

14. Hydrology, Hydrogeology and Peat

Introduction

- 14.1 This Chapter reports the outcome of the assessment of likely significant environmental effects in relation to hydrology, hydrogeology and peat.
- 14.2 The Chapter describes the technical consultation that has been undertaken during the EIA, the scope of the assessment and assessment methodology and a summary of the baseline information that has informed the assessment.
- 14.3 In line with **Chapter 2: Approach to EIA**, the assessment reports on the likely significant environmental effects, the further mitigation measures required to prevent, reduce or offset any significant adverse effects, or further enhance beneficial effects. The conclusions are provided both in terms of the residual effects and whether these are considered to be significant. The assessment of effects takes into consideration both primary and tertiary mitigation (see **Chapter 2: Approach to EIA** for further details).
- 14.4 This Chapter, and its associated **Figures 14.1 – 14.11** and **Appendices 14.1 – 14.9** is intended to be read as part of the wider ES with particular reference to the introductory Chapters of this ES (**Chapters 1 – 5**), as well as **Chapter 9: Ecology**.
- 14.5 In addition, this Chapter should be read in conjunction with **Chapter 16: Assessment of Cumulative Effects**.
- 14.6 The following Chapter specific terminology will be referred to throughout:
- **GWDTes** – Groundwater Dependent Terrestrial Ecosystems are habitats that are dependent on groundwater. They are specifically protected under the Water Framework Directive (WFD)¹;
 - **PLHRA** – Peat Landslide Hazard Risk Assessment. Peat landslides are caused by a combination of factors. To assess the risk of a peat slide occurring in a particular location all of these factors must be determined and then combined into a model that enables a map of peat slide risk to be produced;
 - **PWS** – Private Water Supplies are any water supplies to residents and their land that are not supplied through the public water mains system. PWS can be surface water or groundwater-fed;
 - **Hydrologically / Hydrogeologically Connected** – a receptor that is hydrologically or hydrogeologically connected to a source has potential surface water or groundwater pathways that directly link the two; e.g. the source is upgradient of the receptor in the same catchment;
 - **DWPA** – Drinking Water Protected Areas are defined by the catchments that supply water to the drinking water reservoir or borehole(s); and
 - **FRA** – Flood Risk Assessment.

Summary of Consultation

2025 ES

- 14.7 The Project Team undertook an EIA Scoping exercise (described further under the ‘Scope of Assessment’ section below) in support of the 2025 ES, which included consultation with RMBC and RBC and other stakeholders. The outcomes of this process are documented in **Chapter 2: Approach to EIA** and **Appendix 2.1**. No consultation has been undertaken over and above that completed during the EIA Scoping process. At the time of writing (May 2026), no Scoping Opinion has been received.
- 14.8 **Table 14.1** provides an overview of the consultation that was undertaken to inform the Project for Assessment and EIA, including the consideration of likely significant effects and the methodology for assessment.

Table 14.1: Summary of consultation

Body / organisation	Contact	Date and form of consultation	Summary
Environment Agency	Customer and Engagement Officer	Email, 3 rd January 2025	Request for Private and Public Water Supply abstractions within a 2km boundary of the Assessment Boundary. Summarised in Appendices 14.6 and 14.7 .

2026 FEI ES

- 14.9 No further consultation has been undertaken as part of this ES. However, statutory consultation responses received following submission of the 2025 ES that are directly relevant to the ES, and its supporting material have been considered, with the outcomes documented in **Appendix 2.4**.

Scope of the Assessment

- 14.10 An EIA Scoping Report was submitted to RMBC and RBC on 16th December 2024, as presented as **Appendix 2.1**. At the time of writing (May 2026), no Scoping Opinion has been received. Therefore, the Scope of Assessment is the same as that submitted as part of the EIA Scoping Report, with some minor updates to reflect additional peat probing associated with infrastructure layout changes; and to take account of the consultation comments received following the submission of the 2025 ES.

Effects Unlikely / Not Significant

- 14.11 The following effects were not considered significant as part of the EIA Scoping Report and are not considered further in this Chapter:
- Loss, degradation and disturbance of peatland during operation and decommissioning;
 - Effects on licenced and PWS located over 1km from the Assessment Boundary and over 250m from infrastructure associated with the Project for Assessment; and

- Effects on GWDTEs located over 250m from infrastructures excavations >1m depth and 100m from excavations <1m depth.

14.12 Following the submission of the 2025 ES, further consideration was given to the grid connection routes and laydown area and associated effects on peatland. Effects within these areas are not considered to be significant and justification is provided below.

Loss, degradation and disturbance of peatland associated with grid connection routes and laydown area

14.13 The location of the grid connection routes are located outside of the areas considered to contain deep peat, combining this with the small footprint and immediate reinstatement of any organic soils following any intrusive works effects on peatland associated with the grid connection routes are considered to be not significant and are therefore not included as part of the assessment.

14.14 The laydown area located in the western portion of the Assessment Boundary (as shown in **Figure 4.1**) is on the very edge of the area defined as peat soil and other soils and has no peatland vegetation. The assessment of peat loss, degradation or disturbance is therefore not considered to be significant and is not included in the assessment.

Effects Likely / Significant

14.15 Following the submission of the EIA Scoping Report, the effects and receptors identified have been subject to further analysis and refinement and the scope has been developed. In particular, 'alterations of surface and groundwater flow during operation' which was proposed to be 'scoped out' in the EIA Scoping Report has now been 'scoped in' following further analysis / evaluation. Furthermore, peat landslide hazard risk has been brought into the assessment and this focusses on natural environment (water environment) receptors (major accidents associated with peat slide to human health and infrastructure receptors is as addressed in **Appendix 2.1**).

14.16 **Table 14.2** outlines the effects that are considered likely / significant and are reported within this Chapter. It should be noted that while an 'effect-led' assessment is set out in **Table 14.2**, the assessment is 'receptor-led' and conclusions are presented for each receptor / receptor group in the 'Assessment of Effects, Secondary Mitigation and Residual Effects' section in this Chapter.

Table 14.2: Effects Likely / significant

Likely significant effect	Receptor(s)	Applicable stage(s)*
Erosion and sedimentation effects	Surface water features, public water supplies, PWS, GWDTEs, peat resource	Construction / decommissioning
Alteration of flow, natural drainage patterns / runoff volumes and rates	Surface water features, public water supplies, PWS, GWDTEs	Construction / operation / decommissioning
Potential pollution events affecting groundwater and surface water quality	Surface water features, public water supplies, PWS, GWDTEs	Construction / operation / decommissioning
Peat landslide hazard risk	Surface water features, public water supplies and peat resource	Construction / operation / decommissioning
Loss, degradation and disturbance of peat resource	Peat resource	Construction / decommissioning

* *It is noted that construction is to be used as a 'proxy' for decommissioning.*

Assessment Methodology

Legislative Framework, Policy and Guidance

14.17 The following legislation and policy have informed the assessment of effects within this Chapter:

- The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017¹;
- Water Resources Act 1991²;
- Environmental Protection Act 1990³;
- The EIA Regulations⁴; and
- The Private Water Supplies (England) (Amendment) Regulations 2018⁵.

14.18 The following guidance has informed the assessment of effects within this Chapter:

- The Pollution Prevention Guidelines (PPGs) are being replaced by the Guidance for Pollution Prevention (GPP) and include the documents referred to below. These are the principal documents providing guidance on preventing contamination of surface water from construction activities. Those relevant to the Project for Assessment include:

- GPP1: Understanding your Environmental Responsibilities – Good Environmental Practices⁶;
- GPP2: Above Ground Oil Storage Tanks⁷;
- GPP4: Treatment and Disposal of Sewage Where No Foul Sewer Is Available⁸;
- GPP5: Works and Maintenance in or Near Water⁹;
- PPG6: Working at Construction and Demolition Sites¹⁰;
- GPP8: Safe Storage and Disposal of Used Oils¹¹;
- GPP21: Pollution Incidence Response Planning¹²; and
- GPP26: Storage and Handling of Drums and Intermediate Bulk Containers¹³.

14.19 Other relevant guidance:

- Control of Water Pollution from Construction Sites: Guidance for Consultants and Contractors C532¹⁴;
- Environmental Good Practice on Site C650 2nd Edition¹⁵;
- Control of Water Pollution from Linear Construction Projects: Technical Guidance C648¹⁶;
- Good Practice During Windfarm Construction (Scottish Renewables, Scottish Natural Heritage (SNH), Scottish Environment Protection Agency (SEPA) & Forestry Commission Scotland, 4th Edition, 2019)¹⁷;
- Guidance on Road Construction and Maintenance (Forests and Water Guidelines 5th Edition, 2011, Forestry Commission)¹⁸;
- National Highways Design Manual for Roads and Bridges (DMRB)¹⁹;
- Peatland Survey: Guidance on Developments on Peatland (Scottish Government, Scottish Natural Heritage, SEPA, 2017)²⁰;
- Peatlands: Guidance on Developing Peatland Areas in the UK (IUCN UK Peatland Programme)²¹;
- Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Scottish Government, 2nd Edition, 2017)²²;
- Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems, Land Use Planning System SEPA Guidance Note 31 (SEPA, 2017)²³;
- UK Technical Advisory Group (UKTAG) (2004). *Guidance on the identification and risk assessment of groundwater dependent terrestrial ecosystems*. Wetlands Task Team Working Draft (Version 5, 21 January 2004)²⁴; and

- Natural England (2025) *Definition of favourable conservation status for blanket bog (RP2967)*²⁵.
- SEPA (2024) Recommended Riparian Corridor Layer for use in Land Use Planning²⁶.

Defining the Study Area

- 14.20 The hydrology, hydrogeology and peat assessment has considered the Project for Assessment, including all infrastructure such as wind turbine locations, access tracks, hardstandings, the temporary construction compound and the substation, as shown in **Figure 14.1: Hydrological Setting**. The Assessment Boundary represents the full extent of physical works and potential zones of environmental effect during construction, operation and decommissioning stages.
- 14.21 The study area has been defined to include relevant surface water catchments and sub-catchments, groundwater flow regimes and peat distribution within and immediately surrounding the Assessment Boundary. A buffer of up to 2km from the proposed infrastructure has been considered where appropriate, to identify potential receptors (e.g. watercourses, PWS reliant on groundwater and up to 250m from infrastructure for GWDTEs potentially affected by direct or indirect hydrological or hydrogeological impacts.
- 14.22 The identification and assessment of likely significant effects and the need for mitigation is based on the study area.

Background Studies to Inform the ES

- 14.23 **Table 14.3** summarises all studies / surveys / analysis / evaluations undertaken to inform the assessment presented within this Chapter.

Table 14.3: Studies / surveys / evaluations / analysis undertaken to inform the ES

Study / survey / analysis / evaluation	Overview	Date of completion
Appendix 14.1: Good Practice Methods	Identification of good practice measures to protect the water and soils environment during construction and operation	May 2026
Appendix 14.2: Peat Survey Report	Field survey and mapping of peat depths and characteristics across the Assessment Boundary	May 2026
Appendix 14.3: Outline Peat Management Plan	High-level plan for the handling, storage, and reuse of peat during construction	May 2026
Appendix 14.4: Peat Landslide Hazard Risk Assessment (PLHRA)	Assessment of potential landslide risks associated with peat instability across the Assessment Boundary	May 2026
Appendix 14.5: Watercourse Crossing Inventory	Baseline mapping and summary of all proposed watercourse crossings and associated features	May 2026

Study / survey / analysis / evaluation	Overview	Date of completion
Appendix 14.6: Private Water Supply Assessment	Identification of PWS and assessment of potential risks from construction	May 2026
Appendix 14.7: Public Water Supply Assessment	Identification of public water supplies within the study area and assessment of potential impacts	May 2026
Appendix 14.8: GWDTE Assessment	Assessment of potential GWDTE and sensitivity to change	May 2026
Appendix 14.9: Peat Condition Assessment	Assessment of peat condition on site	May 2026
Flood Risk Assessment	Assessment of potential flood risks to and from the site, including impacts of development and appropriate mitigation measures	May 2026
Drainage Strategy	Outline of proposed drainage approach	May 2026
Phase 1 peat probing	Peat probing on 75m grid	April 2024
Phase 2 peat probing	Peat probing on a 10m grid for infrastructure footprint with a 20m grid completed in a 50m buffer zone	October 2024
Further Phase 2 probing	Peat probing on a 10m grid for infrastructure footprint with a 20m grid completed in a 50m buffer zone where layout adjustments have occurred	February 2025 to April 2026
PLHRA walkover	Site examination of peat and stability features following geomorphological mapping and initial Factor of Safety assessment	February 2025
Hydrology walkover	Identification and assessment of PWS, GWDTE and water features	February 2025 and April 2026
Peat Condition Assessment Mapping	On-site mapping of peatland condition across all areas of the Assessment Boundary where peat was identified	February 2025

Assessment Process

- 14.24 The assessment evaluates the likely significant effects on the hydrology, hydrogeology and peat during the construction, operational and decommissioning stages of the Project for Assessment. The assessment has been undertaken in accordance with the EIA Regulations and relevant technical guidance (outlined under 'Legislation, Policy and Guidance' above) and considers both the baseline conditions and potential impacts arising from the Project for Assessment.

- 14.25 The assessment identifies the potential pressures on the water environment, including surface water, groundwater, PWS and peat stability. It also considers potential changes in water quality, hydrological connectivity, erosion risk and pollution pathways.
- 14.26 No bespoke numerical modelling was undertaken as part of this assessment. Instead, the assessment relies on site-specific data, peat depth probing, GIS-based hydrological interpretation, topographic analysis and professional judgment based on comparable developments and accepted assessment methods. Therefore, the assessment has used a mix of quantitative and qualitative methods.
- 14.27 Construction, operational and decommissioning impacts are considered under a reasonable worst-case approach, factoring in the extent of ground disturbance, likely peat excavation volumes, watercourse crossings and changes in surface water drainage patterns. The assessment assumes primary and tertiary mitigation measures will be implemented as described in **Chapter 4: Development Specification** as well as **Appendix 14.1: Good Practice Measures** and **Appendix 14.3: Outline Peat Management Plan**.

Reporting of the Environmental Effect and Significance Criteria

- 14.28 The assessment of likely significant environmental effects as a result of the Project for Assessment has taken into account the construction, operational and decommissioning stages. The following sections define the approach adopted within the assessment for the determination of sensitivity, magnitude of impact, the level of effect and significance.

Determining sensitivity of receptor

- 14.29 The sensitivity of affected receptors has been considered on a scale of **high, medium, low or negligible**.
- 14.30 Sensitivity criteria are based on both the ability of a receptor to accommodate the anticipated impact of the likely changes as well as the importance of the resource under consideration or designated value of the receptor (e.g. a designated area of international or national importance has a higher value and therefore higher sensitivity than other areas of lower status). Evaluation of the sensitivity of geology, hydrology, hydrogeology and peat receptors requires a considerable degree of judgement, based on defined characteristics and values and professional experience.

Table 14.4: Sensitivity criteria

Sensitivity of environment	Definition
High	Private water supply abstraction for human or stock consumption (surface water or groundwater). Public drinking water supply abstraction (surface water or groundwater). Surface water classified under the WFD as 'high' (or equivalent older chemical or biological monitoring designation). Groundwater classified under the WFD as 'good'. Watercourse designated under the Freshwater Fish Directive or known to have fish spawning grounds. Groundwater vulnerability to pollution Class 5.

Sensitivity of environment	Definition
	Internationally or nationally designated sites (e.g. Ramsar sites, Special Protection Area (SPA), Special Area of Conservation (SAC), Site of Special Scientific Interest (SSSI), National Nature Reserves). Habitats listed in Regional Biodiversity Action Plans or Annex I habitats that are groundwater dependent. Internationally important species sensitive to hydrological change. Peat >2m in open terrain or >3m in forestry, densely drained, eroded or gullied open terrain.
Medium	Private water supply abstraction not for human or stock consumption (surface water or groundwater). Public non-drinking water supply abstraction (surface water or groundwater). Surface water classified under the WFD as 'good' (or equivalent older chemical or biological monitoring designation). Watercourse known to supply Public Water Supply Reservoir. Watercourse known to support important fishery population. Groundwater vulnerability to pollution Class 4. Ecological or hydrological sites designated at a regional level. Peat with depth between 1 m – 2 m in open and undegraded terrain or >2 m in forestry, densely drained, eroded or gullied open terrain. Other water dependent habitats.
Low	Surface water classified under the WFD as 'moderate' (or equivalent older chemical or biological monitoring designation). Ecological or hydrological sites designated at a local level. Peat with depth between 0.3m – 1m in open and undegraded terrain or with depth between 1m – 2m in forestry, densely drained, eroded or gullied open terrain. Groundwater vulnerability to pollution Class 3 or 2.
Negligible	Surface water classified under the WFD as 'poor or bad' (or equivalent older chemical or biological monitoring designation). Groundwater classified under the WFD as 'poor'. Groundwater vulnerability to pollution Class 1. Non-peat or peaty / organic rich soils less than <0.3m in depth, or peat <1m in depth that is in forestry, densely drained, eroded or gullied open terrain.

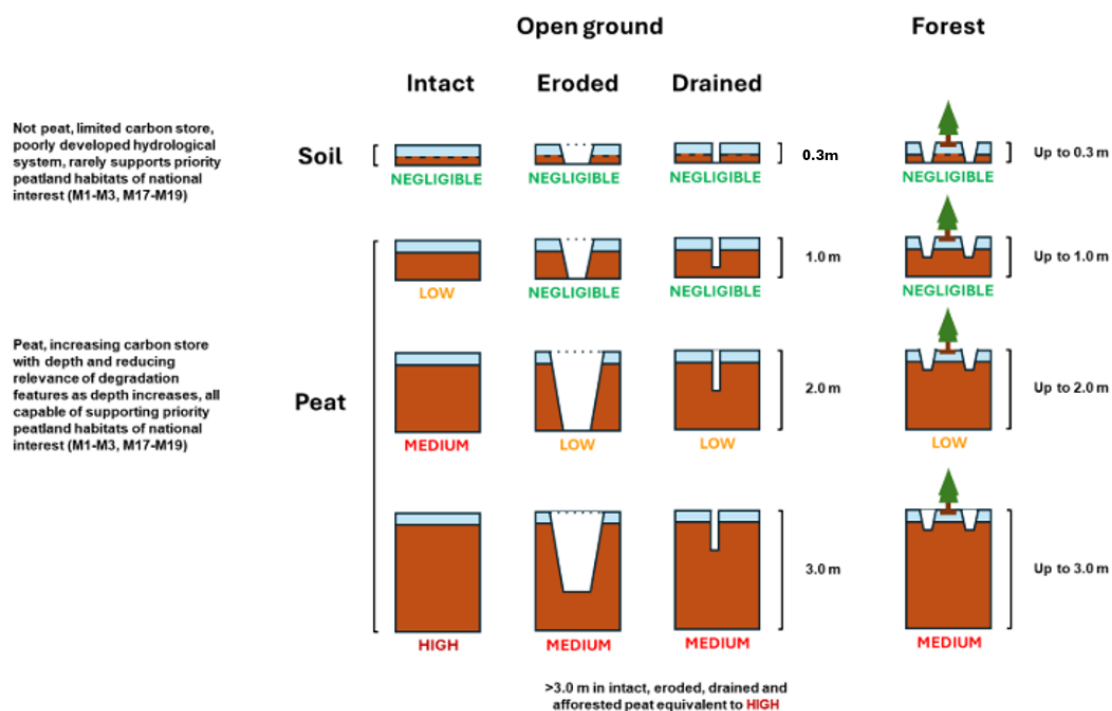
- 14.31 In addition to the criteria set out in **Table 14.4**, assessment of sensitivity of peat is based on the degree by which the peatland in its baseline condition has been degraded by natural or man-made activities. Uneroded, open peatland without evidence of drainage is considered to be of highest sensitivity, while peatlands degraded by forestry, drainage or erosion are considered to have a poorer baseline condition. A depth criterion is also applied, in which deeper peats are considered to hold more carbon (for which peat volume is a proxy) and

more likely to exhibit a functional hydrological system, with associated flood regulation benefits. **Plate 14.1** illustrates this approach with the sensitivity classification for each degradation and depth combination provided below the associated image, coloured using RAG (Red-Amber-Green) styling.

14.32 The sensitivity of any proposed development related to peat is therefore based on the percentage of its infrastructure on each category of peat as:

- **High** – >25% of the infrastructure is located on peat >2m in open terrain or >3m in forestry, densely drained, eroded or gullied open terrain;
- **Medium** – >25% of infrastructure is located on peat with depth between 1m – 2m in open and undegraded terrain or >2m in forestry, densely drained, eroded or gullied open terrain;
- **Low** – >25% of infrastructure located on peat with depth between 0.3m – 1m in open and undegraded terrain or with depth between 1m – 2m in forestry, densely drained, eroded or gullied open terrain; and
- **Negligible** - >75% of the infrastructure is located on non-peat or peaty / organic rich soils less than <0.3m in depth, or peat <1m in depth that is in forestry, densely drained, eroded or gullied open terrain.

Plate 14.1: Peat sensitivity



Determining magnitude of impact

14.33 The magnitude of impact has been considered as the change experienced from the current baseline conditions and has been considered on a scale of **high, medium, low** or **negligible**.

Table 14.5: Magnitude of impact criteria

Magnitude of impact	Definition
High	Impact resulting in total / substantial loss of feature or use. Fundamental (long-term or permanent) changes to surface water, groundwater and geology (in terms of quantity, quality and morphology). Excavated peat volume associated with the infrastructure footprint and associated earthworks is >10% of the peat volume across the peat survey area within a site.
Medium	Impact resulting in loss of part (<10%) of feature or use. Substantial but non-fundamental and short to medium-term changes to the surface water, groundwater and geology (in terms of quantity, quality and morphology). Excavated peat volume associated with the infrastructure footprint and associated earthworks is >5% and <10% of the peat volume across the peat survey area within a site.
Low	Impact on feature or use. Detectable but non-fundamental and temporary changes to the surface water, groundwater and geology (in terms of quantity, quality and morphology). Excavated peat volume associated with the infrastructure footprint and associated earthworks is >2% and <5% of the peat volume across the peat survey area within a site.
Negligible	Impact but of insufficient magnitude to affect feature or use. No perceptible changes to the surface water, groundwater and geology (in terms of quantity, quality and morphology). Excavated peat volume associated with the infrastructure footprint and associated earthworks is <2% of the peat volume across the peat survey area within a site.

- 14.34 The magnitude of impact has been assessed based on the location of the receptor and the proximity of operational infrastructure, or construction activity taking place. Where magnitude of impact is attributed, this takes into account the primary and tertiary mitigation measures described in this Chapter and **Appendices 14.1** and **14.3**.
- 14.35 The assessment of magnitude in relation to peat disturbance is based on the absolute volume of peat calculated to be disturbed by the Project for Assessment as a proportion of the total Assessment Boundary resource, this latter value is based on the full volume of peat calculated across the surveyed peat area. The threshold values (2%, 5% and 10%) reflect increasing levels of magnitude. Importantly, the assumption is that any excavated peat has an appropriate reuse specified within the **Outline Peat Management Plan (Appendix 14.1)**, **Habitat Management and Monitoring Plan** or these documents in-combination.

- 14.36 The peat survey area used for this assessment reflects the mapped extent of peat across the Assessment Boundary and has been defined to capture the full peat resource present. This approach provides a consistent basis for assessing magnitude as a proportion of the affected peat body. The study area is therefore based on peat extent rather than hydraulic catchment boundaries, which is considered appropriate for evaluating direct physical impacts on peat.

Determining level of effect

- 14.37 The predicted level of the effect was determined through a standard method of assessment based on professional judgement while considering sensitivity and magnitude of change as detailed in **Table 14.6**.
- 14.38 The combination of the sensitivity and magnitude of impact combine to provide a matrix categorisation of level of effect (major, moderate and minor), subject to professional judgement.

Table 14.6: Matrix to determine level of effect

Magnitude of impact	Sensitivity of environment			
	High	Medium	Low	Negligible
High	Major	Major	Moderate	Moderate
Medium	Major	Moderate	Moderate	Minor
Low	Moderate	Moderate	Minor	Minor
Negligible	Minor	Minor	Minor	Negligible

- 14.39 The following terms have been used to define the level of the effects identified:
- **Major effect:** Where the Project for Assessment is likely to cause a considerable change from the baseline conditions and the receptor has limited adaptability, tolerance or recoverability or is of the highest sensitivity;
 - **Moderate effect:** Where the Project for Assessment is likely to cause either a considerable change from the baseline conditions at a receptor which has a degree of adaptability, tolerance or recoverability or a less than considerable change at a receptor that has limited adaptability, tolerance or recoverability; and
 - **Minor effect:** Where the Project for Assessment is likely to cause a small, but noticeable change from the baseline conditions on a receptor which has limited adaptability, tolerance or recoverability or is of the highest sensitivity; or where the Project for Assessment is likely to cause a considerable change from the baseline conditions at a receptor which can adapt, is tolerant of the change and / or can recover from the change.
 - **Negligible effect:** Where the Project for Assessment is likely to cause a barely perceptible or imperceptible change from baseline conditions, with no meaningful consequence to the receptor, regardless of its sensitivity or capacity to adapt, tolerate or recover.

- 14.40 In addition to determining the level of the effect, the assessment process also includes a qualitative description regarding the nature of the effect, as set out in **Table 14.7**. These terms add information about how the effect would affect receptors.

Table 14.7: Nature of effect descriptors

Term	Nature of effect descriptors
Adverse	An effect which has the potential to decrease receptor value or status relative to baseline conditions.
Beneficial	An effect which has the potential to increase receptor value or status relative to baseline conditions.
Short-term	Effects that persist only for a short time (defined as up to 2 years), e.g. during the construction (or decommissioning) stage only; includes reversible effects.
Medium-term	Effects that may persist until additional mitigation measures have been implemented and become effective (defined as 2 – 10 years).
Long-term	Effects that persist for a much longer time (defined as greater than 10 years), e.g. for the duration of the operational stage (essentially until the development ceases or is decommissioned); includes effects which are permanent (irreversible) or which may decline over longer timescales.
Temporary	A reversible effect where recovery is possible and for which effects would persist only for a short or medium-term.
Permanent	An irreversible effect that is not expected to diminish over time or be rectified by mitigation; typically remains beyond the life of the development.
Frequent	Refers to a recurring effect that occurs repeatedly; in some cases a lower level of impact may occur with sufficient frequency to reduce the ability of a receptor to recover effectively.

Determining significance

- 14.41 For each effect, a statement has been made as to whether the level of residual effect is 'Significant' or 'Not Significant'. **Major** and **Moderate** effects are considered to be **Significant**. This determination has been based on professional judgement and / or relevant guidance / legislation, where applicable. Where the level of effect is assessed as being moderate or above, additional site-specific mitigation is required.
- 14.42 Significance has only been concluded for residual effects (i.e. following the identification of secondary mitigation).

Baseline Conditions

Introduction

- 14.43 The following section outlines the baseline hydrological, hydrogeological, and geological conditions within the study area. It encompasses an overview of the physical characteristics, designated water bodies, water-dependent habitats, their quality and their current use. The

baseline conditions were assessed by a desk-based study, information request consultations and followed by site walkovers by a qualified hydrologist, hydrogeologist, peatland ecologist and peatland geomorphologist during various phases of the layout refinement.

14.44 The following datasets and mapping resources were reviewed to inform the baseline hydrology, hydrogeology and peat conditions:

- Centre for Ecology and Hydrology (CEH): National River Flow Archive (NRFA)²⁷;
- Cranfield University (2023): Soilsapes [Dataset]. LandIS, Cranfield Soil and Agrifood Institute (CSAI)²⁸;
- Environment Agency: Catchment Data Explorer²⁹;
- Meteorological Office website for rainfall data (accessed May 2026³⁰, <http://www.metoffice.gov.uk/climate/uk/averages/>);
- Ordnance Survey (OS) Mapping³¹;
- British Geological Survey (BGS): GeoIndex Boreholes database, 1:50,000 scale³²;
- BGS Geology Viewer³³;
- National Soil Map for England and Wales³⁴;
- DEFRA / Natural England: Priority Habitat Inventory (includes peat soils and blanket bog habitats)³⁵;
- Environment Agency: Water Framework Directive River Basin Management Plans and Catchment Data Explorer³⁶;
- Environment Agency: Groundwater Vulnerability Maps³⁷;
- Environment Agency: Aquifer Designation Maps (Superficial and Bedrock)³⁸;
- Environment Agency: Flood Map for Planning (Rivers and Sea)³⁹;
- Environment Agency: Drinking Water Safeguard Zones and Source Protection Zones⁴⁰;
- Joint Nature Conservation Committee (JNCC): Designated Sites View and Geological Conservation Review (GCR) site archives⁴¹;
- National Biodiversity Network (NBN) Atlas (formerly NBN Gateway)⁴²;
- Natural England: England Peat Map Project Final Report, May 2025. Natural England Research Report 149⁴³; and
- Multi-Agency Geographic Information for the Countryside (MAGIC) website⁴⁴.

Topography

14.45 A review of Ordnance Survey mapping and aerial imagery (Google, 2026) indicates that the Assessment Boundary is located on gently rolling hills to the south of Cowpe and north of

Ashworth Moor, reaching a high point of circa 477m above ordnance datum (AOD) at Tottington Higher End Moor. Much of the Assessment Boundary consists of a gently sloping plateau with surrounding slopes to valleys in all directions. In the southern part of the Assessment Boundary, the terrain transitions into steep slopes descending Rooley Moor, dropping from approximately 450m AOD down to reservoir level. The topography influences surface water drainage.

Soils

- 14.46 The soils across the Assessment Boundary reflect variations in topography and land use. In the north-west, south, and eastern edge of the Assessment Boundary, soils are classified as '*Freely draining slightly acid loamy soils*' (Soilscape 6). These loamy soils are freely draining but of low fertility, typically supporting arable and grassland land uses, with habitats including neutral and acid pastures and deciduous woodland. The soils predominantly drain to local groundwater and rivers. Whilst their free drainage minimises risks of damage from grazing or machinery, moisture deficits may limit yields, particularly in shallow or stony areas. Soil erosion can contribute to siltation and nutrient enrichment of nearby streams.
- 14.47 In the southern-central section of the Assessment Boundary, the dominant soils are '*Very acid loamy upland soils with a wet peaty surface*' (Soilscape 16). These peaty soils are surface wet, with very low fertility. They primarily support moorland, rough grazing, and forestry, with habitats characterised by grass moor, heather moor and bog communities in wetter areas. Surface wetness poses challenges for land management, with risks of erosion from overgrazing or poor stock feeding practices.
- 14.48 The southern section and northernmost areas of the Assessment Boundary feature '*Slowly permeable wet very acid upland soils with a peaty surface*' (Soilscape 19). These soils are characterised by impeded drainage and low fertility, supporting moorland, rough grazing and forestry. Habitats include grass moor and flush and bog communities. Grazing or trafficking in wet conditions can lead to structural damage and increased surface runoff, necessitating careful management to prevent soil degradation.
- 14.49 The central portion of the Assessment Boundary comprises '*Blanket bog peat soils*' (Soilscape 25), which are naturally wet and have very low fertility. These peaty soils are associated with habitats of wet heather moor and bog communities, with significant ecological value. The high carbon content of the topsoil makes these soils highly sensitive to erosion, particularly where vegetation is disturbed. Drainage waters from these soils may display colloidal colour issues, particularly where peat humification is accelerated by climate change or land management practices. These soils are generally unsuitable for intensive agricultural use, being limited to seasonal extensive grazing.
- 14.50 The soil description is based on National Soil Map for England and Wales, LandIS Soilscales and Natural England Peat Soil Mapping (**Figure 14.2**).

Peat

- 14.51 The spatial occurrence and depth distribution of peat across the Assessment Boundary has been examined extensively based on guidance from Natural England, the UK Peatland Strategy (2018–2040)⁴⁵ and Peatland Survey: Guidance on Developments on Peatland (Scottish Government, Scottish Natural Heritage, SEPA, 2017)⁴⁶. High-density probing has been undertaken at all infrastructure locations to determine peat depth and ensure appropriate and accurate avoidance wherever possible. Probing has not been completed

along potential grid connection routes as these have been scoped out of effects on peat, or the laydown area as this is located outside of the area considered to be deep peat as shown on Figure 14.2. Full results of the peat surveys are described in **Appendix 14.2**. **Figures 14.8** and **14.9** show the peat depth distribution across the Assessment Boundary.

14.52 The following tasks have been completed to obtain this detailed understanding of the spatial and depth distribution of peat and its properties:

- Phase I Habitat Survey and National Vegetation Classification (NVC) ecological habitat mapping by Atmos Consulting (see **Chapter 9: Ecology**);
- Peat probing surveys (**Appendix 14.2**) were carried out between May 2024 and April 2026, totalling 11,485 depth probes and 22 cores. A GPS linked photographic record of photos of peatland and core have also been obtained;
- Development of a maximum depth of peat contour map (**Figure 14.9**) to indicate the peat variation across the Assessment Boundary. The peat depth model presents an accurate peat depth surface with peat depths verified by coring. These data indicate that peat >0.3m depth is present across 69.6% of the study area (as defined in **Figures 14.8** and **14.9**); and no peat (0 – 0.3m depth) is present across 30.4% of the study area. Peat >1.0m depth is present at 6.3% of the study area;
- Examination of the variability of the depth of the acrotelm, the thickness of the catotelm and the thickness of amorphous peat; and
- Completion of a Peatland Condition Assessment (**Appendix 14.9**) to categorise the Assessment Boundary into Near-Natural, Modified, Drained and Actively Eroding areas. Modified habitats have been further divided into Modified with Near-Natural features retained and Modified, to delineate habitats where some Near-Natural features are present with active peat-forming properties however remain in overall Modified condition.

14.53 The following summarises the results of the various phases of the peat survey campaign and subsequent interpreted peat depth contouring across the Assessment Boundary:

- Peat is recorded across much of the Assessment Boundary. However, there are areas, some fairly large, where no peat is present. The largest areas absent of peat are in the southern section of the Assessment Boundary;
- Peat is deepest in the western part of the Assessment Boundary, where it occupies a hilltop area. While there is no strict pattern to its distribution, the deeper deposits tend to occur in pockets rather than forming a continuous expanse. Peat up to 1m in depth is relatively widespread across the area. Overall, peat is extensive across the layout but varies in depth and distribution;
- The maximum peat depth recorded was circa 3.7m in the west of the Assessment Boundary; and
- The coring results have generally verified the depth of penetration probing to be representative of peat depth with some areas of over estimation of peat depth related to encountering soft silty clay.

- 14.54 As a result of modification and degradation of the peat habitats, the depth of the peat does not always relate to the quality of the overlying habitat. The peat on site has been subject to erosion and substantial areas of peat have been completely lost with numerous erosional gullies within the peat continuing to expand and transfer particulate peat off site.

Bedrock Geology

- 14.55 The geology of the Assessment Boundary is underlain by a combination of the Upper Haslingden Flags, Rossendale Formation, Pennine Lower Coal Measures Formation and Woodhead Hill Rock. The northern and southern areas of the Assessment Boundary are predominantly underlain by the Pennine Lower Coal Measures Formation and Woodhead Hill Rock, which consist of interbedded grey mudstone, siltstone, sandstone, and coal seams. In contrast, the eastern, western, and parts of the central areas of the Assessment Boundary are dominated by the Upper Haslingden Flags and Rossendale Formation (**Figure 14.3**). This geological description is based on the 1:50,000 scale British Geological Survey (BGS) mapping (Sheet 86 – Rochdale) and BGS Geoindex.
- 14.56 The Upper Haslingden Flags are primarily sandstone, with limited recorded information on their thickness or boundary definitions. The Rossendale Formation is more complex, consisting of fine- to very coarse-grained feldspathic sandstone interbedded with grey siltstone, mudstone, marine black shales, thin coals and seatearths. It includes a lower mudstone-dominated sequence containing prominent marine bands and an upper sandstone-dominated sequence featuring the Rough Rock and Rough Rock Flags.
- 14.57 The Pennine Lower Coal Measures Formation comprises interbedded mudstone, siltstone and pale grey sandstone, with marine fossils in the lower part and thicker coal seams in the upper part. It typically overlies the Rossendale Formation and is defined by key marker horizons, such as the Subcrenatum Marine Band at its base. The Woodhead Hill Rock, a sandstone unit within the Pennine Lower Coal Measures, has little recorded detail but contributes to the overall stratigraphy in the northern and southern portions of the Assessment Boundary. Overall, the geology reflects a transition from fluvial and deltaic environments (associated with the Millstone Grit Group) to coal-forming environments (Pennine Coal Measures), with potential implications for permeability, groundwater flow, and the presence of historical quarries and mining activity.
- 14.58 Structural features recorded within the Assessment Boundary include three north-west to south-east trending faults and one north-east to south-west trending fault, as shown on BGS mapping. These faults are likely to influence local stratigraphy and groundwater movement, potentially enhancing secondary permeability along fracture zones. The regional dip of the strata is generally shallow, with localised variation in dip which may occur adjacent to fault lines. There is north-east to south-west axial plane of a major fold through Higher Hill and Hailstorm Hill in the south-western section.
- 14.59 Further information on mining activities and the ground conditions is presented within the **Contaminated Land Preliminary Risk Assessment, Mineral Resource Assessment and Coal Mining Risk Assessment** submitted alongside the Applications.

Superficial Geology

- 14.60 The Assessment Boundary is underlain by superficial deposits of Quaternary age, including areas of peat and a small portion of Diamicton Head (**Figure 14.3**). Peat is present around the Assessment Boundary in several relatively large patches, which may have implications for

hydrology and ecology. A small section of Diamicton Head is located at the southern edge of the Assessment Boundary, though its extent is minimal. These superficial deposits suggest varied depositional environments, with peat indicating waterlogged conditions and organic accumulation and Diamicton Head likely representing glacial or periglacial processes.

- 14.61 This geological description is based on the 1:50,000 scale British Geological Survey (BGS) mapping (Sheet 86 – Rochdale) and the BGS Geoindex.
- 14.62 Artificial and Made Ground is also shown in the north-western section of the Assessment Boundary.

Hydrogeology

- 14.63 The BGS Hydrogeology (1:625,000 scale) map shows the Assessment Boundary is influenced by the underlying bedrock and superficial deposits, with groundwater primarily moving through fractures, faults and permeable sandstone layers. The bedrock is classified as a Moderately productive aquifer or Secondary A aquifer (Magic Defra Map, accessed May 2026). The Pennine Lower Coal Measures Formation consists of complex multilayered interbedded sandstone, mudstone, siltstone and coal seams, with groundwater flow largely restricted to fractures and localised variations in permeability. Historical coal mining may have altered groundwater movement, increasing secondary permeability in some areas due to subsidence and old mine workings. The Upper Haslingden Flags and Rossendale Formation, primarily composed of sandstone with interbedded mudstone and siltstone, exhibit moderate permeability where fracture networks are well developed, with potential for minor groundwater storage and flow. The Rough Rock, present within the Rossendale Formation, is known to support groundwater flow in some areas. The Woodhead Hill Rock, a sandstone unit within the Pennine Lower Coal Measures, has limited recorded hydrogeological information but is expected to behave similarly to other sandstone units in the sequence.
- 14.64 Superficial deposits also influence hydrogeology, with peat acting as a water-retaining material that maintains a high water table and contributes to baseflow in nearby surface water and also acts as an aquitard or impermeable layer between bedrock groundwater and the surface. The small area of Diamicton Head, likely composed of clay-rich material, has low permeability and is expected to limit vertical groundwater movement while promoting surface water runoff. The combination of these geological units results in a hydrogeological setting where groundwater flow is largely fracture-controlled, with springs potentially emerging at lithological boundaries and where local variations in permeability, historical mining, and superficial deposits may influence groundwater availability and interaction with surface water features.
- 14.65 The Assessment Boundary is underlain by a Secondary A aquifer, which consists of permeable layers capable of supporting local groundwater flow and supplying water to small abstractions. These aquifers typically include sandstone, siltstone and mudstone formations where groundwater movement is largely fracture-controlled, with higher permeability in more well-developed sandstone units. Secondary A aquifers can play a role in baseflow to surface water features, particularly where springs emerge at lithological boundaries or fault zones. While they generally do not provide a large-scale water supply, they may be important for local water resources, private abstractions and ecological support in nearby watercourses. Groundwater storage and flow are influenced by the degree of weathering, the presence of historical mining activity, and interactions with superficial deposits such as

peat, which can influence recharge and runoff dynamics (Magic Defra Map, accessed May 2026).

- 14.66 The Assessment Boundary lies within the Northern Manchester Carboniferous Aquifers Water Body (ID: GB41202G101800), which covers an area of 629.2km². The groundwater body has an overall status of Poor, with quantitative status classified as Good and chemical status as Poor (Environment Agency, 2026).

Hydrology

- 14.67 The Assessment Boundary is located on a plateau, Hail Storm Hill which is occupied by Cowpe Moss, with spurs to the north-east, Brandwood Moor, and south-east, Rooley Moor. Watercourses radiate in all directions with several being steep and incised, and others on gentler slopes with some sinks and springs present. Many of the watercourses draining the Assessment Boundary are connected to various manmade reservoirs. The hydrological features are presented in **Figure 14.5(a-d): Hydrological Features**.
- 14.68 The entire Assessment Boundary lies within the River Irwell Management Catchment, covering an area of over 777km². The catchment is divided into two primary sub-catchments:
- Croal Irwell Sub-Catchment: Located to the west, this sub-catchment includes areas such as Rossendale, Bury, Blackburn, Darwen, Bolton, Salford and Trafford. It encompasses a mix of rural upland regions in the north and more urbanised areas in the south; and
 - Roch Irk Medlock Sub-Catchment: Situated to the east, this sub-catchment covers regions like Rochdale, Shaw, Heywood, Littleborough, Chadderton, Oldham and Failsworth.
- 14.69 Each sub-catchment has distinct hydrological characteristics and drainage patterns, which are crucial for understanding the Assessment Boundary's water flow dynamics.
- 14.70 The north and north-west of the Assessment Boundary drains to the River Irwell, via Cowpe Reservoir and Scout Moor Reservoir. In the northeastern part of the Assessment Boundary, drainage occurs towards Greens Clough via Well Clough, which ultimately discharges into the River Irwell to the north. The west and south-west of the Assessment Boundary drains to Naden Brook, via several reservoirs, which then discharges to the River Roch south of the Assessment Boundary. The east and south-east of the Assessment Boundary drains to the River Spodden via Cown Reservoir and Spring Mill Reservoir. The River Spodden discharges to the River Roch south-east of the Assessment Boundary in Rochdale. The River Roch discharges to the River Irwell 10km south-west of the Assessment Boundary and the River Irwell discharges to the River Mersey near Irlam, approximately 30km south-west of the Assessment Boundary.
- 14.71 The watercourses within the Assessment Boundary are generally towards the top of the catchment or headwaters and comprise small minor watercourses or drains within peaty soils. Some watercourses shown on the Ordnance Survey mapping were observed to be more natural drainage lines or erosional scars rather than watercourses during the walkover survey. The majority of the watercourses within the Assessment Boundary are unlikely to be suitable for migratory fish migration or habitat due to the soil substrate and presence of reservoirs downstream.

- 14.72 Areas on the plateau were observed to have manmade herringbone grips draining the peatland and some of the natural drainage will have been altered by coal mining and quarries.
- 14.73 Several springs, wells and issues are shown surrounding the Assessment Boundary mostly on the steeper slopes below the plateau and corresponding with the Rossendale Geological Formation. A named well, Waugh's Well is shown at NGR SD 82877 19568 to the east of Scout Moor Reservoir.
- 14.74 A site-specific **Flood Risk Assessment (FRA)** has been undertaken to characterise flood risk within and surrounding the Assessment Boundary. The FRA confirms that the Assessment Boundary lies entirely within Flood Zone 1 and is therefore at low risk of fluvial flooding. However, surface water flow pathways have been identified across parts of the Assessment Boundary, reflecting its upland topography and headwater catchment location.
- 14.75 A **Drainage Strategy** has been developed that will enable appropriately sized water management structures to be designed so that all flows within each catchment are maintained at greenfield rates.

Water Quality

- 14.76 As noted above, the Assessment Boundary lies within the Northern Manchester Carboniferous Aquifers Water Body, which has a poor chemical status.
- 14.77 Several reservoirs in the area have been assessed for water quality, with all classified as heavily modified water bodies. Upper Naden Reservoir, Cowpe Reservoir, Cowm Reservoir and Spring Mill Reservoir each hold a moderate ecological status. The watercourses within the Assessment Boundary have not been classified by the Environment Agency, and those feeding the reservoirs in the area are also not classified. However, based on the site geology, historical mining and quarrying activity they are not expected to be of high quality.
- 14.78 To provide context, the larger watercourses into which these smaller streams and reservoirs discharge have the following water quality statuses:
- River Irwell (Source to Whitewell Brook): This section has been classified as having a moderate ecological status (2022), with moderate biological quality elements and invertebrates, and high physico-chemical quality elements such as ammonia, dissolved oxygen, temperature, and pH;
 - River Spodden: The River Spodden holds a moderate ecological status (2022), with moderate biological quality elements and fish populations. Physico-chemical quality elements such as ammonia, biochemical oxygen demand (BOD), dissolved oxygen, phosphate, temperature, and pH are rated as good or high; and
 - River Naden: The River Naden holds a moderate ecological status (2022), with moderate biological quality elements and invertebrate populations. Physico-chemical quality elements such as ammonia, biochemical oxygen demand (BOD), dissolved oxygen, phosphate, temperature, and pH are rated as high.
- 14.79 These classifications indicate that while the physico-chemical parameters are generally good, however all three catchments failed for the chemical quality in 2020 for the priority hazardous substances polybrominated diphenyl ethers (PBDE) and mercury compounds.

Biological elements such as invertebrates and fish populations are only moderate, possibly due to historical pollution, habitat modification, physical barriers and other anthropogenic factors.

Designated Sites

- 14.80 The Assessment Boundary and its surroundings include several important environmental designations. Lee Quarry, designated as a Site of Special Scientific Interest (SSSI), is located just outside the northeastern boundary of the Assessment Boundary (**Figure 14.1**). Lee Quarry is protected for its geological value.
- 14.81 The Assessment Boundary also lies within or near numerous Drinking Water Protected Areas and Safeguard Zones, which are designated to protect sources of public drinking water from pollution and over-abstraction. A Drinking Water Protected Zone extends across the northern part of the Assessment Boundary and continues further north, covering the Irwell (Source to Whitewell Brook), where a safeguard is in place to ensure water quality. A Drinking Water Safeguard zone (surface water) area also covers much of the southern section of the Assessment Boundary and each of the individual reservoirs in the area.
- 14.82 Several named surface water bodies are located in proximity to the Assessment Boundary. To the south lie Naden Higher Reservoir, Naden Middle Reservoir and Naden Lower Reservoir with Spring Mill Reservoir to the east, Cowm Reservoir situated to the north, while Scout Moor Reservoir is positioned to the west of the Assessment Boundary.
- 14.83 Additionally, the Cowpe Drinking Water Safeguard Zone overlaps the Assessment Boundary and extends to the west. The Clay Lane Safeguard Zone covers part of the southern section of the Assessment Boundary, while the Watergrove Safeguard Zone is situated to the south-east and partially overlaps the Assessment Boundary.

Public Water Supplies

- 14.84 The following public water supply sources are located within or near the study area with further detail provided in **Appendix 14.7** and illustrated in **Figure 14.7.2**:
- **Naden Higher Reservoir:** Naden Higher Reservoir is located to the south of the Assessment Boundary and forms part of the local public water supply network. It is fed by Naden Brook, Ding Clough and an unnamed tributary. Infrastructure is located over 500m from the reservoir and over 50m from watercourses feeding the reservoir. Infrastructure lies within the 3,926,167m² catchment area. The total Project for Assessment footprint (including temporary and permanent infrastructure) within the catchment is approximately 40,099 m², representing about **1%** of the catchment area. The permanent infrastructure footprint is approximately 21,329 m², representing about **0.5%** of the catchment area;
 - **Spring Mill Reservoir:** Spring Mill Reservoir lies approximately 800m east of any proposed infrastructure and is fed by Prickshaw Brook, Fern Isle Brook and a southern tributary. Infrastructure lies within the reservoir's 2,786,945m² catchment. The total Project for Assessment footprint (including both temporary and permanent infrastructure) is approximately 67,095 m², representing about **2.4%** of the catchment. The permanent infrastructure footprint is approximately 27,071 m², or **1%** of the total catchment area;

- Cowm Reservoir: Cowm Reservoir is located approximately 1km east of any proposed infrastructure and is fed by Cowm Brook and Walstead Clough. Infrastructure is located within the reservoir's 4,315,097m² catchment. The total Project for Assessment infrastructure footprint (including both temporary and permanent works) is approximately 32,798 m², representing about **0.76%** of the catchment. The permanent infrastructure footprint is approximately 1,934 m², representing about **0.1%** of the catchment;
- Cowpe Reservoir: Cowpe Reservoir lies 700m north-west of any proposed infrastructure and is fed by two unnamed tributaries and the Cragg Reservoir from the south-east. The tributaries originate approximately 550m from the nearest infrastructure. Infrastructure is not located within the reservoir's 1,036,713m² catchment; and
- Scout Moor High Level Reservoir: Scout Moor High Level Reservoir is located 270m west of any proposed infrastructure and receives inflow from a stream fed by tributaries crossed by proposed infrastructure (e.g. an access track). Infrastructure is located within the reservoir's 748,850 m² catchment. The total Project for Assessment infrastructure footprint (including both temporary and permanent works) is approximately 27,792 m², representing about **3.7%** of the catchment area. The permanent infrastructure footprint is approximately 7,660 m², representing about **1%** of the catchment area.

Private Water Supplies

14.85 The following private water supplies have been confirmed to date within the wider study area (**Appendix 14.6** and **Figure 14.5(a-d)**). This list is based on available information and may not be exhaustive, and other supplies may be present:

- PWS1: The spring source is located at NGR SD 83296 20344 approximately 700m from the nearest proposed infrastructure and lies across a topographical divide, with no infrastructure in the same surface water catchment. Although a hydrogeological connection is theoretically possible, it is considered very unlikely due to the combination of:
 - Significant distance exceeding the 250m risk screening threshold for groundwater sources;
 - Geological setting dominated by low-permeability mudstones and siltstones;
 - Lack of structural connectivity (no identified fractures or conduits);
 - Unfavourable bed dip and spring emergence within low-permeability strata;
 - Attenuation potential of any contaminants; and
 - Small area of infrastructure compared to spring recharge zone and use of semi-permeable surfaces.
- PWS 2: This source is located at NGR SD 86386 18444 is believed to derive from an old mine shaft over 300m from the nearest infrastructure (T3 and T4). It lies within the Pennine Lower Coal Measures Formation, where historical mining may have

introduced secondary permeability. The water supply is unlikely to have a hydrogeological connection to the Project for Assessment due to:

- Its subsurface origin;
- The lack of direct surface water connection; and
- The distance from the infrastructure.

Groundwater Dependent Terrestrial Ecosystems (GWDTEs)

- 14.86 The National Vegetation Survey (NVC) survey for the study area was completed by Atmos Consulting Ltd (Atmos, July to September 2024) and is presented within **Chapter 9: Ecology** and associated appendices. It identified 855 NVC polygons and nine target notes, and of these 43 NVC polygons and one target note had the potential to be groundwater dependent within 100m and 250m buffers of the Project for Assessment.
- 14.87 Based on the hydrology, geology, topography and hydrogeological regime the majority of the potential GWDTEs were assessed as not being truly groundwater dependent but rainwater or surface water dependent or not considered hydrogeologically connected to the Project for Assessment.
- 14.88 One NVC polygon (ID 281) was assessed to be truly groundwater dependent and potentially connected to the Project for Assessment, being located on a steep break of slope with no superficial deposits approximately 130 m downgradient of the substation in the north of the Assessment Boundary. The GWDTE Assessment is presented in **Appendix 14.8** and **Figure 14.8.1** shows all the potential GWDTEs from the NVC survey and **Figure 14.7** shows the GWDTEs potentially connected to the infrastructure.

Peat Slide and Geomorphology

- 14.89 A peat landslide hazard and geomorphological assessment was undertaken using high-resolution satellite imagery and aerial photography, followed by a detailed site walkover in January 2025. This was subsequently developed into a full **Peat Landslide Hazard and Risk Assessment (PLHRA)** to reflect layout revisions, with the updated assessment presented in **Appendix 14.4**.
- 14.90 The Assessment Boundary displays a marked contrast between the western and eastern areas. In the west (e.g. Cowpe Moss), widespread peatland features such as gullies, exposed mineral substrate, bare peat, and trampling were observed—indicating active erosional processes and relative surface instability. In the east, peat cover was thinner, slopes were steeper, and vegetation was dominated by *Molinia caerulea*, with reduced presence of typical peat-forming species. Artificial drainage and limited standing water were also noted.
- 14.91 While no peat landslides were recorded, a small area of quaking bog near Ding Quarry (south-east of T9) was identified and subsequently avoided in the layout.
- 14.92 The mapped geomorphological features provide important context for understanding Assessment Boundary hydrology, erosion processes, and the relative sensitivity of peatland units to development. Further detail including geomorphological mapping and field observations is provided in **Appendix 14.4**.

Future Baseline

- 14.93 In the absence of the Project for Assessment, baseline conditions across the Assessment Boundary are expected to remain broadly similar in the short to medium-term. However, ongoing natural processes and land use pressures may lead to gradual degradation of some environmental features.
- 14.94 Of particular note, areas of peatland across the Assessment Boundary show evidence of active erosion, including haggings and surface cracking. Without intervention or restoration, these processes are likely to continue and may accelerate under the influence of changing climatic conditions, leading to further loss of peat and associated hydrological and ecological function.
- 14.95 In addition, surface water drainage patterns and catchment integrity may be affected over time by land management practices, potentially altering runoff characteristics or increasing sediment loads. Groundwater and surface water quality would be expected to remain broadly consistent, assuming no significant changes in local land use or pollution sources.

Primary and Tertiary Mitigation

Construction Stage

- 14.96 The following primary and tertiary mitigation which has been evaluated as part of the construction stage assessment is outlined below:
- All wind farm infrastructure has been sited with an objective to maintain at least a 30m 'buffer zone' from medium / high sensitivity natural watercourses and water bodies shown on 1:50,000 scale and 1:25,000 scale Ordnance Survey mapping. In the absence of specific English guidance on the latest Scottish guidance on watercourse buffers in construction has been used – SEPA (2024) Recommended Riparian Corridor Layer for use in Land Use Planning;
 - All infrastructure is located outside of flood zones, except for watercourse crossings;
 - Wind farm infrastructure was designed to minimise the number of new watercourse crossings, and existing access tracks have been utilised where possible;
 - Peat deposits were identified across much of the survey area (42% of probes > 0.3m of peat) during the peat depth surveys (**Appendix 14.2**). Avoidance of peat led the design process, though consideration was required to be paid to other environmental considerations (**Chapter 4: Development Specification**). To optimise locations of infrastructure against holistic environmental constraints, it was necessary to site infrastructure in areas of modified peatland habitat. Further design steps were applied to microsite and to reduce environmental effects, such as the optimisation of the orientations of hardstandings to reduce excavation volumes and to allow reinstatement of impacted areas following their usage during construction (i.e. siting of temporary over permanent infrastructure). Additionally, further investigation of the ground conditions and micro-siting of the tracks and wind turbines will be undertaken to ensure the minimal amount of peat is disturbed;

- All wind farm infrastructure has been designed, where possible, to avoid potential peat landslide hazard risk areas and further investigation to identify detailed peat landslide mitigation will be undertaken post-consent;
- Where feasible, and considering other constraints, floating tracks are proposed where tracks are located on peat >0.5m depth and slopes are <5 degrees, to reduce peat excavation;
- Where possible extracted peat will be appropriately reused and restored concurrently without storage. However, where this is not feasible it will be stored appropriately in proximity to its reuse location as detailed in **Appendix 14.3**;
- During the detailed design and construction stage, sections of track will be surveyed and micro-sited to optimise the distance from water bodies, minimise peat disturbance and peat slide hazard;
- Ground investigation surveys will be undertaken to further understand the ground conditions for detailed design;
- A suite of good practice procedures, methods and measures for activities such as fuel handling and storage, concrete batching, pollution prevention, etc. Further details are provided in **Appendix 14.1**. These will be implemented as part of a CEMP;
- Measures and methods to be used when handling excavated materials, storage and reuse of peat. Further details are provided in **Appendix 14.3**. These will be implemented as part of a CEMP / Peat Management Plan (PMP);
- A site-wide Sustainable Drainage System (SuDS), as outlined in the **Drainage Strategy** and summarised in **Chapter 4: Development Specification**, including swales, drainage ditches, attenuation basins and flow control structures to regulate runoff and maintain greenfield discharge rates; and
- Measures to maintain water flow to GWDTEs, such as the discharge of water captured from excavations in close proximity and downgradient of the infrastructure. Further details are provided in **Appendix 14.8**.

Operational Stage

14.97 The following primary and tertiary mitigation which has been evaluated as part of the operational stage assessment is outlined below:

- Implementation of **Drainage Strategy** to manage surface water runoff, maintain greenfield flow rates and support hydrological continuity across peatland areas;
- Drainage management such as cleaning out of culverts, drains and discharge zones;
- Ongoing peat restoration where further intervention is necessary or where any of the preliminary restoration areas are unsuccessful;
- Peat slide / geotechnical register; and
- Water quality monitoring, if required.

Assessment of Effects, Secondary Mitigation and Residual Effects

14.98 The sensitive receptors considered within the assessment are presented in **Table 14.8**.

Table 14.8: Sensitive receptors

Sensitive receptors		Sensitivity	Rationale / designations
Terrestrial	Non peaty or peaty / organic rich soils <0.3 m in depth Peat <1 m in depth in densely drained, eroded or gullied open terrain	Negligible	Guidance on Developments on Peatland - Site Surveys
	Peat >0.3 m to 1 m in depth in open terrain Peat >1 m to 2 m in densely drained, eroded or gullied open terrain	Low	Guidance on Developments on Peatland - Site Surveys
	Peat >1 m in depth in open terrain Peat >2 m in depth in forestry or in densely drained, eroded or gullied open terrain	Medium	Guidance on Developments on Peatland - Site Surveys
	GWDTE	Medium	UK Technical Advisory Group, 2004 / SEPA guidance LUPS-GU31
Groundwater	Shallow groundwater	Low	Maintains GWDTEs and peat resource. Supports surface water features
	Deep groundwater	High	Limited resource, however supplies two private water supplies
Surface watercourses and waterbodies within Assessment Boundary	Naden Brook, Ding Clough, Prickshaw Brook, Cowm Brook, Fern Isle Brook and Various unnamed watercourses	Medium	Tributaries to Public Water Supply Reservoirs
	Walstead Clough, Grain Brook and minor unnamed tributaries	Low / Negligible	Unsuitable habitat for fish habitat and limited impact on reservoirs
Surface watercourses and waterbodies	Naden Higher Reservoir, Spring Mill Reservoir, Cowm Reservoir, Cowpe Reservoir and Scout Moor High Level Reservoir	High	Public Water Supply

Sensitive receptors		Sensitivity	Rationale / designations
downstream of Assessment Boundary	Downstream watercourses	Negligible	Reservoirs act as buffer For directly connected watercourses, risk remains low due to limited contaminant sources, distance to receptors, and natural attenuation

Construction Stage

14.99 Possible hydrological, hydrogeological and peatland effects resulting from the construction of the Project for Assessment are related to five main effects as detailed below:

- Erosion and sedimentation effects;
- Alteration of flow, natural drainage patterns / runoff volumes and rates;
- Potential pollution events affecting groundwater and surface water quality;
- Peat landslide hazard risk; and
- Loss, degradation and disturbance of peat resource.

Erosion and sedimentation effects

14.100 Unmanaged erosion / sediment deposition and suspended solids generated from ground disturbance and new infrastructure, could be transported to receptors directly by surface run-off or could cause modification to stream channel morphology. This can result in smothering of habitats and effects on both terrestrial and aquatic flora and fauna. Potential effects may occur from the following:

- Construction of access tracks. The majority of new and upgraded site tracks will be constructed using a standard cut and fill method which will involve stripping and stockpiling of material to expose underlying soils or bedrock, potentially increasing runoff and the potential for transportation of sediment. Floating tracks will involve building the track on the existing surface vegetation mat with geotextile layers, minimising excavation of peat, however side slopes will be required;
- Construction of four new watercourse crossings increasing the potential for increased runoff of silt and debris and erosion;
- Removal and stockpiling of material for each turbine foundation base and crane hardstanding, which could result in increased silt runoff;
- Dewatering of shallow groundwater and direct rainfall into excavations (potentially containing silt and other debris), which may result in transportation of fine sediments into watercourses. This would be compounded by increased movement over and around these disturbed environments;

- Extreme rainfall events which could result in the overflowing of existing on-site drainage and resulting erosion and sediment transport as well as the potential failure of pollution prevention measures to operate under high runoff flow conditions;
- Vehicle movements transporting silt off-site;
- Rock, topsoil, peat storage and reuse; and
- Peat slides of material into watercourses.

14.101 Effects on specific receptors are discussed and assessed in the relevant section below.

Alteration of flow, natural drainage patterns / runoff volumes and rates

14.102 The development of site access tracks and cable trenches has the potential to alter natural drainage on-site by the creation of altered preferential flow pathways. If constructed against the topographic gradient, roads could act as barriers to run-off resulting in the ponding of water. If constructed in line with the gradient, the development of preferential flow down the roadway could occur.

14.103 Changes to the natural drainage and runoff rates could affect the hydrological continuity within areas of peat, sensitive water dependent habitats, such as bog habitats, as well as species of conservation concern habitats (e.g. otter and water vole) or increase erosional rates.

14.104 The potential for changes to runoff rates and drainage patterns has been assessed in **Flood Risk Assessment** and the methodology for managing flows within **Drainage Strategy**, which sets out the proposed surface water management approach, this is also summarised within **Chapter 4: Development Specification**. This demonstrates that, with the implementation of this primary mitigation, post-development runoff will be controlled to greenfield rates and existing catchment flow pathways will be maintained.

14.105 Effects on specific receptors are discussed and assessed in the relevant section below.

Potential pollution events affecting groundwater and surface water quality

14.106 Pollution of watercourses could potentially occur through the following pathways:

- Oil and chemical spills from:
 - Oil leakages during vehicle movements or when on standby;
 - Refuelling areas in the construction compound; and / or
 - Chemical / fuel storage areas.
- Leakage of cement powder or liquid concrete during batching, transportation or pouring. Concrete is highly alkaline (high pH) and changes in the pH balance could affect the water quality and the species that depend on baseline conditions;
- Plant washing and vehicle wheel wash areas;
- Improper management of on-site waste;

- Poor sanitary plumbing;
- Poor water storage; and
- Sedimentation and erosion (as outlined above).

14.107 The construction compound will be constructed with an impermeable membrane and any surface water runoff along with any pollutants will be routed through an oil / water separator as part of good practice procedures.

14.108 The concrete washout will also be located on an impermeable membrane within the construction compound.

14.109 Even taking into account the application of good practice there is still a small risk of potential fuel spillage on-site due to the number of vehicles, and the potential for leaks or accidents. The effects on specific receptors are discussed and assessed in the section below.

Peat landslide hazard risk

14.110 A PLHRA has been undertaken incorporating a qualitative likelihood assessment and factor of safety analysis, including consideration of undrained loading along floating tracks. This is presented in **Appendix 14.4**. A site walkover showed no indications of past landslides nor indicators of incipient instability. This is consistent with the peatland geomorphology across the Assessment Boundary, where areas of extensive gullying and surface erosion in the west represent degraded peat conditions that are not typically associated with peat landslide initiation, and where neutral to gently sloping terrain dominates much of the eastern areas.

14.111 The likelihood assessment showed the majority of the Assessment Boundary to have a Low baseline likelihood of failure, consistent with the baseline factor of safety assessment. Assessment of undrained loading along floating track alignments showed the proposed routes to be stable. Limited areas of Moderate likelihood are present, primarily on east-facing slopes between Brandwood Moor and Rooley Moor. Proposed infrastructure overlaps these Moderate likelihood areas in four locations, which were taken forward for runout analysis.

14.112 Runout analysis indicates that potential failures would be supply-limited and would thin rapidly downslope. Only one potential source zone has limited connectivity to a minor watercourse, with no potential runout pathways identified that could affect public water supply reservoirs. Neither of the two identified private water supplies are located within areas that have the potential to be affected by peat landslides.

14.113 As a result, calculated risks are Low or Negligible for all potential source zones and risks associated with peat landslides can be controlled by general good practice measures during construction.

14.114 Effects on specific receptors are discussed below.

Loss, degradation and disturbance of peat resource

14.115 The excavation and handling of peat during construction, particularly for site access tracks, wind turbine bases and crane hardstands, has the potential to result in direct loss and degradation of peat resource. Peat may also be disturbed indirectly through changes to local hydrology which, if unmanaged, can lead to desiccation or oxidation of peat soils adjacent to

infrastructure. Disturbance can also affect carbon storage potential and ecological functions associated with peat-forming habitats.

14.116 The layout of infrastructure has been informed by peat probing, with design iterations aiming to avoid areas of deep peat, particularly those associated with active peatland habitats. Where avoidance has not been possible due to topographic or engineering constraints, peat will be managed in accordance with good practice measures outlined in **Appendix 14.3**. This includes micro-siting, minimising excavation volumes and safe storage and reuse protocols.

14.117 Peat disturbance also has the potential to contribute to instability if infrastructure is sited on or near areas of marginal stability or steep slopes. A PLHRA (**Appendix 14.4: Peat Landslide Hazard Risk Assessment**) has been undertaken to inform layout decisions and appropriate mitigation.

14.118 Effects on specific receptors are discussed below.

Effects on specific receptors

14.119 The effects above – in-combination and / or in isolation – are considered with respect to the relevant specific receptors below.

Surface water features

14.120 Infrastructure within the Assessment Boundary has been located, in so far as possible, over 30m from watercourses or waterbodies (as shown on 1:50,000 and 1:25,000 scale OS mapping). With the exception of where site access tracks approach watercourse crossings and at the five infrastructure locations presented in **Appendix 14.5**, there is no infrastructure that encroaches on most of the 30m buffer of medium sensitivity watercourses (**Figure 14.5(a-d)**). All works will be undertaken using the embedded good practice methods (tertiary mitigation) presented in **Appendix 14.1**.

14.121 The sensitivities of the watercourses and waterbodies within the catchments on-site are categorised as negligible to medium (medium where they are directly connected with the public water supply reservoirs). The magnitude of impact on these features is considered to be negligible. When combined with the negligible to medium sensitivity of the affected watercourses, there is likely to be a direct, temporary, short-term adverse effect which is considered to be minor.

14.122 The conclusions above are supported by the **Drainage Strategy** which confirms that runoff from all impermeable areas will be attenuated and discharged at greenfield rates using SuDS features.

14.123 Application of micro-siting allowance does not change the level of effect reported above.

Public water supplies

14.124 This includes public water supply reservoirs, which are considered to be high sensitivity receptors due to their function in providing potable water. While not located within the Assessment Boundary, several of these reservoirs are situated downstream and are fed by catchments which partially extend into the Assessment Boundary.

14.125 Importantly, no infrastructure is proposed adjacent to or within 250m of these public water supply reservoirs nor is any infrastructure located within 30m of medium sensitivity watercourses or waterbody receptors directly associated with them.

14.126 The assessment of the magnitude of impacts on surface waters contributing to these public supplies is based on:

- The avoidance of all associated high sensitivity waterbodies and most medium sensitivity watercourses by at least 30m;
- The primary and tertiary mitigation that will be employed during the construction stage;
- The limited infrastructure footprint during construction and post construction (during / after site reinstatement); and
- The substantial peat restoration areas in each catchment.

14.127 The footprint of construction works within the catchments corresponding to the various reservoirs ranges from no infrastructure for the Cowpe Reservoir catchment to 3.7% of the Scout Moor Reservoir catchment. This figure represents a maximum scenario where all works in a catchment are active at once. Post-construction, following reinstatement, this footprint reduces to 1%.

14.128 While construction works are taking place, peat restoration works (and associated drainage improvements) will also be undertaken within each of these catchments which cover between 4.4% of the Cowm reservoir catchment and 18% of the Cowpe reservoir catchment. These works are expected to offset any potential change in catchment hydrology associated with the introduction of new hardstanding areas, which will also be subject to extensive drainage management including SuDS and sediment control measures (**Drainage Strategy**) (these are discussed further in **Appendix 14.7** which also presents case studies of the benefits of peat restoration on the associated water quality and resource).

14.129 The combination of extensive embedded control measures, the limited duration and extent of works, the distance of activities from the reservoirs, and post-construction restoration of currently degraded areas results in a negligible magnitude of impact on public water supplies. When combined with the high sensitivity of the downstream public water supply reservoirs, there is likely to be a direct, temporary, short-term adverse effect which is considered to be minor.

14.130 Application of microsinning allowance does not change the level of effect reported above.

Private water supplies

14.131 Private water supplies identified during site assessment are also considered to be high sensitivity receptors due to their role in providing drinking water.

14.132 While a hydrogeological connection between the Project for Assessment and PWS1, a spring, cannot be fully ruled out, it is considered to be highly unlikely (with further discussion in **Appendix 14.6**). This conclusion is based on topographic separation, the presence of low permeability geology between the Assessment Boundary and the spring and the specific geological setting of the spring, which emerges from within a mudstone / siltstone sequence

rather than at a permeable boundary. These factors significantly reduce the likelihood of any hydrological pathway between the spring and site infrastructure.

14.133 A similar conclusion applies to PWS2, which is understood to be sourced from a deep mine shaft or adit and is highly unlikely to be hydrogeologically connected to any on-site infrastructure (with further details in **Appendix 14.6**).

14.134 As a result, the magnitude of impact on both supplies is considered to be negligible. When combined with the high sensitivity of receptors, there is likely to be a direct, temporary, short-term adverse effect which is considered to be minor.

14.135 Application of microsinning allowance does not change the level of effect reported above.

GWDTEs

14.136 The GWDTEs identified during the site assessment are considered to be medium sensitivity receptors due to their reliance on consistent groundwater conditions to maintain ecological function.

14.137 One area (Polygon 281) (**Figure 14.7** associated with **Appendix 14.8**) is considered to be primarily groundwater fed and hydrogeologically connected to the Project for Assessment. The groundwater emergence is associated with lithological boundaries and a steep break of slope. These features suggest that groundwater flow, at least in part, supports surface vegetation in this area.

14.138 While a hydrogeological connection between the Project for Assessment and this GWDTE is possible, the likelihood of a significant impact is considered to be low. Furthermore, the implementation of mitigation measures (as detailed in **Appendix 14.8**), including location the proposed infrastructure further away where possible, managing diffuse groundwater discharge and drainage will further reduce the potential for disruption to groundwater supply to GWDTEs.

14.139 As a result, the magnitude of impact on the GWDTE areas is considered to be negligible, and when combined with medium sensitivity, there is likely to be a direct, temporary, short-term adverse effect, which is considered to be minor.

14.140 Application of microsinning allowance does not change the level of effect reported as long as the substation is not moved north or north-west closer to the GWDTE (polygon 281 in **Figure 14.7**).

Peat resource

14.141 The sensitivity of peat to disturbance for this Project for Assessment has the potential to range from low to high based on the definitions presented in **Table 14.4** and depicted on **Plate 14.1**. Infrastructure is located in areas of modified peat with depths between 0.3m to <1m (low sensitivity), equating to 63.3% of infrastructure, and >2m (high sensitivity), equating to 0.8% of infrastructure, although only 0.24% of high sensitivity peat is likely to be excavated to facilitate the proposed infrastructure. A further 30.41% of the infrastructure is located on peat depths of 0–0.3 m, which is classified as effectively no peat. The best quality peatland has been avoided by design, and all excavated peat is therefore considered to be modified in accordance with habitat mapping, **Chapter 9: Ecology** and **Appendix 14.9: Peatland Condition Assessment**. No unmodified peat will be excavated. As >75% of the

Project for Assessment is on <1m of peat, the Project for Assessment is classified as having an overall low sensitivity in accordance with **Table 14.4**.

14.142 Approximately 69.59% of the infrastructure (including earthworks) is located on peat (probing depths >0.3 m) which relates to a total volume of peat to be excavated of 96,674 m³. The total volume of peat that is present across the survey area has been calculated as 4,522,189 m³. The total volume of peat that will be excavated for the Project for Assessment therefore represents approximately 2.1% of the peat volume within the peat survey area. This is considered to be a low magnitude of impact according to **Table 14.5**.

14.143 Over the whole of the Assessment Boundary, conservative estimates for the volume of peat that will be excavated as detailed in **Appendix 14.3** are:

- Total volume of peat excavated = 96,674m³;
- Total volume of acrotelm excavated = 16,746m³; and
- Total volume of catotelm excavated = 79,928m³.

14.144 These volumes are considered to be a worst-case as they assume that all peat located within clearance areas and areas of fill is fully excavated. In reality many of the clearance areas will not require excavation and therefore excavated volumes are expected to be lower.

14.145 While overlap with peat occurs across the Assessment Boundary, extensive efforts have been made to minimise overlap with the deepest peat deposits, locating turbines away from carbon-rich soils where possible, or on shallower depths if this cannot be achieved.

14.146 Where new roads are required, opportunities to use floating track (and therefore avoid peat excavation) have been used wherever possible. Floating tracks are proposed in areas of peat >0.5m depth in order to reduce excavation volumes. However, the use of floating track is constrained by engineering requirements, including gradient, which must generally not exceed 5%. As a result, floating track cannot be applied in all areas of deeper peat.

14.147 Due to the widespread presence of peat across the Assessment Boundary, excavation volumes for the Project for Assessment (96,674 m³) are considered to be relatively substantial. This reflects both the number of wind turbines and the approach to capturing 'worst case' construction footprints, which include earthwork cut and fill surrounding infrastructure footprints.

14.148 Based on the overall low sensitivity of peat resource across the Assessment Boundary combined with the low magnitude of impact, there is likely to be a direct, temporary, short-term adverse effect which is considered to be minor.

14.149 This level of effect is based on the assumption that all excavated peat can be reused appropriately on-site for peat restoration as detailed in **Appendix 14.3: Outline Peat Management Plan**. It should be noted that all peat disturbed is considered to be heavily modified and no unmodified peat will be disturbed for the Project for Assessment.

14.150 Application of micro-siting allowance does not change the level of effect reported above.

Operational Stage

14.151 Possible hydrological, hydrogeological and peatland effects resulting from the operation of the Project for Assessment are related to five main effects as detailed below:

- Erosion and sedimentation effects;
- Alteration of flow, natural drainage patterns / runoff volumes and rates;
- Potential pollution events affecting groundwater and surface water quality;
- Peat landslide hazard risk; and
- Loss, degradation and disturbance of peat resource.

Erosion and sedimentation effects

14.152 During the operational stage, no major ground-disturbing activities are expected, and vegetation cover across reinstated areas will be established and maintained, reducing the likelihood of sediment mobilisation. Drainage infrastructure will continue to function to manage runoff, preventing erosion and associated sediment transport.

14.153 Routine maintenance activities (e.g. occasional vehicle access) are not anticipated to result in significant erosion, provided that appropriate controls and maintenance of drainage features are upheld. Long-term effects on erosion and sedimentation are therefore expected to be unlikely during operation.

Alteration of flow, natural drainage patterns / runoff volumes and rates

14.154 Operational infrastructure such as tracks, hardstanding areas and drainage networks will remain in place and continue to influence surface water flow and groundwater recharge patterns. However, these changes will be consistent with the post-construction drainage regime and will not introduce new hydrological effects beyond those already assessed for the construction stage.

14.155 Drainage designs incorporate attenuation and flow control measures to mimic natural runoff regimes and minimise downstream impacts. Regular inspection and maintenance of drainage infrastructure will be important to ensure ongoing effectiveness. With these controls in place, operational effects on drainage and runoff are unlikely.

Potential pollution events affecting groundwater and surface water quality

14.156 Although pollution risk is significantly reduced during the operational stage compared to construction, potential pollution sources such as fuel storage for backup generators or accidental leaks from maintenance vehicles still exist. However, these are limited in scale and frequency.

14.157 Operational pollution risks will be mitigated through routine inspection, use of spill kits, secondary containment for hazardous substances, and compliance with pollution prevention guidance (e.g. GPPs). As a result, the likelihood of pollution events affecting groundwater or surface water is considered unlikely.

Peat landslide hazard risk

- 14.158 During the operational stage, no new loading or disturbance will be introduced to peatland areas beyond those associated with routine maintenance traffic, which will be infrequent and low in intensity.
- 14.159 The baseline likelihood of peat landslide risk was assessed as low to negligible for the majority of the Assessment Boundary, including in areas where infrastructure overlaps moderate-likelihood zones. This assessment included both static and dynamic slope stability analyses (**Appendix 14.4**).
- 14.160 There is no increased likelihood of peat failure during the operational stage and no expected changes to runoff scenarios identified during construction. Infrastructure will remain stable under operational conditions, and land management measures (e.g. drainage control, peatland restoration) are expected to improve slope stability over time.
- 14.161 Effects on specific receptors are discussed below.

Loss, degradation and disturbance of peat resource

- 14.162 As all earthworks and peat movement will be completed during construction there is no potential for loss or disturbance of peat resource through excavation.
- 14.163 The presence of access tracks and hardstanding has the potential to alter the hydrological continuity within the peat by obstructing and diverting groundwater within the peat. Although peat is essentially rainfall fed, drains and excavated tracks can dewater surrounding formations resulting in adjacent peat drying out if inappropriate designs are used. In order to maintain the hydrological continuity in these areas, the infrastructure will be designed to allow water to flow through the semi-permeable tracks in conjunction with specific drainage and regular culverts that will transfer groundwater and disperse it in a diffuse manner across the down gradient peat. Drainage will also be designed to avoid the development of preferential pathways that can remove water from saturated areas of peat.
- 14.164 Operational effects on peat will be mitigated through drainage and SUDS design that retains water on-site, promotes saturation of peat rather than draining it and maintains hydrological continuity where any infrastructure dissects any peat bodies.
- 14.165 With a robust and effective drainage management plan and designed infrastructure there is unlikely to be a significant effect on peat. This approach is supported by the **Drainage Strategy**, which incorporates attenuation features, controlled discharge and distributed drainage systems designed to retain water within the catchment and avoid the development of preferential drainage pathways.

Effects on specific receptors

The effects above – in-combination and / or in isolation are considered with respect to the relevant specific receptors below.

Surface water features

- 14.166 The operational stage will not introduce new sources of disturbance or discharge to surface water features. Given the limited hydrological connectivity between infrastructure and nearby water features, and continued use of SuDS, attenuation, and erosion control measures, the magnitude of impact is assessed as negligible.

14.167 When combined with the negligible to medium sensitivity of the nearby watercourses (medium - where linked to public water supply), there is likely to be a direct, temporary, long-term, adverse effect which is considered to be minor.

14.168 Application of microsinning allowance does not change this conclusion.

Public water supplies

14.169 Downstream public water supply reservoirs are classified as high sensitivity receptors due to their function in providing potable water, as set out above in the construction stage assessment. No operational infrastructure lies within 30m of main watercourses directly feeding these reservoirs.

14.170 During the operational stage:

- Infrastructure footprints will remain minimal;
- All installed drainage and water management systems will remain in place and undergo regular maintenance; and
- Areas disturbed during construction will be reinstated and subject to ecological and hydrological restoration efforts.

14.171 Accordingly, the magnitude of operational impact on public water supplies is assessed as negligible. When combined with the high sensitivity of these receptors, there is likely to be a direct, temporary long-term adverse effect which is considered to be minor.

14.172 Application of microsinning allowance does not change this conclusion.

Private water supplies

14.173 PWS1 and PWS2 are high sensitivity receptors, as set out above in the construction stage assessment.

14.174 The operational footprint of the Project for Assessment is smaller than the construction footprint and no new infrastructure will be constructed during operation in proximity to these supplies. The required maintenance activities are not expected to alter current hydrological regimes. As established in **Appendix 14.6**, a hydrogeological connection from the Project for Assessment to PWS1 (Cowpe spring) and PWS2 (Stewart Farm) remains highly unlikely due to:

- Geological barriers (mudstone / siltstone);
- Topographic separation; and
- The nature and depth of the abstraction points.

14.175 No change in risk or connectivity arises during operation, and there is no increased risk of contamination or disruption.

14.176 The magnitude of impact is negligible and when combined with high sensitivity, there is likely to be a direct, temporary, long-term, adverse effect which is considered to be minor.

14.177 Application of microsinning allowance does not change this conclusion.

GWDTEs

- 14.178 During the operational stage, impacts on GWDTEs are expected to be minimal given the passive nature of infrastructure and the effectiveness of primary (embedded) mitigation measures, including the drainage strategy. The operational infrastructure (wind turbines, substation and site access tracks) will remain in place. However, once constructed, these features are not anticipated to cause further disruption to shallow groundwater flow patterns.
- 14.179 Drainage measures installed during construction—such as cross drains, culverts, and diffuse discharge points — will remain functional, ensuring continued groundwater recharge and minimising the potential for long-term changes in groundwater distribution. No active groundwater abstraction or discharge is proposed during operation.
- 14.180 Therefore, while the hydrogeological connection between infrastructure and the GWDTE area remains possible, the magnitude of impact during operation is considered to be negligible, with no measurable change to groundwater flow pathways or availability. When combined with medium sensitivity (as identified in the construction stage assessment), this results in a direct, temporary, long-term, adverse effect which is considered to be minor.
- 14.181 Application of microsinning allowance does not change this conclusion.

Peat resource

- 14.182 Operational activities are not expected to require additional excavation or disturbance of peat. All excavated and reused peat will remain in situ following reinstatement, and restoration works undertaken during the construction stage.
- 14.183 No new infrastructure is planned post-construction, and long-term peatland restoration and management (as detailed in **Appendix 14.3** and the **Moorland Restoration and Management Plan**) is expected to continue. This includes:
- The reuse of translocated peat to re-connect fragmented bog areas;
 - Ongoing stabilisation of degraded peatland areas through re-wetting and revegetation; and
 - Minimal disturbance through access or inspection activity.
- 14.184 Peat adjacent to infrastructure or where areas of peat are intersected by tracks could be impacted through diversion or drainage of peat groundwater. Any effects of the constructed infrastructure on peat will be mitigated through drainage and SUDS design that retains water on site, promotes saturation of peat rather than draining it and maintains hydrological continuity where any infrastructure dissects any peat bodies.
- 14.185 As a result, the magnitude of impact on the peat resource is negligible during the operational stage. Given the overall low sensitivity of the modified peat within the Assessment Boundary, there is likely to be a direct, temporary, long-term, adverse effect which is considered to be minor.
- 14.186 Application of microsinning allowance does not change this conclusion.

Secondary Mitigation and Enhancement

Construction stage

14.187 There are no construction stage effects on hydrology, hydrogeology and peat that require additional, secondary mitigation. However, the following further good practice and enhancement measures will be employed to reduce effects where possible for the identified receptors below.

Surface water features

14.188 No secondary mitigation has been identified as being required.

Public Water Supplies

14.189 A monitoring programme will be developed and implemented in conjunction with United Utilities for the public water supply reservoirs to understand the parameters of concern and to set up reporting requirements, a process for information transfer and an emergency response plan. A baseline water quality monitoring programme will be completed followed by monitoring during construction and site restoration / early post construction phases to ensure that no adverse effects occur as a result of the Project for Assessment.

Private water supplies

14.190 A monitoring programme will also be established for the private water supplies (PWS) identified in the PWS assessment, in consultation with the residents. This will involve baseline data collection prior to construction to ensure that all supplies are identified / understood and regular monitoring throughout the construction stage. This programme will allow any potential impacts on the PWS can be promptly identified and addressed.

GWDTEs

14.191 A suite of targeted mitigation measures will be implemented to protect GWDTEs identified as potentially hydrologically connected to the Project for Assessment. These measures have been developed in consideration of the Assessment Boundary's hydrological and geological setting, with emphasis on maintaining shallow groundwater flow pathways that support sensitive habitats.

14.192 Mitigation will include micro-siting of infrastructure, particularly the substation, to maximise the separation from GWDTE area (Polygon 281 in **Figure 14.7**). Where excavations intercept groundwater, it will be discharged in a diffuse manner downslope and in close proximity to the excavation area to maintain natural groundwater gradients and prevent interruption of flow.

14.193 Track infrastructure, including site access tracks, will be constructed with permeable cross drains and small culverts where necessary, to enhance infiltration and avoid disruption to groundwater recharge or surface water distribution. Drains parallel to tracks will be routed through frequent cross drains to avoid channelling or interception of subsurface flow.

14.194 These measures will be embedded into the CEMP and implemented across relevant parts of the Assessment Boundary to ensure that groundwater-fed ecological features remain supported throughout and following construction.

Peat resource

14.195 Where possible, following further detailed ground investigations and subsequent detailed infrastructure specification and design post-consent, micro-siting of infrastructure to further

reduce the amount of peat being disturbed will be undertaken. The infrastructure design will also be reviewed to minimise the excavated footprint where possible.

14.196 Within the Assessment Boundary, there is an opportunity for the following volumes of peat to be re-used within temporary infrastructure areas and translocated to support peatland restoration which will be implemented through the PMP:

- Total volume of peat that can potentially be reused within the Assessment Boundary reinstating infrastructure and in peat restoration = $\sim 96,674 \text{ m}^3$.

14.197 The peat balance for the Project for Assessment (shown in **Table 7 of Appendix 14.3**) indicates that there are sufficient opportunities within the Assessment Boundary to enable reuse of peat to support peatland restoration and minimise the impacts of construction through infrastructure reinstatement.

14.198 The total volume of peat predicted to be excavated as part of the Project for Assessment is $96,674 \text{ m}^3$. A total of $97,537 \text{ m}^3$ of peat has been identified for reuse, including restoration activities across the Assessment Boundary. This reuse volume matches the volume to be excavated, indicating that all excavated peat will be beneficially reused on-site, with restoration proposed in areas of degraded peat. The peat balance demonstrates that peat will be retained and reused as far as practicable, supporting the principles of peat minimisation and site restoration.

14.199 All excavated peat volumes have been demonstrated to be able to be appropriately re-used within the Assessment Boundary. The peat restoration and reuse strategy for the excavated peat is focused on immediate reinstatement of peat through the translocation of peat, where possible, as this reduces potential degradation of peat through storage.

14.200 Other elements detailed in the **Moorland Restoration Management Plan** will be progressed during the construction to help offset any construction effects.

14.201 Full details of these measures will be provided in a CEMP and updated Peatland Management Plan which will be prepared and agreed with the Local Planning Authorities / Environment Agency as part of a planning condition.

Operational Stage

All receptors (surface water features, public water supplies, PWS, GWDTEs and peat resource)

14.202 No secondary mitigation has been identified as being required.

Residual Effects

Construction stage

14.203 The application of micro-siting allowance does not change the residual effects reported below.

Surface water features

14.204 With the secondary mitigation identified, the residual effects of the Project for Assessment on the surface water features are considered to remain unchanged from the pre-mitigation scenario (i.e. Minor adverse), given the embedded mitigation and design measures employed. No infrastructure is located within 50m of High or Medium sensitivity

watercourses or waterbodies, such as those draining directly toward Public Water Supply reservoirs.

Public water supplies

14.205 The potential for indirect effects on Public Water Supply reservoirs has been considered and avoided through careful layout and hydrological review. Main watercourses draining directly toward Public Water Supply reservoirs have been classed as medium sensitivity and no infrastructure is located near these main watercourses directly linked to the reservoirs. The receptors themselves (i.e. the reservoirs) are considered high sensitivity and are not located within the Assessment Boundary. Given the separation distances, hydrological context, and embedded design measures, the magnitude of potential impact is considered to be negligible, resulting in a residual effect that is minor adverse.

Private water supplies

14.206 The potential for indirect effects on Private Water Supplies (PWS) has been considered and minimised through infrastructure layout design and hydrogeological assessment. Identified PWS receptors within and near the Assessment Boundary have been subject to risk screening based on proximity, groundwater flow direction, and geological setting.

14.207 All identified PWS are considered to be of high sensitivity, but due to the separation distances, local hydrogeological context, and the negligible magnitude of potential impact, the residual effect is minor adverse.

GWDTEs

14.208 One GWDTE (Polygon 281) is considered to have a potential hydrogeological connection to the infrastructure, the substation. These areas rely on localised groundwater, typically emerging at lithological boundaries and / or steep slopes without superficial deposits.

14.209 Following the implementation of specific mitigation measures – such as micro-siting to maximise separation from sensitive area, the incorporation of permeable cross drains to retain recharge, and the diffuse discharge of any intercepted groundwater– the magnitude of potential impact on these habitats is expected to be negligible. Given the medium sensitivity of the GWDTE features and the application of effective secondary mitigation, the residual effect is considered to be minor adverse.

Peat resource

14.210 The Project for Assessment has been designed to minimise disturbance to sensitive peatland areas, through measures such as the use of floating track construction where feasible, particularly in areas with peat >1m depth. This has the potential to reduce peat excavation volumes and limit hydrological disturbance.

14.211 The reinstatement of peat around infrastructure following the main construction works and targeted peatland restoration will provide opportunities for the improvement of peatland condition across the Assessment Boundary. The restoration proposals focus on re-profiling, drain blocking and revegetation of degraded peat areas, which will promote re-wetting and contribute to longer-term peat formation. All excavated peat will be managed within the Assessment Boundary, with reuse for reinstatement prioritised.

14.212 With the secondary mitigation identified, the residual effect related to peat is considered to remain unchanged from the pre-mitigation scenario (minor adverse). However, these minor

adverse effects on the peat resource may become beneficial depending on the success of peatland restoration activities, which aim to recover degraded habitats and restore hydrological function. Overall, while a minor adverse effect is the predicted residual outcome at the construction stage, the implementation of peatland restoration measures introduces the potential for long-term beneficial effects, particularly if restoration efforts succeed in enhancing ecological condition and re-establishing natural hydrological processes.

Significance

14.213 The above effects during construction are **Not Significant**.

Operational stage

14.214 The application of micrositing allowance does not change the residual effects reported below.

Surface water features

14.215 In the absence of secondary mitigation, the residual effects for surface water features are the same as that reported in the pre-mitigation scenario, a residual effect of minor adverse.

Public water supplies

14.216 In the absence of secondary mitigation, the residual effects for public water supplies are the same as that reported in the pre-mitigation scenario, a residual effect of minor adverse.

Private water supplies

14.217 In the absence of secondary mitigation, the residual effects for private water supplies are the same as that reported in the pre-mitigation scenario, a residual effect of minor adverse.

GWDTes

14.218 In the absence of secondary mitigation, the residual effects for GWDTes are the same as that reported in the pre-mitigation scenario, a residual effect of minor adverse.

Peat resource

14.219 Assuming the successful implementation and maturation of the proposed peatland restoration measures – particularly the peat translocation and reuse strategies outlined in **Appendix 14.3** and the **Moorland Restoration and Management Plan** – the residual effect on the peat resource is assessed as minor beneficial. These measures are expected to reconnect fragmented peat habitats, stabilise eroding areas and enhance the overall condition of Cowpe Moss over the medium to long-term.

Significance

14.220 The above effects during operation are **Not Significant**.

Limitations and Assumptions

14.221 To ensure transparency within the EIA process, the following limitations and assumptions have been identified.

- **Data availability:** The assessment has been informed by available desk-based data, published geological and hydrological mapping, peat depth probing data, site walkovers, and consultation responses. This includes private water supplies, and it is understood that additional, unregistered supplies may exist beyond those identified through desk study, consultation, or local engagement. While this provides a robust

basis for assessment, it is acknowledged that data availability may be limited in certain areas, which introduces a degree of uncertainty in relation to hydrological connectivity. Further investigation into private water supplies will be required / undertaken;

- **Peat and ground conditions:** Peat depth and condition data were obtained through a detailed desk-based study and a targeted survey campaign that is representative of conditions at the time of survey. It is assumed that peat condition is consistent with observed classifications (modified or degraded), although localised variability may occur. Probing has not been completed for the different grid connection route options as any excavated peat will be placed back in the cable trench, or for the laydown area as it was scoped out for peat. Further ground investigations will be undertaken at detailed design stage to confirm ground conditions and inform final design and mitigation measures;
- **Variable conditions:** Baseline conditions such as surface water flow and visible groundwater emergence are subject to seasonal variation and may not have been fully captured during site visits. While observations were made under varying weather conditions, temporary or ephemeral features may have gone undetected;
- **Hydrological connectivity:** Catchment boundaries and flow paths have been derived from topographical mapping and site walkover observations. While reasonable efforts have been made to verify these, small-scale or sub-surface connectivity (e.g. artificial drainage networks) may not be fully captured. This may influence the interpretation of potential linkages to sensitive receptors such as watercourses or private water supplies; and
- **Modelling and assessment:** No quantitative hydrological modelling has been undertaken for this assessment. Predictions are based on professional judgement, site data, and guidance documents. Assessment of effects is therefore qualitative, and a precautionary approach has been adopted where uncertainties exist.

14.222 These limitations do not prevent a reasoned assessment of likely significant effects, and all conclusions have been reached on the basis of a precautionary, evidence-led approach in line with current guidance and best practice.

Summary

14.223 **Table 14.9** provides a summary of the effects, receptors, residual effects and conclusions of significance considered within the Chapter.

14.224 The table only provides a summary of the residual effects identified within the assessment and details of all primary, secondary and tertiary mitigation measures that have been taken into account are set out in detail within the Chapter and summarised in the Environmental Management Plan included in **Volume 3: Environmental Management Plan**.

Table 14.9: Summary of residual effects

Receptor		Residual effect	Is the residual effect Significant?
Construction stage			
Surface water features	On / off-site waterbodies and watercourses	Minor adverse	No
Public water supply	Reservoirs	Minor adverse	No
Private water supply	Private water supply sources	Minor adverse	No
GWDTes	Polygon 281 (in Figure 14.7)	Minor adverse	No
Peat resource	Peat on-site	Minor adverse	No
Operational stage			
Surface water features	On / off-site waterbodies and watercourses	Minor adverse	No
Public water supply	Reservoirs	Minor adverse	No
Private water supply	Private water supply sources	Minor adverse	No
GWDTes	Polygon 281 (in Figure 14.7)	Minor adverse	No
Peat resource	Peat on-site	Minor beneficial	No

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