

# 10 Geology, Peat, Hydrology and Hydrogeology

## Contents

10.1	Executive Summary	10-1
10.2	Introduction	10-2
10.3	Response to Consultation Responses	10-2
10.4	Effect of Layout Changes	10-4
10.5	Assessment of Residual Effects	10-9
10.6	Additional Mitigation	10-11
10.7	Assessment of Cumulative Effects	10-11
10.8	Comparison of Effects	10-12
10.9	References	10-18

This page is intentionally blank.

# 10 Geology, Peat, Hydrology and Hydrogeology

## 10.1 Executive Summary

- 10.1.1 This chapter presents the Applicant's responses to points raised by consultees following the submission of the 2020 Supplementary Environmental Information (SEI), and assesses the effects of the 2021 Layout on geological, hydrogeological, hydrological and peat receptors. This chapter of SEI 2 should be read in conjunction with 2019 EIA Report and Appendices and the 2020 SEI and Appendices.
- 10.1.2 The Outline Peat Management Plan has been revised for the new 2021 Layout and is presented in Appendix 10.1 to SEI 2. The Peat Landslide Hazard Risk Assessment (PLHRA) has been revisited and those parts that have resulted in a change in assessment have been updated and are presented in Appendix 10.2 to SEI 2.
- 10.1.3 Following the change in design of the Proposed Development from the 2020 Layout to the 2021 Layout, a re-assessment of the potential effects of the Proposed Development upon the receptors identified and assessed in the 2019 EIA Report and that were the subject of assessment in the 2020 SEI has been undertaken. This assessment follows the methodology outlined in Chapter 10 of the 2019 EIA Report and summarises the changes below.
- 10.1.4 The 2020 Layout comprised 23 turbines, 7 borrow pit search areas, three construction compounds (including a substation construction compound) and 15.3 km of track. Under the 2021 Layout, this has been reduced to 18 turbines, 4 borrow pit search areas, three construction compounds (including a substation construction compound) and approximately 11.4 km of track to address some of the objections and concerns to the wind farm development.
- 10.1.5 The changes in the 2021 Layout infrastructure in relation to peat, hydrology, hydrogeology and geology when compared to the 2020 Layout infrastructure are summarised below:
- The overall footprint of the Proposed Development has been reduced from approximately 383,518m<sup>2</sup> to 279,327m<sup>2</sup>.
  - The volume of peat extracted has been reduced from 326,959m<sup>3</sup> in the 2020 SEI to 186,243m<sup>3</sup> a reduction of 43%. In relation to the 2019 Layout the volume has decreased from 394,200m<sup>3</sup> in the 2019 EIA Report, which is therefore a total reduction of 53%.
  - The number of turbines within the Gossa Water catchment (Drinking Water Protected Area DWPA) has reduced from 2 to 1 with the removal of Turbine 10. The area of infrastructure within the Gossa Water and its catchment (3.98 km<sup>2</sup>) has reduced from approximately 13,581m<sup>2</sup> to 7,919m<sup>2</sup> equivalent to 0.34 % of the catchment to 0.20%.
  - The reduction in infrastructure footprint reduces the amount of infrastructure and associated construction activities in each catchment, including the Gossa Water, and therefore the likelihood of pollution incidents, sediment release and change of flow is reduced.
  - Crossings of both 1:50k and 1:25k watercourses have been reduced from 30 to 25 and the 4 watercourse diversions have been completely removed, when compared to the 2020 Layout.
  - The removal of the majority of infrastructure from bog pool complexes.
  - The overall number of areas with a risk of peat slide, albeit minor, have reduced from 17 to 14 due to the removal of infrastructure in some of the areas at risk.
- 10.1.6 In terms of volume, the peat that will be extracted amounts to approximately 0.74% (186,243m<sup>3</sup>) of the peat across the survey area (25,197,358m<sup>3</sup>). This percentage reduces further when considering just deep peat (>1m) as the estimated volume of deep peat across the whole of the surveyed area

is 23,245,861m<sup>3</sup>, whereas the estimated volume of deep peat across the excavated infrastructure footprint is 118,121m<sup>3</sup> or 0.51%.

- 10.1.7 A PMP has been developed that demonstrates that all the excavated peat can be reused around the site to restore some of the areas used for construction. Therefore, the volume of peat predicted to be excavated does not exceed the intended re-use volume so no disposal of excess peat off site is expected for the 2021 Layout of the Proposed Development.

## 10.2 Introduction

- 10.2.1 This chapter has been undertaken by Fluid Environmental Consulting (Fluid) and assesses the potential hydrogeological, hydrological and geological impacts, including peat, of the Proposed Development at Yell, Shetland, Scotland.
- 10.2.2 The chapter should be read in conjunction with Chapter 10 of the 2019 EIA Report and its supporting appendices and 2020 SEI Chapter 10 and supporting appendices. This chapter presents the Applicant's responses to points raised by consultees following the submission of the 2020 SEI, and assesses the effects of the 2021 Layout on geological, hydrogeological and hydrological receptors.
- 10.2.3 A revised Outline Peat Management and Restoration Plan (PMP) has been provided as Appendix 10.1 of this SEI 2 as the reduction in infrastructure significantly reduces the development infrastructure area and volumes of peat extracted and re-used. A revised Peat Landslide Hazard Risk Assessment (PLHRA) has also been provided as Appendix 10.2 as there are areas where infrastructure has changed and therefore assessment is required. A full set of figures, 10.1-10.11, has also been produced to present the interaction of the revised layout with the hydrological, hydrogeological, geological and peat environment.

## 10.3 Response to Consultation Responses

### **Scottish Water**

#### **Consultee Response**

- 10.3.1 Scottish Water confirmed that they had no objection to the Proposed Development presented in the 2020 SEI. They have requested that they are re-consulted during the detailed design phase to ensure that there are no impacts to their assets and that the appropriate mitigation is implemented.

#### **Applicant Response**

- 10.3.2 The Applicant can confirm that they will continue to consult with Scottish Water and implement the mitigation which is outlined within chapter 10 of the 2019 EIA Report and the Scottish Water Mitigation and Contingency Plan Appendix 10.6 of the 2019 EIA Report.

### **SEPA**

#### **Consultee Response**

- 10.3.3 Scottish Environment Protection Agency (SEPA) responded (in their letter of 26 October 2020) to the 2020 SEI objecting to the Proposed Development proposals. Where advice on construction methodology and peat management have been provided these have been included in the updated PMP and these, as well as other pertinent comments, are listed below and subsequently addressed.
- 10.3.4 In paragraph 2.1 SEPA state ' *We maintain our request for peat depth survey probing and submission of interpolated depth maps to the full extent of the 100 metre micro-siting allowance. It is noted that the description of the peat depth survey in the Revised Outline Peat Management Plan indicated that this has been conducted to the extent of a 50 metre micro-siting allowance (Peat Survey Methodology, page 8).*'

- 10.3.5 In paragraph 2.7 SEPA state *'In the PMP, reinstatement of peat on 2 in 1 slopes is described. The applicant must provide more information on methods that will be used to re-establish vegetative cover at these slope angles.'*
- 10.3.6 In paragraph 2.11 SEPA state *'It was not clear how long the peat excavated for cable trenches will be stored while the track is laid. The applicant should provide more information on this to enable evaluation of whether it is reasonable to assume that no losses will result.'*
- 10.3.7 In paragraph 2.14 SEPA state *'Experience of peat excavation for development on Shetland (e.g. Total gas plant) has shown that bulking or expansion of the peat volume on excavation is common, and has resulted in underestimation of the volume of peat to be re-used. It is not clear if this has been considered in the peat excavation volume calculations.'*
- 10.3.8 In paragraph 2.18 SEPA state *'Screening bunds are not an appropriate use of excavated peat (PMP, p35), as previously stated in our response of 24 June 2019. The applicant should confirm what is meant by landscaping in this context.'*
- 10.3.9 Previous SEPA correspondence, PCS/165327 24 June 2019, stated the requirement for a number of planning conditions as presented in the 2020 SEI Chapter 10 which the Applicant is committed to. These SEPA conditions are the same conditions as those agreed in response to the 2019 EIA Report.
- 10.3.10 A meeting was held in December 2020 between the Applicant and SEPA which highlighted the following points:
- SEPA noted concerns whether the proposed mitigation and reinstatement would be successful in returning habitat to prior state.
  - SEPA recommended to provide more detail on the proposed Peat Management Areas including locations.
  - SEPA recommended to look at revising the borrow pit search areas.
- 10.3.11 Further consultation was undertaken with SEPA in May 2021 in relation to the Scope of SEI 2. Comments received, and a subsequent meeting held in July 2021, related to ecological matters and are addressed in Chapter 2 and Chapter 7 of SEI 2.

#### **Applicant Response**

- 10.3.12 The 2020 SEI, was presented with a total of 23 turbines (the 2020 Layout) reduced from the 2019 EIA Report of 29 turbines. The Applicant has subsequently completed further design changes to the 2020 Layout, including reducing the number of turbines to 18, a redesign of the turbine foundation and crane hardstanding, further optimisation of access tracks and a reduction in the borrow pits to four as discussed in Chapter 3 of this SEI 2. The changes took into account peat and hydrology impacts including the Gossa Water drinking water supply catchment. Borrow pit search areas were revised, with a number removed and the peat management areas further refined.
- 10.3.13 In response to SEPA's request in their letter of 26 October 2021 for detail on peat management the relevant information is provided in SEI 2 Appendix 10.1 PMP. In addition the following points are noted:
- For the placement of peat on track verges the contractor will undercut the vegetation layer at the edge of the cut track and roll back the vegetation whilst excavating the track; when the excavation is finished the vegetation would then be rolled back over the 2 in 1 batter as described in the PMP (SEI 2 Appendix 10.1).
  - In response to the time peat excavated for cable trenches will be stored, this would be of short duration as the material would be replaced as soon as the cables are laid. In the event that there is any excess peat generated from this activity this would be placed directly into borrow pits as the cable trenches will be installed subsequent to the track construction and therefore a number of borrow pits will be available for immediate peat restoration SEI 2 Appendix 10.1.

- The requirement to consider bulking of peat once excavated has been taken into account by the allowance of a 10% bulking factor which allows a more accurate peat reuse strategy to be defined.

## 10.4 Effect of Layout Changes

10.4.1 Following the change in design of the Proposed Development from the 2020 Layout to the 2021 Layout a re-assessment of the potential effects of the Proposed Development upon the receptors identified in the 2019 EIA Report has been undertaken. This assessment follows the methodology outlined in Chapter 10 of the 2019 EIA Report and summarises the changes below.

10.4.2 The 2020 Layout for 23 turbines, 7 borrow pit search areas, three construction compounds (including a substation construction compound) and 15.3 km track has been reduced to 18 turbines, 4 borrow pit search areas, three construction compounds (including a substation construction compound) and 11.4 km track to address some of the objections and concerns to the Proposed Development.

10.4.3 The changes in the 2021 Layout in relation to the hydrology, hydrogeology and geology of the 2020 Layout are summarised below:

- The overall footprint of the Proposed Development reduced from approximately 383,518m<sup>2</sup> to 279,327m<sup>2</sup>.
- The number of turbines with the Gossa Water catchment (Scottish Water public drinking water supply source) has reduced from 2 to 1 with the removal of Turbine 10. The area of infrastructure within the Gossa Water and its catchment (3.98 km<sup>2</sup>) has reduced from approximately 13,581m<sup>2</sup> to 7,919m<sup>2</sup> equivalent to 0.34 % of the catchment to 0.20%.

### ***Effect of Infrastructure Removal***

10.4.4 The following Table 10.1 presents the infrastructure that has been removed and the positive impact.

**Table 10.1 – Effect of Infrastructure Removal**

<b>Infrastructure Removed</b>	<b>Benefit</b>
Borrow Pit B	The removal of borrow pit B avoids the excavation of ~15,270m <sup>3</sup> of peat, avoids the loss of a pool shown on the 1:50k OS map and removes the diversion of a 1:25k watercourse
Borrow Pit F	The removal of borrow pit F avoids the excavation of ~47,200m <sup>3</sup> of peat in an area of deep peat and excavation within a bog pool complex.
Borrow Pit H	SEPA had previously requested borrow pit H to be removed due to the impact on a watercourse and deep peat. The removal of this borrow pit avoids the excavation of ~34,800m <sup>3</sup> of peat and negates the diversion of a 1:25k watercourse, as well as avoiding excavation within a bog pool complex.
Turbine 5 and associated hardstanding	The removal of this turbine and associated hardstanding avoids the excavation of ~4,540m <sup>3</sup> of peat and avoids excavation within a bog pool complex.

Infrastructure Removed	Benefit
Turbine 6 and associated hardstanding	The removal of this turbine and associated hardstanding avoids the excavation of ~6,550m <sup>3</sup> of peat, negates the crossing of a 1:25k watercourse and removes infrastructure within an area of potential bog burst (peat slide risk).
Turbine 9 and associated hardstanding	The removal of this turbine and associated hardstanding avoids the excavation of ~5,820m <sup>3</sup> of peat and avoids excavation within a bog pool complex.
Turbine 8 and associated hardstanding	The removal of this turbine and associated hardstanding avoids the excavation of ~3,610m <sup>3</sup> of peat and avoids excavation within a bog pool complex.
Turbine 10 and associated hardstanding	The removal of this turbine and associated hardstanding avoids the excavation of ~3,690m <sup>3</sup> of peat. It also removes further infrastructure from the Gossa Water catchment area.
Track section from Turbine 11 north to T8, T9, T6, T5 and BPH	The removal of this track reduces the number of 1:50k watercourse crossings by 3 (crossings 4, 5 and 6) and the number of 1:25k watercourse crossings by 6 (crossings 7, 8, 9, 10, 11 and 12). Most of the track was programmed to be floated but a section was due to be excavated which also reduces the overall peat volume to be removed.
Track from T12 to T10	The removal of this section of floated track further reduces potential impact on the Gossa Water catchment

### ***Effect of Layout Redesign***

10.4.5 The remainder of the site layout was optimised which resulted in the following main changes:

- Optimisation of the turbine base area, crane hardstanding area, temporary laydown area and temporary assembly area to reduce size and the associated volumes of peat to be excavated.
- Engineering optimisation of the track layout for both floating and excavated track so that the presented layout is constructable.
- Realignment of some sections of track for numerous environmental reasons as well as engineering optimisation resulting in the adjustment, removal and addition of a number of watercourse crossings and change in the PLHRA zones.

### **Watercourse Crossings**

10.4.6 The redesign of the layout results in minor adjustments to the remaining watercourse crossings as presented in Table 10.2. Watercourse crossings are shown on Figure 10.6.

**Table 10.2 – Watercourse Crossing Changes**

<b>Watercourse Crossing</b>	<b>Effect</b>
Crossing 7 1:50k	Moved 3m south, no significant change
Crossing 8 1:50k	Moved 4m to North East, no significant change
Crossing 9 1:50k	Moved 3m to South East, no significant change
Crossing 10 1:50k	No change
Crossing 11 1:50k	No change
Crossing 12 1:50k	Moved 3m to North, no significant change
Crossing 13 1:50k	Moved 9m to North, no significant change
Crossing 14 1:50k	New Location. Existing crossing of existing track to be upgraded. Location is same as on previous layout but was omitted from watercourse crossing list.
Crossing 13 1:25k	No change
Crossing 14 1:25k	Moved 15m South. No significant effect.
Crossing 15 1:25k	Removed. Low positive effect.
Crossing 16 1:25k	No change
Crossing 17 1:25k	No change
Crossing 18 1:25k	Move 5m south. No significant effect.
Crossing 19 1:25k	Removed. Low positive effect.
Crossing 20 1:25k	No change
Crossing 21 1:25k	No change
Crossing 22 1:25k	No change
Crossing 23 1:25k	Moved 7m South East. No significant effect.
Crossing 24 1:25k	Moved 3m South. No significant effect.
Crossing 25 1:25k	No change
Crossing 26 1:25k	No change
Crossing 27 1:25k	New crossing at Turbine 19. Low negative effect.

Watercourse Crossing	Effect
Crossing 28 1:25k	New location on rerouted excavated access track. Low negative effect.
Crossing 29 1:25k	New location. Existing crossing of existing track to be upgraded. Location is same as on previous layout but was omitted from watercourse crossing list.

10.4.7 Requirements for main watercourse crossings (shown on 1:50,000 scale Ordnance Survey Mapping) has therefore reduced from 10 to 8 (labelled as watercourse crossing numbers 7 to 13 and described in the 2019 EIA Report, Appendix 10.5 Watercourse Crossing Inventory plus one upgrade to an existing crossing and shown as green circles on SEI 2, Figure 10.6b, c, d and e). Requirements for other watercourse crossings (shown on 1:25,000 scale OS mapping or identified during the site walkover) has reduced from 20 to 15 (labelled as 13, 14, 16, 17, 18, 20 to 28 and described in the 2019 EIA report, Appendix 10.5 Watercourse Crossing Inventory, plus one upgrade to an existing crossing and shown as red dots on SEI 2, Figure 10.6b, c, d and e). The approximate 180 known new crossings of minor man-made drains, natural ephemeral drains and diffuse drainage areas or ephemeral flows crossing the site has been reduced to approximately 140 new minor crossings. These crossings will comprise of culverts or where the drainage area is wide a series of culverts. The design of the watercourse crossings will follow good practice industry guidelines and will be adequately sized to enable them to convey the 1 in 200 year design flow at each point without causing constriction of flow or exacerbation to flood risk elsewhere.

#### Peat

10.4.8 Peat has been determined to be present up to a maximum depth of 6.15 m and an average depth of 1.45 m across the site based on 13,061 depth of penetration probes across the site and 174 cores undertaken near to proposed infrastructure. The data indicates that deep peat (>1.0 m depth) is present across 68.45% of the 2021 Layout infrastructure (192,596m<sup>2</sup>) and no peat (0 – 0.5 m depth) is present across 6.94% of the 2021 Layout infrastructure (19,524m<sup>2</sup>). Acrotelm thickness ranges from 0.00 m to 0.30 m with an average depth of 0.15 m. The average peat depth within the site boundary (as described in Chapter 10 of the 2019 EIA Report) is calculated to be approximately 1.45m. The average peat depth within the infrastructure footprint is reduced from the 2020 Layout at 1.32m to 1.30m for the 2021 Layout.

10.4.9 The Outline Peat Management Plan has been revised and appended to this chapter (SEI 2, Appendix 10.1) to reflect the reduction and redesign of infrastructure under the 2021 Layout. Full details of peat excavation associated with each individual infrastructure are provided including allowances for slope batters and drainage arrangements.

10.4.10 The layout optimisation and infrastructure area reduction have resulted in very significant reductions in the volume of peat that will require to be excavated. These are presented below:

**Table 10.3 – Excavated Peat Volumes**

Description	2020 Layout	2021 Layout	% change
Total volume of acrotelm peat	41,428m <sup>3</sup>	26,045m <sup>3</sup>	37%
Total volume of catotelm peat	285,531m <sup>3</sup>	160,198m <sup>3</sup>	44%

Description	2020 Layout	2021 Layout	% change
Total volume of excavated peat	326,959m <sup>3</sup>	186,243m <sup>3</sup>	43%

10.4.11 These values can be compared to the peat across the site to provide context for volume of peat removed.

- The estimated volume of peat across the whole of the surveyed area is 25,197,358m<sup>3</sup>. This can be compared to the total volume of peat that will be excavated for the proposed development of 186,243m<sup>3</sup>, which accounts for 0.74% of the estimated peat across the whole of the survey area.
- The estimated volume of deep (>1m) peat across the whole of the surveyed area is 23,245,861m<sup>3</sup>, whereas the estimated volume of deep (>1m) peat across the infrastructure footprint is 290,849m<sup>3</sup> but as some of the infrastructure is floated only 118,121m<sup>3</sup> is excavated which accounts for 0.51% of the estimated deep peat across the whole of the surveyed area.
- In terms of area, deep (>1m) peat occupies 13,016,626m<sup>2</sup> (or ~78%) of the whole of the survey area and is present across 192,596m<sup>2</sup>, or 1.48%, of the infrastructure footprint.

10.4.12 These numbers demonstrate the deep peat nature of the area.

10.4.13 Taking into account consideration of a bulking factor, as requested by SEPA in their response of 26 October 2020, a 10% expansion has been applied in order to determine the volume of peat for reuse and restoration. SEI 2 Appendix 10.1 presents the peat reuse strategy on site which demonstrates that all excavated peat, including the volumes once the bulking factor has been applied, can be reused on site.

**Table 10.4 – Net Peat Balance**

Description	Excavated Volume (m <sup>3</sup> ), including 10% bulking factor	Peat Reuse Volume (m <sup>3</sup> )	Net Balance
Acrotelm	28,650m <sup>3</sup>	24,882m <sup>3</sup>	3,768m <sup>3</sup>
Catotelm	176,218m <sup>3</sup>	188,600m <sup>3</sup>	-12,382m <sup>3</sup>
Total	204,867m <sup>3</sup>	213,481m <sup>3</sup>	-8,614m <sup>3</sup>

10.4.14 Based on the figures and reuse strategy presented in SEI 2 Appendix 10.1 it is expected that over the life time of the Proposed Development there will be a potential for more peat to be reused on the site than the volume excavated. This is as a result of about 17.5ha of peatland habitat being directly lost to tracks, turbines and crane hardstandings generating a total amount of excavated peat plus 10% bulking of around 205,000m<sup>3</sup> and there is a capacity for the reuse of almost 213,500m<sup>3</sup> of peat onsite. No off-site disposal of peat is therefore required.

10.4.15 The full calculations associated with these volumes are presented in detail in SEI 2 Appendix 10.1 along with the peat reuse strategy which follows the same approach detailed in the 2019 EIA Report and 2020 SEI and comprises reinstatement in the following areas:

- In all four borrow pits to a depth of 2m as peat within borrow pits and in adjacent areas is present up to 2m and in places up to 3m, along with the deep peat nature of the whole of the survey area;

- In construction compound 1 to a depth of 2m as peat within footprint and in adjacent areas is present up to 2m;
- along the 2 in 1 sloped verges along all tracks (both cut and floated) and around all infrastructure where it is adjacent to peat in a 0.5m thickness. In practice this will involve peeling back the top 0.5m of peat in these areas and relaying it over the slope along with controlling water runoff from the track and flows from adjacent peat. This is described further below;
- in areas where floated construction compounds are removed subsequent to the construction period in a 0.3m thickness; and
- in any drains that can be backfilled subsequent to restoration, e.g. around the borrow pits and around as much infrastructure as possible to promote peat restoration.

#### **Peat Landslide Hazard Risk Assessment**

- 10.4.16 The redesign of the layout from the 2020 to 2021 Layout has resulted in some changes in the peat slide risk associated with the infrastructure (SEI 2 Appendix 10.2). The PLHRA identified landslide source zones as part of the original analysis of the site where infrastructure overlapped with areas of Moderate or above peat slide or bog burst likelihood. Landslide likelihood is a function of ground conditions and the assessment of this has not changed since the 2020 SEI. However, the location and extent of source zones depends on the position of infrastructure relative to areas of Moderate or above landslide likelihood, and the change in layout has required a review of the previously identified source zones.
- 10.4.17 The layout change previously presented in 2020 SEI removed source zones 1, 2, 3, 6 and 7 with zones 4, 5 and 8 to 22 remaining. The removal of infrastructure for the 2021 Layout removes a further three source zones, 4, 5 and 10, due to the removal of turbines 5, 6, 8, 9 and 10. The 2021 Layout optimisation results in minimal other change as follows:
- Source zone 17: this zone, associated with Turbine 24 has expanded due to an increase in overlap with a moderate likelihood area by 18 m to the north.
  - Source zone 22: this zone, associated with Turbine 25 has contracted due to a decrease in overlap with a moderate likelihood area by 26 m to the south.
  - There are no changes to source zones 8-9, 11-16 and 18-21.
- 10.4.18 It should be noted that all the infrastructure locations and detailed design are subject to further ground investigations and for that reason have a micro siting allowance of up to 100 m which may facilitate some further refinements into even better locations, taking into account all the constraints from all disciplines, with the current locations reflecting the worst case position for EIA purposes. The Applicant will commit to completing peat surveying in the 100m micrositing allowance area prior to construction.

## **10.5 Assessment of Residual Effects**

### ***Residual Effects***

- 10.5.1 Following the change in design of the Proposed Development from the 2020 Layout to the 2021 Layout, a re-assessment of the residual effects of the Proposed Development upon the receptors identified in the 2019 EIA Report has been undertaken. This assessment follows the methodology outlined in Chapter 10 of the 2019 EIA Report and assumes that all mitigation detailed within the 2019 EIA Report and 2020 SEI is undertaken.
- 10.5.2 These effects are assessed taking into account the updated PMP which presents measures including:
- Avoidance and minimisation of peat disturbance throughout construction;

- Peat is handled in a suitable way during construction to avoid any degradation and to ensure it is suitable for re-use; and,
  - All excavated peat is re-used onsite in borrow pits, construction compounds, along track verges and at turbine foundations and hardstandings.
- 10.5.3 The implementation of the PMP will ensure the volume of peat predicted to be excavated does not exceed the intended re-use volume so no disposal of excess peat off site is expected for the 2021 Layout of the Proposed Development.

#### **Construction**

- 10.5.4 The residual significant effect during the construction phase can be reassessed as detailed below.

#### Water Quality

- 10.5.5 The Gossa Water Scottish Water drinking supply catchment would need to be carefully managed in accordance with the Drainage Strategy presented in Appendix 3.1 of the 2019 EIA Report and the Scottish Water Mitigation and Contingency Plan Appendix 10.6 of the 2019 EIA Report due to its very high sensitivity. The amount of infrastructure has decreased but the significance remains as previously assessed as **Minor /Moderate**.

- 10.5.6 Other watercourse catchments are considered to have a residual significance of effect of **Minor** once all mitigation is considered.

#### Drainage Alteration

- 10.5.7 All diversions of 1:50,000 and 1:25,000 OS Mapping watercourses have now been removed. There will still likely be some diversions of very minor watercourses or drainage ditches, however these will result in an overall residual effect of **Minor**.

- 10.5.8 On a catchment scale a small amount of bog pools will be lost and drainage diverted which will not significantly affect flood risk or habitats in the watercourses downstream on a catchment scale and therefore is considered to be an effect of **Minor** significance.

- 10.5.9 Despite considerate design and additional measures, which include avoiding watercourses, drains and bog pool where possible, the disturbance and removal of bog habitats can only be partly mitigated by the development of new replacement habitats elsewhere. The re-creation of blanket bog within the borrow pits and the restoration of additional areas of blanket bog outwith the site boundary is detailed within the Outline Habitat Management Plan, presented within Appendix 7.1 of this SEI 2. Taking this mitigation into account, the overall residual effect is assessed to be **Minor** to **Moderate**. **Minor/Moderate** for the Gossa Water DWPA due to its sensitivity and **Moderate** where the excavation of bog pools cannot be avoided and are classified as Oligiotrophic and Dystrophic standing water habitats of National level importance in the Ecology Chapter 7 of the 2019 EIA Report.

#### Geological Alteration

- 10.5.10 Despite considerate design and additional measures with regards to appropriate peat re-use to offset for excavated peat and avoiding deep peat and peat slide risk areas where possible, the disturbance and excavation of peat and peatland habitats cannot be fully mitigated; therefore, the overall residual effect is assessed to be **Minor** to **Major**, and **Major** where the excavation of deep peat cannot be avoided.

#### **Operation**

- 10.5.11 The residual significant effects of operation can be reassessed as detailed below.

### Water Quality

- 10.5.12 The impact on water quality as a result of diverting some minor water flows, the use of the access tracks, activities onsite and potential incidents on a catchment scale is considered to be of low magnitude, therefore the residual effect significance is **Minor**, with the exception of the Gossa Water Drinking Water protected catchment where the residual significance is **Minor/Moderate** due to the sensitivity of the catchment. Rigorous mitigation will be put in place in accordance with the agreed water quality monitoring and contingency plan agreed with Scottish Water (2019 EIA Report Appendix 10.6 Scottish Water Contingency Plans).

### Drainage Alteration

- 10.5.13 Hydrological changes, as a result of diverting some minor water flows, drainage and oxidation of some peat and the removal of some bog pools attenuating water on a catchment scale is considered to be low magnitude and therefore the residual effect significance is **Minor**.

### Geological Alteration

- 10.5.14 No further earthworks or additional land take should be required. With the mitigation outlined, as referenced in paragraph 10.5.11, the magnitude of risks from peat slide should remain low. Therefore, there will be no further disturbance of peat and the residual significant effect is **Minor**.

### **Decommissioning**

- 10.5.15 The residual significant effect of decommissioning can be reassessed as detailed below.

### Water Quality

- 10.5.16 Method statements, pollution controls and management plans and mitigation applied to protect the watercourses will ensure protection of the site water resource. For the residual assessment, the significance is assessed to be **Minor** for the majority of the site.
- 10.5.17 The exception is the Gossa Water Scottish Water drinking supply catchment would need to be carefully managed in accordance with the Drainage Strategy presented in 2019 EIA Report Appendix 3.1 and the Scottish Water Contingency Plan 2019 EIA Report Appendix 10.6 due to its very high sensitivity. For the residual assessment, the significance is assessed as **Minor/Moderate**.

### Drainage Alteration

- 10.5.18 The risk of drainage alteration during decommissioning is considered to be of **Minor** significance with the exception of the Gossa Water catchment which is **Minor/Moderate** due to its sensitivity.

### Geological Alteration

- 10.5.19 No additional land take should be required other than temporary reopening the construction compound areas which will be restored. Therefore, there will be no significant further disturbance of peat other than some marginal areas and the peat slide risk will remain low so that the residual significance is **Minor**.

## 10.6 Additional Mitigation

- 10.6.1 No additional mitigation to that previously proposed in the 2019 EIA Report and 2020 SEI is required.

## 10.7 Assessment of Cumulative Effects

- 10.7.1 At time of writing, the only wind farm project in close proximity to the Proposed Development that could have a hydrological connection is the five-turbine Garth Wind Farm, located on north Yell (the closest Garth turbine is just over 1.5 km to the east of the Proposed Development site boundary). This project has no direct connectivity with the Proposed Development, being located within a different catchment and therefore outwith the hydrological zone of influence.

10.7.2 In terms of the hydrological zone of influence, cumulative adverse impacts are only likely in relation to fish and otter which are covered by Chapter 7: Ecology.

10.7.3 There are therefore considered to be no significant cumulative effects on hydrology and hydrogeology. Peat is not considered in terms of cumulative effects.

## 10.8 Comparison of Effects

10.8.1 The reduction of the Proposed Development infrastructure in the 2021 Layout has resulted in a 43% reduction in excavated peat volumes (186,243 m<sup>3</sup> for the 2021 Layout, reduced from 326,959 m<sup>3</sup> predicted as a result of the 2020 Layout). Table 10.2 below provides a comparison of effects between the assessment undertaken on the 2020 Layout reported within the 2020 SEI, and the assessment undertaken on the 2021 Layout reported above.

**Table 10.3 – Summary of Effects**

Description of Effect	2020 Effects		2021 Effects	
	Significance	Beneficial/ Adverse	Significance	Beneficial/ Adverse
<b>Construction</b>				
<b>Erosion and Sedimentation</b>				
Water Quality	Minor to Minor/ Moderate, Minor/Moderate for the Gossa Water DWPA due to its sensitivity	Adverse	Minor to Minor/ Moderate, Minor/Moderate for the Gossa Water DWPA due to its sensitivity.	Adverse
Drainage Alteration	Minor to Minor/Moderate Minor/Moderate for the Gossa Water DWPA due to its sensitivity.	Adverse	Minor Minor/Moderate for the Gossa Water DWPA due to its sensitivity.	Adverse
Peat Disturbance	Minor	Adverse	Minor	Adverse
Peat Slide	Minor	Adverse	Minor	Adverse
<b>Pollution</b>				
Water Quality	Minor to Minor/ Moderate, Minor/Moderate for the Gossa Water DWPA due to its sensitivity	Adverse	Minor to Minor/ Moderate, Minor/Moderate for the Gossa Water DWPA due to its sensitivity.	Adverse
<b>Natural Drainage Alteration</b>				

Description of Effect	2020 Effects		2021 Effects	
	Significance	Beneficial/ Adverse	Significance	Beneficial/ Adverse
Watercourse Crossings	Minor	Adverse	Minor	Adverse
Watercourse Diversions	Moderate	Adverse	Minor	Adverse
Bog Pools and waterbodies	Minor to Moderate. Moderate where the excavation of bog pools cannot be avoided and are classified as Oligiotrophic and Dystrophic standing water habitats in the Ecology Chapter 7.	Adverse	Minor to Moderate. Moderate where the excavation of bog pools cannot be avoided and are classified as Oligiotrophic and Dystrophic standing water habitats in the Ecology Chapter 7.	Adverse
Peat Slide	Minor	Adverse	Minor	Adverse
<b>Geological Alteration</b>				
Disturbance of peat	Minor to Major. Major, where excavation of Annex I deep peat cannot be avoided	Adverse	Minor to Major. Major, where excavation of Annex I deep peat cannot be avoided	Adverse
Peat Slide	Minor	Adverse	Minor	Adverse
<b>Operation</b>				
<b>Erosion and Sedimentation</b>				
Water Quality	Minor to Minor/ Moderate,	Adverse	Minor to Minor/ Moderate,	Adverse

Description of Effect	2020 Effects		2021 Effects	
	Significance	Beneficial/ Adverse	Significance	Beneficial/ Adverse
	Minor/Moderate for the Gossa Water DWPA due to its sensitivity		Minor/Moderate for the Gossa Water DWPA due to its sensitivity.	
Pollution	Minor	Adverse	Minor	Adverse
<b>Natural Drainage Alternation</b>				
Alteration of natural drainage patterns	Minor	Adverse	Minor	Adverse
Flood Risk	Minor	Adverse	Minor	Adverse
<b>Geological Alteration</b>				
Disturbance of peat	Minor	Adverse	Minor	Adverse
Peat Slide	Minor	Adverse	Minor	Adverse
<b>Decommissioning</b>				
<b>Erosion and Sedimentation</b>				
Water Quality	Minor to Minor/ Moderate, Minor/Moderate for the Gossa Water DWPA due to its sensitivity.	Adverse	Minor to Minor/ Moderate, Minor/Moderate for the Gossa Water DWPA due to its sensitivity.	Adverse
Drainage Alteration	Minor to Minor/Moderate	Adverse	Minor to Minor/Moderate	Adverse

Description of Effect	2020 Effects		2021 Effects	
	Significance	Beneficial/ Adverse	Significance	Beneficial/ Adverse
	Minor/Moderate for the Gossa Water DWPA due to its sensitivity.		Minor/Moderate for the Gossa Water DWPA due to its sensitivity.	
Peat Disturbance	Minor	Adverse	Minor	Adverse
Peat Slide	Minor	Adverse	Minor	Adverse
<b>Pollution</b>				
Water Quality	Minor to Minor/ Moderate, Minor/Moderate for the Gossa Water DWPA due to its sensitivity.	Adverse	Minor to Minor/ Moderate, Minor/Moderate for the Gossa Water DWPA due to its sensitivity.	Adverse
<b>Geological Alteration</b>				
Disturbance of peat	Minor	Beneficial	Minor	Beneficial

**Table 10.4 – Summary of Cumulative Effects**

Receptor	Effect	Cumulative Developments	2019 Cumulative Effect		2020 Cumulative Effect	
			Significance	Beneficial/ Adverse	Significance	Beneficial/ Adverse
Hydrology	No direct connectivity with the Proposed Development, being located within a different	Five-turbine Garth Wind Farm, located on north Yell (the closest	No effects	N/A	No effects	N/A

Receptor	Effect	Cumulative Developments	2019 Cumulative Effect		2020 Cumulative Effect	
			Significance	Beneficial/ Adverse	Significance	Beneficial/ Adverse
	<p>catchment and therefore outwith the hydrological zone of influence.</p> <p>In terms of the hydrological zone of influence, cumulative adverse impacts are only likely in relation to fish and otter which are covered by Chapter 7: Ecology</p>	<p>Garth turbine is just over 1.5 km to the east of the Proposed Development site boundary).</p>				

## 10.9 References

As per the 2019 EIA Report, with the addition of the following guidance update:

Scottish Renewables, SNH, SEPA & Forestry Commission Scotland (2019); Good practice during windfarm construction, 4<sup>th</sup> Edition.