR	Environmental Impact Assessment Report
g	Gram
GWDTE	Groundwater Dependent Terrestrial Ecosystem
GWh	Gigawatt Hour
ha	Hectares
HMP	Habitat Management Plan
IPCC	Intergovernmental Panel on Climate Change
km	Kilometre
kV	Kilovolt
m	Metre
m^2	Square metre
m^3	Cubic metre
m/s	Metres per second
mg	Milligram
mm	Millimetre
mph	Miles per Hour
MW	Megawatt
NGR	National Grid Reference
rpm	Revolutions Per Minute
RSPB	Royal Society for the Protection of Birds
SEPA	Scottish Environment Protection Agency
TMP	Traffic Management Plan

Section 2: Detailed Project Description

2.1 Introduction

2.1.1 This section describes the proposed development, addressing the physical characteristics of the wind farm, its components and design together with methods and timescales for construction and operation.

2.1.2 Elements of the wind farm design and the construction methodology will depend upon the final details of the equipment to be installed, preferences of the construction contractor, availability of installation plant and most notably, development in installation techniques in the near future.

2.1.3 The project description is based on current best industry practice, and the extensive experience gained from the construction of our previous projects at Dalry, Aikengall, Millour Hill, Calder Water and CWL's most recent onshore wind projects, Sanquhar Community Wind Farm in Dumfries and Galloway, and Aikengall IIa Community Wind Farm in Scottish Borders. Calculations presented have been informed using a combination of manufacturer design specifications and the experience gained during the construction of these onshore wind projects located across Scotland.

2.2 Project Description

2.2.1 The Applicant proposes to design, install, operate, and decommission a wind farm comprising 75 wind turbines. The final turbine design contains turbines of varying tip heights:

- 4 wind turbines will have a maximum tip height of 180m;
- 47 wind turbines will have a maximum tip height of 200m;
- 2 wind turbines will have a maximum turbine height of 225m; and
- 22 wind turbines will have a maximum tip height of 250m.

2.2.2 The assumed typical rated capacity of each turbine is 7 Megawatts (MW), giving the total installed generating capacity of 525 MW for the wind farm.

2.2.3 In addition to the proposed 75 turbines the project will consist of the following infrastructure:

- Crane hardstands;
- New on-site access tracks and the utilisation of existing tracks;
- Substation/control room buildings and compounds;
- Underground electrical and fibre optical cables to each turbine;
- Three 125 m meteorological masts;
- Up to three energy storage facilities (to be built where the temporary substation construction compound and temporary construction compounds were situated);
- Scottish Power onsite substation; and
- High Voltage connection to a grid supply point (which will be dealt with via a separate Section 37 planning application).

2.2.4 In addition to this, the following will be required during the construction of the wind farm:

- Up to 8 temporary borrow pits and the expansion of 6 existing quarries/borrow pits, with associated temporary screening or crushing plant, which will be reinstated post-construction;
- A temporary substation construction compound;
- Temporary construction and storage compounds which will be removed post-construction (except where they are proposed for the four energy storage facilities); and
- A temporary concrete batching plant located in one or more of the excavated borrow pits or construction compounds.

2.2.5 The development will include permanent enhancements to the natural habitat both within and surrounding the development site. These proposals will be referenced in both Section 7 (Ornithology) and Section 8 (Ecology) of the EIAR and will be incorporated into a Habitat Management Plan (HMP), which will be designed and implemented through consultation with key consultees to enhance biodiversity. The application is accompanied by a standalone Outline HMP which presents the proposed ecological and ornithological improvements.

2.2.6 The turbines will have an operational life of 40 years; therefore the Applicant is seeking planning permission of 40 years from when the turbines are fully installed and commissioned.

2.3 Scotland's Energy Mix and Carbon Savings of Scoop Hill Community Wind Farm

Electricity Produced

2.3.1 The efficiency of a wind farm is described by the term 'capacity factor' which is explained as follows; if a wind farm is said to operate at 100% capacity factor, this means that each turbine will be producing its maximum power output (e.g. 7 MW) for 24 hours a day, every day throughout the year. For this to occur, wind speeds would have to continuously exceed 15 metres per second (m/s) (around 33 or 34 mph), which is never the case.

2.3.2 Given the predicted and known wind regime, Scoop Hill Community Wind Farm is anticipated to operate at a capacity factor in the region of 50%. Nonetheless, although these are realistic assumptions, for the purpose of this EIAR and resulting calculations, a more conservative capacity factor of 45% will be used. This means that the 75-turbine proposal would produce approximately 2.1 TWh of electricity per year. Based on BEIS statistics, this would be enough electricity to power over 572,000 homes each year (calculations of energy and emissions are shown in Appendix 2.1).

2.3.3 Scoop Hill Community Wind Farm will make a strategic and material contribution towards the Scottish Government's 2030 target for the equivalent of 50% of the energy for Scotland's heat, transport and electricity consumption to be supplied from renewable sources (Scottish Government, 2017). Furthermore, the development would bring the Scottish Government closer to its long-term aim for a near complete decarbonisation of the Scottish energy system by 2045.

2.3.4 The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 (The 2019 Act) introduces even more ambitious targets than those contained in the Climate Change (Scotland) Act 2009, and in doing so, Scotland has become one of the first countries to legislate support for the aims of the Paris Agreement.

2.3.5 The 2019 Act amends those parts of the Climate Change (Scotland) Act 2009 that relate to emission reduction targets and associated reporting duties. The detailed proposals and policies for delivering against targets are to be set out in the current and future Climate Change Plans.

2.3.6 The 2019 Act sets a target date of 2045 for reaching net-zero emissions, and states that the Scottish Ministers must ensure that the net Scottish emissions account for the year:

- 2020 is at least 56% lower than the baseline;
- 2030 is at least 75% lower than the baseline; and
- 2040 is at least 90% lower than the baseline.

2.3.7 The proposed Scoop Hill Community Wind Farm will contribute significantly to the UK and Scottish Government's binding targets for renewable electricity generation, improved with the integration of energy storage proposals. Scoop Hill will displace 931,000 tonnes of CO_2 each year, providing clean green renewable electricity to power not just domestic and industrial electricity demand but the growing energy demand for electric vehicles and electric based domestic heating.

Displacement of Fossil Fuel Emissions

2.3.8 The project will contribute towards the global need to reduce the amount of greenhouse gases being emitted into the earth's atmosphere. In the UK, the *Climate Change Act* (2008) confirmed the urgent actions required to reduce greenhouse gas emissions; legally binding targets have been set to reduce carbon emissions to 80% below 1990 levels by 2050. This has been reinforced in the Intergovernmental Panel on Climate Change (IPCC) Special Report (2018), which indicates that current global efforts to reduce greenhouse gas emissions are not enough to meet the 2015 Paris Agreement which aims to keep global average temperature rise under 1.5°C by the end of the century, and urges for a rapid and far reaching transition in land, energy, infrastructure and industrial systems.

2.3.9 The development of Scoop Hill Community Wind Farm would displace approximately 931,000 tonnes of Carbon Dioxide (CO_2) per annum (based on RenewableUK and DECC statistics – see Appendix 2.1).

2.3.10 Over the 40-year lifetime of the wind farm, this would be equivalent to approximately 37 million tonnes of (CO_2) as illustrated in Appendix 2.1.

Wind Turbine Carbon Dioxide Lifetime Assessment

2.3.11 Wind turbines do not produce any emissions during operation however carbon dioxide is generated in the manufacturing, construction, transportation and decommissioning of a wind turbine.

2.3.12 By calculating the CO_2 released over the lifetime of a wind turbine and estimating the renewable energy produced during its lifetime, an amount of CO_2 emitted by the turbine per unit (1 kWh) of electricity produced can be calculated. This is also comparable against conventional power generation from coal and natural gas, as seen in Table 2.1.

Table 2.1 – Comparison of Emissions of Different Fuels per kWh (Forest Research, 2019)

	CO2 Equivalent (g/kWh)					CO2 averted (g/kWh)			
	Onshore wind*	Coal	Oil	Gas	Grid Mix	Onshore vs. coal	Onshore vs. oil	Onshore vs. gas	Onshore vs. Grid Mix
Carbon dioxide Equivalent (g/kWh)	8	414	314	227	256	406	306	219	248

2.3.13 Every unit of electricity from a wind turbine displaces one from conventional power stations. In 2011, onshore wind turbines in the UK had the capacity to prevent the emission of 6.3 million tonnes of CO_2, which is more than the carbon footprint of a city the size of Leeds (DECC, 2013).

2.3.14 As of the time of submission, there is 13,650 MW of installed onshore wind capacity in the UK compared to the 4,500 MW installed by the end of 2011 which demonstrates the positive strides the industry has made towards reducing emissions from electricity production (RenewableUK 2020 and DECC 2012).

Carbon Payback

Carbon Losses

2.3.15 The carbon payback time for a wind farm is calculated by comparing the loss of carbon from the site due to wind farm development along with the emissions generated through the manufacturing and construction, with the annual carbon savings achieved by the wind farm in displacing electricity generated from coal fired capacity, grid mix or fossil fuel mix.

2.3.16 Based on the figures calculated using the Scottish Government Wind Farm Carbon Calculator Tool v.1.6.1 (Scottish Government, 2020) the following carbon costs and payback periods have been produced:

- Manufacturing, construction and decommissioning of turbines – 6,167 tonnes of CO_2 is produced per turbine; and
- Manufacturing of cement – 0.360 tonnes of CO_2 is produced per cubic metre (m^3).

2.3.17 For the Scoop Hill Community Wind Farm, a carbon cost of around 462,578 tonnes of CO_2 has been calculated in association with the manufacturing, construction and decommissioning of the 75 turbines.

2.3.18 The loss of CO_2 from carbon soils is 113,536 tonnes, with a further loss of 6,146 tonnes due to limited carbon fixing potential.

2.3.19 Taking into account the carbon losses due to turbine manufacture, construction, decommissioning and loss of Carbon soils, the overall carbon cost associated with the development is 7,763 tonnes of CO_2 per wind turbine. The results from the Scottish Government's Wind Farm Carbon Calculator Tool are detailed in Appendix 2.2.

2.3.20 The losses from forestry have not been considered here, as is clarified in Section 13: Forestry of the EIAR, as Community Windpower and the Applicant will replant all of the 293ha of forestry to be felled to accommodate the wind farm.

Carbon Offsetting

2.3.21 Scoop Hill Community Wind Farm will also provide an annual carbon saving by displacing emissions produced from non-renewable electricity generation.

2.3.22 During the lifetime of the wind farm, carbon will also be offset through localised planting and habitat management. Further information on the habitat management scheme can be found in Section 8: Ecology of the EIAR and the Outline HMP. In addition, 293ha of key-hole forestry felling required to accommodate the wind farm, will be replaced with compensatory planting both on and off site. This will offset the carbon losses from the felling of forestry.

2.3.23 The annual carbon saving associated with the proposed 75 turbines is 1.93 million tonnes of CO_2 when assessed against coal fired electric generation and 931,000 tonnes of CO_2 when compared with a fossil fuel mix.

2.3.24 The carbon payback period for Scoop Hill Community Wind Farm, calculated using the Scottish Government Wind Farm Carbon Calculator Tool v.1.6.1, is 11 months when compared with a grid mix electricity generation. Appendix 2.2 includes the carbon calculations used to produce these figures.

2.4 Site Location and Description

2.4.1 The wind farm is located approximately 5 km south east of Moffat and 11 km north east of Lockerbie as shown in Figures 1.1 and 1.2. These distances are calculated to the nearest turbine. The central point of the wind farm is NY155985. The proposed wind farm will cover an area of around 5,685 hectares (ha), with a total permanent land take within the development boundary of 63ha, which is equivalent to 1.1% of the overall site area and temporary land take of 42ha which will be restored post construction and a further 230ha of forestry will be available for replanting post decommissioning.

2.4.2 The proposed layout of the wind turbines and associated infrastructure is presented in Figures 2.1 and 2.2.

2.4.3 The A74M is the largest major road nearest to, and to the west of the development, which is paralleled by the B7076. From the A74M a number of smaller A and B roads feed into the towns of Lockerbie and Moffat.

2.4.4 The landform of the site varies across the proposed development site however it is generally described as the following:

2.4.5 To the East of the proposed development, the Eskdalemuir commercial forestry complex continues for more than 20km. To the land immediately east, lies a series of privately and publicly owned commercial forestry plantations. Here the land falls away, but retains some topography at heights above 400m AOD, such as Ashy Bank, which peaks at 430m AOD. An equally prominent landform here however is the 1.5km long, Black Esk reservoir, fed by the Muckle White Hope River and its tributaries.

2.4.6 To the South, the extent of commercial forestry is less, however some large forestry plantations can still be found. Here the topography falls away much faster than to the East, with heights reaching no greater than 331m AOD at Hart Fell. Continuing south, there a number of consented and operational wind farms, such as Ewe Hill, Little Hartfell, Crossdykes, Loganhead, Craig (& Extension) and Hopsrig. The Dryfe Water, which can be found in the development area, can be found flowing South-West through the village of Boreland and into Lockerbie.

2.4.7 Also, to the south of the development is the 44MW Stevens Croft biomass power station, with tall cooling towers and hoppers, on the northern edges of Lockerbie. Operational since 2000, the biomass sees heavy traffic flow on the B7076 and Breckenery Road, leading from the extensive commercial forestry across Eskdalemuir.

2.4.8 To the West of the development area, the topography is that of the Annan valley, which has been exaggerated in size by the A74(M), on the valley floor, which is mirrored by the B7076. There is also an existing 275Kv power line utilising large steel lattice pylon/tower, which connects to the recently constructed large SPEN substation at Bearholm. On the western side of the valley lies the range of hills upon which the operational wind farm Minnygap is found, where the largest landform Minnygap Height has a maximum height of 399m AOD. Continuing further west, a cluster of forestry plantations can be found, in addition to the large operational wind farm Harestanes. Here the topography raises to the larger landform of Queensberry Hill at 697m AOD and Wee Queensberry at 512m AOD.

2.4.9 When looking North of the development area, the topography begins to increase in height, with the prominent landforms of Loch Fell at 688 AOD and Croft Head at 637m AOD. Beyond this the commercial forestry, which is dominant to the South and East, is less common and is in turn replaced with steep valleys which belong to the tributaries of the Moffat Dale.

2.4.10 The site covers three catchment areas; Newbigging Burn catchment to the west, encompassing the western site access, Wamphray Water catchment running through the centre and Dryfe Water catchment to the east.

2.4.11 All catchments run from North to South through the site, and flow into the River Annan, which discharges into the Solway Firth. More information can be found in Section 10: Hydrology, Geology and Hydrogeology of the EIAR which contains baseline information regarding the hydrological catchments.

2.5 Site Layout

2.5.1 The layout of the wind farm, as shown in Figures 2.1 and 2.2, has been designed to capture the energy of the wind effectively, whilst simultaneously minimising visual, technical and environmental effects. The wind turbines must be spaced apart so as not to interfere aerodynamically with one another. The predominant on-site wind direction is from a west-south-westerly direction therefore, the separation distance between the turbines will be greater in the south west to north east direction.

2.5.2 The layout of the turbines has been carefully designed to reflect:

- Topographical and physical constraints;
- On-site wind regime;
- Spacing between the turbines;
- Commercial Forestry operations;
- Ground conditions, vegetation, sensitive habitats and watercourses avoided; and
- Landscape and visual impacts from key viewpoints in the local area.

2.5.3 Further details of the constraints that informed the wind farm layout can be found in Section 3: Site Selection, Design and Evolution within this EIAR.

2.5.4 The precise final locations of the turbines and associated infrastructure will be confirmed by geotechnical surveys, on-site intrusive ground investigations and trial pits which will be undertaken following planning consent but prior to construction, to determine the ground conditions, soil structure and suitability for turbine foundations. However, some knowledge of the site's ground conditions has been established during the onsite ground investigations undertaken for ecology and hydrology assessments including peat depth surveying, Phase 1 and NVC habitat mapping, during the environmental impact assessments for the proposed Scoop Hill site.

2.5.5 A micro-siting allowance of up to 100 m in all directions from each turbine position is required to accommodate actual ground conditions. Micro-siting is a design mitigation measure which allows for the construction work to account for unknown ground conditions; to reduce potential impacts on sensitive habitats or GWDTEs; and to mitigate runoff into any adjacent watercourses, thereby avoiding potential pollution risks. Where micro-siting is required, it will be managed on-site by an Environmental Clerk of Works (ECoW) prior to and during the construction phase. The micro-siting allowance will also apply to all associated the infrastructure across the site.

2.5.6 At the site entrance there will be a temporary security point and construction compound. This will control and limit vehicle access to the site during the construction period. During operation this site entrance will be gated, again to limit vehicle access to the site. The Applicant is also reviewing additional emergency access points for vehicle access only by emergency vehicles in case of an incident. Further details are provided in Section 12: Transport Assessment.

2.6 Wind Turbines

2.6.1 The wind farm will comprise of 75 wind turbines and associated infrastructure.

2.6.2 The proposed turbine tower is a conical multi-sectioned structure. The turbines are to be three-bladed horizontal axis machines. The 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 there are different construction methods employed by different manufacturers.

2.6.3 The tower, blades and nacelle will have 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. Typical specifications of the types of turbine and colour being considered are presented in Figure 2.3a and 2.3b.

2.6.4 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.

2.6.5 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.

2.6.6 The final choice of turbine specification and manufacturer will be decided following a tendering process and commercial and technical appraisal; however, the turbines will not exceed the maximum tip height of 250m.

2.6.7 Plates 2.1a and 2.1b illustrate the wind turbines recently installed at Sanquhar Community Wind Farm which are a similar style to those proposed for Scoop Hill Community Wind Farm.

2.6.8 Prior to the erection of the first wind turbine, the Applicant shall submit a scheme for aviation lighting for the wind farm to the Planning Authority for written approval in consultation with the CAA and the MOD. The scheme shall include details of the types and specifications of aviation lighting to be applied. No lighting other than that described in the approved scheme may be applied at the site, other than as required for health and safety, unless otherwise agreed in advance.

2.6.9 The Development shall thereafter be operated fully in accordance with the approved scheme. Table 2.2 details the national grid references for the proposed 75 turbines.

Table 2.2 – Wind Turbine Locations

WTG	Grid Reference	WTG	Grid Reference
1	NY126990	39	NY154960
2	NY126984	40	NY159965
3	NY126977	41	NY159957
4	NY130997	42	NY155952
5	NY134992	43	NY160952
6	NY133986	44	NY161980
7	NY133979	45	NY161972
8	NT125002	46	NY167979
9	NT129008	47	NY168972
10	NT132015	48	NY176974
11	NT138018	49	NY164963
12	NT138012	50	NY165957
13	NT137007	51	NY169952
14	NT136003	52	NY173961
15	NT144023	53	NY176957
16	NT147018	54	NY176951
17	NT163028	55	NY183954
18	NT163022	56	NY193953
19	NT165017	57	NY191959
20	NT158014	58	NY183963
21	NT162010	59	NY189972
22	NT165005	60	NY193967
23	NT152008	61	NY198951
24	NT157001	62	NY200946
25	NY149999	63	NY179968

26	NY162998	64	NY184974
27	NY165994	65	NY182979
28	NY168990	66	NY180984
29	NY154991	67	NY181991
30	NY146990	68	NY179997
31	NY158988	69	NT179005
32	NY149985	70	NT177011
33	NY153981	71	NT172005
34	NY154975	72	NT171011
35	NY148970	73	NT174018
36	NY154968	74	NT173025
37	NY148962	75	NT171031
38	NY147955		

2.7 Turbine Foundations

2.7.1 Turbine foundations typically consist of either a square, circular or octagonal reinforced concrete base usually over 18m in diameter and founded approximately 3.5 m below the ground surface. The base tower section of the turbine is connected to the foundation by bolts that are cast into the full depth of foundation with the bolts emerging from the upstanding section of the foundation. The weight of the foundation and the backfill material provides the stability required for the turbine.

2.7.2 Figure 2.4 and Plates 2.2a, 2.2b, 2.3a and 2.3b show the construction of a typical turbine foundation.

2.7.3 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 (formation) 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. Some soil may be removed from the area and used elsewhere on site, possibly to backfill borrow pits.

2.7.4 Once the foundations have been excavated, the formation is tested to confirm bearing capacity using 500mm of stone, then rolled, levelled and protected with a layer of blinding concrete, typically 100m thick. A series of ducts are then installed to allow the cabling to be brought up the middle of the foundation via a service trench from the outside the foundation.

2.7.5 The steel reinforcement is constructed on this firm base and external formwork will be used to contain the poured in-situ concrete.

2.7.6 It is anticipated that concrete will be batched on site at either the location of a borrow pit or within a construction compound. After discharging concrete and prior to returning to the batching compound, the concrete wagons will be washed out which would be controlled through the installation of a settlement or discharge pit in the construction compound or another agreed location, in agreement with the ECoW and Site Engineer.

2.7.7 The surrounding ground around the turbine base would be backfilled and restored to tie in with the original and adjacent surface levels by using the previously stored overburden soil. Stored topsoil would be used to reinstate the area around the turbine.

2.7.8 The final foundation design and dimensions will be confirmed at the detailed design stage of the project when results of geotechnical investigations are available and the required loadings are confirmed by the turbine manufacturer.

2.8 Meteorological Mast

2.8.1 Three permanent meteorological masts, typically 125 m in height will be erected and retained for the operational life of the wind farm. Two of the three proposed meteorological masts are located where the consented temporary masts are currently located. An additional mast will be located in the south, 300m south of turbine 43. The mast will be used to monitor the on-site wind conditions (speed and direction) along with meteorological conditions, to provide information for the effective control and operation of the site.

2.8.2 Each mast will be a lightweight triangular lattice tower made of galvanized steel tube welded together in a lattice arrangement. The mast will have circular hollow section legs and solid round bracings and will either be self-supporting or guyed; depending upon the final design selected.

2.8.3 The mast will be erected by suitably experienced and qualified personnel who will be employed by the mast supplier. No cranes or heavy plant is required for the erection of the mast. The tower is equipped with climbing step bolts mounted on one of the legs, with Latchways fall arrest system also fitted for health and safety purposes. To prevent climbing by unauthorised personnel, an anti-climbing device can be fitted to the mast at 3.25 m AOD.

2.8.4 A typical specification of a self-supporting mast is presented in Figure 2.5 however, a guyed mast would be of similar design.

2.8.5 Table 2.3 below details the national grid references for the proposed three meteorological masts.

Table 2.3 – Meteorological Mast Locations

Met Mast ID	Grid Reference
A	NT160011
B	NY178936
C	NY160948

2.9 Transportation of Materials, Construction Plant and Turbine Components

Abnormal Load Access Routes (Port to A74M)

2.9.1 There are two proposed abnormal load routes, from King George V dock in Glasgow and the port of Grangemouth, which will transport the large turbine components such as turbine blades, tower sections, rotors and nacelles. It is currently unknown which location would be used to transport the turbine components; thus both have been provided in Figure 2.6a.

Abnormal Load Access Routes (A74M to the development)

2.9.2 Following a detailed feasibility study, site review and discussions with consultees, multiple access points, suitable for both abnormal loads (turbine component delivery) and construction traffic, have been identified. There are three main routes options; 1, 2 and 3. Within Option 2, there are further options to gaining access to the site. Option 1 and 2 are suitable for all abnormal loads and construction traffic, Option 3 is suitable for abnormal loads (except the blade delivery vehicles), and construction traffic.

2.9.3 It may be that these routes are utilised and promoted as a one-way route in and out of site. This would reduce the amount of traffic on each section or route (as there would only be one-way traffic flows) and avoid any potential congestion of vehicles trying to access and exit the site at any one time. This one-way system is being explored and if suitable and acceptable to all, would be highlighted in both the construction and abnormal load TMP. However, for the purposes of vehicle numbers within this document, any one-way systems have not been considered.

2.9.4 Option 1 (For Abnormal loads and Construction related traffic) will exit the A74M using the southbound exit slip road at Junction 17:

- Turn left onto B7068;
- At the roundabout, take the 1st exit onto the B7076;
- Turn right towards Breckenry Road;
- Turn right onto Breckenry Road;
- Continue onto B723; and
- Turn left onto C102A before Boreland.

2.9.5 Option 2 (For Abnormal loads and Construction related traffic) will exit the A74M using the southbound exit slip road at Junction 17:

- Turn left onto B7068;
- At the roundabout, take the 1st exit onto the B7076;
- Continue along the B7076 until either:
  - Turn right after Cogrieburn Farm, towards Cogrie Farm and Cottages, over the existing A74(M) bridge;
    - After Cogrie Cottages, turn left along a stone track toward the existing old quarry road and over the existing railway bridge heading to Murthat Bank (old Quarry);
    - Cross the River Annan with a new bridge; and
    - Cross the B707 at the site entrance. Or;
  - Turn right along the old quarry road, which travels under the A74(M);
    - Continue along this private track, over the existing railway bridge heading towards Murthat Bank (old Quarry);
    - Cross the River Annan with a new bridge; and
    - Cross the B707 at the site entrance. Or,
  - Turn right towards Mid Murthat Farm, over the existing A74(M) bridge;
    - Before the railway turn right, along an existing stone track heading south alongside the railway;
    - Swing left on to the existing old quarry road and over the existing railway bridge heading to Murthat Bank (old Quarry);
    - Cross the River Annan with a new bridge; and
    - Cross the B707 at the site entrance.

2.9.6 Option 3 (For Abnormal loads (except blade delivery vehicles), and Construction related traffic) will exit the A74M using the southbound exit slip road at Junction 17:

- Turn left onto B7068;
- At the roundabout, take the 1st exit onto the B7076;
- Turn right towards Breckenry Road;
- Turn right onto Breckenry Road;
- Continue onto B723; and
- Turn left before Sandyford Water treatment plant, at the entrance to Silton Forestry.

2.9.7 The final choice of access route for abnormal loads and construction traffic will be made post consent. However, it is important that all various options are viable and useable; particularly given the possibilities of utilising a one-way system.

2.9.8 CWL and the Applicant will work with Dumfries and Galloway Roads Department, Transport Scotland and Local Communities to establish a best route for abnormal load delivery.

2.9.9 All of the options above can be seen in Figure 2.6b.

Site Access Points for Construction Traffic

2.9.10 Construction of the wind farm will require the delivery of various materials, construction plant, wind turbine components and personnel.

2.9.11 Access to the wind farm for construction traffic will be acquired via one of the abnormal load access point indicated above and in Figure 2.6c.

2.9.12 Confirmation of traffic flows into the development would be confirmed in a Traffic Management Plan post consent to be agreed with the Dumfries and Galloway Roads Department (see Section 12 of the EIAR).

2.10 Public Road Modifications

2.10.1 Following an assessment of the public road network, it is anticipated that only minor road modifications would be required in order to accommodate the turbine delivery vehicles, such as the temporary removal of street furniture and minor overrun areas.

2.10.2 More major road modifications have already been completed to accommodate other large wind farms within the local area, particularly the Cross Dykes development.

2.10.3 Further details can be found in the Transport Assessment in Section 12 of this EIAR. The extent of these minor modifications would be quantified and finalised following consent and once a turbine manufacturer has been selected. There is also the option of utilising a purpose-built blade carrier vehicle which can tilt and lift the blades thus shortening the length of the abnormal load, again further information on this can be found in Section 12.

2.11 On-Site Access Tracks

2.11.1 The project will require the construction of on-site access tracks to each turbine location, including passing places and turning areas to allow for a smooth flow of construction traffic and abnormal turbine component deliveries. The tracks will be of a typical 5 m running width to allow for the passage of large plant such as cranes. The new tracks will be constructed using site-won stone from onsite borrow pits to ensure the tone and character of the tracks are in keeping with the area and to reduce vehicular traffic off-site. Typical access track construction design is shown in Figures 2.7a and 2.7b.

2.11.2 A larger proportion development area forms a part of commercial forestry plantations, many of which have an existing network of access tracks. These existing access tracks are more than 40km in length and cover an area of nearly half of the development. This has significantly reduced the requirement for new access tracks to access turbines in the commercial forestry plantations.

2.11.3 The design of the access tracks has been completed in accordance with Scottish Natural Heritage (now known as NatureScot) guidelines *'Constructed Tracks in the Scottish Uplands'* (SNH, 2015), as well as typical requirements from turbine suppliers regarding minimum bend radii, maximum slope gradients and frequency of passing places.

2.11.4 In order to satisfy NatureScot (formerly SNH) guidelines, the tracks have been designed to reflect the topography of the site. The track therefore follows the natural contours where possible and follows a sweeping, sinuous route in order to avoid the introduction of incongruous linear forms into the landscape. This design has the further benefit that cut and fill is minimised, which will result in less disturbance to the ground and reduced visual and environmental impacts.

2.11.5 By considering the design constraints, the track layout has been designed to be as efficient as possible in terms of the amount of material required for construction. The layout aims to keep the amount of new tracks to a minimum, re-using and improving existing tracks wherever possible. The crossing of watercourses has also been avoided where possible in order to simplify construction and reduce any impacts on hydrology and sensitive species.

2.11.6 Natural Power Consultants have completed a Watercourse Crossings assessment as part of its hydrological and geological work for Scoop Hill which is presented in Section 10: Hydrology, Geology and Hydrogeology of the EIAR and Appendix 10.1. Its assessment concludes that the requirement for new watercourse crossings for the access tracks as part of the proposal, has been minimised to 13, whilst utilising 35 existing crossings. Each watercourse crossing will be designed and constructed in line with current best practice guidance and in accordance with a SEPA construction license. Typical details of culvert and watercourse crossings are shown in Figure 2.7b and more information is provided in Technical Appendix 10.1 of Section 10.

<u>New Access Tracks</u>

2.11.7 One method of construction of the new access tracks involves 'cut' construction. This method is used where suitably stable formation lies close to the ground surface. This method involves stripping the organic soils and any heather turves and storing nearby for use in re-instatement. The subsoil would then be excavated until a solid formation layer or rock is reached.

2.11.8 The track is built up from this formation in layers of stone. Coarser stone is laid and compacted in layers not exceeding 200 mm in depth, followed by finer, graded material. The total depth of construction is typically around 500 mm. The same method is used for the widening of existing tracks; the verge is stripped of organic soil and excavated to a solid formation layer. Crushed stone is then compacted in layers to tie in with the level of the existing surface course. The existing tracks on site may need an additional capping layer of stone to provide the necessary bearing capacity. This will consist of a layer of crushed stone, approximately 100 mm deep. Additionally, layers of geo-textile may be introduced to aid stability and improve strength of all tracks. These would be laid within the general make-up of the track.

2.11.9 Depending on the ground condition and general surrounding levels, a drainage channel approximately 500 mm deep and 450 mm wide may be formed between the toe of an uphill batter and the edge of the road. This will intercept any rainwater runoff and channel it at regular intervals via appropriately sized pipes or culverts under the road, over vegetated ground, avoiding existing ditches and streams. No roadside drainage run-off will discharge into existing watercourses. Measures and care shall be taken to ensure the run-off water is not contaminated with silts or sediments at the point of discharge. Silt settling will be achieved by silt traps, silt dams, attenuation ponds and silt nets.

2.11.10 Reinstatement is a key part of the construction process as it will help to minimise the visual impacts of the new tracks. Stored organic soil and heather turves will be used when backfilling the excavation for the road and to tie it in with the existing ground levels.

2.11.11 The use of 'live' turves is the ideal reinstatement technique as recommended by NatureScot and will be left to establish naturally, however, if these areas fail to re-vegetate naturally, the topsoil will be re-seeded using a suitable and approved seed-mix.

2.11.12 An alternative and more sensitive construction method is 'floating road' construction, which has been chosen where ground conditions dictate. This method consists of a geo-textile membrane being laid directly on the vegetation, and layers of compacted stone added on top. This method of construction is typically used where a suitable formation level is greater than 500 mm below the required access track level, or as in this instance, where the ground consists of peat and therefore it is better that the peat is left undisturbed. Therefore, floating access tracks will be used when the peat is 0.5m or deeper in depth, meaning an extent of nearly 13km of floating track.

2.11.13 The total depth of stone for a floating road is likely to be 600 – 700 mm to achieve the required strength. Excess excavated topsoil from turbine bases and hardstands can be used to create a gentle slope on either side of the floating road. These slopes can then be re-seeded if necessary, in order to assist with blending the track into the landscape.

2.11.14 A track micro-siting allowance of 100 m is required to allow for ground conditions and to mitigate pollution risks to watercourses. Micro-siting will be managed and approved by an on-site ECoW who will be responsible for ensuring the road design and installation causes minimal impact to the drainage and environmental conditions on site.

2.11.15 Following construction of the wind farm, the tracks will be used infrequently, mainly for maintenance purposes. There will be regular inspections of the tracks throughout the operational life of the wind farm to ensure that the track is properly maintained, and any damage is adequately repaired. Pollution prevention measures will be maintained throughout the life of the wind farm. These measures will become less used as the vegetation regenerates and locks in the exposed soil surfaces.

2.11.16 Plates 2.4a, b and c demonstrate the floating road construction at CWL's Sanquhar Community Wind Farm project. The re-use of the live turfs can be seen, plus topsoil has been used which is beginning to become repopulated with local plant species. Also shown in the photograph is the cross-fall on the road, the drainage channel, and the well compacted surface finish. A similar or improved quality of construction will be achieved at Scoop Hill Community Wind Farm.

2.12 Crane Hardstands

2.12.1 The construction of each turbine will require a primary large sized crane and two secondary small sized cranes. These cranes will require areas of hardstand to provide a stable and firm base during the installation of the turbines. These crane hardstand areas will also be available for the outriggers of the respective cranes. The crane hardstands will 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 at height etc. A typical crane hardstand area is shown in Figure 2.4.

2.12.2 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.

2.12.3 Underlying subsoil 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.

2.13 Borrow Pits

2.13.1 For the construction of new on-site access tracks and hardstands, locally won stone material will be required and it has been estimated that up to 350,000 m^3 of borrow pit stone will be required for the construction of the wind farm.

2.13.2 Six existing borrow pits and quarries that have been identified for potential usage within the development boundary were identified through consultation with the forestry managers, landowners and though site walkovers and inspections. Where possible, these borrow pits and quarries will be re-opened first to reduce the potential extraction of material from the new onsite sources.

2.13.3 It has been estimated that the six existing borrow pits could yield more than 253,300m^3 of material. This is however an estimate of suitable material remaining and as a result, new borrow pits may require to be opened in addition.

2.13.4 Therefore, allowance has been made for up to eight new borrow pits. The eight new borrow pits could potentially yield up to 600,000 m^3 of material. It is estimated that around 25% of this material will be unsuitable overburden.

2.13.5 Full details of the borrow pit selection methodology, extraction methods and pollution prevention measures can be found in Appendix 2.3.

2.14 Concrete Batching Plant

2.14.1 Concrete is required for the wind turbine foundations and this can be made (batched) away from the construction site and delivered to site ready-mixed, or the concrete could be batched on site. Due to the location of the site and its distance from existing concrete batching plants in the wider area, it is most likely that onsite batching will be undertaken for the construction of Scoop Hill.

2.14.2 To undertake onsite batching, specialist plant will be provided by the appointed concrete supplier. This will be delivered in pieces by road transport and connected onsite, with testing to prove that the quality of concrete being produced is as specified for the foundations.

2.14.3 The batching site will be located at either the location of a borrow pit or within one of the construction compounds to allow good access to all foundations. Ideally it will be positioned on a flat area, cleared of vegetation and topsoil and a hardcore stone base will be placed and compacted on the surface. Drainage will be installed around the site to collect and settle storm water run-off from this area.

2.14.4 The batching plant will be assembled on a small concrete plinth to support the columns. Simple bays will be made to store materials used in concrete batching, such as sand and aggregate. Cement will be delivered in sealed units and vacuum-extracted through a sealed system into storage silos. It will be dispatched into the concrete mix through a similar sealed venting system to ensure no cement can enter the atmosphere or pollute the environment.

2.14.5 A smaller back-up concrete mixing plant will be based onsite in case of breakdown of the primary plant during a concrete pour.

2.14.6 Water will be stored in silos on site; the source can be from the wind farm site through licensed extractions e.g. borehole, or from an off-site source delivered to site by tanker.

2.14.7 The concrete will be mixed on demand to the exact specifications of the designer and delivered in regular concrete delivery wagons to the required locations onsite. Prior to returning to the batching compound, the concrete wagons will be washed out at a specific washout point. This will collect the dirty water and it will be cleared out regularly and disposed of through a licensed waste carrier to a licensed disposal site.

2.14.8 It is possible to move the batching compound and relocate the plant during construction to minimise internal concrete wagon journeys, and this decision would be made at that time, depending on many variables and in consultation with the ECoW and Site Engineer.

2.14.9 The use of on-site batching is preferred as it reduces the number of deliveries to site as the raw materials such as stone and water may be won on site. Petrographic studies from existing borrow pits have confirmed onsite stone is suitable for concrete usage. Therefore, there will be a significantly lower number of vehicle movements to and from site along the local road network compared to offsite batching. If implemented, the onsite batching can be more controlled in terms of the timing of the deliveries for materials to produce the concrete, and therefore would be more suitable and less disruptive to local residents.

2.14.10 The on-site batching plant is likely to produce less noise than a standard concrete wagon truck when rotating, and so noise would not be an issue.

2.15 Energy Storage Facilities

2.15.1 Four Energy Storage Facilities are proposed as part of this planning application, which would be located on the ground accommodating temporary construction compound areas. This utilises the temporary construction compound area's and avoids having to construct elsewhere on the site.

2.15.2 The largest energy storage facility, adjacent to the main substation and control room, is expected to contain approximately 25 containerised units and associated electrical infrastructure and would connect directly into the adjacent Scoop Hill substation via underground cables.

2.15.3 The three smaller units will contain fewer containerised units and associated electrical infrastructure and would connect directly into the satellite substations via underground cables, as they will be located adjacent to each other. A typical layout for the energy storage facilities are detailed in Figure 2.9a and 2.9b.

2.15.4 These energy storage facilities would provide real-time grid stabilisation to the National Grid, allowing excess electricity generated by the wind farm, to be stored in the containerised storage units during times of low demand. This stored electricity can then be fed back to the grid during times of peak demand.

2.15.5 The energy storage facilities are anticipated to consist of the following associated infrastructure and would remain in-situ for the lifetime of the wind farm:

- Containerised energy storage units;
- Containerised switchgear and control rooms;
- Underground cabling;
- Inverters;
- Transformers;
- Perimeter security fencing; and
- CCTV security system.

2.16 Cabling

2.16.1 The grid connection will be made at a 132kV primary onsite substation within the development boundary. From the onsite substation, an underground cable will export the electricity generated by the wind farm directly to Scottish Power Energy Networks (SPEN) onsite substation, which forms a part of the substation and control room in Figure 2.1.

2.16.2 The SPEN substation will connect to existing large substation at Bearholm and has available contracted capacity secured for the proposed wind farm development. The grid connection from the onsite SPEN substation, forms part of a separate Section 37 application by SPEN.

2.16.3 The proposed wind turbines will be connected by 33 kilovolt (kV) underground cables to the onsite primary substation and satellite substations. Underground cabling will also be installed to connect the proposed energy storage facilities to the Scoop Hill onsite substation. The underground cables will be placed in trenches that generally follow the route of the onsite access tracks. The route will be marked above ground clearly with identification posts, spaced evenly along the length. The cables would be buried to a depth of approximately 1 m.

2.16.4 A separate communication cable and earth tape would also be laid in the trench. Cables would be laid in sand for protection, with warning tapes/boards placed above high voltage cables to mitigate the risk of unintentional excavation. Where trenches are located on downhill gradients, impermeable barriers (plugs) would be placed in the sand layer at regular intervals to prevent the trench acting as a water conduit.

2.16.5 The cables would be laid by trenching methods which minimise the disturbance to the surrounding land and allow the area to be reinstated quickly. Each 33kV cable would come as three separate insulated cores. These would be gathered in the trench and bound together along the entire length of the trench in a trefoil arrangement, as illustrated in Figure 2.7a.

2.16.6 The underground 33kV cables routed from the proposed turbines would be brought together via underground cables to a new onsite substation. The electricity will be stepped up from 33kV to 132kV at the substation before being connected to the grid.

2.17 Primary and Satellite Substation/Control Room Buildings and Compounds

2.17.1 Scoop Hill will utilise a new system of satellite substations and shorter lengths of 33kV cable from the turbines to the satellite substations. The satellite substations will be connected to the primary substation and network operator building via 132kV cables.

2.17.2 The proposed development will require a primary on-site substation compound collector station, accommodating a network operator control building, wind farm control building and outdoor electrical infrastructure including but not limited to 132kV switchgear and 132kV transformers.

2.17.3 The location of the substation/control room buildings and compound are shown in Figures 2.1 and 2.2.

2.17.4 The substation buildings are proposed to be constructed with metal cladding. The buildings would be painted dark green 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 construction.

2.18 Construction and Storage Compounds

2.18.1 Due to the size of the proposed Scoop Hill scheme, more than one temporary construction and site storage compound may be required to provide site offices and welfare facilities for the on-site construction teams. This will minimise movements of personnel between site offices and areas of working, as well as having suitably sited locations for health and safety purposes and welfare units. Other small temporary construction compounds will also be used to accommodate storage of materials and equipment to minimise the movement of vehicles on site, as well as welfare areas for personnel.

2.18.2 These compounds will also provide storage and a lay-down area for plant and materials and for the secure storage of turbine components and equipment. All fuels and oils would be securely bunded or stored with double skinned containers of 110% capacity. The dimensions of the main construction compounds would be approximately 100 m x 50 m. Other compounds would be proportionally smaller, depending upon their requirements and typically would be 50 m x 50 m.

2.18.3 Each compound would be located adjacent to the proposed access tracks and sited at suitable distances from each other to allow easy access to the areas of working for the construction teams.

2.18.4 In addition, a further construction compound will be required solely for the primary substation construction works. This compound will be located immediately adjacent to the proposed substation for Scoop Hill and can be seen on Figures 2.1 and 2.2. This particular construction compound would be used to site the primary energy storage facility noted in 2.15, once the substation works are complete.

2.18.5 The construction and storage compound would be constructed in a similar way to that of the adjacent roads and hardstands, using locally won stone. A hardstand area of locally won stone will be required for the base for these compounds. They would be constructed at a sensible gradient, utilising geo-textile material to reduce excavation depths to below 500mm, to allow easy access and movement within the compound area.

2.18.6 At the end of the construction period, all equipment will be removed and the storage hardstand will be covered over with stored topsoil. The exception would be the substation construction compound as this hardstand area would remain to provide the base for the energy storage facility for the life of the wind farm.

2.18.7 A typical temporary construction compound layout can be found in Figure 2.8.

2.19 Land Take

2.19.1 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; access tracks, hardstands, substation/control room compounds 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 is shown bounded in red in Figures 2.1 and 2.2 and is equivalent to approximately 5,685 hectares.

2.19.2 The temporary land take incorporates all of the associated wind farm infrastructure, including borrow pits and construction compounds, (energy storage facilities will be located on the site of three smaller temporary construction compounds). This was calculated to be 42 ha, approximately 0.75% of the development boundary.

2.19.3 Based on the proposed site layout, the permanent land take has been calculated to be 63 hectares and the temporary land take of 42ha which is approximately 1.1% and 0.75% respectively, of the development area.

2.19.4 It should also be noted that these are permanent land take areas which could potentially be removed post decommissioning. However, the access tracks and hardstands would remain as the landowners and forestry managers will utilise these access tracks to continue with their agricultural and forestry management practices throughout their land holding, as well as for the retention of the walking routes created as a result of the proposed Scoop Hill Community Wind Farm.

2.19.5 The existing forestry infrastructure including access tracks and quarries has not been considered here, as this infrastructure was present before the construction of the wind farm development.

2.20 Habitat and Land Management

2.20.1 CWL will undertake habitat management enhancement measures to improve the biodiversity of the site and encourage and protect wildlife. A comprehensive series of surveys of flora and fauna have been undertaken by professional ecologists. The results of these extensive studies and surveys have been used to develop and inform the Habitat Management Plan (HMP). Further development of this plan will be undertaken in discussion and agreement with SNH, RSPB, SEPA and Dumfries and Galloway Council.

2.20.2 The initial proposals have been incorporated into a separate Outline HMP which accompanies the S36 application, and includes:

- Environmental enhancements for Black Grouse, Golden Eagles and Goshawks;
- Bog Enhancements and Riparian Woodland Planting;
- Monitoring of bird activity for the species listed above;
- Specific construction practises and buffer zones for protected species such as Red Squirrels, Otters, Badgers, Fish and Bats; and
- Land Management proposals.

2.20.3 The outline HMP for Scoop Hill Community Wind Farm will be developed in more detail in consultation with the above stated organisations during planning, post consent and will be an evolving plan which takes account of best practice and tailored accordingly to the habitats and wildlife within the site. However, for initial HMP proposals, refer to Section 7: Ornithology and Section 8: Ecology of this EIAR and the accompanying Outline HMP.

2.21 Waste Management

2.21.1 Waste management will be an integral part of the proposed project and the Waste Management Strategy will have two principle 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.

2.21.2 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.

2.21.3 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, all as approved by SEPA.

2.21.4 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.

2.21.5 Concrete is most likely to be mixed on-site in temporary batching plants located in the construction compound(s) or borrow pits. A settlement and wash-out pit will be constructed alongside to facilitate any washing-out that may be required, and this will be constructed in strict accordance with SEPA requirements.

2.21.6 During operation, a commercially available wastewater treatment system (septic tanks) would be on site to deal with wastewater from the control room/substation buildings 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) and in consultation with SEPA.

2.21.7 It is envisaged that a route to market will be found for all timber and material garnered from forestry activities. This will reduce the quantity of residual material on site. Further details of the forestry waste management can be found in Section 13: Forestry.

2.21.8 Waste management details will be incorporated into a Construction Environmental Management Plan (CEMP) which will be agreed with SEPA, NatureScot and the local authority prior to construction commencing. An Outline version of the CEMP however accompanies this S36 application.

2.22 Wind Farm Operation

2.22.1 The wind farm will operate all year round, with the majority of operations being managed automatically or remotely.

2.22.2 Depending on wind speeds, a wind turbine can be remotely controlled to enter a safety mode where the turbine will gradually reduce power output by orientating the rotor blades out of the wind direction by limiting rotational speed in proportion to the increase in wind speed and turbulence. This eliminates the need for an abrupt shut down and can significantly improve grid stability. The turbine would automatically begin operation as usual, once average wind speeds reduce to safe levels.

2.22.3 If the sensors within the turbine identify any abnormal readings or fault, the turbine will automatically shut down and 'park' the blades securely. Depending on the nature of shutdown, the turbine will either automatically restart or will need to be manually restarted. A manual restart can either be initiated remotely by the wind farm operator, or the fault may require further inspection by the onsite wind turbine engineers or by the Operation and Maintenance team and then restarted by them.

2.23 Central Monitoring System

2.23.1 The proposed wind farm will require a central monitoring system, consisting of a computer system located within the control room of the substation. This is known as a SCADA system (Supervisory Control and Data Acquisition). This system monitors the status and operation of all the turbines.

2.23.2 Each turbine has its own internal control system which controls various elements including the turbines yaw, blade pitch, hub rotation, and generator frequency. Some of the information from this is fed via fibre optic cable (following the access tracks) to the SCADA system.

2.23.3 The SCADA system allows the wind farm to be monitored and controlled remotely via Virtual Private Networks or the Internet. The operational status will be managed by the onsite engineers and by the Applicant, using the SCADA control system.

2.24 Wind Farm Maintenance

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

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

2.24.3 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.

2.24.4 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 stated schedules and procedures.

2.24.5 Preference will be given to local people for employment opportunities which relate to the wind farm.

2.25 Project Timescales

Construction

2.25.1 It is envisaged that the main construction period for the wind farm will be around 18 months. This is from commencement of construction and enabling works, through to installation and commissioning of the wind turbines, ending with site reinstatement. Construction would consist of the following stages, which although presented in a typical sequence, may overlap or occur concurrently:

- Construction of a site entrance and a site construction compound to accommodate site offices, welfare facilities and to provide a storage area for off-loading materials and components;
- Construction of main access track and opening up of borrow pits to ‘win’ stone material;
- Construction/upgrading of site tracks for access to turbine locations;
- Construction of turbine foundations;
- Construction of the on-site substation;
- Construction of grid connection line (to be submitted as a separate Section 37 Application);
- Laying of the on-site cabling;
- The delivery, erection and installation of turbine towers, nacelles and blades;
- Erection of the meteorological masts;
- Commissioning of the turbines;
- Site reinstatement (although this may commence earlier during other activities such as access and site track construction).

2.25.2 A detailed programme will be developed by the construction contractor and will include allowances for weather disruption; however an indicative construction programme is provided in Table 2.4.

2.25.3 The operational life of Scoop Hill Community Wind Farm will begin once all turbines have been commissioned, green electricity is exported to the grid, and the site is handed over to the Applicant’s internal Operations and Assets Team.

2.26 Operation

2.26.1 Once the turbines are commissioned and handed over, 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 a team of seven people (six wind turbine technicians and one supervisor engineer), with specialist personnel contracted to cover specific aspects of wind turbine maintenance work.

2.26.2 A separate maintenance team comprising of four maintenance workers will also be required to provide general maintenance for the wind farm site including access track repairs, fencing, checking drainage, and habitat management works as required.

2.27 Decommissioning

2.27.1 Wind turbines can be decommissioned, and sites cleared and restored easily and rapidly, typically within a period of 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.

2.27.2 At the end of the wind farm's operational life, it is proposed that the turbines and the on-site substation would be removed. The upper sections of the turbine foundations will be removed and backfilled with a minimum of 1 m depth of appropriate material, subsoil or topsoil replaced and the area reseeded. Access tracks that will be utilised for land and forestry management operations or by the landowners will be left in-situ.

2.27.3 The decommissioning work would be the responsibility of the Developer and a 'Decommissioning Bond' would be put in place with the Local Authority, as part of the planning conditions set by the Scottish Government.

2.27.4 Prior to decommissioning, a review of the site's environmental data, environmental legislation and current (at the time of decommissioning) best practice, in association with the local authorities and key stakeholders, will be undertaken in order to agree the best approach to decommission the wind farm after 40 years of operation.

2.27.5 It is anticipated that some degree of environmental monitoring will be required during the decommissioning process. This assessment and monitoring will need to be determined at the time of decommissioning with due regard to both legislative requirements and best practice at that time.

2.27.6 It is proposed that at least 12 months prior to decommissioning, a 'Decommissioning Method Statement' will be produced, and agreed with the local authority, landowners and other statutory stakeholders such as SEPA.

Table 2.4 – Indicative Construction Programme

* May commence earlier during other activities such as access and site track construction

	Construction Week																																						
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	27	28	29	30	31	32	33	34	35	36	37	38	39
Mobilisation	■	■	■	■	■																																		
Access & Site tracks		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■								
Foundations						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■						
On-site cabling														■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■										
Crane Pads																		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Substation - Civil																									■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Substation - Electrical																																	■	■	■	■	■	■	■
Off-site Cabling																																		■	■	■	■	■	■
Turbine Delivery																																			■	■	■	■	■
Turbine Erection																																					■	■	■
Energy Storage Installation																																						■	■

Task	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78
Crane Pads	■																																						
Substation - Civil	■	■	■																																				
Substation - Electrical	■	■	■	■	■	■	■																																
Off-site Cabling	■	■	■	■	■	■	■	■	■																														
Turbine Delivery	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■											
Turbine Erection	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■								
Energy Storage Installation	■	■	■	■	■	■	■	■																															
Commissioning and Testing												■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		
Site Reinstatement*																															■	■	■	■	■	■	■	■	■

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Appendix 2.1 – Energy and Carbon Calculations

Predicted Energy Production

Based on the proposed development of 45 wind turbines (candidate turbine 7MW):	75 Turbines X 7 MW	525 MW

Maximum theoretical electrical generation per year, based on 8,760 hours per year (365 days x 24 hours):	525 MW X 8760 Hours	4,599,000 MWH
It is accepted that although wind turbines operate for around 80% of the time, they do not produce the full installed capacity rating all that time. Using a capacity factor of 45%, gives a conservative predicted energy production of:	0.45 % X 4,599,000.00 MWH	2,069,550 MWH

Based on the above assumptions and average UK domestic consumption, this is equivalent to [(1)]:	2,069,550.00 MWH / 3.619 MWH	571,857 Homes

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)]:	2,069,550.00 MWH X 450 kg	931,298 Tonnes

40 Year 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)]	931,298 Tonnes X 40 Years	37,251,900 Tonnes

The scheme at Scoop 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 EIAR 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 2.1 Terawatt hours (TWh) of electricity per annum. Based on BEIS statistics this would be enough electricity to power around 571,857 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 2018) is 3.619MWh. More information on these statistics can be found on Page 11 of the following document: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/853760/sub-national-electricity-and-gas-consumption-summary-report-2018.pdf

(2) It is currently agreed that each kWh of electricity produced using the UK's average fuel mix results in the emission of 450g of CO_2 (or 450kg per MWh). Further details can be found at: Page 96 of the following document: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/840015/DUKES_2019_MASTER_COPY.pdf

Appendix 2.2 – Scottish Government Carbon Calculator Tool Results

1. Windfarm CO_2 emission saving • CRR2-HBKW-4TUK v4

MENU

Emissions due to turbine life
The carbon payback time of the windfarm due to turbine life (eg. manufacture, construction, decomissioning) is calculated by comparing the emissions due to turbine life with carbon-savings achieved by the windfarm while displacing electricity generated from coal-fired capacity or grid-mix.

Capacity factor calculated from forestry data

Area name	Value type	Capacity factor (%)	Wind speed ratio	Average site windspeed (m/s)	Annual theoretical energy output (MW / turbine yr)

Capacity factor - Direct input

	Exp.	Min.	Max.
Capacity factor (%)	45.0	40.0	50.0

	Exp.	Min.	Max.
Annual energy output from windfarm (MW/yr)			
RESULTS			
Emissions saving over coal-fired electricity ge...	1,903,986	1,571,544	2,266,650
Emissions saving over grid-mix of electricity g...	524,796	433,165	624,758
Emissions saving over fossil fuel - mix of elect...	931,298	768,690	1,108,688

2. CO_2 loss due to turbine life • CRR2-HBKW-4TUK v4

MENU

Emissions due to turbine life
The carbon payback time of the windfarm due to turbine life (eg. manufacture, construction, decomissioning) is calculated by comparing the emissions due to turbine life with carbon-savings achieved by the windfarm while displacing electricity generated from coal-fired capacity or grid-mix.

Calculation of emissions with relation to installed capacity

	Exp.	Min.	Max.
Emissions due to turbine frome energy output (t CO2)	6073	5606	6540
Emissions due to cement used in construction (t CO2)	7110	6952	7268

Direct input of emissions due to turbine life

	Exp.	Min.	Max.
Emissions due to turbine life (tCO2/windfarm)			

RESULTS

	Exp.	Min.	Max.
Losses due to turbine life (manufacture, construction, etc.) (t CO2)	462578	427381	497774
Additional CO2 payback time of windfarm due to turbine life			
...coal-fired electricity generation (months)	3	3	3
...grid-mix of electricity generation (months)	11	12	10
...fossil fuel - mix of electricity generation (months)	6	7	5

3. CO_2 loss due to backup • CRR2-HBKW-4TUK v4

MENU

Emissions due to backup power generation
CO2 loss due to back up is calculated from the extra capacity required for backup of the windfarm given in the input data.

Wind generated electricity is inherently variable, providing unique challenges to the electricity generating industry for provision of a supply to meet consumer demand (Netz, 2004). Backup power is required to accompany wind generation to stabilise the supply to the consumer. This backup power will usually be obtained from a fossil fuel source. At a high level of wind power penetration in the overall generating mix, and with current grid management techniques, the capacity for fossil fuel backup may become strained because it is being used to balance the fluctuating consumer demand with a variable and highly unpredictable output from wind turbines (White, 2007). The Carbon Trust (Carbon Trust/DTI, 2004) concluded that increasing levels of intermittent generation do not present major technical issues at the percentages of renewables expected by 2010 and 2020, but the UK renewables target at the time of that report was only 20%. When national reliance on wind power is low (less than ~20%), the additional fossil fuel generated power requirement can be considered to be insignificant and may be obtained from within the spare generating capacity of other power sectors (Dale et al, 2004). However, as the national supply from wind power increases above 20%, without improvements in grid management techniques, emissions due to backup power generation may become more significant. The extra capacity needed for backup power generation is currently estimated to be 5% of the rated capacity of the wind plant if wind power contributes more than 20% to the national grid (Dale et al 2004). Moving towards the SG target of 50% electricity generation from renewable sources, more short-term capacity may be required in terms of pumped-storage hydro-generated power, or a better mix of offshore and onshore wind generating capacity. Grid management techniques are anticipated to reduce this extra capacity, with improved demand side management, smart meters, grid reinforcement and other developments. However, given current grid management techniques, it is suggested that 5% extra capacity should be assumed for backup power generation if wind power contributes more than 20% to the national grid. At lower contributions, the extra capacity required for backup should be assumed to be zero. These assumptions should be revisited as technology improves.

Assumption: Backup assumed to be by fossil-fuel-mix of electricity generation. Note that hydroelectricity may also be used for backup, so this assumption may make the value for backup generation too high. These assumptions should be revisited as technology develops.

	Exp.	Min.	Max.
Reserve energy (MWh/yr)	229,950	0	246,375
Annual emissions due to backup from fossil fuel-mix of electricity generati...	10,348	0	11,087
RESULTS			
Total emissions due to backup from fossil fuel-mix of electricity generatio...	413,910	0	498,909

4. Loss of CO_2 fixing potential • CRR2-HBKW-4TUK v4

MENU

Emissions due to loss of bog plants
Annual C fixation by the site is calculated by multiplying area of the windfarm by the annual C accumulation due to bog plant fixation.

	Exp.	Min.	Max.
Area where carbon accumulation by bog plants is lost (ha)	129.85	77.61	234.77
Total loss of carbon accumulation up to time of restoration (tCO2 eq./ha)	41	17	63
RESULTS			
Total loss of carbon fixation by plants at the site (t CO2)	5356	1298	14677
Additional CO2 payback time of windfarm due to loss of CO2 fixing potential			
...coal-fired electricity generation (months)	0	0	0
...grid-mix of electricity generation (months)	0	0	0
...fossil fuel - mix of electricity generation (months)	0	0	0

5. Loss of soil CO_2 (a, b) • CRR2-HBKW-4TUK v4

MENU

Emissions due to loss of soil organic carbon
Loss of C stored in peatland is estimated from % site lost by peat removal (table 5a), CO2 loss from removed peat (table 5b), % site affected by drainage (table 5c), and the CO2 loss from drained peat (table 5d).

5. Loss of soil C02

	Exp.	Min.	Max.
CO2 loss from removed peat (t CO2 equiv.)	73515.76	40111.22	101902...
CO2 loss from drained peat (t CO2 equiv.)	30144.46	0	101265...
RESULTS			
Total CO2 loss from peat (removed + drained) (t CO2 e...	103660...	40111.22	203167...
Additional CO2 payback time of windfarm due to loss ...			
...coal-fired electricity generation (months)	0.65	0.31	1.08
...grid-mix of electricity generation (months)	2.37	1.11	3.9
...fossil fuel - mix of electricity generation (months)	1.34	0.63	2.2

CO_2 loss from removed peats
If peat is treated in such a way that it is permanently restored, so that less than 100% of the C is lost to the atmosphere, a lower percentage can be entered in cell C10.

5b. CO2 loss from removed peat

	Exp.	Min.	Max.
CO2 loss from removed peat (t CO2)	98938.69	68934.59	136797...
CO2 loss from undrained peat left in situ (t CO2)	25422.93	28823.38	34895.20
RESULTS			
CO2 loss atributable to peat removal only (t CO2)	73515.76	40111.22	101902...

Volume of Peat Removed
% site lost by peat removal is estimated from peat removed in borrow pits, turbine foundations, hard-standing and access tracks. If peat is removed for any other reason, this must be added in as additional peat excavated in the core input data entry.

5a. Volume of peat removed

	Exp.	Min.	Max.
Peat removed from borrow pits			
Area of land lost in borrow pits (m2)	80000	48600	108900
Volume of peat removed from borrow pits (m3)	0	0	0
Peat removed from turbine foundations			
Area of land lost in foundation (m2)	24300	19200	30000
Volume of peat removed from foundation area (m3)	9963	7680	12600
Peat removed from hard-standing			
Area of land lost in hard-standing (m2)	90000	84825	95325
Volume of peat removed from hard-standing area (m3)	36900	33930	40036.5
Peat removed from access tracks			
Area of land lost in floating roads (m2)	46000	45500	46500
Volume of peat removed from floating roads (m3)	23000	22295	23715
Area of land lost in excavated roads (m2)	234000	233500	234500
Volume of peat removed from excavated roads (m3)	234000	210150	257950
Area of land lost in rock-filled roads (m2)	0	0	0
Volume of peat removed from rock-filled roads (m3)	0	0	0
Total area of land lost in access tracks (m2)	280000	279000	281000
Total volume of peat removed due to access tracks (m3)	257000	232445	281665
RESULTS			
Total area of land lost due to windfarm construction (m2)	474300	431625	515225
Total volume of peat removed due to windfarm constructio...	303863	274055	334301.5

5. Loss of soil CO_2 (c, d, e) • CRR2-HBKW-4TUK v4

MENU

Volume of peat drained
Extent of site affected by drainage is calculated assuming an average extent of drainage around each drainage feature as given in the input data.

CO_2 loss due to drainage
Note, CO2 losses are calculated using two approaches: IPCC default methodology and more site specific equations derived for this project. The IPCC methodology is included because it is the established approach, although it contains no site detail. The new equations have been derived directly from experimental data for acid bogs and fens (see Nayak et al, 2008 - Final report).

5c. Volume of peat drained

	Exp.	Min.	Max.
Total area affected by drainage around borrow pits (m2)	23968	6696	67500
Total volume affected by drainage around borrow pits (m3)	0	0	0
Peat affected by drainage around turbine foundation and hardst...			
Total area affected by drainage of foundation and hardstanding ...	126000	47700	319500
Total volume affected by drainage of foundation and hardstandi...	25830	9540	67095
Peat affected by drainage of access tracks			
Total area affected by drainage of access track(m2)	674200	290100	1445500
Total volume affected by drainage of access track(m3)	331400	127575	783475
Peat affected by drainage of cable trenches			
Total area affected by drainage of cable trenches(m2)	0	0	0
Total volume affected by drainage of cable trneches(m3)	0	0	0
Drainage around additional peat excavated			
Total area affected by drainage (m2)	0	0	0
Total volume affected by drainage (m3)	0	0	0
RESULTS			
Total area affected by drainage due to windfarm (m2)	824168	344496	1832500
Total volume affected by drainage due to windfarm (m3)	357230	137115	850570

5d. CO2 loss from drained peat

	Exp.	Min.	Max.
Calculations of C Loss from Drained Land if Site is NOT Restored after De...			
Total GHG emissions from Drained Land (t CO2 equiv.)	116315.15	34489.31	348056.41
Total GHG emissions from Undrained Land (t CO2 equiv.)	86170.69	34489.31	246790.99
Calculations of C Loss from Drained Land if Site IS Restored after Decomi...			
Losses if Land is Drained			
CH4 emissions from drained land (t CO2 equiv.)	-649.19	-424.27	-905.25
CO2 emissions from drained land (t CO2)	60279.21	23429.29	175943.54
Total GHG emissions from Drained Land (t CO2 equiv.)	116315.15	34489.31	348056.41
Losses if Land is Undrained			
CH4 emissions from undrained land (t CO2 equiv.)	1569.42	-424.27	20790.22
CO2 emissions from undrained land (t CO2)	42606.77	23429.29	103321.48
Total GHG emissions from Undrained Land (t CO2 equiv.)	86170.69	34489.31	246790.99
RESULTS			
Total GHG emissions due to drainage (t CO2 equiv.)	30144.46	0	101265.41

Emission rates from soils
Note, CO2 losses are calculated using two approaches: IPCC default methodology and more site specific equations derived for this project. The IPCC methodology is included because it is the established approach, although it contains no site detail. The new equations have been thoroughly tested against experimental data (see Nayak et al, 2008 - Final report).

5e. Emission rates from soils

	Exp.	Min.	Max.
Calculations following IPCC default methodology			
Flooded period (days/year)	178	178	178
Annual rate of methane emission (t CH4-C/ha year)	0.04	0.04	0.04
Annual rate of carbon dioxide emission (t CO2/ha year)	35.2	35.2	35.2
Calculations following ECOSSE based methodology			

6. CO_2 loss by DOC & POC loss • CRR2-HBKW-4TUK v4

MENU

Emissions due to loss of DOC and POC
Note, CO2 losses from DOC and POC are calculated using a simple approach derived from generic estimates of the percentage of the total CO2 loss that is due to DOC or POC leaching.

No POC losses for bare soil included yet. If extensive areas of bare soil is present at site need modified calculation (Birnie et al, 1991)

	Exp.	Min.	Max.
Gross CO2 loss from restored drained land (t CO2)	0.00	0.00	0.00
Gross CH4 loss from restored drained land (t CO2 equiv.)	0.00	0.00	0.00
Gross CO2 loss from improved land (t CO2)	0.00	0.00	0.00
Gross CH4 loss from improved land (t CO2 equiv.)	58.67	0.00	9944.10
Total gaseous loss of C (t C)	1.43	0.00	243.20
Total C loss as DOC (t C)	0.37	0.00	97.28
Total C loss as POC (t C)	0.11	0.00	24.32
RESULTS			
Total CO2 loss due to DOC leaching (t CO2)	1.37	0.00	356.69
Total CO2 loss due to POC leaching (t CO2)	0.42	0.00	89.17
Total CO2 loss due to DOC & POC leaching (t CO2)	1.79	0.00	445.87
Additional CO2 payback time of windfarm due to DOC & POC			
...coal-fired electricity generation (months)	0	0	0
...grid-mix of electricity generation (months)	0	0	0
...fossil fuel - mix of electricity generation (months)	0	0	0

7. Forestry CO_2 loss • CRR2-HBKW-4TUK v4

MENU

CO_2 loss from forests - calculation using detailed management information

Forest carbon calculator (Perks et al, 2009)

Total potential carbon squestration loss due to felling of forestry for the wind ...
Total emissions due to cleared land (t CO2)
Emissions due to harvesting operations (t CO2)
Fossil fuel equivalent saving from use of felled forestry as biofuel (t CO2)
Fossil fuel equivalent saving from use of replanted forestry as biofuel (t CO2)
RESULTS
Total carbon loss associated with forest management(t CO2)

Emissions due to forest felling - calculation using simple management data

Emissions due to forestry felling are calculated from the reduced carbon sequestered per crop rotation. If the forestry was due to be removed before the planned development, this C loss is not attributable to the wind farm and so the area of forestry to be felled should be entered as zero.

	Exp.	Min.	Max.
Area of forestry plantation to be felled (ha)	293	290	296
Carbon sequestered (t C ha-1 yr-1)	3.6	3.5	3.7
Lifetime of windfarm (years)	40	35	45
Carbon sequestered over the lifetime of the windfarm (t C ha-1)	144	122.5	166.5
RESULTS			
Total carbon loss due to felling of forestry (t CO2)	154705.41	130259.52	180709.64
Additional CO2 payback time of windfarm due to management of forestry			
...coal-fired electricity generation (months)	0.98	0.99	0.96
...grid-mix of electricity generation (months)	3.54	3.61	3.47
...fossil fuel - mix of electricity generation (months)	1.99	2.03	1.96

8. CO_2 gain - site improvement • CRR2-HBKW-4TUK v4

MENU

Gains due to site improvement
Note, CO2 losses are calculated using two approaches: IPCC default methodology and more site specific equations derived for this project. The IPCC methodology is included because it is the established approach, although it contains no site detail. The new equations have been thoroughly tested against experimental data (see Nayak et al, 2008 - Final report).

Degraded Bog

	Exp.	Min.	Max.
1. Description of site			
Area to be improved (ha)	100	0	101
Depth of peat above water table before improvement (m)	0.2	0.1	0.4
Depth of peat above water table after improvement (m)	0.1	0.3	0
2. Losses with improvement			
Improved period (years)	0	10	0
Selected annual rate of methane emissions (t CH4-C ha-1 yr-1)	0.137	0.001	0.495
CH4 emissions from improved land (t CO2 equiv.)	0	0	7483.591
Selected annual rate of carbone dioxide emissions (t CO2 ha-...	2.416	10.815	0.295
CO2 emissions from improved land (t CO2 equiv.)	0	0	152.878
Total GHG emissions from improved land (t CO2 eqiv.)	0	0	7636.469
3. Losses without improvement			

Felled Forestry

	Exp.	Min.	Max.
1. Description of site			
Area to be improved (ha)	0	0	0
Depth of peat above water table before improvement (m)	0	0	0
Depth of peat above water table after improvement (m)	0	0	0
2. Losses with improvement			
Improved period (years)	0	0	0
Selected annual rate of methane emissions (t CH4-C ha-1 yr-1)	0.492	0.488	0.495
CH4 emissions from improved land (t CO2 equiv.)	0	0	0
Selected annual rate of carbone dioxide emissions (t CO2 ha-...	0.029	-0.237	0.295
CO2 emissions from improved land (t CO2 equiv.)	0	0	0
Total GHG emissions from improved land (t CO2 eqiv.)	0	0	0
3. Losses without improvement			

Borrow Pits

	Exp.	Min.	Max.
1. Description of site			
Area to be improved (ha)	8	0	8
Depth of peat above water table before improvement (m)	0	0	0
Depth of peat above water table after improvement (m)	0	0	0
2. Losses with improvement			
Improved period (years)	0.5	4	0
Selected annual rate of methane emissions (t CH4-C ha-1 yr-1)	0.492	0.488	0.495
CH4 emissions from improved land (t CO2 equiv.)	29.427	0	237.104
Selected annual rate of carbone dioxide emissions (t CO2 ha-...	0.029	-0.237	0.295
CO2 emissions from improved land (t CO2 equiv.)	0.06	0	4.844
Total GHG emissions from improved land (t CO2 eqiv.)	29.487	0	241.948
3. Losses without improvement			

Foundations & Hardstanding

	Exp.	Min.	Max.
1. Description of site			
Area to be improved (ha)	12.6	4.77	31.95
Depth of peat above water table before improvement (m)	0.41	0.4	0.42
Depth of peat above water table after improvement (m)	0.3	0.4	0.1
2. Losses with improvement			
Improved period (years)	36.5	33	40
Selected annual rate of methane emissions (t CH4-C ha-1 yr-1)	0.004	-0.008	0.141
CH4 emissions from improved land (t CO2 equiv.)	29.245	-22.892	2223.407
Selected annual rate of carbone dioxide emissions (t CO2 ha-...	11.081	14.854	2.682
CO2 emissions from improved land (t CO2 equiv.)	2610.792	1452.02	1448.548
Total GHG emissions from improved land (t CO2 eqiv.)	2640.036	1429.128	3671.955
3. Losses without improvement			

Appendix 2.3 – Borrow Pit Assessment & Outline Scheme of Works

1 Introduction

1.1 Background Information

1.1.1 Community Windpower Ltd (CWL) has applied for S36 planning consent for Scoop Hill Community Wind Farm. The wind farm is located approximately 5 km south east of Moffat and 11 km north east of Lockerbie. These distances are calculated to the nearest turbine. The central point of the wind farm is NY155985. The proposed wind farm will cover an area of around 5,685 hectares (ha), with a total permanent land take within the development boundary of 63ha.

1.1.2 The Applicant proposes to design, install, operate, and decommission a wind farm comprising 75 wind turbines.

1.1.3 In addition to the proposed 75 turbines the project will consist of up to 14 temporary borrow pits, consisting of the expansion of six existing quarries/borrow pits and creation of eight new borrow pits, with associated temporary screening or crushing plant, which will be reinstated post-construction.

Introduction

1.1.4 This Borrow Pit Technical Appendix has been created to outline;

- Suitable sources of stone onsite;
- Local geology types (Superficial and Underlying Bedrock);
- An estimate of the available aggregate; and
- Details of the techniques used to extract aggregate and the protection of sensitive environmental receptors.

1.1.5 Initial siting of borrow pits utilised a desk-based assessment consisting of the analysis of the following data:

- Geology types (Superficial and Underlying Bedrock);
- Dumfries and Galloway cultural heritage data set;
- SNH peatland and soils classification; and
- Presence of existing onsite quarries / borrow pits.

1.1.6 Following this, extensive site walkover surveys have been utilised to confirm the suitability of borrow pit locations, including:

- Phase 1 & NVC (including GWDTE's);
- Ecological and Ornithology Species Surveys;
- Petrographic Survey of material from existing borrow pits;
- Phase 1 & 2 peat depth surveys; and
- Archaeological Walkover Surveys.

1.1.7 At the current phase of the development, the required aggregate quantities remain approximate. The final detailed design of the development will provide finalised aggregate quantities.

1.1.8 Borrow locations can be found in Figures A to E of this Appendix.

2 Baseline Conditions

2.1 Superficial Geology

2.1.1 British Geological Survey (BGS) data indicates that the development is underlain by a combination of Glacial till, mainly diamicton, which forms a part of the greater Langholm unit. The main valleys of the Anna, Dryfe and Wamphray water contain alluvium, a fluvial deposit made up of Sand, Gravel and Silt.

2.1.2 Very little of the development area is covered by carbon soils such as peat, as indicated by the NatureScot peatlands and carbon soils classification dataset and the extensive phase 1 and 2 peat surveys. Full results of the peat surveys can be found in Section 10 of the EIAR and its Technical Appendices.

2.1.3 In areas of higher elevation, BGS has no records of superficial geologies.

2.2 Bedrock Geology

2.2.1 The northern extent of the development lies on a bedrock of sandstone, mudstone and siltstone known as the Glendearg Foundation. These are fluvial in origin and is course material.

2.2.2 The central section of the development lies on a bedrock of metasandstone and metamudstone knows as the Carghidown Formation. These are sedimentary in origin, graded sediments.

2.2.3 The lower and eastern section of the development lies on the Hawick group of Wacke. This is also sedimentary but in marine origin, consisting of a coarse marine material.

2.2.4 Running through the centre of the development in a thin line, is the Mull dyke swarm made up of Quartz and Microgabbro. This material is igneous and magmatic in origin.

3 Construction Requirement

3.1.1 For the construction of new on-site access tracks, locally won stone material will be required. Up to eight new borrow pit locations are intended to be opened with a further six existing borrow pits being re-opened on the Scoop Hill Community Wind Farm site.

3.1.2 Stone will be required for the construction of the following infrastructure:

- Access Tracks (New and upgrades to existing tracks);
- Turbine Foundations;
- Crane Hardstands; And
- Substation and Control Room Foundations.

3.1.3 Although the stone quantities are currently indicative, the stone required for construction would be in the region of 350,000m^3.

3.1.4 Table 1 below outlines the stone requirement for access tracks (new and existing) and turbines (hardstands, laydowns and foundations) at each new borrow pit and/or cluster of existing borrow pits. Additional stone required for the Substation and Control Room's has been included into borrow pits N2, N3, N4 and N5.

3.1.5 Also included is the required minimum depth of each new borrow pit based on an indicative 100m*100m excavation area.

3.1.6 Traditionally, temporary construction compounds and met masts required stone. However, for the Scoop Hill proposal, a geo-textile matting will be utilised for temporary construction compounds which will be removed post-construction. Met masts will be self-supporting and will not require stone hardstanding's.

Table 1 – Indicative borrow pit stone requirements and depth

Borrow Pit	Turbine Stone Requirement (m3)	Access Track Stone Requirement (m3)	Total Stone Required per Borrow pit	*Required Depth of Borrow pit
N1	6000	48033	54033	6.75
N2	9000	37505	47130	5.89
N3	5250	29778	35653	4.46
N4	7500	47531	56281	7.04
N5	4500	26607	31732	3.97
N6	3000	23345	26345	3.29
N7	5250	37572	42822	5.35
N8	5250	14759	20009	3.48
E1, E2 and E4	3750	10969	14719	3.23
E3 and E6	4500	7828	12328	3.46
E5	2250	7063	9313	6.74

*Overburden of 25% is assumed for new borrow pits and an average of 15% for existing borrow pits has been applied to the required depth.

3.1.7 In addition, where access tracks will be cut and turbine foundations excavated, it is more than likely that the extracted material will be also be utilised on site.

4 Borrow Pit Site Selection

4.1.1 In order to remove and reduce the environmental impact of the on-site borrow pits, the following criteria have been used to establish the location of borrow pits.

- Avoidance of peat depths greater than 0.5m;
- Avoidance of sensitive habitats, particularly GWDTE's (a 250m buffer has been applied per SEPA guidance);
- Avoidance of ecological and ornithological sensitive areas;
- Avoidance of watercourses (a 50m buffer has been applied to borrow pits and associated areas of search);
- Previous land use - previously used borrow pits/quarries have been identified for priority usage; and
- Strategic location within the larger development area - Locating borrow pits at suitable distances from one another to reduce travel time between sources of stone.

4.1.2 The criteria set out above applied to both new and existing borrow pits and their associated areas of search.

4.1.3 Based on the selection criteria above, three existing borrow pit and quarriers within the development area have been removed from consideration for further usage.

4.1.4 A total of eight new borrow pits have been identified for suitable usage, along with six of the existing borrow pits and quarries on site.

5 Description of New and Existing Borrow Pits

5.1.1 There are six existing borrow pits and quarries that have been identified for potential usage within the development boundary.

5.1.2 It is estimated that up to a further eight temporary borrow pits may be required in order to extract the stone needed.

5.1.3 Borrow pits are identified by **"N"** for new and **"E"** for existing.

5.1.4 Borrow pit locations can be seen in Figures A to E.

5.2 New Borrow Pits

<u>N1</u>

5.2.1 Located 500 metres from the existing access track in the southern entrance of the development, on a bedrock of metasandstone and metamudstone, this borrow pit would serve the South-western turbine array from Sembletree Knowe up to Milne Height. Borrow pit N1 serves as the principle borrow pit for the preferred site entrance option.

<u>N2</u>

5.2.2 This borrow pit is located on the South-western slopes of Macmaw Edge, on a bedrock of Wacke, would serve the South-eastern array of turbine from Macmaw Edge and Hill to Dunscore Hill. Borrow pit N2 serves the largest cluster of turbines, but due to the large network of existing access tracks, contains a reduced amount of new access tracks.

<u>N3</u>

5.2.3 Located on Milne Height, this borrow pit serves a central but western cluster of turbines, up to and beyond Laverhay Height and into the commercial forestry, on a bedrock of metasandstone and metamudstone. Where the previous borrow pits had associated areas of search 200m x 200m in size, N3 uses a reduced area of search to limit potential intrusions on the 250m GWDTE buffer.

N4

5.2.4 This borrow pit is located in the recently felled sections of the Dundoran Plantation, on a bedrock of metasandstone and meta mudstone, serving the most Western array of turbines, to Gallatae along Craig Fell and to Priestgill Head. This borrow pit serves the largest area but is easily accessible by existing forestry tracks.

N5

5.2.5 The borrow pit serves the most central cluster of turbines within the Kirkhill and Black Hill area, on a bedrock of metasandstone and metamudstone. Situated on the southern slopes of Black Hill within dense commercial forestry, access to borrow pit E5 is via the existing access tracks off Ruegill Hill.

N6

5.2.6 This borrow pit is located on the steeper south-western slopes of Jocks Shoulder in the North-East of the development, on a bedrock of metasandstone and metamudstone. This borrow pit is supported by several smaller existing borrow pits which traverse the far Eastern ridge of the development, this serves the smallest cluster of turbines.

N7

5.2.7 Borrow pit N7 is located on Priestgill Head on a bedrock of metasandstone and metamudstone, and it will provide aggregate for the proposed access tracks that will allow movement across the Wamphray Water valley. It also serves several turbines in the north-east of the development.

N8

5.2.8 Borrow pit N8 is located in the Northern sections of the Wamphray Water Valley, on the opposite side to borrow pit N7, on a bedrock of metasandstone and metamudstone. N10 will act as the main source of aggregate leading up Ewelairs Hill and either down to Ruegill Hill and Borrow Pit N5 or across the Dryfe Water valley to Jocks Shoulder and borrow pit N6. This borrow pit serves a smaller cluster of turbines but will provide aggregate for large sections of new access tracks.

5.3 Existing Borrow Pits and Quarries

E1, E2 and E4

5.3.1 Borrow pits E1 and E2 are located on Three Mullach Hill and borrow pit E4 on Ramshaw Rig, lie on a bedrock of metasandstone and meta mudstone. These existing borrow pits/quarries serve the cluster of turbine down to Scoop Hill. Due to the extent of the existing forestry network of access tracks here, the quantity of stone required for new tracks is low.

E3 and E6

5.3.2 E3 is located north of Macmaw Edge on the most eastern extent of the existing forestry tracks, along with borrow pit E6 at Peat Hill, on a bedrock of metasandstone and meta mudstone. These two serve a moderate cluster of turbines but by utilising the existing track network, these borrow pits serve little in regards to new access tracks.

E5

5.3.3 Borrow pit E5 located South-east of Black Hill, on a bedrock of metasandstone and metamudstone, serves the smallest cluster of turbines and limited stretches of new access tracks. This borrow pit provides the least amount of stone on site.

6 Borrow Pit Establishment

6.1 Preliminary Works

6.1.1 Geotechnical surveys post-consent and pre-construction, will assess the borrow pit locations in order to determine the extent and suitability of material available for extraction.

6.1.2 Every effort will be made to utilise the existing borrow pits and quarries prior to the opening of new borrow pits and new borrow pits will only be opened where necessary.

6.1.3 The results of the survey will further inform the detailed specifications of the borrow pits. However, typically the borrow pits will have a maximum area of 10,000 m^2 and a maximum depth of approximately 8m, although most will not require this depth of excavation.

6.1.4 Prior to opening a borrow pit, if required, the area will be inspected by the ECoW for ground nesting birds. Once ECoW permission is given, cut off drains will be excavated to redirect surface water around the borrow pit area. The land will be stripped of vegetation and turves and this will be stored at the perimeter of the borrow pit in mounds no higher than 2 metres. The organic soil below will then be stripped and stored for later re-use. Post and wire fencing may be installed to improve safety and minimise risk.

6.1.5 Stone extraction and grading using machinery will then take place to provide the stone necessary for the construction works.

6.2 Drainage

6.2.1 Good drainage is vital for borrow pit establishment to control surface runoff, minimise the impact on local hydrology and maintain the quality of the track. Good practice guidelines will be followed in the drainage design and construction.

6.2.2 The drainage will be designed to ensure that clean and dirty water are kept separate.

6.2.3 The overland surface water above any new infrastructure will be diverted away from the new borrow pits using ditches, and directed away from the infrastructure, whilst maintaining existing paths and drainage systems. These 'cut-off' drains will discharge little and often to maintain the existing nature of runoff and to prevent accumulation of sediment and siltiness. The cut-off drains will discharge to vegetation, through silt nets or stone aprons as deemed necessary by the ECoW.

6.2.4 The design of the attenuation features shall be in accordance with best practice and in particular the SuDS Manual (C753), December 2015.

6.2.5 The drainage measures employed for the borrow pits will comprise cut-off channels at the crest and flanks of the borrow pit excavations. Where the borrow pit base level is lower than the connecting site tracks, the water will be directed to a sump and may be pumped from the base of the pit, if necessary, into a series of settlement ponds.

6.2.6 Cut-off drains may be excavated above infrastructure to collect clean run-off from the surrounding landscape in order to prevent contaminating clean surface water run-off with track water. Likely locations include the up-gradient side of borrow pits, turbine bases and the compound. This clean water does not require treatment and will be directed towards watercourses without being contaminated by silty run-off. Water running off from track drains will be treated separately to remove silt.

6.2.7 On steeper slopes, regular cross drains will be installed in tracks.

6.2.8 Water pumped from the borrow pits would be discharged into a settlement lagoon that will be constructed adjacent to the borrow pits to treat surface runoff. All settlement lagoons would be constructed to meet SEPA requirements.

7 Excavated Materials

7.1.1 Efforts will be made to minimise excavations as far as is practical and feasible within the engineering and environmental constraints of the wind farm construction.

7.1.2 All construction works involving excavation of rock and soils will be flexible and adaptable to take account of changing conditions, particularly in relation to weather and ground conditions that may be encountered during the works. Ground disturbing activities will be restricted during periods of heavy rainfall and weather forecast information will be utilised to plan the timing of excavation work.

7.1.3 Excavated rock and soils should be kept separate to avoid, where possible, cross contamination of distinct horizons. Organic soils will be used to reinstate the areas where they were removed.

7.1.4 Turves will be stripped and handled with care such that damage to the living vegetation mat is prevented or minimised as far as possible. Turves will be stored separately to soil and used in the re-instatement works.

7.1.5 Stripped materials will be stored in appropriately designed and clearly defined separate piles.

7.1.6 Soils and turves will be stored adjacent to tracks, turbine bases, the compound etc. and used in the re-instatement works for each of these structures. They will be stored in a manner that minimises run off and pollution. Height will not exceed 2m.

7.1.7 When re-instating track verges, turbine bases etc, soil will not be spread deeper than 2m.

7.1.8 Excess stone and soils will be used in the re-instatement of the borrow pits.

7.1.9 Stockpiles will be sited a minimum of 50m from watercourses, ditches and drains. Soils will be stored to minimise run off of soil. Sides will be battered to prevent erosion from rainwater and the height will not exceed two metres.

7.1.10 Cut-off drains and silt nets may be required for run off from stockpiles.

7.1.11 If soil is drying out, stockpiles will be damped down to reduce dust.

7.1.12 In order to reduce the need for temporary storage, reinstatement of soils and turves around infrastructure, and in restoration and landscaping works on areas of excavated/disturbed ground, will be carried out during the construction phase or as soon as is practical after the completion of the works in any one area of the site.

7.1.13 To minimise handling and haulage distances, where possible excavated material will be stored local to the site of excavation and/or local to the end–use site where it is required for re-profiling and landscaping purposes. These locations will be decided upon following consultation with the appointed ECoW with sensitive habitats and species in mind as well as considering potential risks from material instability and run off into watercourses.

7.1.14 Where material is stockpiled, excess consolidation will be avoided, and material will be placed on level ground.

7.1.15 Prior to any excavations taking place, hydrology shall be considered to minimise the disturbance as much as possible. In order to achieve this, the following objectives have been followed during the design of the wind farm:

- Minimising the construction footprint and ground/habitat disturbance;
- Restoring vegetation and habitats as early as possible;
- Minimising disruption to major hydrological flow paths; and
- Reducing run off from exposed areas.

8 Borrow Pit Reinstatement

8.1.1 Due to the topography of the site, each borrow pit may have a different restoration objective, which will be confirmed following the site geotechnical investigations, however typically the borrow pit areas will be reinstated in accordance with the following principles:

- Any unsightly areas of rock excavation (for example those which appear as spoil heaps or obviously man-made excavations with straight edges) and areas likely to encourage erosion would be graded to more gentle profiles that are appropriate with the existing natural topography;
- The slopes and floors of borrow pits will be shaped to best-fit local contours and will be used to establish semi-natural habitats, including shallow pools;
- Any excess subsoil material from elsewhere on site would be used to backfill and contour areas of the borrow pits. If required, materials used for the reinstatement shall be agreed in advance with SEPA to ensure compliance with waste management;
- The fill material will be placed so as to cover unsightly areas and provide reshaping of the borrow pits to form stable profiles (unlikely to erode or slump), similar to the existing natural landform and allow the natural regeneration of the vegetation;
- This plan for the borrow pit reinstatement will be agreed with the ECoW, and the works itself would be overseen by the ECoW;
- The external edges of the borrow pits will be re-profiled and graded to a gentler profile, at a gradient of around 1 in 3. The final slope gradient will be dependent upon the materials available but is unlikely to be greater than 45 degrees;
- Backfilled areas, if required, will be lightly compacted to remove air pockets. Organic soil and vegetated turves set aside from the borrow pit stripping will be used to reinstate the borrow pit upper surface;

8.1.2 The ECoW will review the reinstatement works and instruct whether seed mix is to be applied to accelerate vegetation growth. Any seed mix would be agreed between the ECoW and the relevant authority.

8.1.3 A borrow pit restoration profile can be seen in Figure F.

9 Conclusion

9.1.1 The proposed wind farm will require in the order of 350,000m^3 of aggregate, predominantly for the construction of Access Tracks (new tracks and upgrading of existing tracks); Turbine Foundations; Crane Hardstands; and Substation and Control Room Foundations.

9.1.2 A total of 14 borrow pits are proposed, comprising eight new borrow pits and six existing sources of aggregate, for the 75-turbine wind farm development.

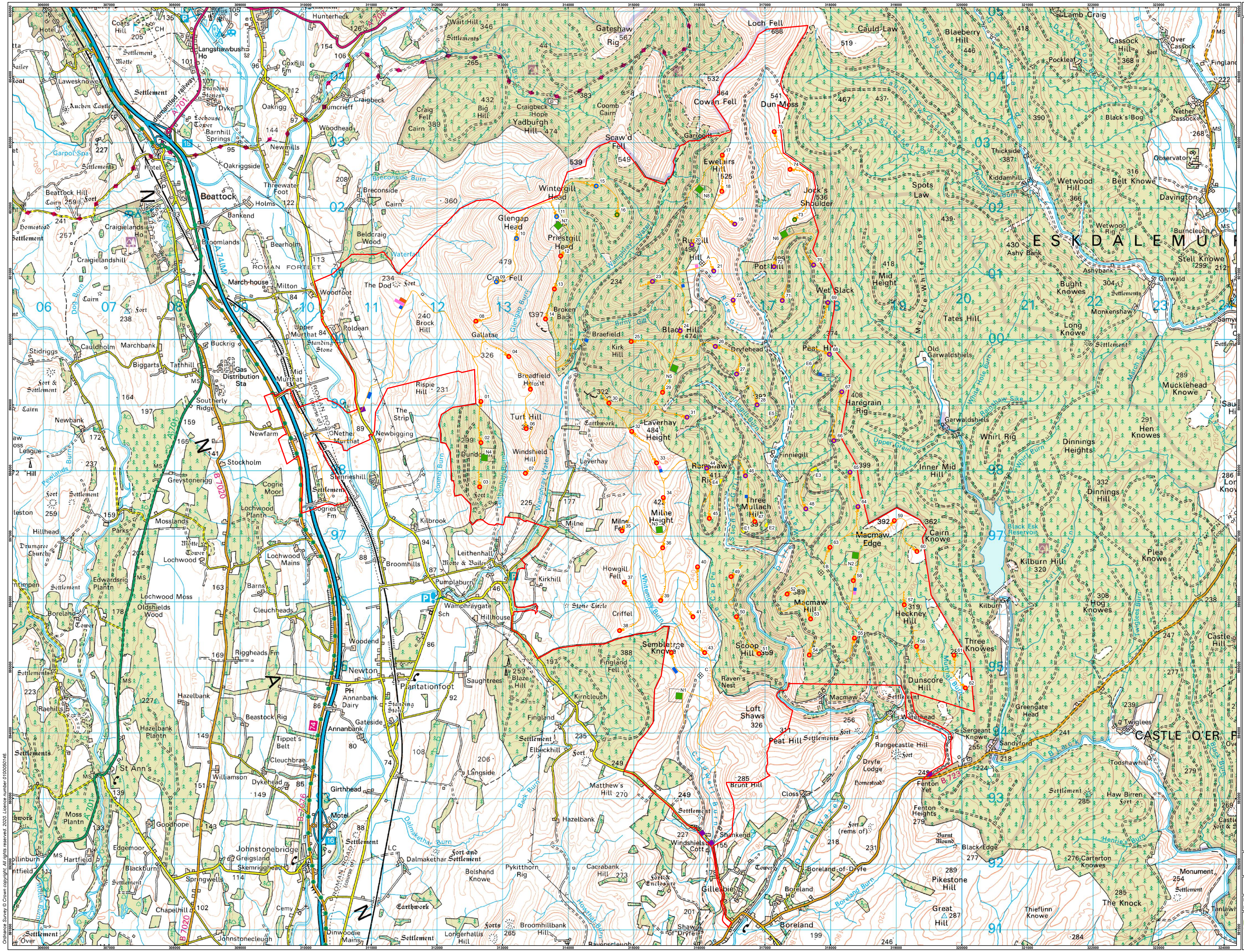
9.1.3 The development is situated on a complex geological foundation with bedrock of sandstone, mudstone and siltstone known as the Glendearg Foundation, metasandstone and metamudstone knows as the Carghidown Formation and the Hawick Wacke group.

9.1.4 The development utilises the existing infrastructure developed as part of the extensive commercial forestry which forms a part of the development area.

9.1.5 Borrow pit locations have been designed to take into consideration sensitive environmental receptors, avoiding deep peat over 0.5m, GWDTE's, watercourses, archaeological assets and other ecological or ornithological receptors.

9.1.6 Based on the quality of the locally sourced stone used in the creation of the existing onsite access tracks and the results of a professional petrographic study, the material on site is expected to be of sufficient quality and quantity to meet the criteria for construction. It is not expected that aggregate will need to be sourced from outwith of the development area.

374 Scoop Hill



Legend

- Site Boundary
- Wind Turbine (180m to tip)
- Wind Turbine (200m to tip)
- Wind Turbine (225m to tip)
- Wind Turbine (250m to tip)
- Permanent Met Masts
- Access Tracks
- Site Entrance
- Existing Access Tracks to be Upgraded
- Substation & Control Room
- Substation & Control Room Construction Compound
- Temporary Construction Compound
- Borrow Pit
- Existing Quarries or Borrow Pit
- Borrow Pit Area of Search

Notes: N/A
Revisions: N/A
Turbine Layout: 374-191212-9018

0 250 500 1,000 m
Scale: 1: 25,000 @ A1
N

Figure 2.1 - Site Layout

Date: 31/07/2020	Ref: 374-200422-7278-A	
Produced: DR	Reviewed: SM	Approved: GC

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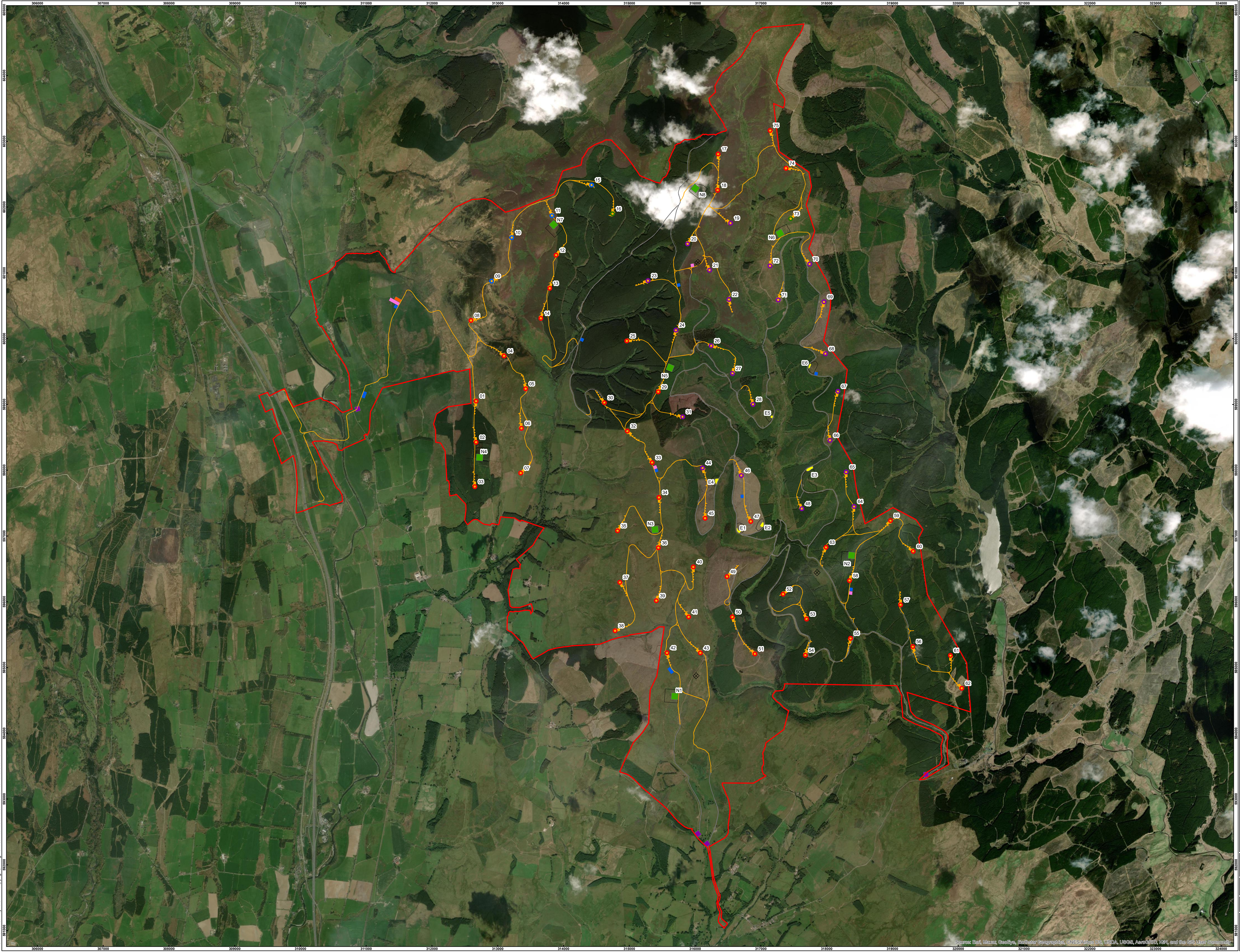
374 Scoop Hill



Legend

- Site Boundary
- Wind Turbine (180m to tip)
- Wind Turbine (200m to tip)
- Wind Turbine (225m to tip)
- Wind Turbine (250m to tip)
- Permanent Met Masts
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- Substation & Control Room
- Substation & Control Room Construction Compound
- Temporary Construction Compound
- Borrow Pit
- Existing Quarries or Borrow Pit
- Borrow Pit Area of Search

Notes: N/A
Revisions: N/A
Turbine Layout: 374-191212-9018

0 250 500 1,000 m
Scale: 1: 25,000 @ A1
N

Figure 2.2 - Site Layout (Aerial Imagery)

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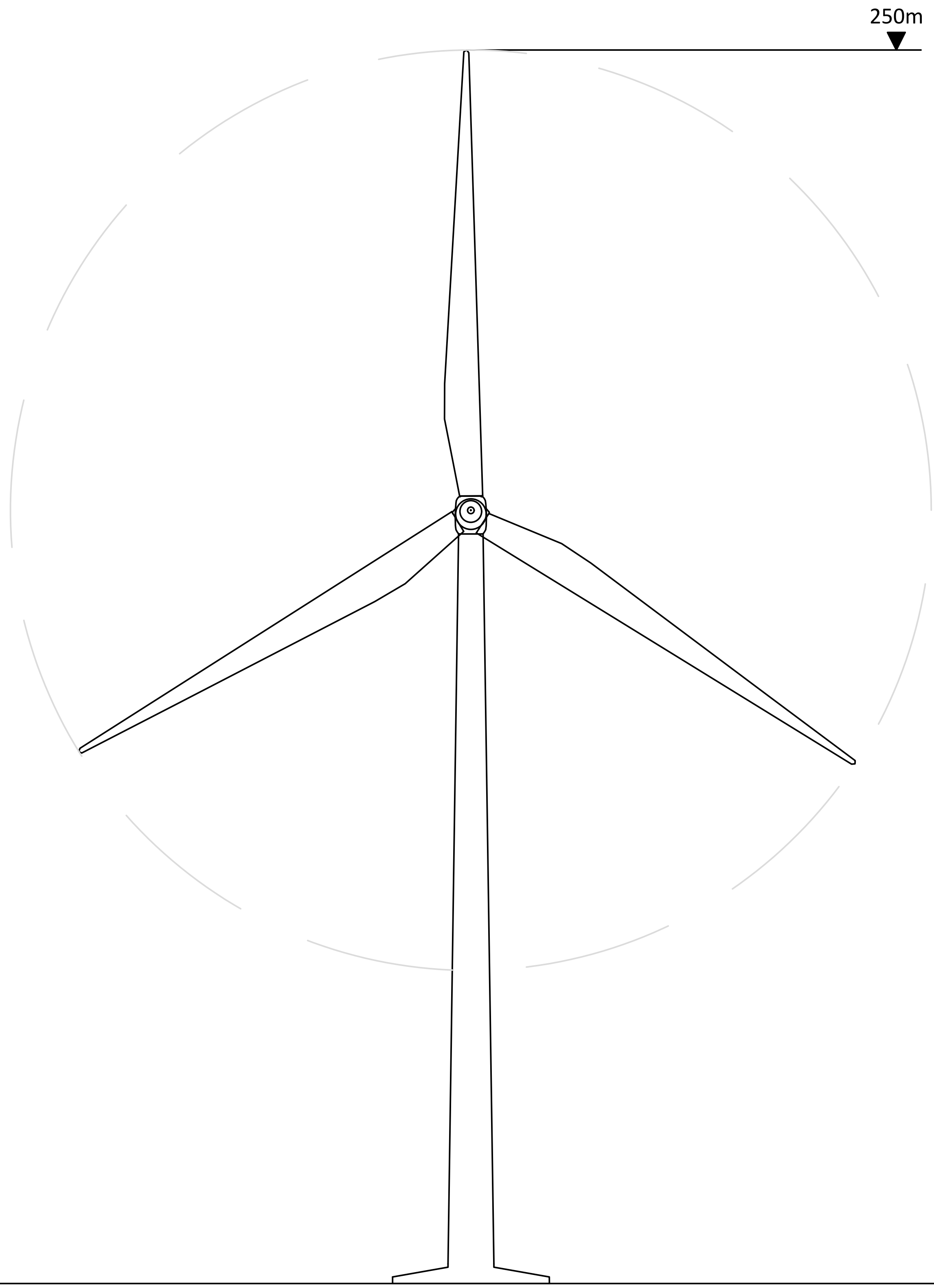
Scale: 1:1,250 @A3



374 Scoop Hill

Recommended Turbine Colour

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

Notes: Maximum Hub Height 175m
Revisions:

Figure 2.3a - Typical Wind Turbine Specification (250m Tip Height)

Date: 30/07/2020 Ref: 374-200730-7379
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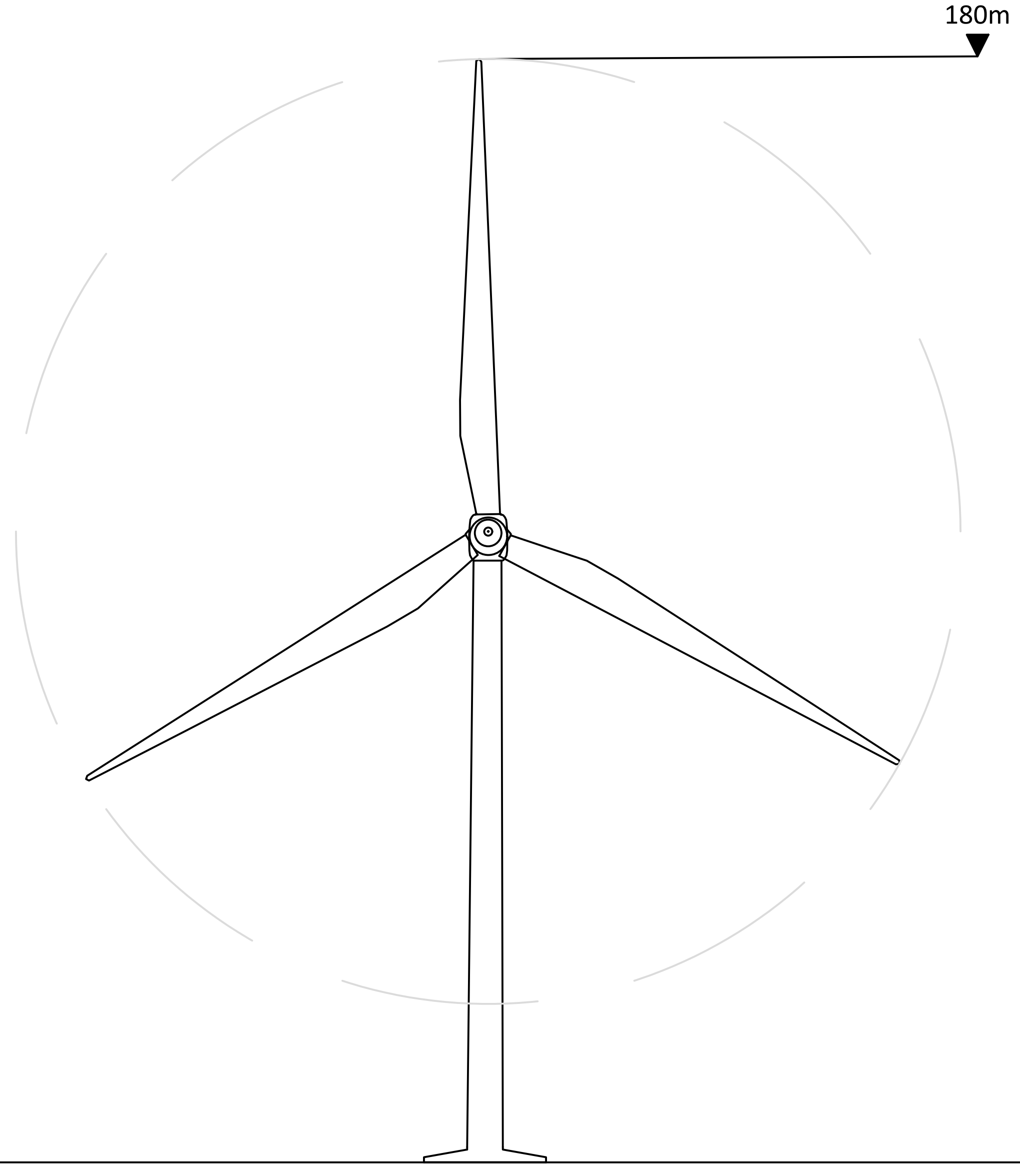
Scale: 1:1,250 @A3



374 Scoop Hill

Recommended Turbine Colour

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

Notes: Maximum Hub Height 105m
Revisions:

Figure 2.3b - Typical Wind Turbine Specification (180m Tip Height)

Date: 30/07/2020 Ref: 374-201103-7425

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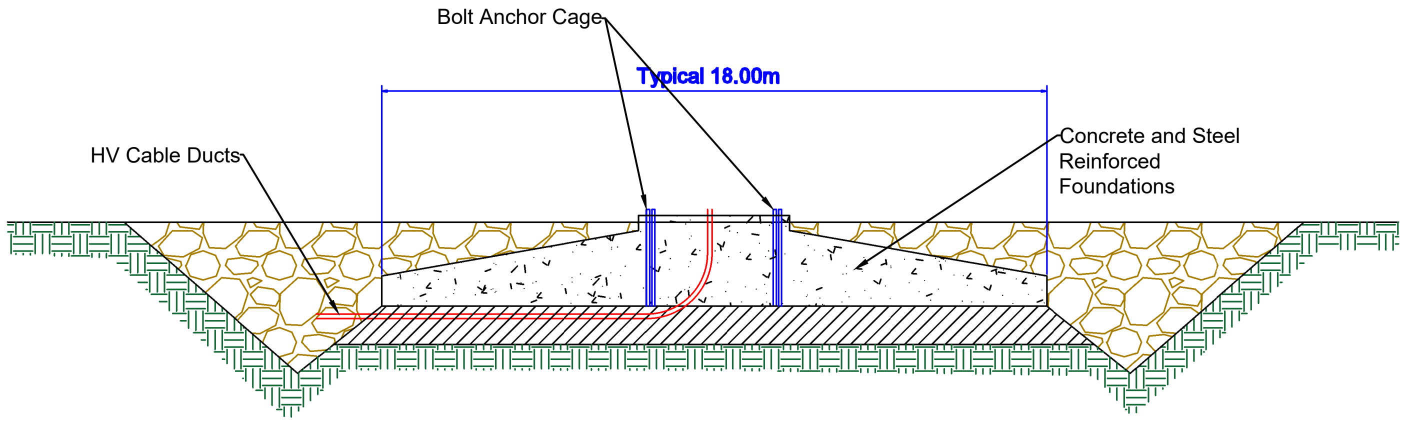
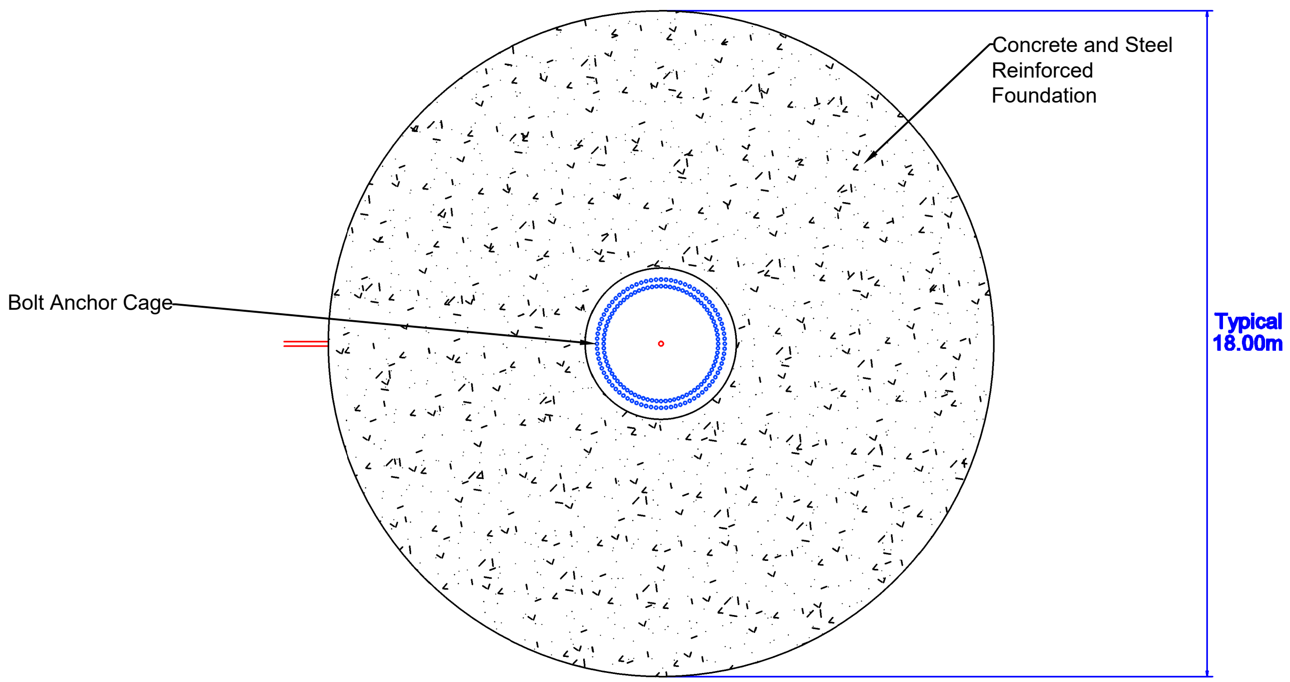
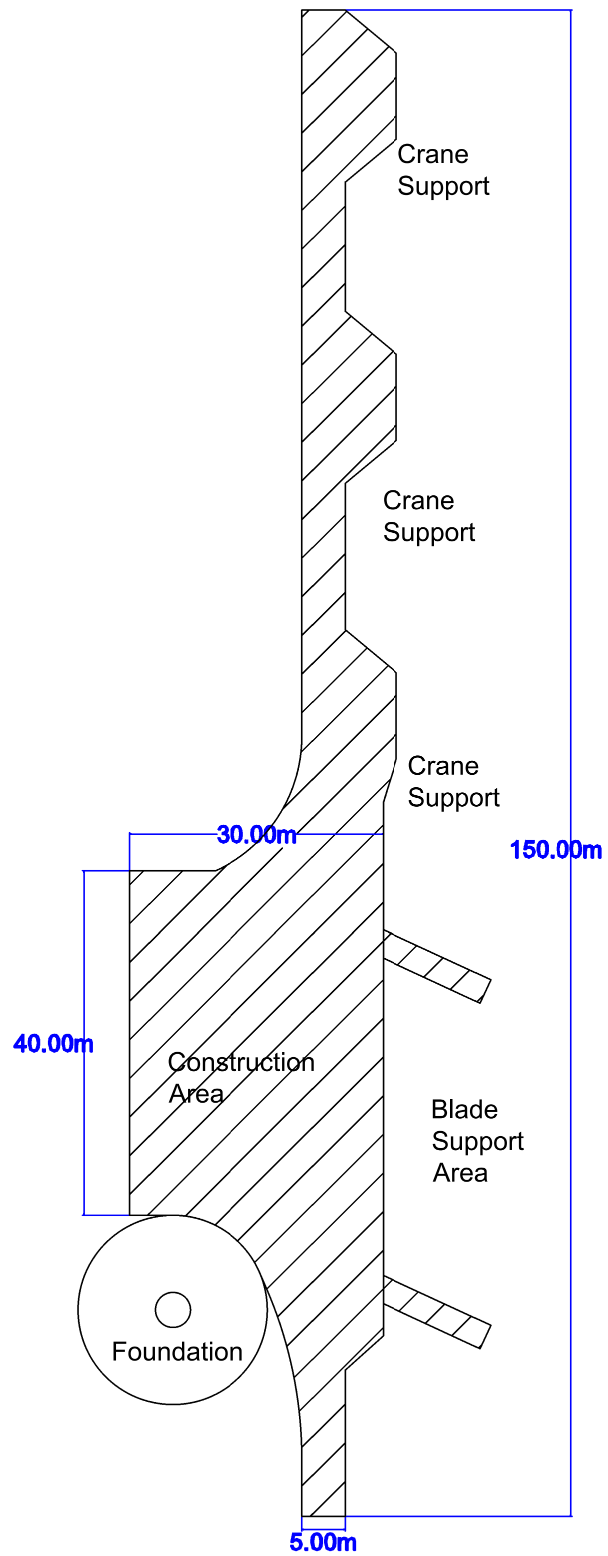


Section View of Typical Turbine Foundation



Plan View of Typical Turbine Foundation

Scale: NTS



Typical Crane Hardstand Area

Scale: NTS

374 Scoop 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 2.4 - Typical Foundation & Crane Hardstand Design

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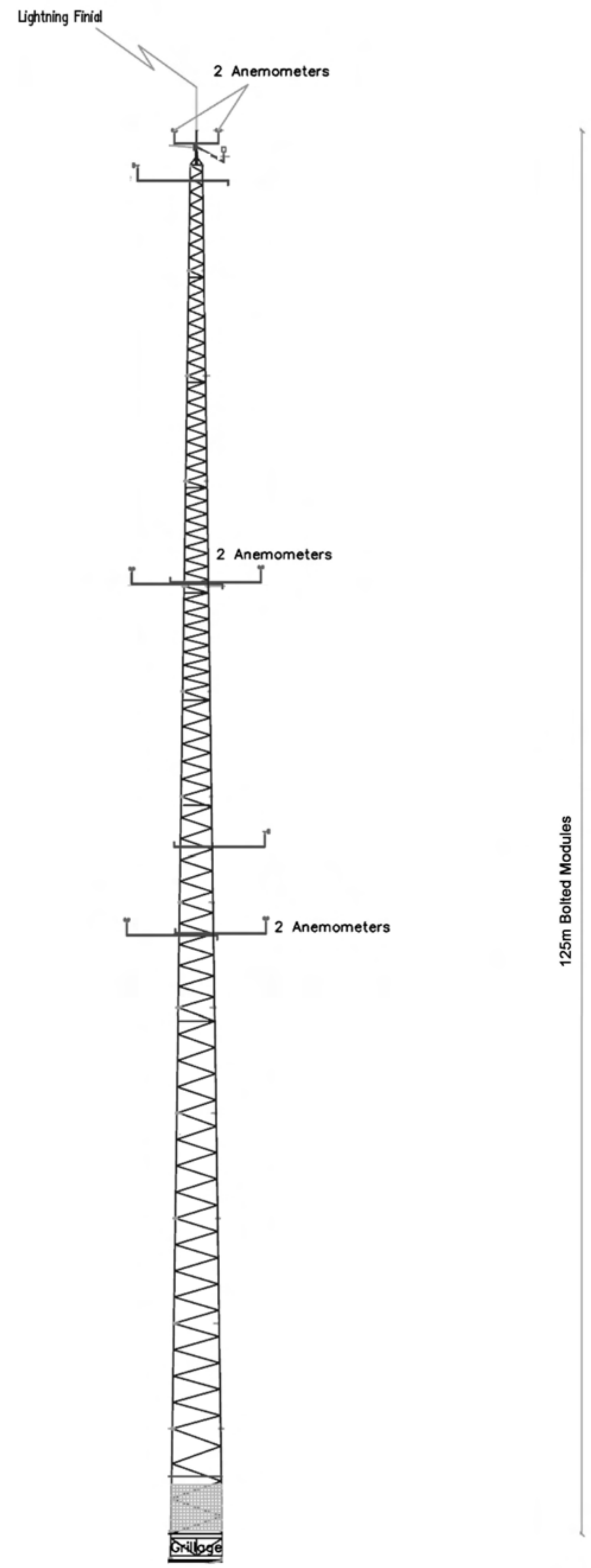
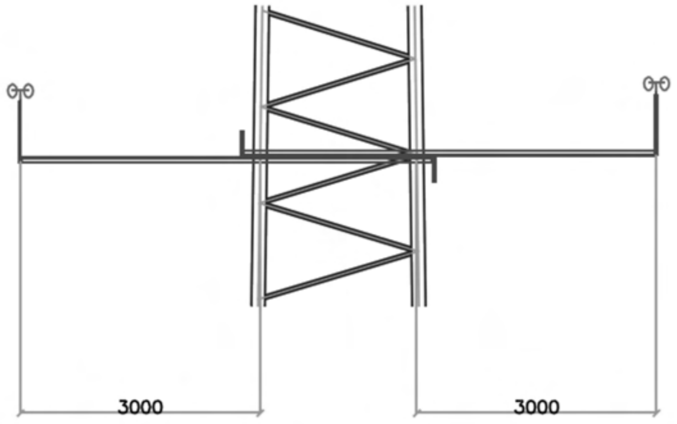
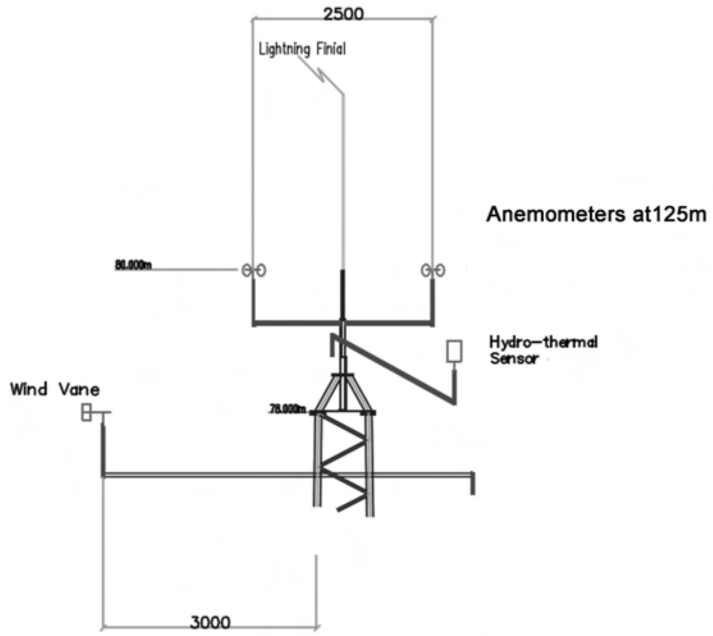
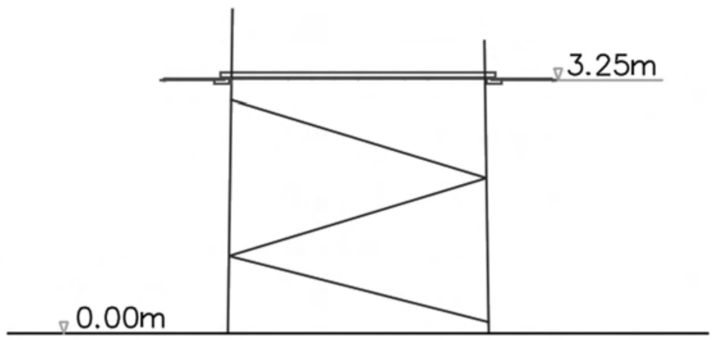




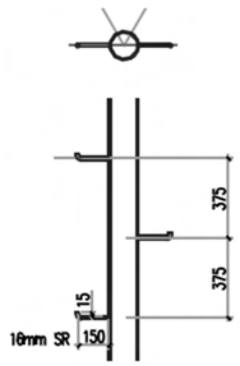
Typical Anemometer Support Booms



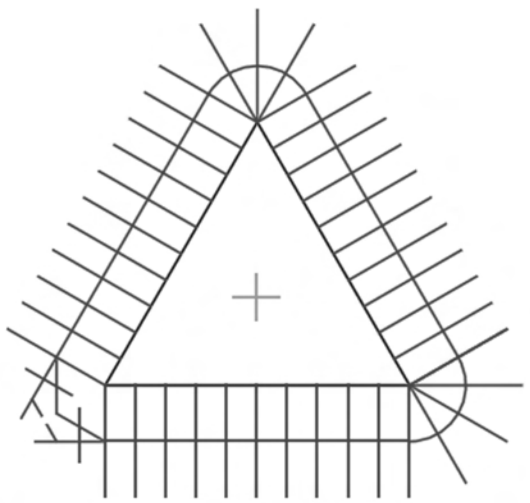
Tower Peak, Sliding Pole and Typical Booms



Base of Met Mast at ground level



Climbing Step Bolts on one leg



Plan View of Anti-climbing Device at 3.25m above ground

Notes:

1. The tower is triangular lattice construction with circular hollow sections throughout.
2. Wind loading and design in accordance with BS8100 and BS5950.
3. All steelworks would be supplied in accordance with current British Standards of grades S275 and S355.
4. All connections for bracing members will be with a minimum 2 bolts of grade 8.8 complete with nuts and spring washers.
5. All steelworks would be hot dip galvanised to BS EN ISO 1641 with minimum average coating of 85 microns.
6. The Lightning Finial would be fitted to the tower top and each leg of the tower should be connected to an adequate earth system with copper tapes.

NOT TO SCALE

Figure 2.5 - Typical Self Supporting Meteorological Mast

Date:30/07/2020 Ref: 374-200730-7380

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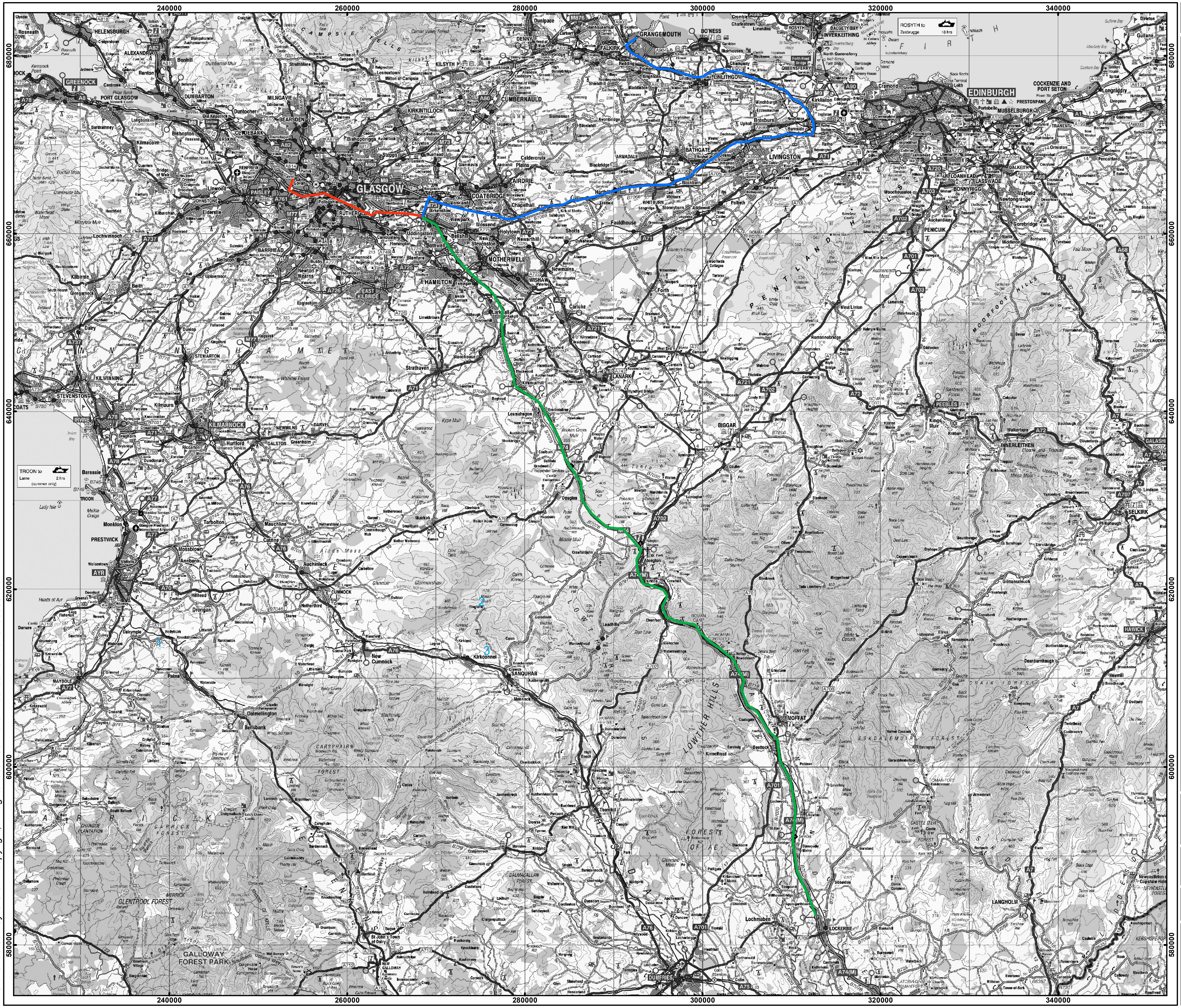
374 Scoop Hill



Legend

- Access Along A74(M)
- Route from Grangemouth Port
- Route from King George V Dock

Notes: N/A
Revisions: N/A

0 5 10 20 Km
N
Scale: 1:400,000 @ A3

Figure 2.6a - Proposed Abnormal Access Routes (Port to A74(M))

Date: 31/07/2020 Ref: 374-200422-7280
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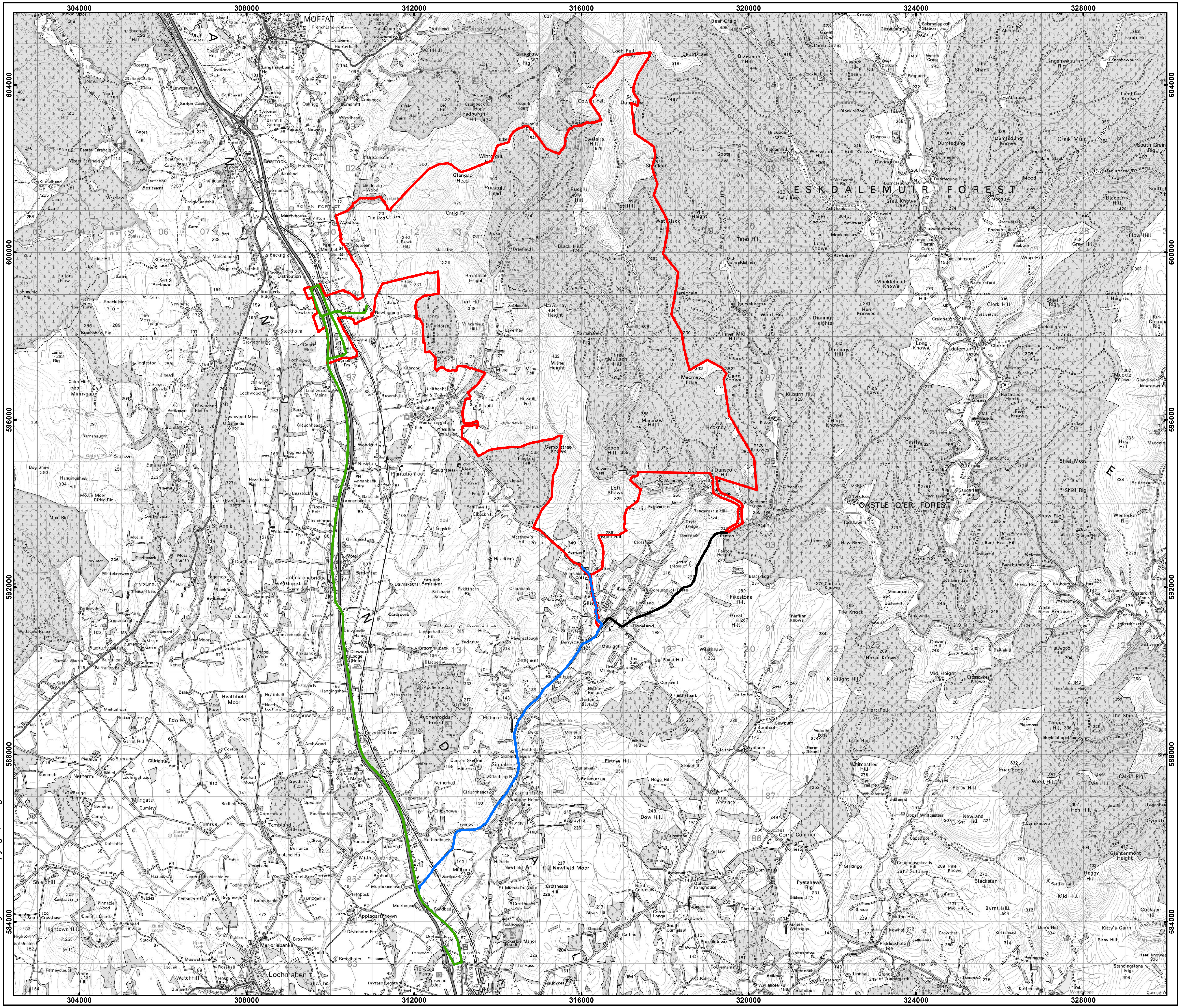

374 Scoop Hill

Legend

- Site Boundary
- Option 1
- Option 2
- Option 3

Notes: N/A
Revisions: N/A

0 1,000 2,000 4,000 m

Scale: 1:85,000 @ A3

N

Figure 2.6b - Proposed Abnormal and Construction Access Routes

Date: 31/07/2020 Ref: 374-200602-7304
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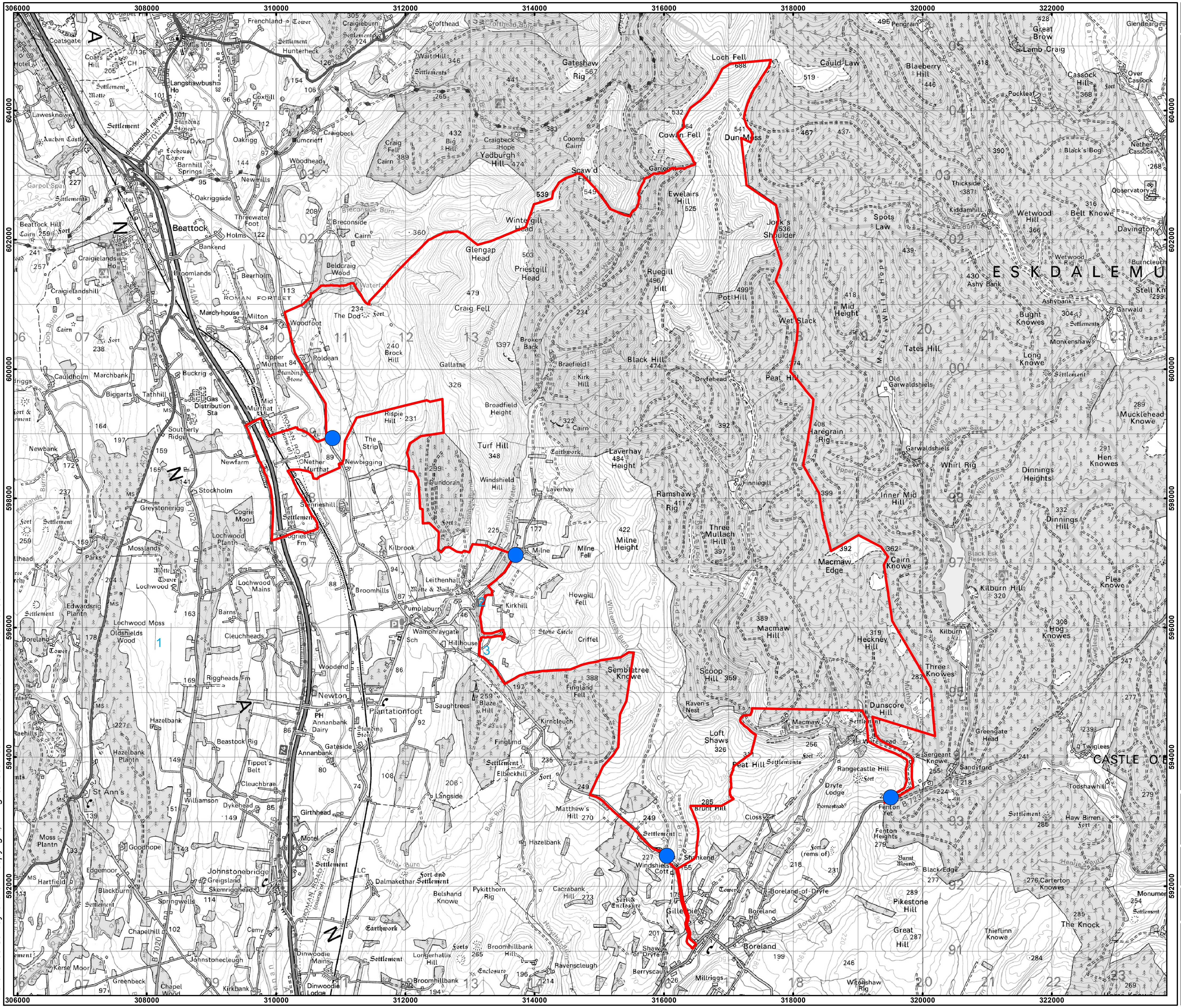

374 Scoop Hill

Legend

- Site Boundary
- Operational and Emergency Access Points

Notes: N/A
Revisions: N/A

0 500 1,000 2,000 m

Scale: 1:55,000 @ A3

N

Figure 2.6c - Proposed Operational and Emergency Access Points

Date: 02/06/2020 Ref: 374-200602-7305

Produced: DR Reviewed: SM Approved: GC

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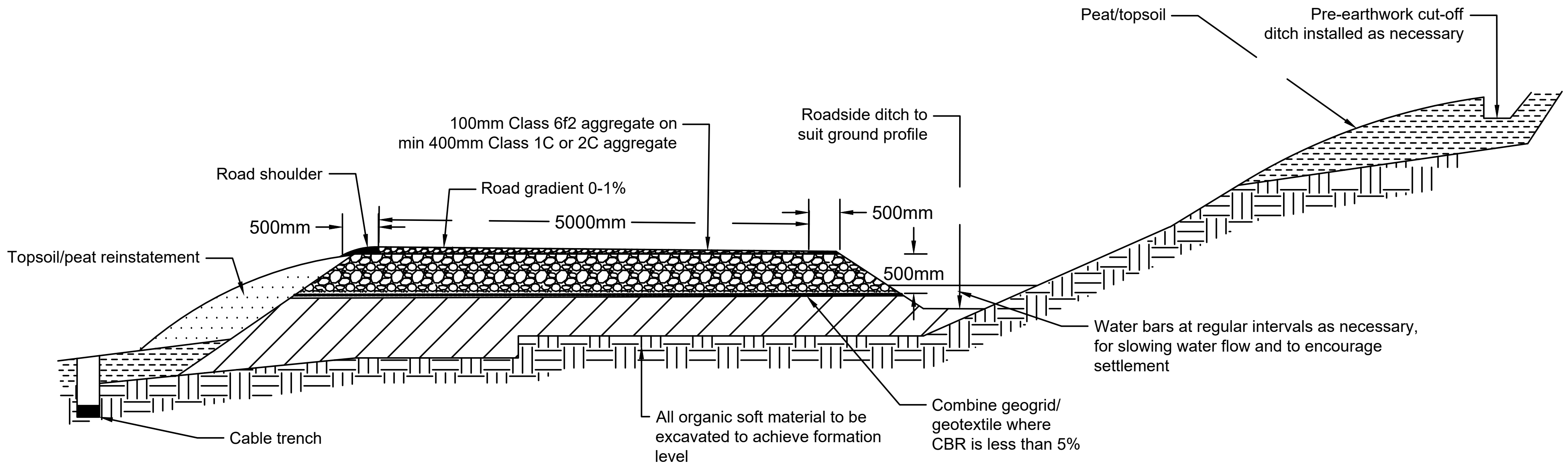
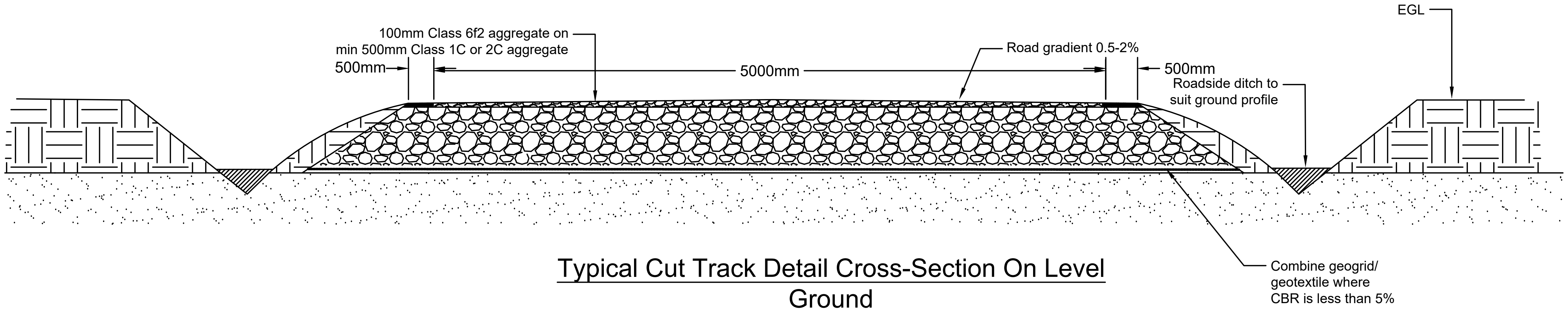
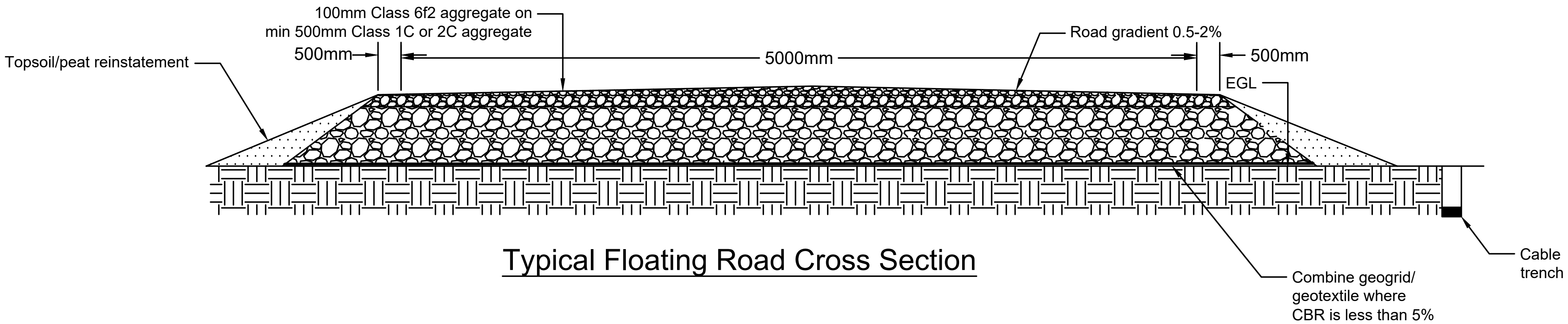
Not To Scale



Typical Cut Track Detail Cross-Section On Slightly Sloping Ground



Typical Cut Track Detail Cross-Section On Level Ground



Typical Floating Road Cross Section

374 Scoop Hill

Notes: N/A
Revisions: N/A

Figure 2.7a - Typical Access Track Design

Date: 30/07/2020 Ref: 374-200730-7375
Produced: DR Reviewed: SM Approved: RF

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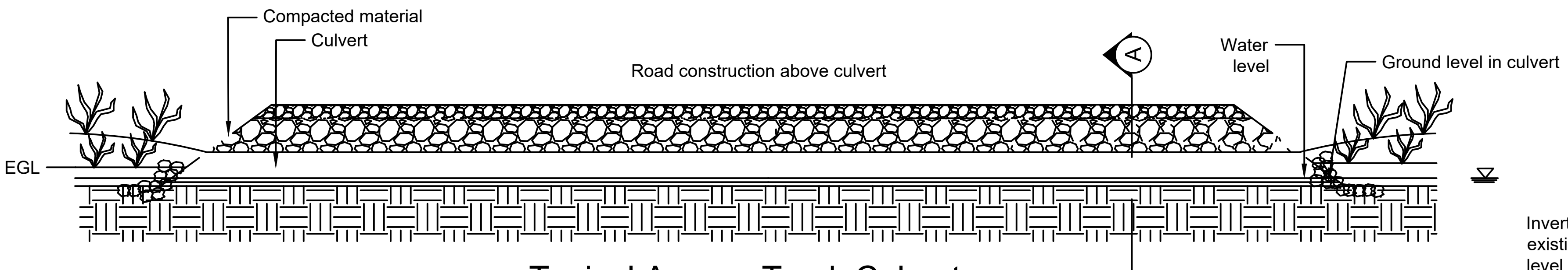
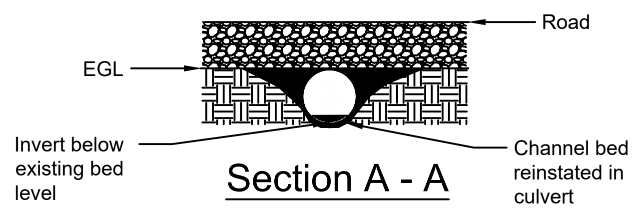
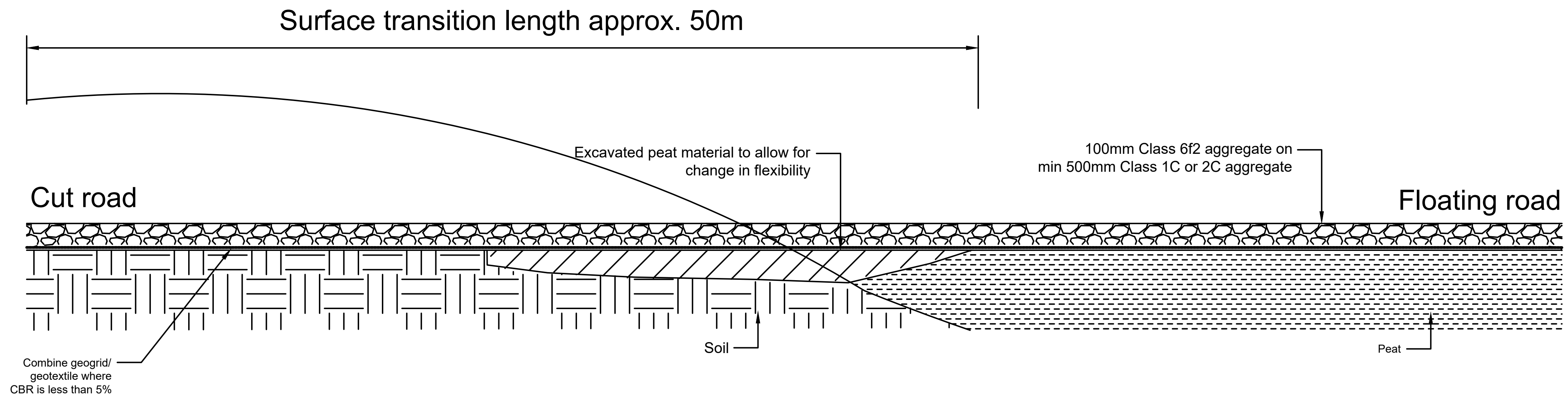
374 Scoop Hill



Typical Access Track Culvert



Section A - A



Typical Transition From Floating Road To Cut Track Construction Detail

Notes: NTS
Revisions:

Figure 2.7b - Typical Access Track, Track Methodology And Culvert Design

Date:30/07/2020 Ref: 374-200730-7376
Produced: DR Reviewed: SM Approved: RF

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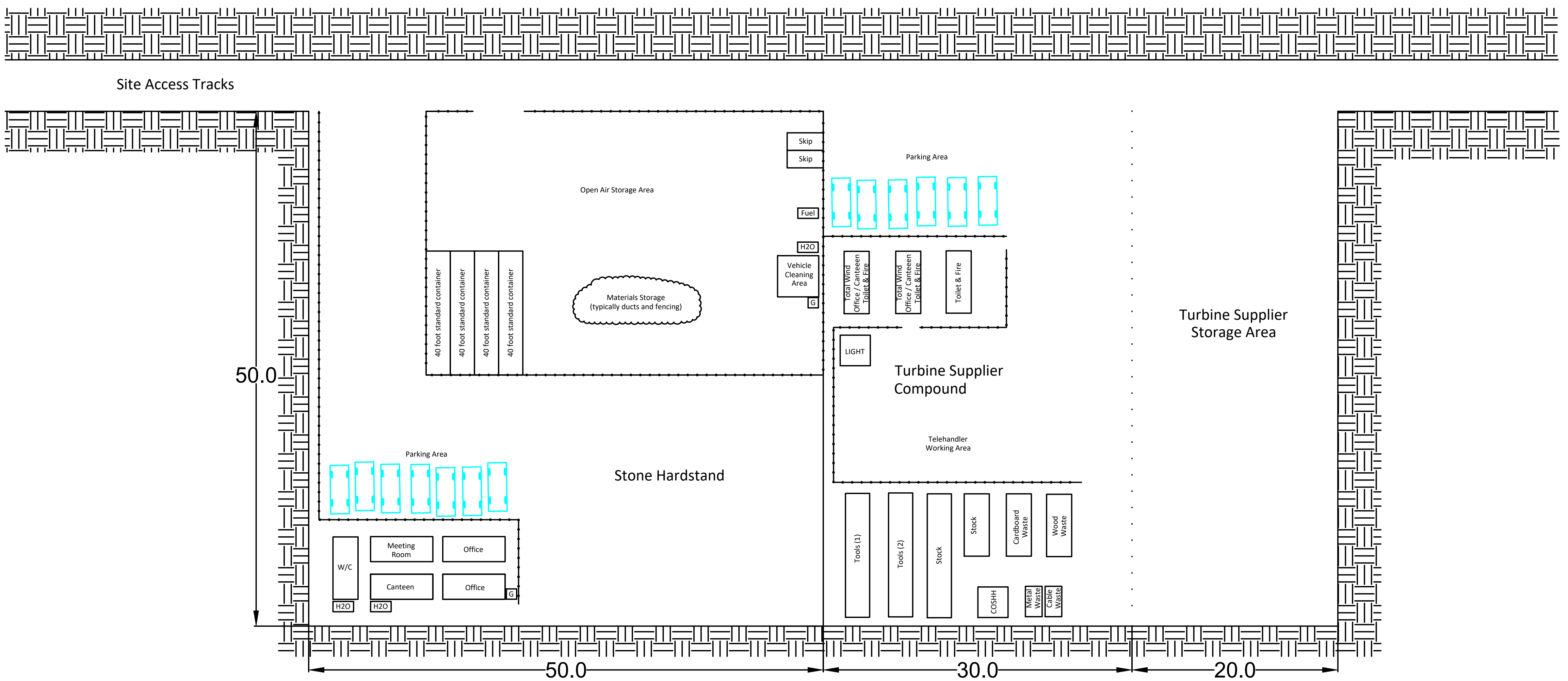
Scale: 1:500 @ A3



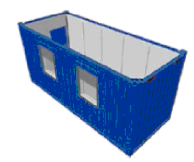
374 Scoop Hill

Legend

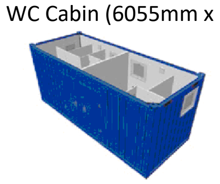
Fence
Generator
Car / LGV
Fuel Bowser
Water Bowser

Compound Items

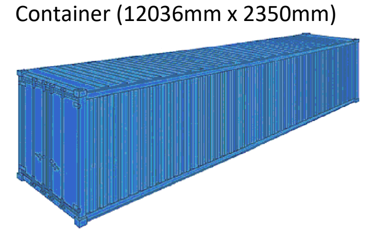
Office Cabin (6055mm x 2435mm)



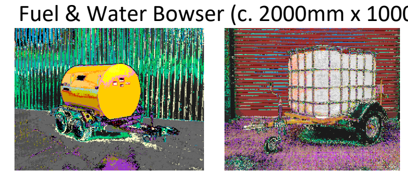
WC Cabin (6055mm x 2435mm)



Container (12036mm x 2350mm)

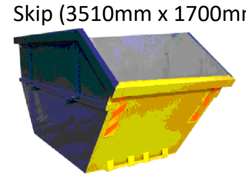


Fuel & Water Bowser (c. 2000mm x 1000mm)



Diesel Generator (c. 1000mm x 1000mm)

Skip (3510mm x 1700mm)



Notes:
Individual cabins have internal lighting and external safety lighting.
A mobile lighting column will also be located in the compound area.
Rolled stone finish for temporary site compound finished surface.

Revisions: N/A

Figure 2.8- Typical Temporary Construction Compound Layout

Date: 30/07/2020 Ref: 374-200730-7378

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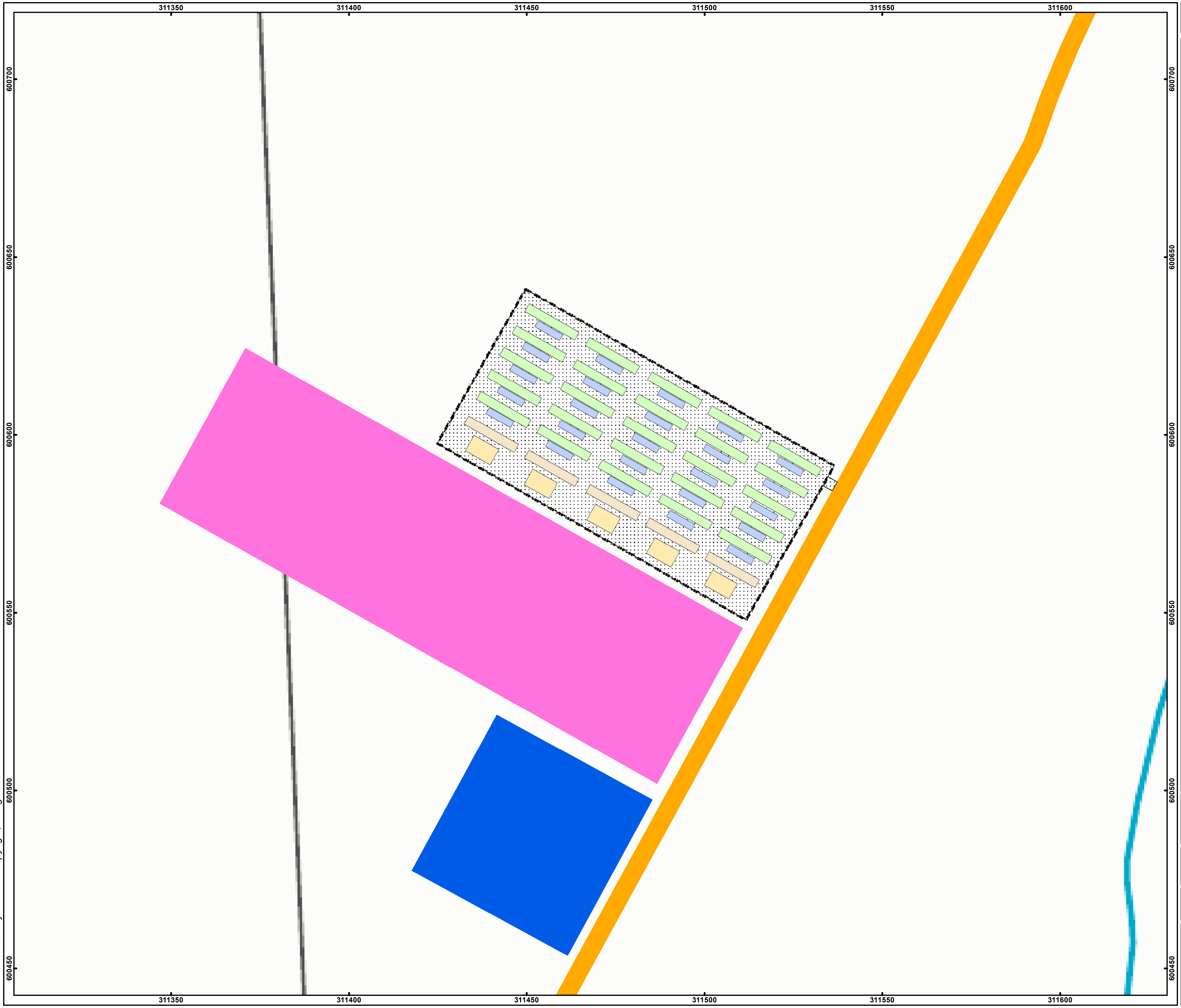


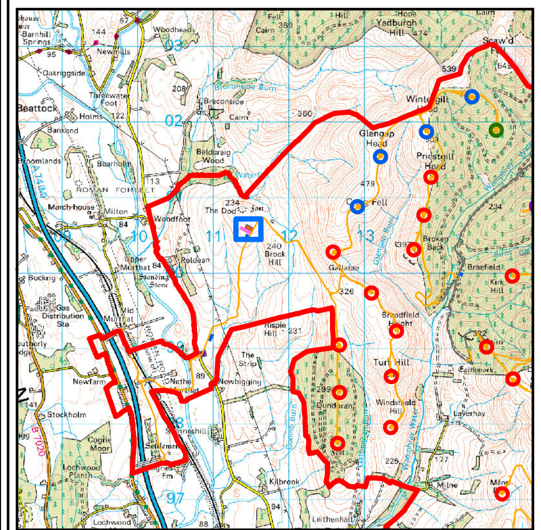
374 Scoop Hill

Legend

- Access Tracks
- Substation & Control Room
- Temporary Construction Compound

Primary Energy Storage Facility

- Containerised Unit
- Containerised Switchgear & Control Room
- Inverter & Equipment
- Transformer
- Access Track
- Security Fence



Notes: N/A
Revisions: N/A

0 12.5 25 50 m
Scale: 1:1,000 @ A3
N

Figure 2.9a - Typical Primary Energy Storage Facility Layout

Date: 28/07/2020 Ref: 374-200730-7381
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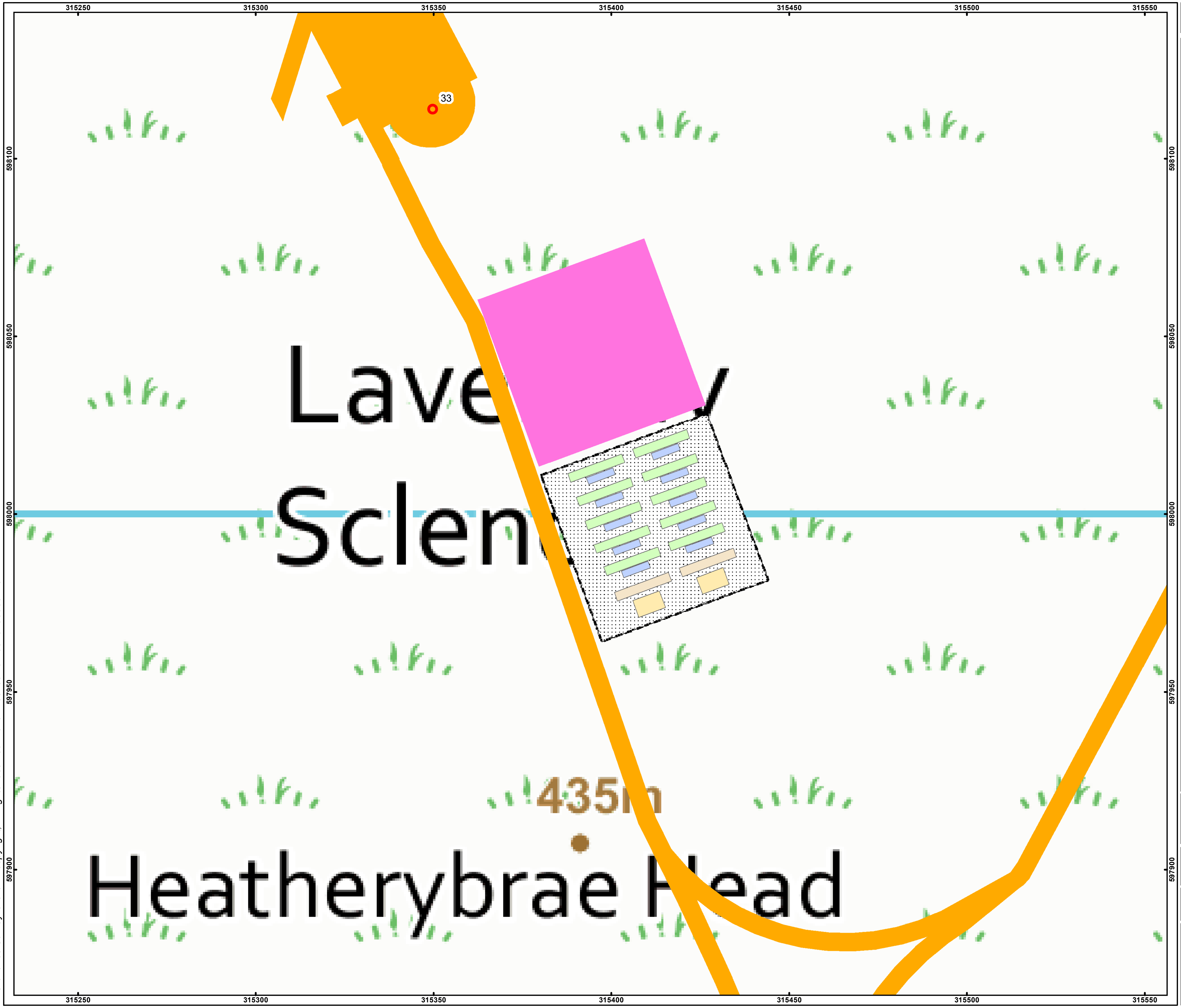
374 Scoop Hill

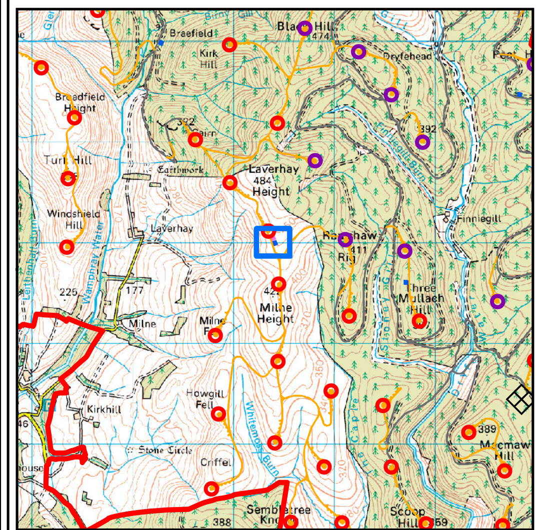


Legend

- Wind Turbine (180m to tip)
- Wind Turbine (200m to tip)
- Wind Turbine (225m to tip)
- Wind Turbine (250m to tip)
- Access Tracks
- Substation & Control Room

Satellite Energy Storage Facility

- Containerised Unit
- Containerised Switchgear & Control Room
- Inverter & Equipment
- Transformer
- Access Track
- Security Fence



Notes: N/A
Revisions: N/A

0 12.5 25 50 m
Scale: 1:1,000 @ A3
N

Figure 2.9b - Typical Satellite Energy Storage Facility Layout

Date: 28/07/2020 Ref: 374-200730-7382
Produced: DR Reviewed: SM Approved: GC

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Plate 2.1a - The wind turbines installed at Sanquhar Community Wind Farm

Plate 2.1b - The wind turbines installed at Sanquhar Community Wind Farm

Notes: N/A
Revisions: N/A

Plates 2.1a - 2.1b: Sanquhar Community Wind Farm

Date: 06/11/2020 Ref: 374-201106-7429

Produced: DR Reviewed: SM Approved: GC

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Plate 2.2a - Steel reinforcement which forms the turbine foundation at Sanquhar Community Wind Farm

Plate 2.2b - Steel reinforcement which forms the turbine foundation at Sanquhar Community Wind Farm

Plate 2.3a - Concrete finishing to a turbine foundation before backfilling at Sanquhar Community Wind Farm

Plate 2.3b - Concrete finishing to a turbine foundation after backfilling at Sanquhar Community Wind Farm

Notes: N/A
Revisions: N/A

Plates 2.2a - 2.3b : Turbine foundation

Date: 06/11/2020 Ref: 374-201106-7430
Produced: DR Reviewed: SM Approved: GC

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Plate 2.4a - The construction of a floating road at Sanquhar Community Wind Farm

Plate 2.4b - Floating track into cut track transition at Sanquhar Community Wind Farm

Plate 2.4c - Completed floating access track at Sanquhar Community Wind Farm

Plate 2.5 - Drainage Ditch Adjacent to access track at Sanquhar Community Wind Farm

Notes: N/A
Revisions: N/A

Plates 2.4a - 2.5 : Access Track Construction

Date: 06/11/2020 Ref: 374-201106-7431
Produced: DR Reviewed: SM Approved: GC

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Legend

Reinstated Borrow Pit

Plate 2.6 - Borrow pit operation at Sanquhar Community Wind Farm

Plate 2.7a - Borrow pit reinstatement at Sanquhar Community Wind Farm

Plate 2.7b - Borrow pit reinstatement at Sanquhar Community Wind Farm

Plate 2.7c - Borrow pit reinstatement at Sanquhar Community Wind Farm

Notes: N/A
Revisions: N/A

Plates 2.6 - 2.7c: Borrow Pits

Date: 06/11/2020 Ref: 374-201106-7432

Produced: DR Reviewed: SM Approved: GC

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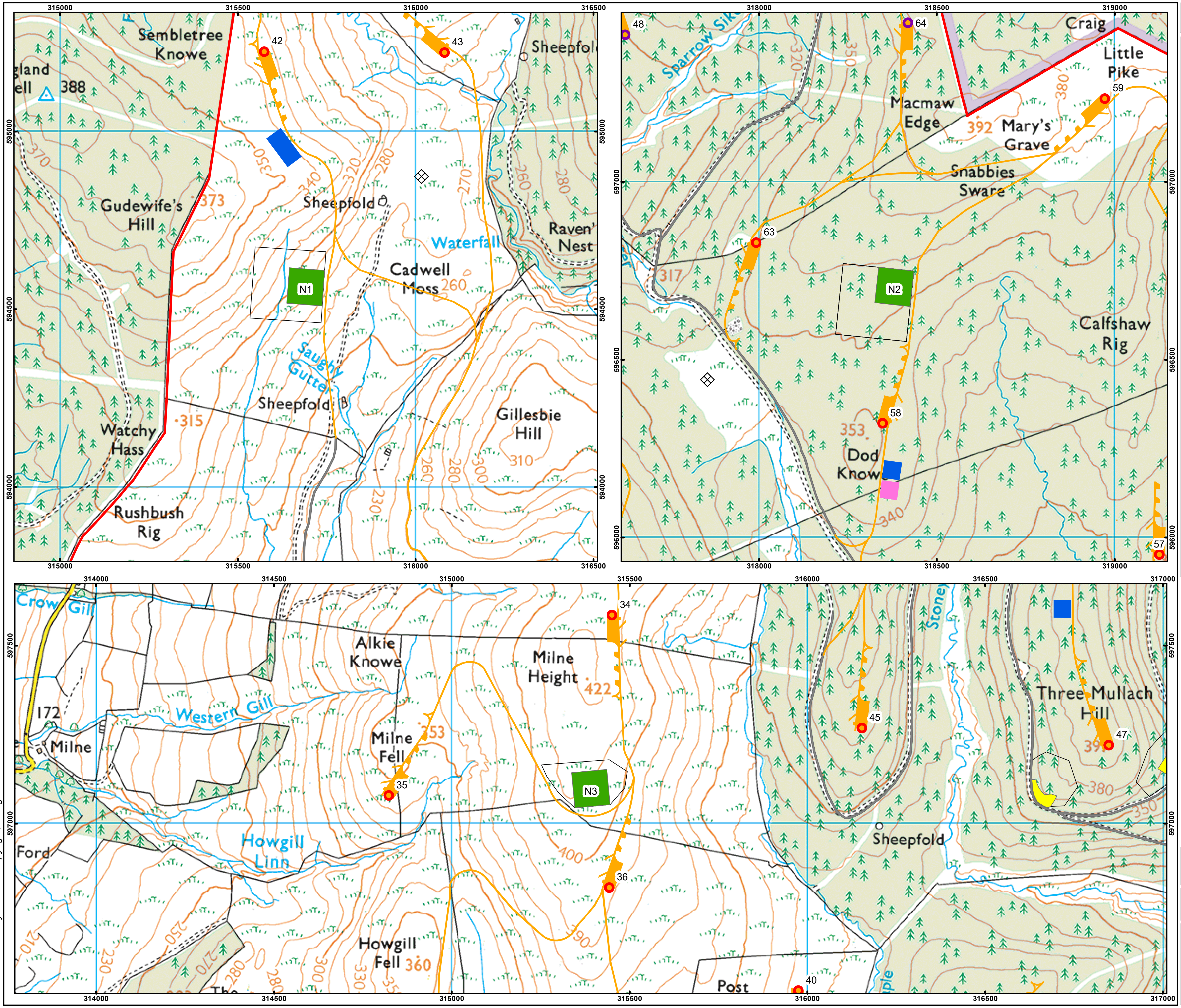
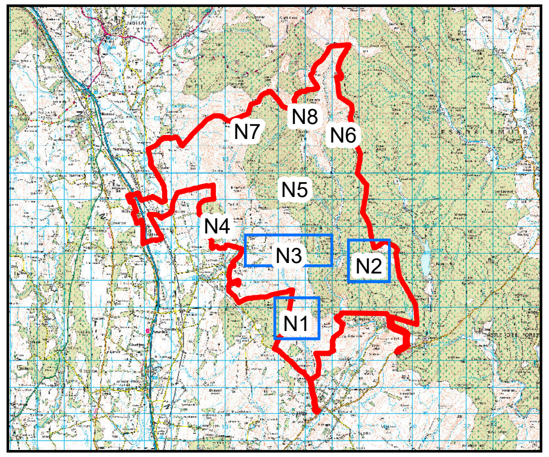
374 Scoop Hill



Legend

- Site Boundary
- Wind Turbine (180m to tip)
- Wind Turbine (200m to tip)
- Wind Turbine (225m to tip)
- Wind Turbine (250m to tip)
- Permanent Met Masts
- Access Tracks
- Site Entrance
- Existing Access Tracks to be Upgraded
- Substation & Control Room
- Substation & Control Room Construction Compound
- Temporary Construction Compound
- Borrow Pit
- Existing Quarries or Borrow Pit
- Borrow Pit Area of Search

Notes: N/A
Revisions: N/A



0 125 250 500 m
N
Scale: 1:10,000 @ A3

Figure A – Proposed New Borrow Pit Locations – N1 to N3

Date: 22/04/2020 Ref: 374-200422-7281
Produced: DR Reviewed: SM Approved: GC

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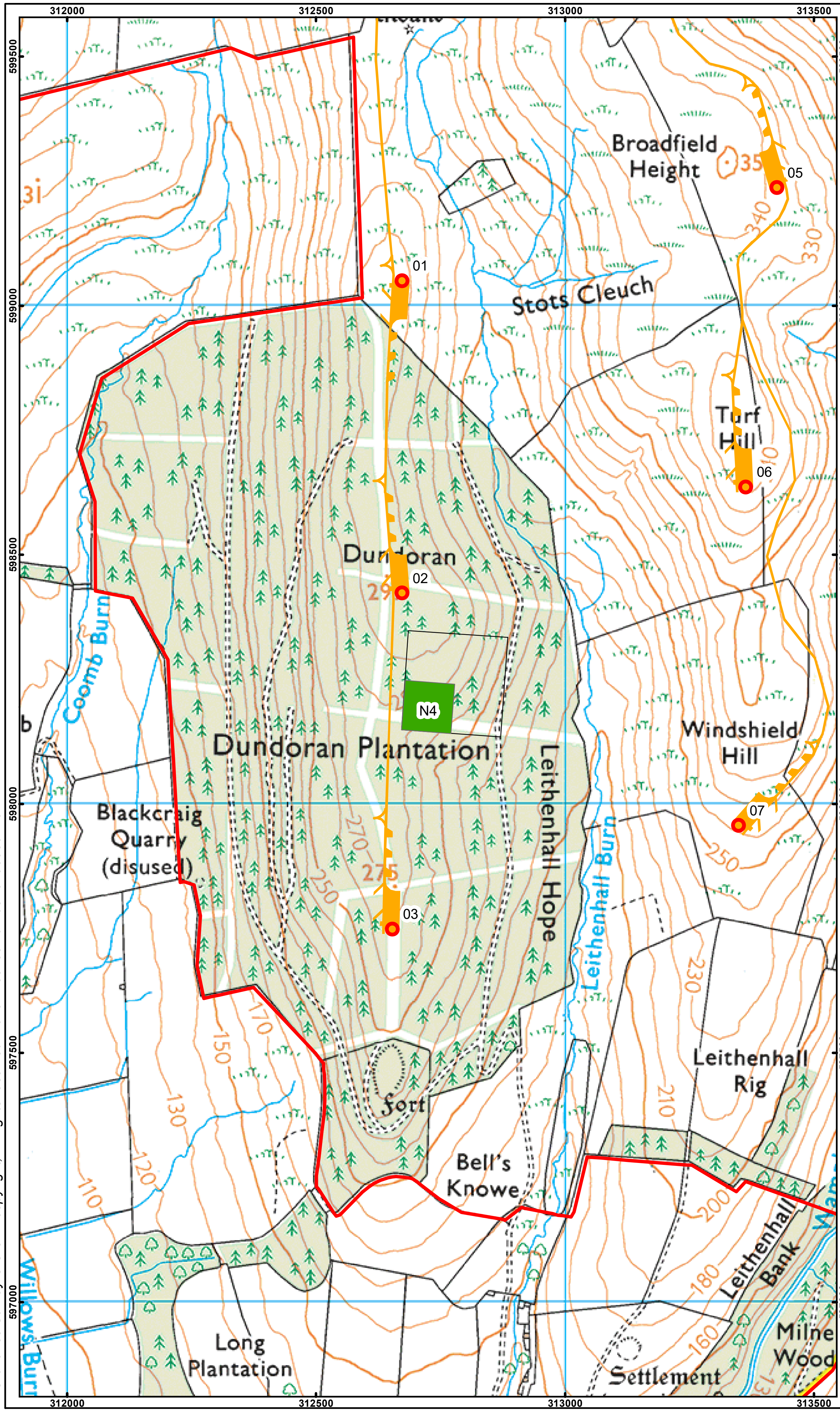
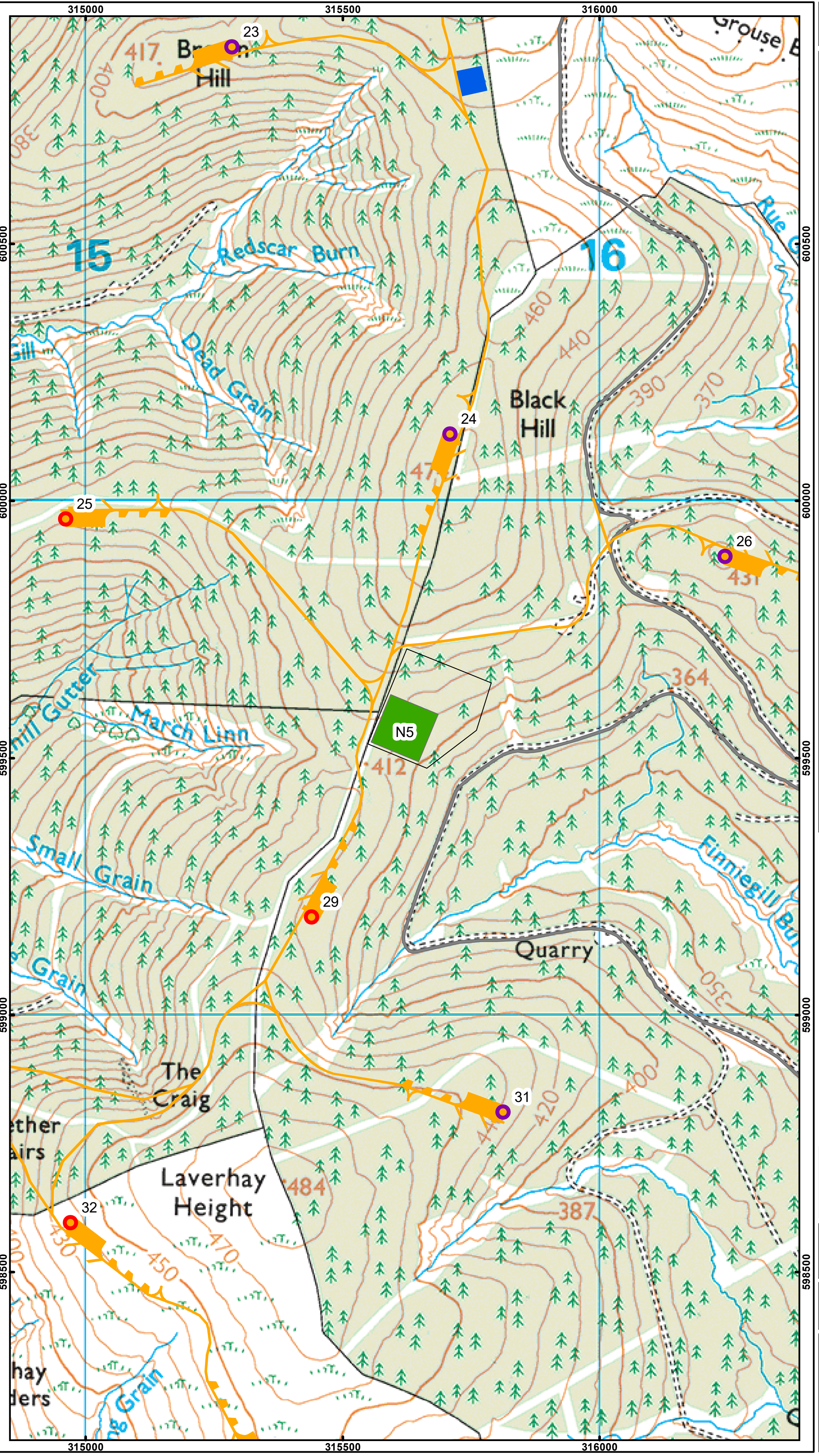
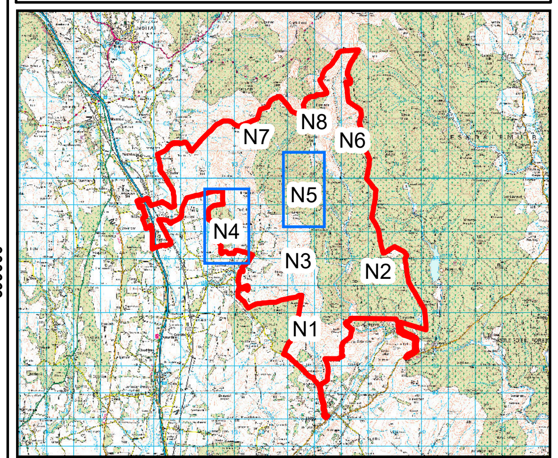




Legend

- Site Boundary
- Wind Turbine (180m to tip)
- Wind Turbine (200m to tip)
- Wind Turbine (225m to tip)
- Wind Turbine (250m to tip)
- Permanent Met Masts
- Access Tracks
- Site Entrance
- Existing Access Tracks to be Upgraded
- Substation & Control Room
- Substation & Control Room Construction Compound
- Temporary Construction Compound
- Borrow Pit
- Existing Quarries or Borrow Pit
- Borrow Pit Area of Search

Notes: N/A
Revisions: N/A



0 125 250 500 m
Scale: 1:10,000 @ A3
N

Figure B – Proposed New Borrow Pit Locations – N4 & N5

Date: 22/04/2020 Ref: 374-200422-7282
Produced: DR Reviewed: SM Approved: GC

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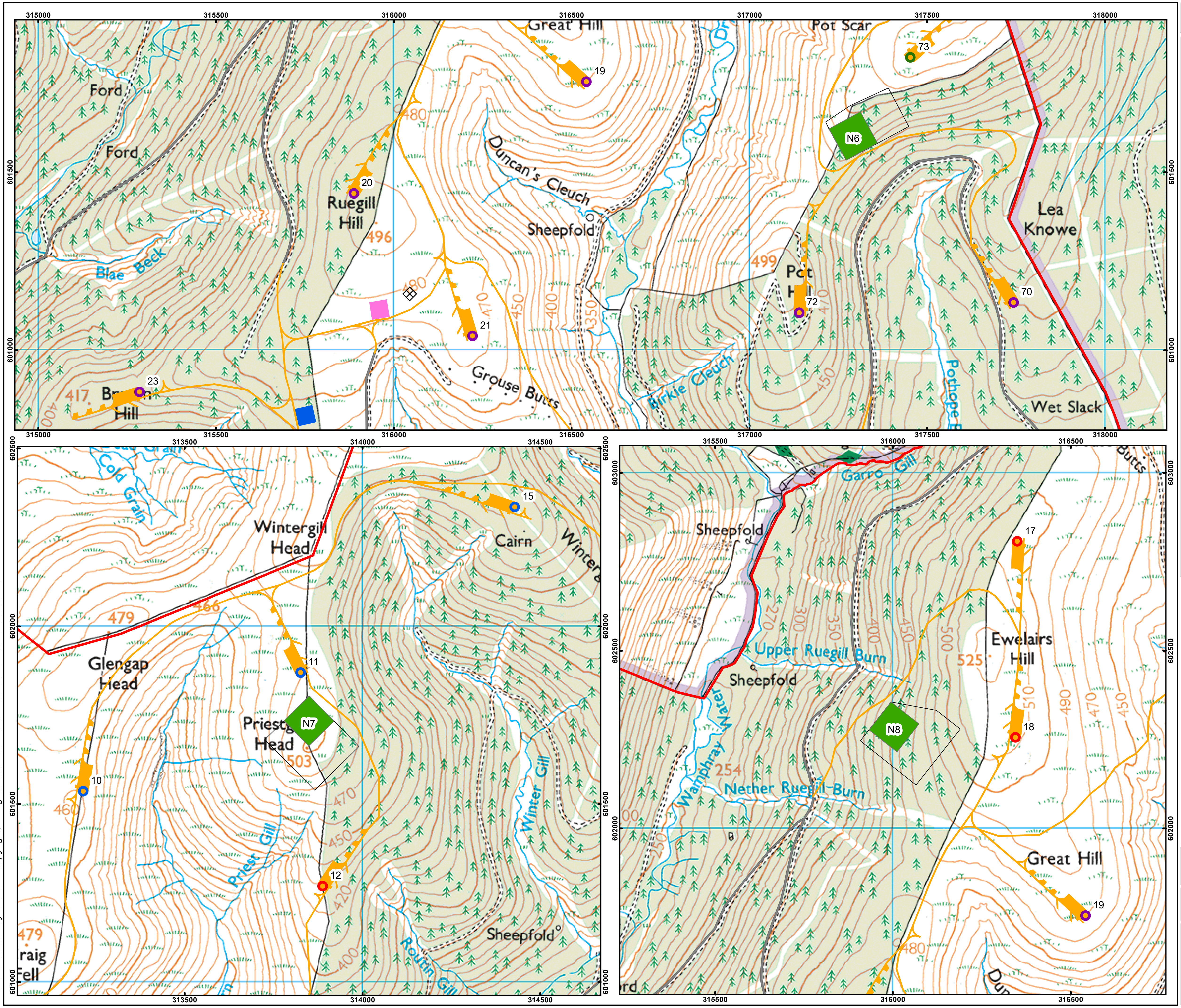
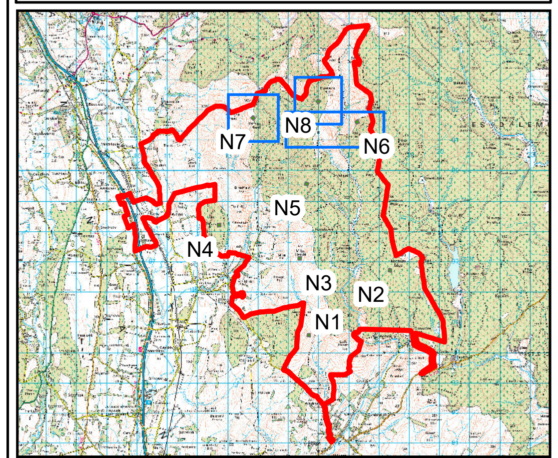


Legend

- Site Boundary
- Wind Turbine (180m to tip)
- Wind Turbine (200m to tip)
- Wind Turbine (225m to tip)
- Wind Turbine (250m to tip)
- Permanent Met Masts
- Access Tracks
- Site Entrance
- Existing Access Tracks to be Upgraded
- Substation & Control Room
- Substation & Control Room Construction Compound
- Temporary Construction Compound
- Borrow Pit
- Existing Quarries or Borrow Pit
- Borrow Pit Area of Search

Notes: N/A
Revisions: N/A



0 125 250 500 m
N
Scale: 1:10,000 @ A3

Figure C – Proposed New Borrow Pit Locations – N6 to N8

Date: 22/04/2020 Ref: 374-200422-7283
Produced: DR Reviewed: SM Approved: GC

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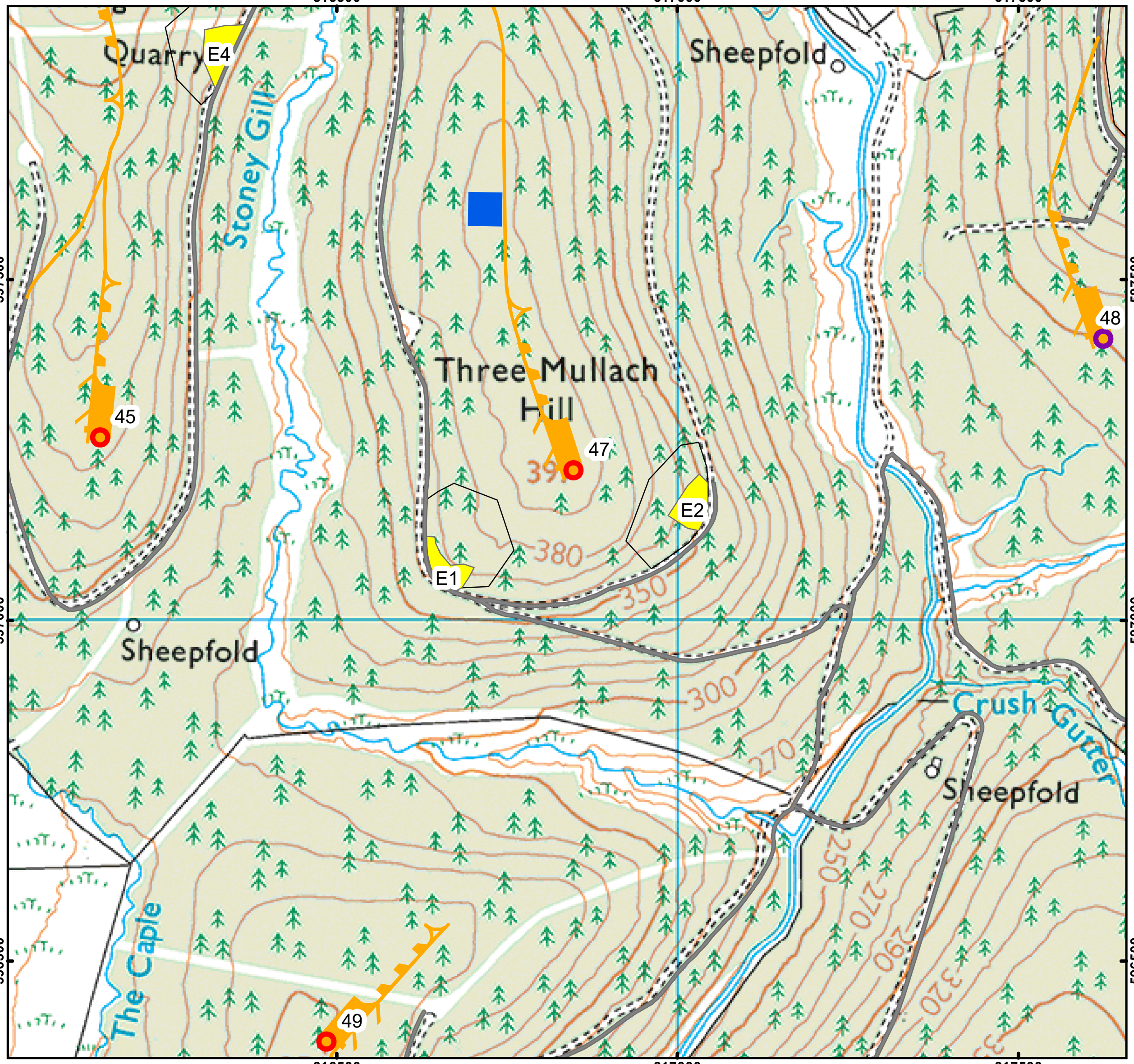
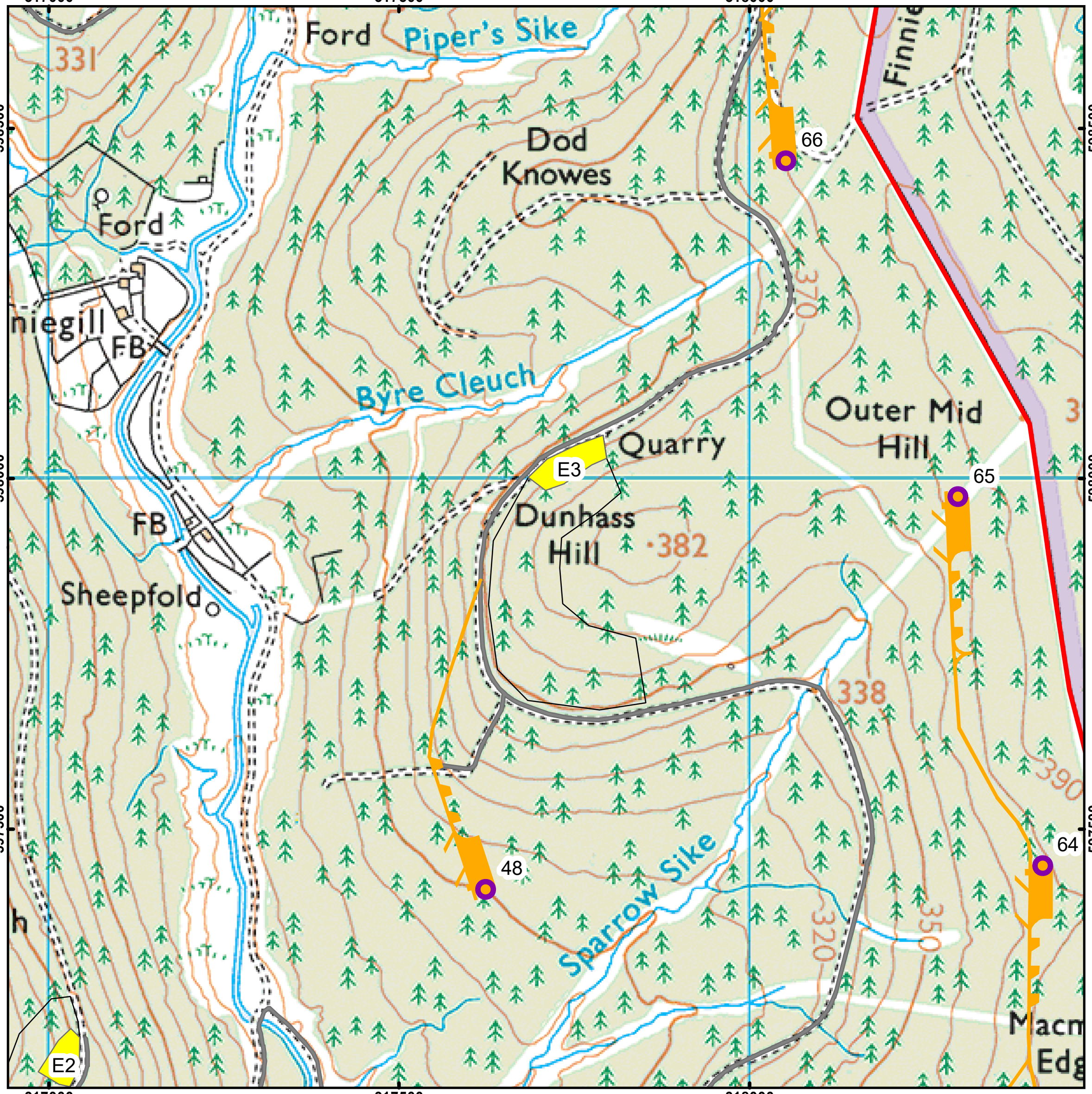
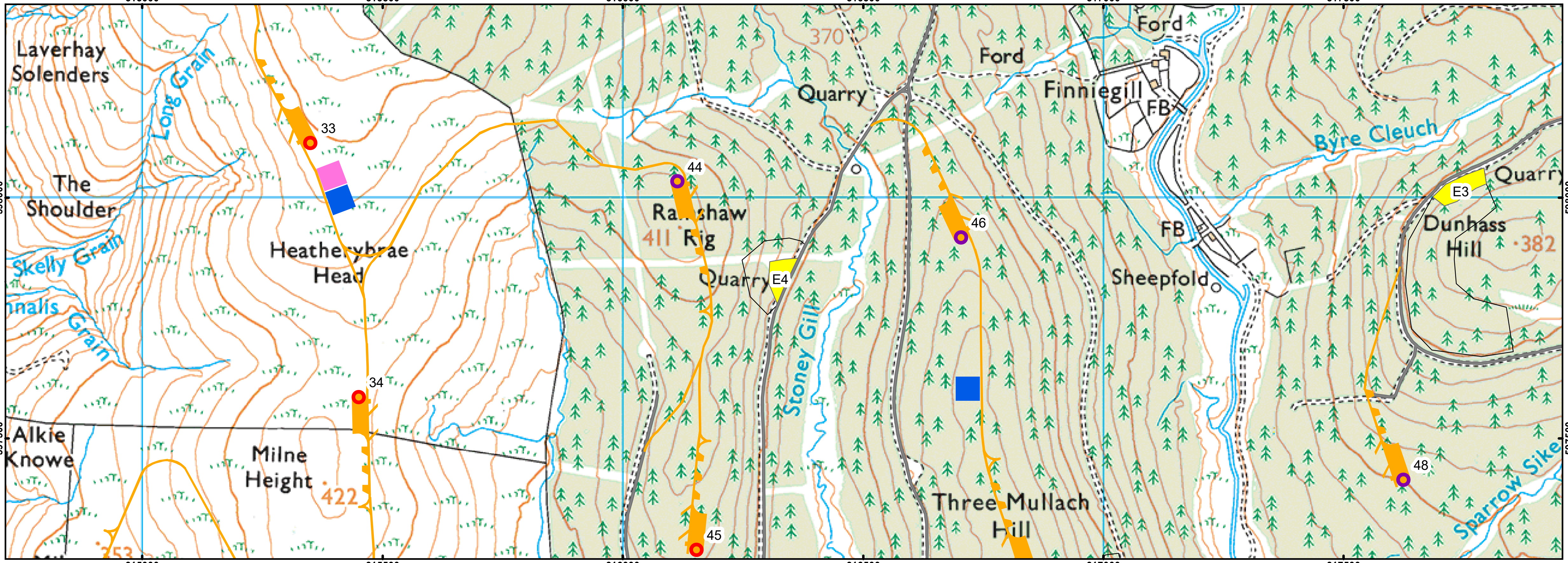




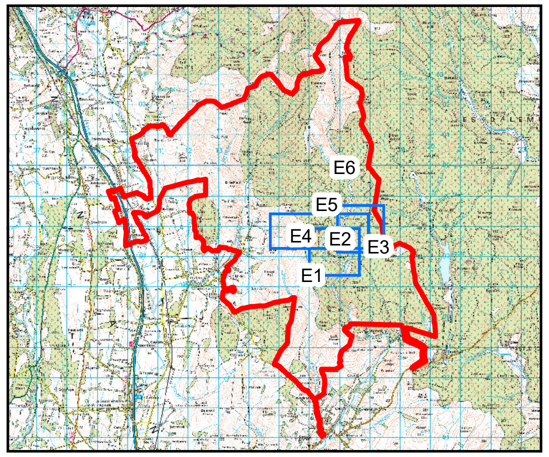


374 Scoop Hill

Legend

- Site Boundary
- Wind Turbine (180m to tip)
- Wind Turbine (200m to tip)
- Wind Turbine (225m to tip)
- Wind Turbine (250m to tip)
- Permanent Met Masts
- Access Tracks
- Site Entrance
- Existing Access Tracks to be Upgraded
- Substation & Control Room
- Substation & Control Room Construction Compound
- Temporary Construction Compound
- Borrow Pit
- Existing Quarries or Borrow Pit
- Borrow Pit Area of

Notes: N/A
Revisions: N/A



0 125 250 500 m
N
Scale: 1:10,000 @ A3

Figure D – Proposed Exisiting Borrow Pit Locations – E1 to E4

Date: 22/04/2020 Ref: 374-200723-7356
Produced: DR Reviewed: SM Approved: GC

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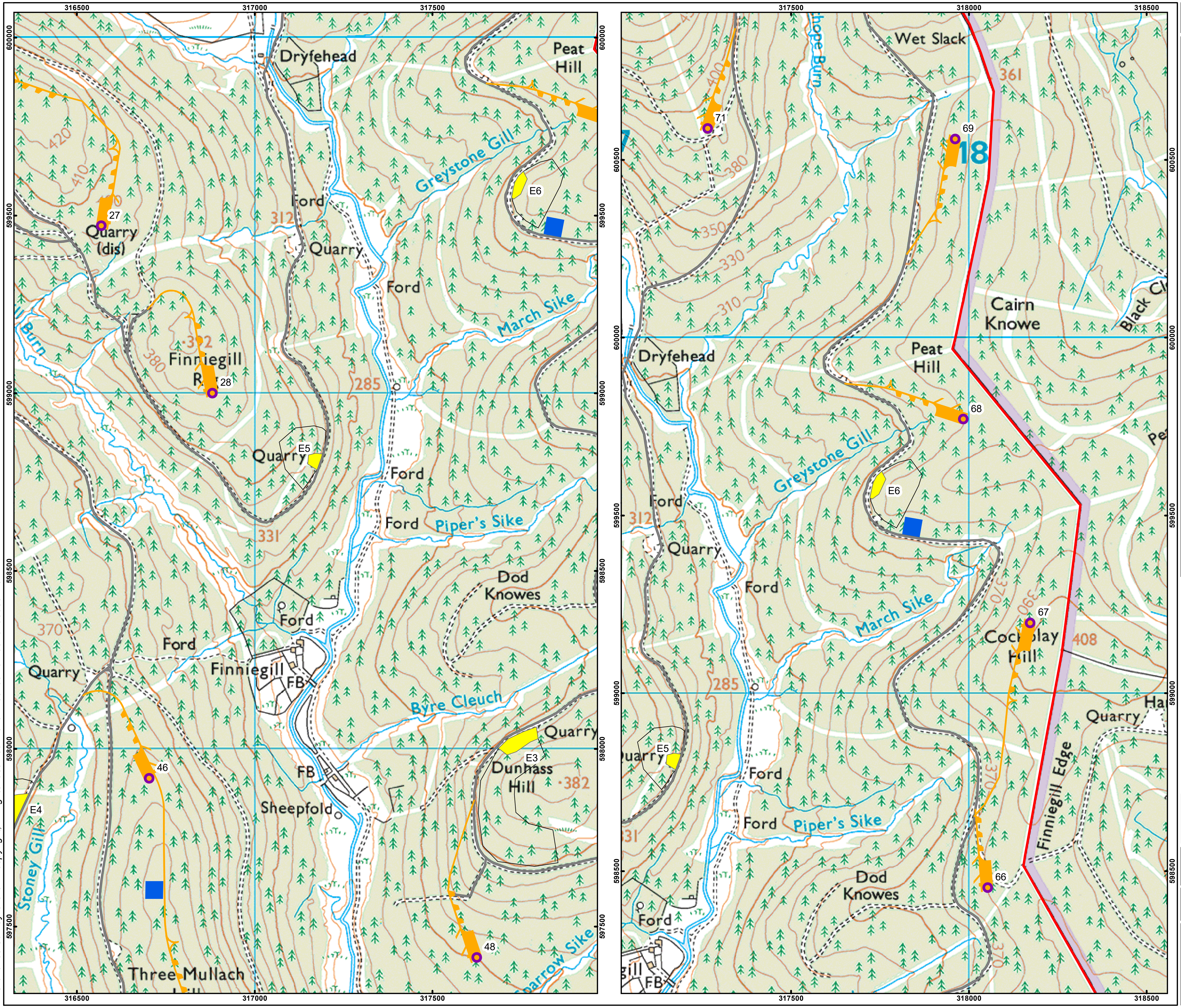
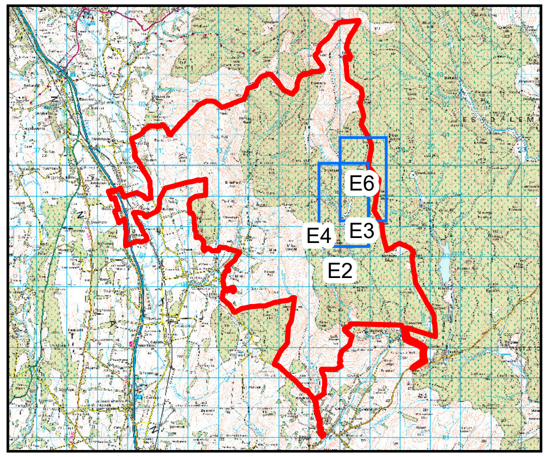


Legend

- Site Boundary
- Wind Turbine (180m to tip)
- Wind Turbine (200m to tip)
- Wind Turbine (225m to tip)
- Wind Turbine (250m to tip)
- Permanent Met Masts
- Access Tracks
- Site Entrance
- Existing Access Tracks to be Upgraded
- Substation & Control Room
- Substation & Control Room Construction Compound
- Temporary Construction Compound
- Borrow Pit
- Existing Quarries or Borrow Pit
- Borrow Pit Area of

Notes: N/A
Revisions: N/A



0 125 250 500 m
Scale: 1:10,000 @ A3
N

Figure E – Proposed Exisiting Borrow Pit Locations – E5 & E6

Date: 22/04/2020 Ref: 374-200723-7357
Produced: DR Reviewed: SM Approved: GC

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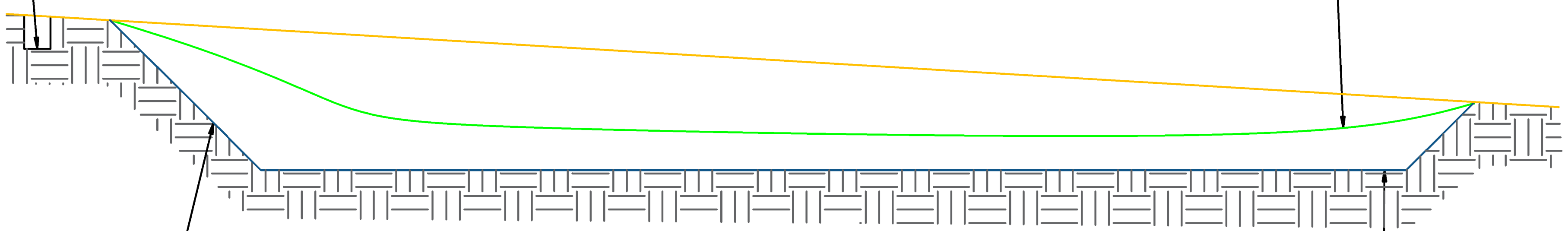
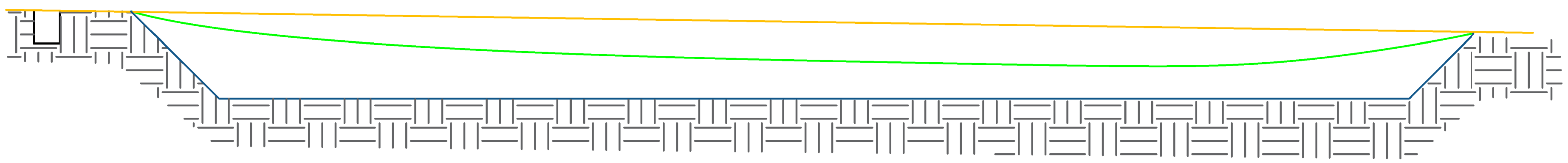
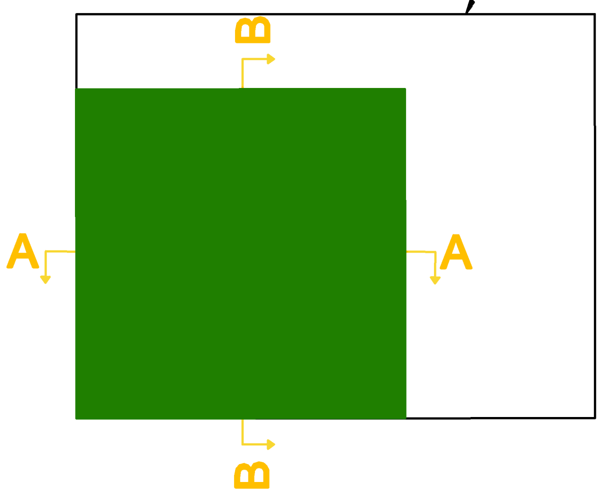


TYPICAL BORROW PIT CROSS SECTION A-A



TYPICAL BORROW PIT CROSS SECTION B-B



Scale: NTS

374 Scoop Hill

Legend

Existing Ground Level

Proposed Excavation Level

Indicative Reinstatement Level

Notes: N/A
Revisions: N/A

Figure F - Typical Borrow Pit Restoration Profile

Date: 30/07/2020	Ref: 374-200730-7377	
Produced: DR	Reviewed: SM	Approved: RF

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