Appendix 6.2

Soil and Peat Management Plan

SCOTTISHPOWER RENEWABLES

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6 Soil and Peat Management Plan

6.1 Introduction

1. This report has been developed to provide additional information to **Chapter 6: Hydrology, Hydrogeology, Geology and Soils** of the Environmental Impact Assessment Report (EIAR) and should be read with reference to the chapter and associated figures.

2. The Proposed Development is located in South Ayrshire, approximately 6 kilometres (km) south of Straiton and is described in detail in **Chapter 4: Development Description** of the EIAR.

3. There are a number of existing forestry tracks within the Site due to current forestry operations.

4. Further site descriptions and photographs are provided in **Chapter 6: Hydrology, Hydrogeology, Geology and Soils** of the EIAR and **Appendix 6.1 Peat Landslide and Hazard Risk Assessment** of the EIAR.

5. During initial investigations it was established that peat was present within the Site, with focus on the Developable Area, where the proposed infrastructure is located. Further work was commissioned to establish peat characteristics, depths and extent.

6. In its regulatory position statement Developments on Peat (Scottish Environment Protection Agency (SEPA, 2010a)), SEPA state that "*developments on peat should seek to minimise peat excavation and disturbance to prevent the unnecessary production of waste soils and peat*". This report examines the volume of soil and peat likely to be excavated during the construction process, and the potential for minimising excavation and identifying volumes for re-use. It is recognised that while re-use of any peat and soil during the construction process represents the preferred option, any such use should be carefully considered regarding risks to the environment or human health.

6.2 Scope of Work

7. During the construction phase there would be a need to excavate peat and soil for infrastructure such as access tracks and wind turbine foundations. Where there is not a defined use for this material during the construction process, excess material would be considered as waste and would need to be disposed of in accordance with regulatory requirements.

8. This report defines the likely excavation volume based on the Proposed Development's layout and dimensions and evaluates options to minimise excavated volumes and examines potential re-use strategies for excavated material. While there may be minor amendments to the Site layout, this strategy ensures appropriate plans for excavation, storage, re-use, and (if necessary) disposal of soil and peat have been considered in advance of the construction phase.

9. Reference has been made to the following guidance documents during the development of this report:

- Promoting the sustainable re-use of greenfield soils in construction (Scottish Natural Heritage) (SNH)[1], 2010);
- Regulatory Position Statement – Developments on Peat (SEPA, 2010a); and
- Developments on Peatland Guidance – Waste (SEPA, 2010b).

[1] Now known as NatureScot.
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6.3 Methodology

10. Soil mapping of the Proposed Development area consist of brown forest soils, podzols, gleys, noncalcerous gleys, blanket peat, alluvial soils (for further details, please refer to **Chapter 6: Hydrology, Hydrogeology, Geology and Soils** of the EIAR). **Chapter 6: Hydrology, Hydrogeology, Geology and Soils** of the EIAR also noted that Importance Classes 1 and 2 ('areas of significant protection') are identified within the Site (SNH[2], 2016).

11. Excavated soil and peat management during the construction process falls into four main categories as follows:

- excavation – at the location of all site infrastructure, including access tracks, wind turbine foundations, hardstandings, Substation Compound, construction compound, and borrow pits;
- re-use – including backfilling around wind turbine foundations, reinstatement of construction phase infrastructure and trackside banking. There may be options for further re-use of excavated material onsite;
- storage – limited to the short-term storage of excavated material before re-use; and
- disposal – where there is an excess of excavated material following reasonable opportunities for re-use in line with good practice, there may be a need for disposal of that material to a licensed waste facility.

12. James Hutton Institute Soils Maps (1982) and Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Scottish Government, 2017), both indicate a minimum depth for soil to be defined as peat of 0.50 metres (m).

13. A proportion of the sub-soils may be suitable as a base on which to lay aggregate for construction of hardstandings and access tracks, thus reducing the requirement to excavate material. The values calculated are therefore considered to be a combination of soil types, including peat. Peat sub-categories are considered separately in **Section 1.5**.

14. Peat probing determines the depth of soils through which a probing rod will travel. It is not possible to confirm the nature of these soils at all locations probed, other than by intrusive investigation, such as coring or trial pitting. Limited coring has occurred (**Appendix 6.1 Peat Landslide and Hazard Risk Assessment** of the EIAR), with further activities forming part of the pre-construction ground investigation (GI).

15. Volumes are generally quoted to the nearest 100m^3, in recognition that the numbers used are in many cases estimates based on professional judgement and design data available. Excavation and re-use volumes are calculated based on the average peat probing depth results assigned to each infrastructure item. Once the final volumes for each broad category are calculated (e.g. wind turbines, tracks, etc), then the total volume for each development component are quoted to the nearest 100m^3 (rather than for each individual wind turbine, etc) which is considered a precautionary and conservative assessment approach at this stage. Rounding is only taken at the last step of the assessment and, therefore, does not result in cumulative errors and typically expected to balance across various infrastructure components.

6.3.1 Excavation

16. Peat depths applied to this report are based on a combination of actual probing data or estimated from the indicative peat depth map, **Figure 6.1.5 Peat Overview**, with methodology and further details provided in **Appendix 6.1 Peat Landslide and Hazard Risk Assessment** of the EIAR.

17. The estimation of volume of excavated material includes all soil types, based on site characteristics, a substantial proportion of this material would not be peat, as discussed in the section above.

18. Site probing provided a dataset of 1,818 peat depths, 35.8% of which recorded depths of less than 0.50m (indicating that some areas of the Site would not be considered to be peat based on the 0.50m depth-based definition), 62.4% less than 1.00m and an average depth of 0.99m.

19. Within 25m of all access track infrastructure (including new access track and existing forestry track requiring upgrade), there are 589 probing records, with this dataset including adjacent wind turbine foundations and hardstandings, with the average probe depth being 0.79m, slightly shallower than the overall probing average, reflecting peat depth constraint input to infrastructure design.

20. The layout of the windfarm and dimensions of infrastructure are presented within **Chapter 4: Development Description** of the EIAR.

21. The estimation of volume of excavated material includes all soil types, based on site characteristics, however a substantial proportion of this material would not be peat, as discussed in the section above. Applicable peat volumes have been separately noted for infrastructure components.

22. Initial excavation estimates for access tracks, wind turbine foundations, hardstandings, construction compound and other identified infrastructure were developed in a spreadsheet to provide a total excavated volume of all soil types. A refinement exercise was then carried out to revise the initial estimates and identify good practice opportunities to minimise the excavated soil and peat volumes.

6.3.2 Re-use

23. The initial estimation of the volume of excavated soil and peat that can be re-used during construction was very conservative and limited to backfilling the batter areas around wind turbine foundations and hardstandings, use of small bankings either side of access tracks and restoring the borrow pit footprints with excavated material.

24. Given local soil conditions, it is reasonable to expect that a percentage of non-peat material could be reused on Site as engineering fill or for landscaping purposes. This possibility would be investigated further at detailed design stage.

25. By using an iterative approach, values have been refined to generate volumes of material where there is clearly identified and quantified potential for additional re-use.

6.3.3 Storage

26. Storage considerations relate to short term storage and segregation of excavated material identified for re-use onsite. Typically, it would be expected that such material would be re-used nearby and within six weeks of excavation. At all times the volume and duration of storage would be minimised.

27. This report does not include long term material storage, e.g. for decommissioning purposes, as none is proposed or required.

6.3.4 Disposal

28. Should there be an excess of excavated material or material unsuitable for re-use, disposal options would be explored and recommendations made as to the potential disposal routes for any such material.

6.4 Results

29. In this section, calculated values for excavation and re-use, review of the data and layout, and discussion of the re-use volumes is detailed for each infrastructure type. The location of the Site layout is provided on **Figure 4.1 Site Layout** of the EIAR**.** The results are summarised in **Tables 6.2.1**, **6.2.2** and **6.2.3**, at the end of this document.

6.4.1 Access Tracks

30. Access tracks comprise a total length of approximately 16.20km, with 7.43km tracks being new ‘cut and fill’ type (average depth of 0.79m within 25m of centrelines of all track types). This technique requires excavation of surface deposits and backfilling with aggregate to produce a final track level at, or close to, the existing surface level.

31. There are 8.77km of existing cut forestry track sections requiring upgrade/widening, which would follow similar techniques to that described above, anticipated as widening to one side of the existing forestry track.

32. All access tracks within the Site are considered to be on peatland based on the average peat depth.

33. For this assessment, it is assumed that floating access tracks are not currently proposed as part of the Proposed Development. Where there is a benefit, the construction of floating access tracks would be considered during pre-construction. Floating access tracks require the placing of a geotextile membrane on existing topsoil/peat and vegetation, with overlain aggregate layers to form a running surface.

34. Access track types and routes are displayed overlying peat depth mapping on **Figure 6.5 Peat Overview** of the EIAR.

6.4.1.1 Cut and Fill Track

35. Typical track construction information for cut and fill tracks is provided in **Chapter 4: Development Description** of the EIAR and associated drawings of the EIAR. A minimum running width of 5.00m for cut and fill tracks is indicated, calculated as a width of 7.50m to include potential ditches and banks. The new track positioning has taken account of constraints mapping, avoiding areas of deeper peat, wherever practicable.

36. Where existing forestry tracks are to be upgraded/widened, this track has been assumed to require a 1.5m excavation on average to widen the running width and include equivalent sized shoulders and ditch to the standard design, to one side and contingency for any extra works. During the site visits, the existing forestry tracks were estimated to be approximately 4.00m running width plus adjacent banks and drainage features.

37. To provide additional depth information, specific to the new cut access track locations, analysis was undertaken to identify the average peat depth within 25m of the proposed new cut access track routes; from 405 records the average depth is 0.95m. The equivalent average depth for the existing forestry track to be widened is 0.51m from 262 records.

38. Initial estimated peat excavation values are calculated using mean averages for the 7.43km of new excavated access track and 8.77km of widened existing forestry track. This gives a combined peat volume of 59,700m^3.

39. The depth of excavated material at the shallow cut track locations is likely to be less than that initially assumed because either the full depth or a proportion therein would be suitable for access track construction. It is considered that achieving a 0.10m improvement in soil depth is feasible for new cut access track locations, given that the average value includes all depth records within 25m of the new cut track centreline. Note that the existing forestry track required to be widened would not have the opportunity for such improved positioning as is dictated by the present alignment. Taking account of this reduced excavation requirement for new access tracks, the combined access track excavated peat volume would be reduced by 5,600m^3 to 54,100m^3. All excavated material for access track construction is assumed to be peat.

40. For a similar development application in 2021, additional depth of peat restoration within borrow pits has been suggested by SEPA to be preferable to trackside embankments exceeding 0.50m height. This is to ensure water content is retained in these linear features and reduce the likelihood of upper levels of soils/peat drying out due to potential lack of connectivity with the underlying peat body, enhancing conditions conducive to peatland restoration and vegetation re-establishment on track verges.

41. Assuming a narrow triangular profile bank at either side of the access track of 1.75m width and 0.50m height for the cut and fill tracks, the estimated re-use of excavated peat for new access track and widened existing forestry track (to one side only) is 10,400m^3.

42. The use of excavated material for reinstatement and/or landscaping would not be uniform across the Site, and experience of other similar projects has shown that substantial volumes of excavated material may be necessary for reinstatement and/or landscaping for banking downslope of cut and fill tracks where these traverse a hillside, as occurs on this Site, as shown on **Plate 6.2.1**.

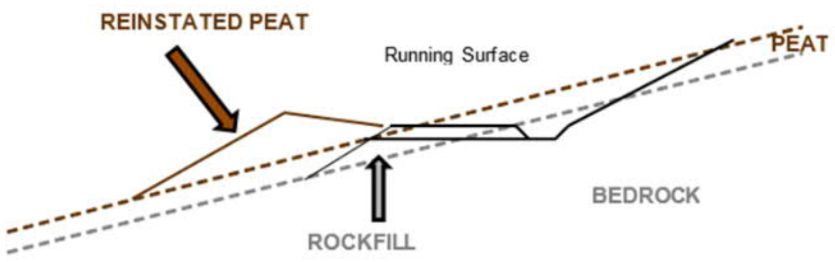


Plate 6.2.1: Cross-gradient schematic of cut and fill track construction

43. For this type of construction, the quantity of excavated material required for landscaping of the downslope banking varies with the cross-slope angle. The extent of downslope banking required may be substantial. The re-use of peat and soil on the disturbed ground immediately adjacent to the track corridor is considered pragmatic. Assuming a revised larger average bank at either side of the track of 3.50m width (retained at 0.50m maximum height) for the cut and fill tracks and existing forestry tracks to be upgraded, the potential estimated re-use of excavated material is increased to 20,700m^3.

6.4.1.2 Turning Heads

44. It has been determined that a number of turning heads would be required to enable safe delivery and installation of site equipment, particularly wind turbine components.

45. Each turning head would be located perpendicular to the access track and information provided by the civil engineering design team indicates an average surface area of approximately 474m^2. The average soil depth for the turning heads is 1.09m, with results at each location ranging from 0.20m to 2.51m.

46. With nine planned turning heads located within peatland, the combined volume of excavated material is estimated as being 4,400m^3, all of which would be peat.

47. Should there be the potential to re-use excavated material for some of the turning heads and/or reduce size, this would provide an appropriate re-use of excavated material and/or minimise excavation. This would be considered further at the pre-construction stage.

6.4.1.3 Passing Places

48. A number of new passing places would be required to allow the passage of abnormal loads. They would have a typical running width of approximately 5.0m and would be placed approximately every 500m.

49. A number of new passing places would be required, as per **Chapter 4: Development Description** of the EIAR. It is anticipated that approximately 30 passing places would be necessary. These would require an excavation of 70m by 5m (350m^2), resulting in a combined area of 10,500m^2. The precise locations of the passing places have not been confirmed, applying the average depth along new and existing forestry tracks of 0.79m leads to an estimated value for total excavated material of 8,300m^3. It has been assumed that the passing places would all be located within peatland, based on peat survey data alongside the tracks, with all excavated material being anticipated as peat but seeking to avoid amorphous catotelmic peat deposits.

50. Should there be the potential to re-use excavated material for some of the passing places and/or reduce size, this would provide an appropriate re-use of excavated material and/or minimise excavation. It is anticipated that the Site would have a number of existing passing places that could be upgraded, which would minimise the excavation. This would be considered further at the pre-construction stage.

6.4.2 Wind Turbine Foundations and Crane Hardstandings

51. Construction of the 13 wind turbine foundations would require excavation to a suitable load-bearing layer. **Chapter 4: Development Description** of the EIAR and associated drawings of the EIAR, identifies the wind turbine base foundation as approximately 30.00m diameter. As the wind turbine base foundations are embedded within the Crane Hardstandings foundation zone, the wind turbine excavation is included within the **Section 1.4.2.1** below.

6.4.2.1 Crane Hardstandings

52. The 13 crane hardstandings associated with the wind turbine foundations are required for supporting lifting equipment. These would be created by excavation to suitable load-bearing layer and backfilling the excavation with aggregate to form a stable surface from which construction activities can be carried out.

53. The proposed dimensions for crane hardstandings associated with each wind turbine are approximately 34m x 94m (3,196m^2), as per **Chapter 4: Development Description** of the EIAR and **Figure 4.6 Indicative Crane Hardstanding** of the EIAR. It has been assumed that each hardstanding would be within an overall surface excavation of 44m x 104m (4,576m^2). The overall surface excavation includes a batter area (1,380m^2) adjacent to the hardstanding to enable construction.

54. The assumption for peat/soil excavated at hardstandings was based on peat probing data, the range of average peat depths at each hardstanding was 0.50m to 1.73m, with an overall average peat depth of 1.04m. This leads to an estimated combined excavated volume of 52,400m^3 for the Site's 13 hardstanding areas, including adjacent batter areas. Based on the peat probing data, it is conservatively anticipated that all material excavated would be peat.

55. Although the crane hardstandings are not planned for reuse of material, the batter areas would be partially backfilled with excavated material, resulting in re-use of 9,300m^3 across the Site.

56. If micrositing allows and taking account of other constraints, relocation of hardstandings positioned in deeper peat depths can been considered. This is particularly relevant for wind turbines 1, 3, 8 and 13, where the average peat depths are deeper than 1.50m. These issues would be considered further at the pre-construction stage when additional GI information is available.

57. From conceptual design inputs, it is considered likely that there would be a need for 'fill' material to 'level' each crane hardstanding to meet crane manufacturer installation requirements. It is reasonable to anticipate that some of the material excavated at each hardstanding would have suitable characteristics to be used for this purpose. Such reuse, local to each hardstanding, has not been quantified in this report but would be considered at the pre-construction stage to minimise transfer of materials around the Site.

6.4.2.2 Crane Boom Assembly Hardstandings

58. There are two small crane boom assembly hardstandings proposed for each wind turbine, on approach to the main crane hardstanding areas, with a total of 26 locations across the Site. Each has a proposed hardstanding area of 174m^2, within an overall surface excavation area of 238m^2, including batter area.

59. The average peat depth for each crane boom assembly position was used to calculate the excavated material. The peat depths within 25m of the crane boom assembly hardstandings range from 0.00m to 2.95m, with an overall average depth of 1.04m. This results in a total excavated peat volume of 5,600m^3 for the combined 26 crane boom assembly areas, including surrounding batter areas. All material excavated for crane boom assemblies is anticipated to be peat.

60. These batter areas would be partially backfilled with excavated material, resulting in re-use of 400m^3 across the Site.

6.4.2.3 Blade Laydown Areas

61. 13 blade laydown areas would be required, which are large areas that are located parallel to each of the crane hardstandings. It has been assumed that there might be a requirement to place aggregate on the area to create a temporary hardstanding. Each of the blade laydown areas are 78m by 28m (2,184m^2).

62. The average peat/soil depth for the blade laydown areas is 1.07m, with average results across the 13 locations ranging from 0.19m to 3.33m. Using a conservative assumption that all such material requires to be excavated in

order to achieve level ground, the combined excavation volume for blade laydown areas across the Site is estimated as 30,400m^3, all of which is considered to be peat.

63. On the basis that all such material is excavated, it is anticipated that all material would be re-used elsewhere in the blade laydown area to achieve a level profile or for reinstatement of this temporary construction area, resulting in re-use of 30,400m^3. As a result, the balance between excavation and re-use would be zero.

64. It is reasonably likely that the construction strategy at these locations can avoid wholescale excavation and use less intrusive methods to achieve a sufficient degree of levelling. A hardstanding dressing may be avoidable and should local ground conditions be poor, consideration would be given to the use of a temporary geotextile surface dressing or other techniques that would enable short-term blade storage, pre-lift, and substantially reduce excavation requirements and potentially reduce aggregate demand. Such techniques would be expected to minimise the volume of disturbed material, particularly at locations where deeper peat was present, such as wind turbine 10 where the average depth at the blade laydown area is 3.31m, with average depths of 1.84 and 1.81 recorded at wind turbines 1 and 3, respectively.

6.4.1 Substation Compound and SPEN Temporary Construction Compound

65. The proposed dimensions for the Substation Compound are 189m x 126m (23,800m^2), with a surface excavation area of approximately 27,100m^2, including a batter area of 3,100m^2. The Substation Compound has a proposed associated temporary construction compound for SPEN of 60m x 60m (3,600m^2), which will be fully reinstated and is therefore not considered further in the assessment.

66. Based on peat probing within the Substation Compound and the SPEN temporary construction compound, the average value for soil/peat depth is 0.72m, which equates to approximately 18,300m^3 of excavated material, all considered peat.

67. Approximately 1,200m^3 of material would be re-used for reinstatement on the batter area surrounding the constructed substation.

68. The Substation Compound is a permanent feature, so it would not be reinstated.

6.4.2 Temporary Construction Compounds

69. The main construction compound proposed (100m x 100m (10,000m^2)), will have a surface excavation area of approximately 12,100m^2, including a batter area of 2,100m^2.

70. Based on peat probing within the construction compound, the average value for soil/peat depth is 0.96m, with approximately 10,600m^3 of excavated material, all considered peat.

71. Approximately 1,000m^3 of material would be re-used for reinstatement on the batter area surrounding the construction compound.

72. A second temporary construction compound (30m x30m) is proposed for similar requirements on a smaller scale. The Applicant proposes to convert the 30m x 30m temporary construction compound, near the northern access with the C46W into a permanent car park for recreational users of the Carrick Forest upon completion of construction works. The proposed dimensions for the temporary construction compound are 30m x 30m (900m^2), with a surface excavation of approximately 1,600m^2, including a batter area of 700m^2. The location of the temporary construction compound is shown on **Figure 4.1 Site Layout**.

73. Based on peat probing within 25m of the car park, the average value for soil/peat depth is 0.50m, which equates to 600m^3 of excavated material, all considered peat.

74. For the purpose of this assessment, it has been assumed that the temporary construction compound will be a permanent feature. Approximately 200m^3 of material would be re-used for reinstatement on the batter area surrounding the temporary construction compound.

6.4.3 Cable Trenches

75. It is intended that all cable trenches would be located alongside new access tracks and existing forestry tracks, with excavated material used to infill the cable trench. Therefore, this is effectively neutral, with the associated peat balance of zero, these are not considered further in this assessment.

6.4.4 Borrow Pits

76. Four borrow pit search areas have been identified for the Proposed Development. The location of these are provided on **Figures 4.1 Site Layout** and **Figure 6.1.5 Peat Overview** of the EIAR and detailed in **Appendix 6.6 Borrow Pit Assessment** of the EIAR.

77. The four borrow pit search areas have a combined surface area of 254,927m^2 (**Appendix 6.6 Borrow Pit Assessment** of the EIAR). It is proposed that the actual borrow pit footprint(s) would be within the respective search areas but considerably smaller than the surrounding search area. For the purposes of this assessment, it has been assumed the actual areas utilised as borrow pit footprints would represent approximately 30% of each of the search areas. Thus, the total utilised surface area of borrow pits is estimated as 76,478m^2.

78. Based upon peat probing in the vicinity of the borrow pit search areas, the average value for soil depth at the borrow pits is 0.47m (also known as overburden). Although peat probing records record deeper peat on the periphery of the borrow pit search areas, this would be avoided by siting the borrow pits where shallower overburden occurs. As a result, it has been estimated the excavation would be soil rather than peat. Based on opening borrow pits which represent a third of the footprint of the combined search areas, the excavation volume of would be 30,200m^3, none of which is anticipated as peat.

79. Restoring the borrow pit footprints with excavated material provides a re-use purpose, with BP03 planned to be partially restored (to 50% of its footprint), to facilitate the ongoing extraction of material for track maintenance. On this basis, a reinstatement depth of 1.9m across all borrow pits would equate to re-using 137,300m^3 of material.

80. Each additional 0.10m of material required for reinstatement/reprofiling of the borrow pit footprints outlined above equates to a further 7,200m^3 of re-used material.

81. Should borrow pit footprint(s) be larger than that assumed above, this would increase the capacity for re-use, without increasing the depth of material at each location. Conversely, should the borrow pit footprint required be smaller, reuse of a similar volume of material would necessitate a deeper restoration profile.

82. Further restoration potential was identified within the existing quarries/borrow pits to the east of BP02 (named as BP02-E) and north of BP03 (named as BP03-N). BP02-E and BP03-N have a combined surface area of approximately 8,662m^2. Restoring these existing borrow pit footprints to an average depth of 1.90m, would re-use 16,500m^3 of material. This approach has taken account of the potential aggregate demand for ongoing forestry operations and/or storage of material at the quarry south of BP03 (BP03-S), which has not been considered for restoration in this document.

83. Any reinstatement depths greater than 2.00m would be anticipated to involve discussion of rationale and engineering techniques with SEPA and could potentially become a regulated matter under the waste management regulations.

6.5 Peat Categorisation

84. Based on peat depth surveys and site characteristics noted in **Chapter 6: Hydrology, Hydrogeology, Geology and Soils** of the EIAR**,** site soils are mainly blanket peat and noncalcareous gleys. Further peat data is provided in **Appendix 6.1 Peat Landslide and Hazard Risk Assessment**, **Figures 6.5a-c Peat Overview**, **Figure 6.1.12 Geomorphology** and **Figure 6.1.6 Peat Core Locations** of the EIAR.

85. Peat is a soft to very soft, highly compressible, highly porous organic material which can consist of up to 90% water by volume. Unmodified peat typically has two layers, a surface layer or acrotelm which is often considered to be

0.10-0.30m deep, highly permeable and receptive to rainfall. The acrotelm layer generally has a high proportion of fibrous material and often forms a crust under dry conditions. The second layer, or catotelm, lies beneath the acrotelm and forms a stable colloidal substance which is generally saturated and acts as an impermeable layer. As a result, the catotelm usually remains saturated with little groundwater flow. A typical threshold value of 1.00m depth for catotelmic peat has been suggested by SEPA in the published waste guidance related to peatland (SEPA, 2010b).

86. Within the catotelmic peat, there can be a sub-divide, with a more structured and fibrous upper material and underlying amorphous material with a higher water content. Amorphous catotelmic peat may not always be present within the peat-containing soil structure. Due to the inherent lack of structure in amorphous catotelmic peat, which often displays liquid rather than solid physical properties, it is more difficult to manage and successfully re-use when excavated. Thus, a good design seeks to minimise excavating such sensitive material in the first instance, but where there is a requirement to excavate deeper peat, it is important to establish the likely volumes of amorphous catotelmic peat in a pragmatic manner in order to apply practicable measures to minimise adverse effects relating to excavation, handling, transit, storage and local receptors.

87. The split between excavated acrotelmic, fibrous catotelmic and amorphous catotelmic peat is difficult to precisely quantify, especially where a variety of topographic and peatland features are present, such as at this Site. Peat core and peat depth data aid this process.

88. Peat core data is provided in **Appendix 6.1 Peat Landslide and Hazard Risk Assessment** of the EIAR, amorphous catotelmic peat conditions were identified at PC01a, PC04 and PC05, taken at depths of 2.00m, 1.30m and 1.60m, respectively. Based on site data, it is judged that amorphous catotelmic peat is unlikely to be present at depths of less than 1.30m. However, peat core data notes that amorphous catotelmic material is not always present at depths exceeding 1.30m, with this being a particularly shallow outcome in comparison with a large number of other sites, in similar terrain, where peat cores have been collected by WSP. Therefore, the applied 1.30m threshold depth may be considered very conservative and further GI could lead to a potentially deeper threshold depth across the Site.

89. Within 25m of new access track, there are 405 probing records, with the average probe depth being 0.95m, 62.4% of depth records were less than 1.00m and 76.7% were less than 1.50m. Including records outwith infrastructure locations, approximately 71.1% of depth records were shallower than 1.30m.

90. Estimated volumes for total peat excavation have been provided in **Table 6.2.3**, including peat sub-categories applying site-specific 0.30m and 1.30m threshold depths between the three categories, taking account of the SEPA guidance regarding a 1.00m expectation for overall catotelmic peat (SEPA, 2010b). These estimated excavated peat volumes are noted in **Section 1.4**.

91. Infrastructure with recorded or indicative depths of less than 0.50m (non-peat) have been removed from **Table 6.2.3**, which was limited to the four borrow pit search areas. As although peat probing records show deeper peat on the periphery of some of these borrow pit search areas, this would be avoided by siting the borrow pits where overburden depth is reduced.

6.5.1 Amorphous Catotelmic Peat

92. As the calculation within **Table 6.2.3** of specific peat volumes is an approximation based on threshold depths for the three peat sub-categories within overall probing results for grouped infrastructure components, this was noted to be masking specific locations where deeper peat was apparent from probing data but not reflected in the mean value across the Site. Therefore, a review was undertaken to ensure that infrastructure locations where amorphous catotelmic peat may be expected to be present were identified, based on the aforementioned threshold depth of 1.30m for amorphous catotelmic peat – in addition to the crane hardstandings and blade laydown areas that estimated volumes of such material for individual wind turbine areas.

93. Applying the conservative amorphous catotelmic peat threshold depth of 1.30m, along with the considerations above, has led to an excavation estimation of 15,900m^3 in **Table 6.2.3**. Should additional GI information lead to an increase in the assumed threshold depth, the estimated volumes of such material arising, following same estimation principles, would be expected to reduce substantially. These outcomes demonstrate the importance of developing a strong understanding of local peat conditions at all excavation zones.

94. Where confirmed necessary to excavate such material, provisions should be made to re-use this material rapidly, in close proximity and for appropriate purposes. Handling via plant equipment and transportation is likely to lead to loss of structure and the material becoming more susceptible to stability failure or increasingly subject to wind or water erosive forces. Amorphous catotelmic peat should be laid under acrotelmic peat, with associated vegetation encouraged to regenerate above. Confirmation of acceptable re-use of amorphous catotelmic peat from stakeholder bodies should be sought at the pre-construction stage and built into construction phase environmental and waste management plans.

95. There are a number of infrastructure locations where amorphous catotelmic peat is likely to be present on the Site, based on the 1.30m threshold depth applied, the key locations identified are described below and include potential opportunities to minimise excavation:

- Wind turbine 1 and 2 Area;
- Wind turbine 3 Area;
- Wind turbine 7 Area;
- Wind turbine 10 Area; and
- Wind turbine 13 Area.

96. Opportunities for improvement have the potential to reduce the average soil/peat depth at various infrastructure locations. Detailed design and micrositing of the access tracks, wind turbines and hardstandings in these areas would seek to minimise peat volumes excavated and reduce the likelihood of encountering amorphous catotelmic peat, as additional GI data becomes available.

6.5.1.1 Wind Turbines 1 and 2 Area

97. In the western area, soil mapping suggests blanket peat is predominant. In terms of priority peatland and carbon-rich soil mapping, the area is mostly considered of Importance Category 5 with a small pocket of Category 4 to the east of the area; ‘vegetation cover does not indicate peatland habitat, however, all soils are considered carbon-rich soil and deep peat’, and ‘area unlikely to be associated with peatland habitats or include carbon-rich soils’, respectively (SNH, 2016). This area is shown on **Photograph 6.2.1** and has also been modified by forestry artificial drainage, also see **Figure 6.5 Peat Overview** and **Figure 6.5a Peat Detail Western**.

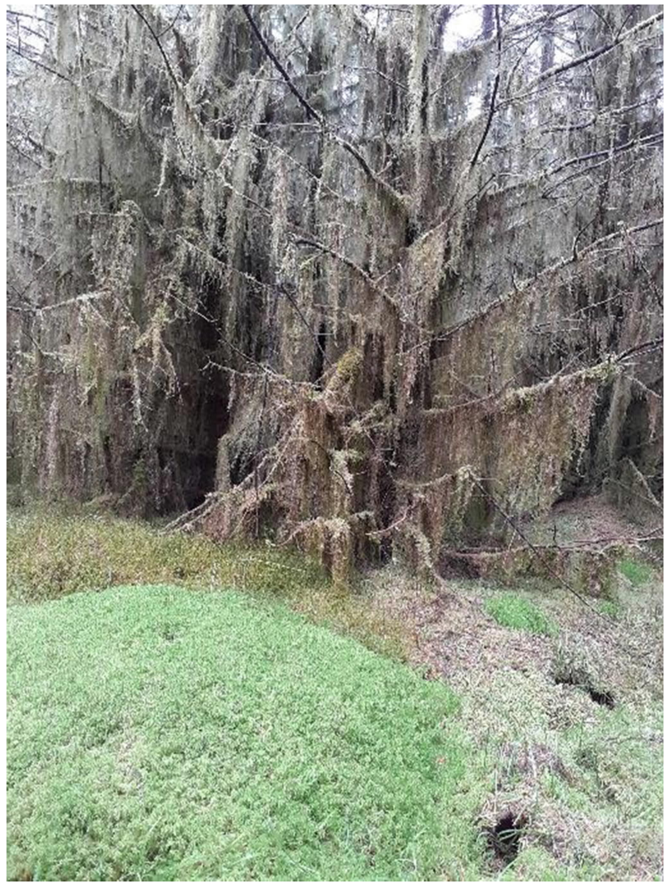
98. Site observation and depth records provide evidence of deep peat records in the vicinity of wind turbines 1 and 2, with 67 records confirming depths of between 0.30m to 2.77m, with a mean depth of 1.25m.

99. Peat cores (PC) PC03, PC04 and PC05 were collected in this area at depths of 1.40m, 1.30m and 1.60m and assessed via the Von Post technique as Von Post H5 – ‘Moderately Decomposed’, H6 – ‘Strongly Decomposed’ and H7 – ‘Highly Decomposed’, respectively. These results suggest amorphous catotelmic peat is present locally at depths of 1.30m and 1.60m.

100. Wind turbine 1 has been relocated to the west to an improved location, the proposed location has depths of over 1.50m but avoids the steeper slope and break of slope to the north. The new access track route between wind turbine 1 and wind turbine 2 also seeks to avoid the local break of slope and crosses relatively level ground with peat depths typically over 1.00m. Wind turbine 2 has an isolated pocket of deeper peat on the new access track adjacent to the blade laydown area, this wind turbine has been relocated south west to an improved position at shallower peat. There is potential for micrositing of the access track between Wind turbine 1 and 2, plus consideration should be given to potential for floating track construction to minimise peat disturbance on this section.

101. This location is also assessed in **Appendix 6.1 Peat Landslide and Hazard Risk Assessment** of the EIAR, as it extends across both Peat Stability Area (PSA) Areas A and B.

Photograph 6.2.1. Looking South from 234298, 599022, Approximately 10m South of Wind Turbine 1



Photograph 6.2.2. Looking North from 235701, 599335, at the Wind Turbine 3 Location

6.5.1.2 Wind Turbine 3 Area

102. In the north west area, soil mapping suggests blanket peat is predominant. In terms of priority peatland and carbon-rich soil mapping, the area is mostly considered of Importance Category 5; 'vegetation cover does not indicate peatland habitat, however, all soils are considered carbon-rich soil and deep peat' (SNH, 2016). This area is shown on **Photograph 6.2.2** and has also been modified by forestry artificial drainage, also see **Figure 6.5 Peat Overview** and **Figure 6.5a Peat Detail Western**.

103. Site observation and depth records provide evidence of deep peat basins in the vicinity of wind turbine 3, there are 29 depth records in the vicinity of wind turbine 3, with confirmed depths between 0.30m and 2.82m, with a mean depth of 1.55m.

104. Peat core PC02 was collected 400m south of the wind turbine 3 at a depth of 1.90m and assessed via the Von Post technique as H5 – 'Moderately Decomposed', with distinct plant material. This data suggests amorphous catotelmic peat is not present locally at depths of 1.90m.

105. The hardstanding, blade laydown area and crane boom assembly associated with wind turbine 3 have depth records over 1.50m, with potential for micrositing to reduce excavation at these locations.

6.5.1.3 Wind Turbine 7 Area

106. In the central area, soil mapping suggests blanket peat is predominant. In terms of priority peatland and carbon-rich soil mapping, this area is mostly considered of Importance Category 5; 'vegetation cover does not indicate peatland habitat, although soils within Category 5 are considered carbon-rich soil and deep peat' (SNH, 2016). This area is shown on **Photograph 6.2.3** and has been modified by forestry artificial drainage, also see **Figure 6.5 Peat Overview** and **Figure 6.5b Peat Detail Eastern**.

107. Site observation and depth records provide evidence of deep peat north of the existing forestry track and borrow pit BP02. There are 24 depth records in the vicinity of wind turbine 7, with confirmed depths between 0.28m and 2.95m, with a mean depth of 1.10m.

108. Two peat cores, PC01a and PC01b, were collected in this area at depths of 2.00m and 3.10m and assessed via the Von Post technique as H6 – 'Strongly Decomposed' and H5 – 'Moderately Decomposed', respectively. This suggest amorphous catotelmic peat may be present at a depth of 2.00m locally, but unusually the deeper core exhibited less decomposed peat material (not considered amorphous) – possibly due to a local surface water channel influencing the shallower peat conditions.

109. The crane boom assembly and turning head associated with Turbine 7 have depth records over 1.50m, with potential for micrositing to improve excavation at these locations.

Photograph 6.2.3. Looking West From 236449, 598947, From the Proposed Wind Turbine 7

6.5.1.4 Wind Turbine 10 Area

110. In the Eastern Area, soil mapping suggests peaty podzols are predominant. In terms of priority peatland and carbon-rich soil mapping, this area is mostly considered of Importance Category 5; 'vegetation cover does not indicate peatland habitat, although soils within Category 5 are considered carbon-rich soil and deep peat' (SNH, 2016). This area is shown on **Photograph 6.2.4** and has been modified by forestry artificial drainage, also see **Figure 6.5 Peat Overview** and **Figure 6.5b Peat Detail Eastern**.

111. Site observation and depth records provide evidence of deep peat in this area. There were 80 depth records in the vicinity of wind turbine 10 confirmed varying depths between 0.10 and 4.66m, with a mean depth of 1.82m. No peat cores were collected in this area.

112. Wind turbine 10 has been relocated south into an improved position with shallower peat, compared to provisional locations to north and east, however the blade laydown area is placed on peat depths of over 2.50m, with some similar peat depth records at the crane hardstanding. There is potential for micrositing to improve excavation at this location.

Photograph 6.2.4. Looking West from 238634, 598715, Approximately 40m North of the Proposed Wind Turbine 10

6.5.1.5 Wind Turbine 13 Area

113. In the south east area, soil mapping suggests blanket peat is predominant. In terms of priority peatland and carbon-rich soil mapping, the area is mostly considered of Importance Category 5; 'vegetation cover does not indicate peatland habitat, however, all soils are considered carbon-rich soil and deep peat' (SNH , 2016). This area is shown on **Photograph 6.2.5** and has also been modified by forestry artificial drainage, also see **Figure 6.5 Peat Overview.**

114. Site observation and depth records provide evidence of deep peat records in the vicinity of wind turbine 13, with 44 records confirming depths of 0.34m to 2.32m, with a mean depth of 1.38m. No peat cores were collected in this area.

115. This area includes an upgraded existing forestry track to the east of wind turbine 13 and new access track to north west of wind turbine 13, where peat depths exceed 1.50m. Wind turbine 13 has been relocated north east to an improved position with shallower peat, however the hardstanding, blade laydown area and crane boom assembly are located on peat depths of over 1.50m. Micrositing may be possible for some of these components.

Photograph 6.2.5. Looking North from 238010, 597329, Approximately 20m West of Wind Turbine 13

116. Should amorphous catotelmic peat be confirmed or additional areas identified during pre-construction or construction activities, this material should be reported and consideration should be given to relocating infrastructure within the micrositing allowance, or use of alternative methods of construction to reduce excavation. The Geotechnical Risk Register should include for potential excavation and management of this material.

6.6 Soil Management and Storage

117. This section focuses on temporary storage of peat and soil onsite during the construction phase.

6.6.1 Management of Excavated Peat and Soils

118. It is expected that prior to construction commencing, in accordance with **Appendix 4.2 Outline Construction Environmental Management Plan** of the EIAR, the contractor would provide a plan, detailing potential locations for temporary storage and an outline programme indicating the duration and quantity of stored peat and measures to mitigate and/or capture sediment runoff from stored material. At all times the primary objectives would be to minimise both the time and volume of temporary storage and to prevent sedimentation of any watercourse or waterbody. Where practical, excavated peat would immediately be used locally for reinstatement and/or landscaping.

119. Good practice methods include careful removal of vegetated turves, short timescales between lifting and replacement of turves (with a 6 week reinstatement objective) and ensuring stored turves are kept in good condition (including watering when weather conditions could lead to desiccation). Revegetation of bare soil with native vegetation would be undertaken as soon as practicable. Excavated material would be re-used as close to excavation location as practicable and as soon as possible.

120. The scheme would follow standard good practice with regards to soil/peat storage (CIRIA, 2006) as stated in **Appendix 4.2: Outline Construction Environmental Management Plan** of the EIAR. This would include temporary storage of materials at a minimum distance of 10m from any watercourses and 50m from any watercourse identified on Ordnance Survey 50,000 scale mapping, with soil mounds and restoration depths no higher than 2.00m and with stable banking. Specific additional details on catotelmic peat management are provided separately below.

121. Elements of the management and re-use of excavated material may require approval from statutory stakeholders, including SEPA, taking account of reducing erosion/compaction, protecting the soils from pollution and retaining/enhancing soil functionality as a resource.

6.6.2 Decommissioning

122. No decommissioning phase storage has been evaluated or quantified in this report, in keeping with previous consultation with SEPA representatives for similar projects.

6.6.3 Disposal

123. It is anticipated that by considering the various discussed techniques and applying these at appropriate locations all of the excavated site material can be re-used and no disposal would be required.

124. In the event that there is an excess of excavated material, the application of additional options at the detailed design and construction phases would be required, as outlined above, in order to avoid offsite disposal. Furthermore, if no site use is available, offsite re-use options should be explored, with appropriate disposal as waste considered only as the final option, in line with the 'waste hierarchy' and in discussion with SEPA.

6.7 Summary and Conclusions

125. The layout design has taken account of constraints mapping and utilised existing forestry track routes to minimise incursion into areas of deeper peat, wherever practicable, given other environmental and engineering constraints.

126. This report identifies a number of areas of excavation, reinstatement and re-use around infrastructure to be carried out during construction. It is recognised that there is a degree of professional judgement involved in quantified assumptions. Volumes for all excavated soil and peat material are presented in **Table 6.2.1** as the 'Revised Estimate for Excavation' totalling 214,900m^3.

127. There are a number of opportunities, as identified in the text above and summarised in **Table 6.2.2**, to reduce the extent of excavation and/or increase the extent of re-use opportunities as good practice measures. These include:

- reducing excavation depth and footprint required for site infrastructure;
- appropriate re-use of excavated material for reinstatement and profiling of track verges on disturbed ground;
- appropriate re-use of excavated material to reinstate and/or reprofile proposed borrow pits to an average 1.90m depth (not to exceed 2.00m depth); and
- appropriate re-use of excavated material to reinstate and/or reprofile existing quarries/borrow pits to an average 1.90m depth (not to exceed 2.00m depth).

128. Applying the reasonable assumptions discussed in sections above, summarised in **Table 6.2.1** and **Table 6.2.2**, indicates sufficient re-use opportunities, as per the 'Revised Estimate for Re-use', that exceed the excavation volume by approximately 2,100m^3. This is shown on **Table 6.2.1** as the 'Revised Estimate Balance'.

129. Therefore, with consideration of the above, all excavated material could be re-used (i.e. balance) with no material needed to be brought onto Site for restoration. All excavated material would be re-used nearby and in as short a timeframe as is feasible during the construction phase.

130. Specific peat values are presented in **Table 6.2.3**, estimating the total peat excavation as 184,700m^3. Three sub-categories of peat have been distinguished, with estimated quantities for acrotelmic, fibrous catotelmic and amorphous catotelmic peat at defined threshold depths. Due to the iterative design process using peat depth constraints as a key component for new infrastructure locations, the deeper peat locations where more sensitive amorphous catotelmic material is predicted have been avoided, where practicable. A precautionary threshold depth of 1.30m has been applied for this material, based on Site peat core data, with an anticipated excavation volume of 15,900m^3 recorded in **Table 6.2.3**, it is likely that the actual volume of this material will be less as the detailed design is developed as further GI data becomes available. The infrastructure likely to lead to excavation of amorphous catotelmic peat, at a threshold depth of 1.30m or greater, are generally related to the ancillary infrastructure around wind turbine locations such as the blade laydown areas, crane hardstandings, turning heads and crane boom assembly areas, as well as specific access track sections; for which opportunities to avoid or reduce excavation have been noted within this report and are summarised listed below.

131. The borrow pit's detailed design and subsequent restoration will be tailored in relation to ground conditions, excavation profile, locally excavated materials and drainage in order to optimise and sustain habitat opportunities whilst minimising transfer of peat across the site. Peat placed within the borrow pit shall be restored in sequential horizons to replicate natural conditions. The borrow pit restoration enables the creation of suitable permanent storage areas for the transfer of any amorphous catotelmic peat excavated nearby, which would be placed as the lowest horizon, with fibrous catotelmic peat placed mid-layer and acrotelmic peat/turves placed on the surface. Specific materials and drainage features to channel and store runoff within restored peat bodies shall be designed for the borrow pit, in order to maintain high soil moisture content, whilst enabling natural seasonal changes in water level, plus providing local flow attenuation and habitat benefits.

132. Appropriate methods for further consideration to reduce peat disturbance or enhance peat re-use on this Site include:

- micrositing of specific access track sections, crane hardstandings and blade laydown areas in deeper peat, such as ancillary infrastructure adjacent to wind turbines 1, 3, 8, 10 and 13.
- blade laydown areas constructed with minimal excavation to achieve level ground requirement;
- further consideration of floating track construction technique, for new access track sections crossing deeper peat such as between wind turbine 1 and wind turbine 2, and the Substation Compound;
- micrositing and/or restoration of construction compound, turning heads and passing places;
- potential for soil re-use as fill material within the crane hardstandings areas, using locally excavated material;
- potential to increase restoration profile peat depth at borrow pits, subject to these being beneficial in terms of habitat creation; and
- potential for soil re-use at wind turbine bases or other hardstandings, such as a 0.50m top-dressing of peaty soils (rather than peat), where appropriate.

133. Micrositing activities, during detailed design and construction, to shallowest local locations would both reduce the overall volume of excavated material and reduce the more onerous handling and re-use issues associated with amorphous catotelmic peat.

134. Where operational concerns allow and taking account of maintenance requirements, there could be potential to avoid excavation at blade laydown areas, as well as restore some infrastructure locations with excavated material following completion of the construction phase. Restoration considerations would include the construction compound, turning heads and passing places, but additional opportunities should also be reviewed. As this reinstatement may occur post-construction, these would most appropriately be restored with topsoil, rather than peat, due to lengthier timeframe.

135. **Table 6.2.3** quantities are conservative and would include peaty soils and boulder clay that are likely to dominate the shallower soils on steeper slopes in the western area of the Site, where probe depths are regularly less than 0.50m (**Figure 6.5a Peat Detail Western**). These non-peat soils may have characteristics that do not require full excavation and present better opportunities for local re-use.

136. Pre-construction it would be recommended to undertake a series of additional peat probes and trial pits following forestry clearance at excavation locations, particularly at crane hardstandings and other locations where deeper peat was recorded, to enhance understanding of infrastructure-specific soil conditions and potentially further improve the iterative design, this study should include determination of amorphous catotelmic material and also enable sample collection for laboratory analysis. Further GI data and associated detailed design amendments may enable a substantial reduction in the anticipated excavation volume of amorphous catotelmic peat, the Geotechnical Risk Register should include for potential excavation and management of this material.

Infrastructure Description	Initial Estimate (m³) [1]			Revised Estimate (m³) [1]		
	Excavation	**Re-use**	**Balance**	**Excavation**	**Re-use**	**Balance**
Access Tracks	59,700	10,400	49,300	54,100	20,700	33,400
Turning Heads	4,400	-	4,400	4,400	0	4,400
Passing Places	8,300	-	8,300	8,300	0	8,300
Crane Hardstandings, including wind turbines	52,400	9,300	43,100	52,400	9,300	43,100
Crane Boom Assembly	5,600	400	5,200	5,600	400	5,200
Blade Laydown	30,400	30,400	0	30,400	30,400	0
Substation Compound and SPEN Temporary Construction Compound	18,300	1,200	17,100	18,300	1,200	17,100
Temporary Construction Compounds	11,200	1,200	10,000	11,200	1,200	10,000
Borrow Pits, including existing sites	30,200	30,200	-	30,200	153,800	- 123,600
Total	**220,100**	**83,100**	**137,400**	**214,900**	**217,000**	**-2,100**

[1] All volumes are quoted to nearest 100m³.

Table 6.2.1: Volume Estimates for Excavation and Re-use of All Material (Soil and Peat)

Infrastructure Description	Reduction and Re-use	Excavation Volume (m³) [1]	Re-use Volume (m³) [1]
Access Tracks	Micrositing to reduce peat depth by 0.10m in cut track sections	-5,600	
	Extended width of bankings for re-use of peat on track verge for cut track sections		10,300
Borrow Pits	Restoring borrow pit footprints with excavated material to an average depth of 1.90m (not to exceed 2.00m depth)		107,100
	Restoring existing borrow pits with excavated material to an average depth of 1.90m (not to exceed 2.00m depth)		16,500
Total		**-5,600**	**133,900**

[1] All volumes are quoted to nearest 100m³.

Table 6.2.2: Summary of Justification for 'Revised Estimate' Outcomes Compared to 'Initial Estimate', Applied in **Table 6.2.1**

Infrastructure Description	Total Peat Excavation (m3) [1]	Peat Sub-Categories, Based on Site-Specific Threshold Depths (m3) [1]		
	Based on Table 6.2.1 Revised Estimate, Excavation	**Acrotelmic Peat** (<0.30m)	**Fibrous Catotelmic Peat** (0.30m to <1.30m)	**Amorphous Catotelmic Peat** (1.30m+) [2]
Access Tracks	54,100	20,700	30,700	2,700
Turning Heads	4,400	1,200	2,200	1,000
Passing Places	8,300	3,100	5,200	-
Crane Hardstandings, including wind turbines	52,400	14,700	32,800	4,900
Crane Boom Assembly	5,600	1,600	3,500	500
Blade Laydown	30,400	8,300	15,300	6,800
Substation Compound and SPEN Temporary Construction Compound	18,300	7,600	10,700	-
Temporary Construction Compounds	11,200	3,700	7,500	-
Borrow Pits	-	-	-	-
Total	**184,700**	**60,900**	**107,900**	**15,900**

[1] All volumes are quoted to nearest 100m³.

Table 6.2.3: Volume Estimates for Excavation of Peat

6.8 References

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