Chapter 7

Geology, Hydrogeology and Hydrology

SP ENERGY NETWORKS

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7.1 Introduction

1. This Chapter of the EIAR presents the findings of the assessment of the likely significant effects of the proposed development described in **Chapter 4: Development Description** on the existing geological, hydrogeological and hydrological conditions within the proposed route, and identifies and assesses the potential impacts that may be caused by the proposed development. This includes site preparation, construction works, restoration of construction works, site operation that may be employed to relieve any adverse effects are also set out. Mitigation measures that may be employed to relieve any adverse effects are also set out.

2. Within this Chapter, the proposed route is considered to include the proposed route and an area up to 2 km from its boundary. For hydrological concerns, areas downstream of the planning application boundary are considered at a distance greater than 2 km as it is possible for effects to be transmitted downstream for greater distances.

3. This Chapter is also accompanied by **Appendix 7.1 Minerals Report**.

7.2 Scope and Methodology

4. The assessment is undertaken through a desk study and proposed route inspection of existing geology, hydrogeology and hydrology-related features within and surrounding the proposed route. The existing conditions are described and potential risks that may be associated with the proposed development are identified and assessed. This includes damage to soils and designated sites, damage to private water supplies, damage to watercourses and flood risk.

5. A number of data sources were considered in writing this chapter; the main sources are detailed below:

- Ordnance Survey topographical mapping, current and historical;
- British Geological Survey (BGS) geological mapping, superficial and bedrock;
- BGS online borehole database;
- Scotland's Soils mapping; and
- Scottish Environment Protection Agency's (SEPA) online flood mapping.

7.2.1 Effects Evaluation

6. The significance of potential effects has been classified taking into account three principal factors: the sensitivity of the receiving environment, the potential magnitude of the effect and the likelihood of that effect occurring. This approach is based on guidance contained within the joint Scottish Natural Heritage (SNH)/Historic Environment Scotland (HES) publication Environmental Impact Assessment Handbook v5 (SNH/HES, 2018).

7.2.1.1 Receptor Sensitivity

7. The sensitivity of a receptor represents its ability to absorb the anticipated effect without resulting perceptible change. Four levels of sensitivity have been used, as defined in **Table 7.1**.

Sensitivity	Definition
Very high	The receptor has very limited ability to absorb change without fundamentally altering its present character, is of very high environmental value and/or is of international importance.
High	The receptor has limited ability to absorb change without significantly altering its present character, is of high environmental value and/or is of national importance.
Moderate	The receptor has moderate capacity to absorb change without significantly altering its present character, has moderate environmental value and/or is of regional importance.
Low	The receptor is tolerant of change without detriment to its present character, is of low environmental value and/or of local importance.

Table 7.1: Sensitivity Ratings

7.2.1.2 Effect Magnitude

8. The magnitude of effects includes the timing, scale, size and duration of the potential effect. Four levels of magnitude have been used, as defined in **Table 7.2**.

Magnitude	Definition
Substantial	Substantial changes, over a substantial area, to key characteristics or to the geological/hydrogeological/peatland classification or status for more than 2 years.
Moderate	Noticeable but not substantial changes for more than 2 years or substantial changes for more than 6 months but less than 2 years, over a substantial area, to key characteristics or to the geological/hydrogeological/peatland classification or status.
Slight	Noticeable changes for less than 2 years, substantial changes for less than 6 months, or barely discernible changes for any length of time.
Negligible or no change	Any change would be negligible, unnoticeable or there are no predicted changes.

Table 7.2: Magnitude Ratings

7.2.1.3 Likelihood of Effect

9. The likelihood of an effect occurring is evaluated to three levels: unlikely, possible or likely.

7.2.2 Effects Significance

10. The findings in relation to the three criteria discussed above have been brought together to provide an assessment of significance for each potential effect as shown in **Table 7.3**. Potential effects are concluded to be of major, moderate, minor or negligible significance. Potential effects are assessed considering the proposed mitigation measures. The assessment concludes with a review of various effects to determine if they would be significant in terms of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017. Effects assessed as major or moderate are deemed to be significant; those assessed as minor or negligible are deemed to be not significant.

Sensitivity	Magnitude	Likelihood	Significance
Very High	Substantial	Likely	Major
		Possible	Major
		Unlikely	Moderate
	Moderate	Likely	Major
		Possible	Moderate
		Unlikely	Moderate
	Slight	Likely	Moderate

Sensitivity	Magnitude	Likelihood	Significance
		Possible	Minor
		Unlikely	Minor
	Negligible/no change	Likely	Minor
		Possible	Negligible
		Unlikely	Negligible
High	Substantial	Likely	Major
		Possible	Major
		Unlikely	Moderate
	Moderate	Likely	Moderate
		Possible	Moderate
		Unlikely	Minor
	Slight	Likely	Minor
		Possible	Minor
		Unlikely	Minor
	Negligible/no change	Likely	Minor
		Possible	Negligible
		Unlikely	Negligible
Moderate	Substantial	Likely	Major
		Possible	Moderate
		Unlikely	Minor
	Moderate	Likely	Moderate
		Possible	Minor
		Unlikely	Minor
	Slight	Likely	Minor
		Possible	Minor
		Unlikely	Negligible
	Negligible/no change	Likely	Negligible
		Possible	Negligible
		Unlikely	Negligible
Low	Substantial	Likely	Moderate
		Possible	Minor
		Unlikely	Negligible
	Moderate	Likely	Minor
		Possible	Minor
		Unlikely	Minor
	Slight	Likely	Minor
		Possible	Negligible
		Unlikely	Negligible
	Negligible/no change	Likely	Negligible
		Possible	Negligible
		Unlikely	Negligible

Table 7.3: Effects significant matrix

7.2.3 Limits and Uncertainties

11. The site visit followed a standard 'reconnaissance level' walkover survey to obtain an overview of the proposed route conditions at the time of the visit. The information gathered has been combined with information from site visits for other disciplines and available photography to give as full a picture of the proposed route conditions as possible.

12. The reconnaissance survey was undertaken on 01 and 02 March 2021. The weather was sunny on day one and foggy on day two. On day one, the survey started at the Coalburn Substation, south of the Station Road at Douglas. On the second day, the southern section from Douglas to Auchendaff Hill was covered. Pictures and notes of potential constraints to the proposed development were taken.

7.3 Consultation Undertaken

13. Consultation was undertaken with a number of statutory and non-statutory consultees and interested parties, including South Lanarkshire Council, SEPA, NatureScot (formerly SNH) and local stakeholders. Responses with relevance to geology, hydrogeology and hydrology are provided in **Table 7.4**.

Name of Stakeholder/ Consultee	Key concerns	Response
The Coal Authority	Identified routes fall within the Development High Risk Area, there are coal mining features and hazards that need to be considered in relation to this project.	The mining history of the proposed route has been identified in **Section 7.4.5**. The Development High Risk areas have been included in the influence on design, **Section 7.5**.
NatureScot	Protected areas of concern, Coalburn Moss Special Area of Conservation and SSSI, Kennox Water SSSI. Concerns over carbon-rich soils, deep peat and priority peatlands habitats.	Designated sites and peatland habitats have been identified in **Sections 7.4.12** and **7.4.4**. Effects on peat and designated sites are discussed in **Sections 7.6.2.2, 7.6.2.7** and **7.6.2.4**. Mitigation commitments have been discussed in **Section 7.6.6.2**.
SEPA	Map and assessment of all engineering activities in or impacting the water environment including proposed buffers, details of any flood risk assessment and details of any related CAR applications.	Watercourse crossings and impacts to the water environment have been assessed in **Sections 7.6.2.1**, **7.6.2.2**, **7.7.4.1** and **7.6.6.2**. Flood risk has been identified in **Section 7.4.11** and assessed in **Sections 7.7.2.5, 7.6.3.5** and **7.7.4.5.**
	Pollution Prevention Plan and Construction Method Statement. Expect the application to be supported by a comprehensive site-specific peat management plan.	All necessary permissions relating to construction works, plus accompanying pollution prevention plans, would be obtained prior to any construction work beginning. Construction best practice is outlined in **Sections 7.6.2** and **7.6.6.** Methods for managing peat on site are outlined in **Sections 7.6.2.7**,**7.7.4.2, 7.7.4.7**. Construction within peatland has been kept to a practical minimum. A peat management plan would be created prior to construction in any areas of peatland identified in **Section 7.5.4**.

Name of Stakeholder/ Consultee	Key concerns	Response
	Map and assessment of impacts upon groundwater abstractions and buffers.	Private water supplies are identified in **Section 7.4.10** and **Figure 7.6**. Impacts on PWS have been assessed in **Sections 7.6.2.4**, **7.6.3.4** and **7.7.4.4**.
	Maps of proposed surface water drainage layout with details of the proposed operating regime	Maps of proposed surface water drainage would be provided pre-construction as part of the Pollution Prevention Plan.
	Peat depth survey and table detailing re-use proposals.	Methods for managing peat on site are outlined in **Sections 7.7.2.7**, **7.7.4.2** and **7.7.4.7**. Construction in peatland has been kept to a practical minimum. Peat surveys are anticipated to be undertaken prior to construction in any areas of peatland identified in **Section 7.5.4**. The surveys would be used to best inform detailed design in these areas to control any impacts on peatland.
South Lanarkshire	Flood Risk Assessment must satisfy the requirements of the Council's Developer Design Guidance document dated May 2020. A Sustainable Drainage System serving the Application Site, designed and independently checked in accordance with the Council's current Developer Design Guidance is to be provided	Flood risk has been identified in **Section 7.4.11** and assessed in **Section 7.6.2.5**. Natural flood management techniques are used where possible. Details of drainage infrastructure would be provided pre-construction as part of the Pollution Prevention Plan and following detailed design.
Energy Consents Unit	Section 37 applications should be assessed for peat landslide risk where infrastructure is proposed in peatland areas. Where it is proposed that at Peat Landslide Hazard and Risk Assessment (PLHRA) is not provided, clear justification for not carrying out such a risk assessment is required. Scottish Ministers consider that where there is a demonstrable requirement for PLHRA, one should be carried out. The assessment should provide a clear understanding of whether any risks identified in the assessment are acceptable and capable of being controlled by mitigation measures. The Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Second Edition), published at http://www.gov.scot/Publications/2017/04/8868, should be followed in the preparation of the EIA report, which should contain such assessment and details of mitigation measures.	A Peat Management Plan and PLHRA have both been scoped out of the EIA as a result of the very limited anticipated effects associated with the proposed works. A desk-based review has been undertaken to consider locations where peat may be present and the proposed construction activities that may disturb peat. Incursion into areas of peat has been minimised by design. With appropriate site environmental management, anticipated activities are not expected to cause a significant effect. During pre-construction, collection of additional data would be undertaken at key locations. Any required mitigation would be determined as part of this work.

Table 7.4: Consultee responses relevant to geology, hydrogeology, peat and hydrology

7.3.1 Statutory and Planning Context

14. In preparing this Chapter of the EIAR, consideration has been given to relevant planning guidance at all levels. This includes, but is not limited to, the following:

- The European Water Framework Directive (2000/60/EC) and associated daughter Directives including the Groundwater Directive (2006/118/EC);
- The European Mining Waste Directive (2006/21/EC);
- The Environmental Protection Act 1990 (as amended);
- The Water Environment and Water Services (Scotland) Act 2003;
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 as amended;
- The Pollution Prevention and Control (Scotland) Regulations 2012;
- The Water Environment (Oil Storage) (Scotland) Regulations 2006;
- Scottish Planning Policy 2014;
- Scottish Government's Planning Advice Note 51: planning, environmental protection and regulation (2006);
- South Lanarkshire Council's Local Development Plan 2 adopted 9th April 2021;
- SEPA's Position Statement WAT-PS-10-01: Assigning Groundwater Assessment Criteria for Pollutant Inputs (2014); and
- SEPA's Guidance for Pollution Prevention, with particular reference to:
  - PPG 1: Understanding your environmental responsibilities – good environmental practice;
  - PPG 6: Working at construction and demolition sites.

7.4 Existing Environment

7.4.1 Meteorology and Climate

15. The proposed route is located in the western part of the central lowlands, within the UK Meteorological Office's Western Scotland regional climatic area (Met Office, 2021). Much of Western Scotland is exposed to rain-bearing westerly winds, particularly areas along the coast. The proposed route is located in the Central Lowlands between the higher areas of the southern Highlands to the north and the Southern Uplands to the south. The proposed route is located roughly in the centre of the region in an area of relatively low hills around 300-500 m in height. Lower elevations tend to have less rainfall (Met Office, 2021); therefore, the proposed route is expected to have lower rainfall than the region in general.

16. Much of the Western Scotland climatic area constitutes high ground (i.e. more than 200 m above sea level), especially in the north, where many peaks exceed 1,000 m. Fjord-like sea lochs and islands characterise the west of the region, and the south contains the Southern Uplands. The Clyde and its associated sea lochs forms the major sea inlet. Much of Western Scotland has a climate strongly influenced by the rain-bearing westerly winds and the effects of altitude, as air cools as it rises and condenses to produce precipitation. Average annual rainfall ranges from less than 1,000 mm in the upper Clyde valley and along the coasts of Ayrshire and Dumfries and Galloway to over 3,500 mm in the west Highlands, approaching the maximum values of over 4,000 m further north in Fort William.

17. Average annual rainfall for the proposed route catchments varies between 1,225 and 1,165 mm (CEH, 2021), indicating it is in a relatively dry region of the Western Scotland climatic area. The mean catchment altitudes range from 284 m to 302 m. Average annual rainfall for the climate monitoring stations at Drumalbin and Saughall are 900.3 mm and 1,387.2 mm respectively (Met Office, 2021). The monitoring station at Drumalbin is approximately 20 km north-east of the Study Area, and the station at Saughall is approximately 22 km north-west. **Figure 7.1** shows the average rainfall distribution through the year for both monitoring stations.

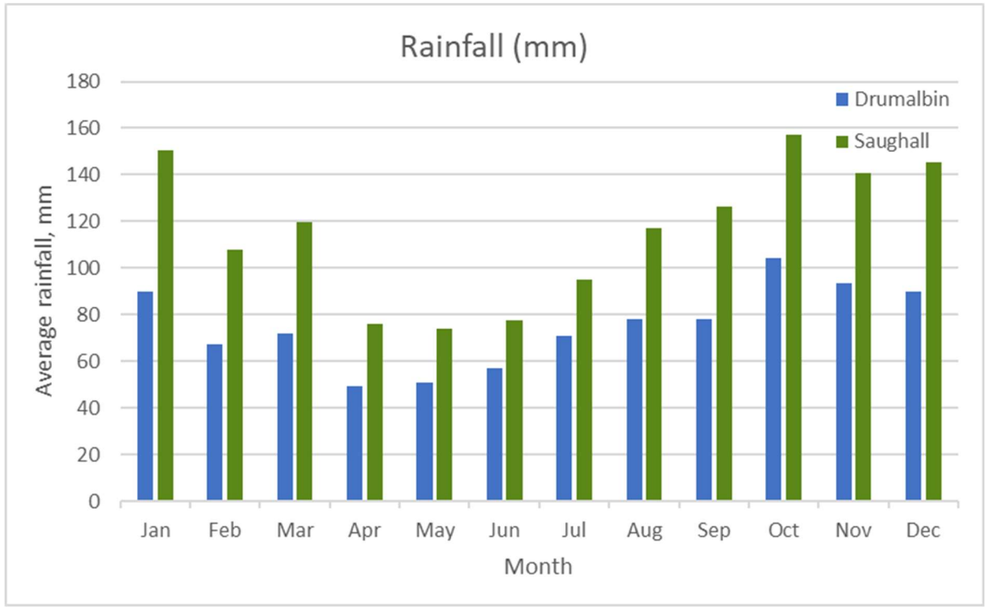

Figure 7.1: Monthly rainfall averages for monitoring stations at Drumalbin and Saughall. Averages cover the period 1981-2010 (Met. Office, 2021).

7.4.2 Geology

7.4.2.1 Bedrock geology

18. Geological information is derived from the BGS GeoIndex online geological mapping 1:50,000 and 1:625,000 maps (BGS, 2021) and the Geological Survey of Scotland 1:63,360/1:50,000 geological map series (Peach *et al*., 1929).

19. The bedrock geology of the proposed route is dominated by Carboniferous strata, which contain most of the potential resources in the area. The geology of the area is complex, consisting mainly of rocks from the Scottish Coal Measures, the Clackmannan Group, the Strathclyde Group and the Inverclyde Group.

20. All the main rock formations are characterised by cyclic sequences of sandstones, siltstones and mudstones. They include interbeds of ironstone, seatearth, limestone and coal seams in varying proportions. The seatearths, coals and limestones have traditionally been the main units targeted for exploitation. The older Inverclyde Group is dominated by sandstones with silty mudstone interbeds, and is largely lacking coals, seatearths and exploitable limestone.

21. The central-western part of the proposed route is characterised by rocks from the Lanark Group, of Silurian and Devonian age. These include the Swanshaw Sandstone and Quarry Arenite Formations and are typically sandstones with minor conglomerate and mudstone.

22. Some igneous rocks are present, mainly also Silurian and Devonian in age. These consist of volcanic sequences within the Lanark Group, mainly basaltic in composition, and are present in the south-western and south-eastern parts of the proposed route.

23. A series of dykes cuts across the region, with a characteristic north-west to south-east trend. These are all Palaeogene in age, associated with the volcanic activity on Mull and related areas, and are typically of dolerite or quartz dolerite composition.

7.4.3 Structural geology

24. The proposed route shows considerable faulting and formation of basin fold structures. The proposed route is located just north of the Southern Uplands Fault, a major extensional fault that forms the southern boundary of the Midland Valley of Scotland. A number of prominent regional north-east to south-west trending faults are associated with movement on the Southern Uplands Fault.

25. In addition, a series of west to east and north-west to south-east faults are associated with the formation of basins during the Carboniferous period. The proposed route contains part of a major local syncline (downfold) structure, the centre of which exposes the Passage Formation sandstones and coals at the top of the Clackmannan Group, located at the eastern side of the proposed route.

26. The BGS GeoIndex online ‘Modern instrument recorded earthquakes’ map (BGS, 2021) was consulted to determine earthquake risk. The largest recorded earthquake in the area was a 1.2 magnitude micro-earthquake occurring in 2008. Based on magnitude and frequency of recorded events and fault locations, earthquakes are deemed not to be of concern in the area.

7.4.3.1 Superficial Geology

27. The superficial deposits are predominantly diamicton (glacial till), clays to sands and gravels, of Devensian age.

28. There are glaciofluvial deposits of Quaternary age and alluvium of Holocene age within the proposed route, which are mainly confined to river valleys. The glaciofluvial deposits consist of sand and gravel with occasional lenses of silt, clay or organic material. The alluvium, of similar characteristics, comprises soft to firm, consolidated, compressible silty clay, with some layers of silt, sand, peat and basal gravel. The glaciofluvial and alluvium deposits are broader and more notable adjacent to Poniel Water, near the M74, and along the Douglas Water, from around Glespin and continuing north-east under the M74.

29. There are some areas of discontinuous peat deposits across the hill slopes, and in isolated lowland areas such as to the south of Coalburn and the lower flanks of the north side of Hagshaw Hill and Henry’s Hill.

30. Areas with no superficial cover mainly identify former opencast coal mines, where the cover is no longer natural material (classed as ‘made ground’), and some steeper hillslopes.

7.4.4 Soils and Peat

31. The 1:250 000 National soil map of Scotland, Soil Survey of Scotland 1981 identifies five main soil types across the proposed route: gleys, podzols, brown forest soils, and blanket and basin peats (James Hutton Institute, 2021). Gleys form the dominant soil type across much of the proposed route. Some podzols are identified, notably near the southern end and in the northern half of the proposed route. Brown forest soils mainly occupy the lower-lying areas in river valleys. Basin and blanket peats are limited in area, with some presence in the northern part of the proposed route and a small section towards the southern end.

32. Further details on soils within the proposed route are provided in **Table 7.5**. Soils, peat and carbon mapping are provided on **Figure 7.2**.

Soil Assoc.	Parent Material	Component Soils	Landforms	Area %
Bargour	Drift derived from Barren Red Sandstones of Carboniferous age	Brown forest soils with gleying; some noncalcareous and humic gleys	Undulating lowlands with gentle and strong slopes	4.7
Darleith	Drifts derived from basaltic rocks	Peaty podzols, peaty gleys, peat; some rankser	Hills with gentle to strong slopes: slightly rocky	0.1
		Peaty gleys, peat; some humic gleys	Undulating hills with strong slopes; non-rocky	5.7
Darvel	Fluvioglacial sands and gravels derived mainly from Carboniferous rocks	Brown forest soils, gleys, alluvial soils	Mounds and terraces with gentle and strong slopes	4.2

Soil Assoc.	Parent Material	Component Soils	Landforms	Area %
Glenalmond	Drifts derived mainly from sandstones of Lower Old Red Sandstone age	Noncalcareous gleys, brown forest soils with gleying; some peaty gleys	Undulating lowlands and foothills with gentle and strong slopes	3.3
		Brown forest soils with gleying; some brown forest soils and gleys	Undulating lowlands and foothills with gentle and strong slopes	5.7
Organic soils	Organic deposits	Dystrophic blanket peat	Uplands and northern lowlands with gentle and strong slopes	5.4
		Dystrophic basin peat	Basins and valleys	5.3
Reppoch	Drifts derived from Downtonian sandstones and shales	Brown forest soils; some brown forest soils with gleying and gleys	Undulating uplands with gentle and strong slopes	3.4
		Noncalcarous gleys; some brown forest soils with gleying and peaty gleys	Undulating uplands with gentle and strong slopes	11.5
		Peaty podzols, humus-iron podzols; some brown forest soils, gleys and peat	Undulating uplands with strong slopes	0.1
Rowanhill	Drifts derived from Carboniferous sandstones, shales and limestones	Brown forest soils	Mounds on valley sides with strong slopes	1.6
		Peaty gleys; some peat and noncalcareous gleys	Undulating foothills with gentle and strong slopes	26.7
		Noncalcareous gleys; some brown forest soils with gleying and peaty gleys	Undulating lowlands with gentle and strong slopes	1.6
		Humus-iron podzols; some brown forest soils and gleys	Undulating foothills with gentle and strong slopes	5.4
		Peaty podzols, peaty gleys	Hills with strong slopes	1.6
Sorn	Drifts derived from Lower Carboniferous and Upper Old Red Sandstone sediments and lavas	Peaty podzols, peaty gleys	Hills with strong slopes	5.3
		Peaty gleys, humic gleys; some peaty podzols and peat	Undulating lowlands and uplands with gentle and strong slopes	3.4
		Brown forest soils, noncalcareous gleys, peaty gleys, peaty podzols	Hills with strong slopes	<0.1

Table 7.5: Soil types within the planning application boundary

33. The Carbon and Peatland 2016 map has been consulted to understand the carbon-rich soils, peat and priority peatland habitat within the proposed route (SNH, 2016). The map classifies soils into five carbon classes plus three classes for mineral soils, non-soil or unknown. Classes 1 and 2 are considered to be nationally important carbon-rich soils.

34. Three small areas of Class 1 peat are located within or immediately adjacent to the proposed route. These are two small sections of Coalburn Moss, immediately east of the proposed route at the northernmost end, and an area of peatland immediately north-west of Coalburn village. The rest of the proposed route is dominated by Classes 3, 4 and 5 in the south and western region of the proposed route, while the eastern part is dominated by Class 0 mineral soils. The areas of each carbon and peatland class within the proposed route are provided in **Table 7.6**.

Peatland Class	Description	Area %
Class 0	Mineral soils; peatland habitats are not typically found on such soils	58.5
Class 1	Nationally important carbon-rich soils, deep peat and priority peatland habitat. Areas likely to be of high conservation value	2.0
Class 3	Dominant vegetation cover is not priority peatland habitat but is associated with wet and acidic type. Occasional peatland habitats can be found. Most soils are carbon-rich soils, with some areas of deep peat	14.1
Class 4	Area unlikely to be associated with peatland habitats or wet and acidic type. Area unlikely to include carbon-rich soils	9.6
Class 5	Soil information takes precedence over vegetation data. No peatland habitat recorded. May also include areas of bare soil. Soils are carbon-rich and deep peat	15.8

Table 7.6: Carbon and peatland classes present within the proposed route

35. During the walkover survey, boggy areas and peat features were recorded. To the north-west of Coalburn, the area was relatively flat and boggy, *Sphagnum* moss was observed, and peat was identified along the cut banks of drainage ditches. To the west of Coalburn, adjacent to Middlemuir Road within the forestry section, boggy conditions were observed with trees exhibiting stunted growth and a fence sunken approximately 0.75 m into the ground.

36. To the north of Chapel Hill, running parallel to the forestry block, a large area of boggy ground was identified. Within the area, several trees had fallen over, smaller trees with stunted growth were observed and the fence running alongside the forestry was sunken 1.0 m into the ground in some sections.

7.4.5 Mining

37. Mining information is derived from the BGS GeoIndex online geological mapping and borehole data (BGS, 2021); South Lanarkshire Council Adopted Minerals Local Development Plan Volumes 1 and 2 (South Lanarkshire Council, 2021); past and extant planning applications including consents, agreements and associated documents submitted to South Lanarkshire Council; Coal Authority online mapping portal (Coal Authority, 2021); Ramboll Environ minerals report for Dalquhandy to Coalburn OHL (Ramboll Environ, 2017), produced for SPEN; and satellite imagery. Minerals and mining mapping are provided on **Figure 7.3**. Mine entries are provided on **Figure 7.4**. The data and its location relative to the proposed route has been provided in **Table 7.7.**

38. The proposed route is located in a region with a long history of mining and mineral extraction in relation to coal, peat, aggregate, limestone, fireclay, seatearth and ironstone.

39. The proposed route includes a number of former opencast coal sites. The main coal mine sites are Dalquhandy and Glentaggart. A smaller site, Mainshill, is present in the eastern part of the proposed route. Broken Cross, another major opencast coal site, is located just outwith the proposed route boundary to the north-east.

40. The Dalquhandy Opencast Site occupied an area of approximately 10 km^2 and extracted from a number of coal seams within the Limestone Coal Formation. Dalquhandy is now completely restored. The Dalquhandy site covers a large area surrounding Coalburn, extending from Stockbriggs in the north to the edge of the forestry at Henry's Hill in the south, and east to the dismantled railway at Long Plantation.

41. The Glentaggart Opencast Site exploited coal reserves within the Scottish Coal Measures. Glentaggart was closed in 2011 and more recently restored. The Glentaggart site covers a large area south of Glespin, extending from the Douglas Water at Glespin, south-west to Kennoxhead, and east to Glentaggart and Dykehead.

42. The Mainshill Opencast Site is located to the north-east of Douglas, adjacent to the M74. It targeted coal and fireclay within the Upper Limestone and Limestone Coal Formations. Work at Mainshill ceased in 2013 after its owner, Scottish Resources Group, went into administration. The site began restoration in 2018 and is currently considered restored.

43. Poniel mine was the site of an Opencast Coal mine. The coal mine work ceased in 2011. This site is located south-west of junction 11 of the M74. There is now a whisky maturation facility located north of this site with large warehouse buildings visible from aerial imagery.

44. Poniel Quarry, an active sand and gravel quarry, is located immediately east of the M74 at Junction 11. This site is currently operational.

45. In addition to opencast sites, there are former colliery spoil heaps, known as bings, within the proposed route. The Auchlochan No. 9 Bing and the Bellfield Bing are located in the proposed route. The northern part of the proposed OHL travels across the north-west corner of the Auchlochan No. 9 Bing. The associated colliery here closed in 1968. The Bellfield Bing is located east of the proposed route in the north. This bing is surrounded to the south and west by housing.

46. There is no planned future mining in the area. There was a planning application for a new coal mine, Glentaggart East, submitted in 2016. However, this was withdrawn on 18 February 2020.

47. The Coal Authority interactive map viewer (Coal Authority, 2021) has identified several Development High Risk (DHR) areas that contain mine entries and past shallow coal working areas. There are multiple regions in which the proposed route passes through DHR areas. To the north of the Coalburn substation and surrounding the town of Coalburn, the proposed route passes through a large DHR area with multiple mine entries and past shallow coal workings, particularly to the west of Coalburn. To the south of Glespin another large DHR area has been identified, with multiple mine entries and past shallow coal workings.

48. A detailed Minerals Report has previously been produced for the proposed OHL and is provided as **Appendix 7.1 Minerals Report** to this Chapter. The report only considered the proposed OHL route and not the proposed underground cable section due to the locations of the adits and shafts.

Name	Commodity	Status	Distance & Direction from Route	Linkage?
Mainshill	Coal and fireclay (opencast)	Recently restored	2.2 km E	None
Dalquhandy	Coal (opencast)	Historic	0 km	The proposed route passes through this former mine area. Approximately 4.9 km of the northern part of the proposed route is through this area
Poniel (Mine)	Coal (opencast)	Closed	1.0 km NE	None
Glentaggart	Coal (opencast)	Closed	0 km	The proposed route passes through the NW section of this site
Broken Cross	Coal (opencast)	Closed (1988)	1.4 km E	None
Poniel (Quarry)	Sand & gravel	Active	2.5 km NE	None
Bings				
Auchlochan No. 9	Bing (coal)	Seemingly abandoned	0 km	Proposed route runs through the northern section of this site
Bellfield	Bing (coal)	Restored	0.7 km NE	Located 0.8 km NE of proposed route

Table 7.7: Historic mines within the proposed route

49. During the walkover survey several mining features were observed. Where the proposed route crosses the Auchlochan No 9 Bing, the area consisted of loose made ground. In addition to mining waste, it appears to have been used for fly tipping and domestic waste such fridges and gas canisters was observed. To the south of Middlemuir Road, Coalburn, at the ponds the ground appeared to have been fully restored and gas vents were observed.

50. Around the southernmost section of the proposed OHL and the adjoining cable section, in the area between Kennox and Kennoxhead, a number of ponds were observed during the site walkover. In addition, this area has previously been excavated and is now reinstated to some extent. The area is indicated on OS mapping to be former opencast workings. A large flooded void, possibly a quarry or part of the opencast workings, is present immediately south of the former Chapel Hill.

7.4.6 Geomorphology

51. The proposed development which runs between Kennoxhead Windfarm Substation and Coalburn Substation is located in the central region of the Central Lowlands, between the higher areas of the Southern Highlands to the north and the Southern Uplands to the south.

52. The proposed route falls into three sections: the northernmost section from Coalburn to the Poniel Water; the central section from the Poniel Water to the Douglas Water; and the southernmost section from the Douglas Water to Kennoxhead.

53. The northern section around Coalburn is the lowest section of the proposed route at 220 m AOD. This section is relatively flat between the substation and the town of Coalburn, with the flat area of Coalburn Moss to the east. The land rises gently towards the south until it reaches the Poniel Water, which is located in a sharply incised channel. Much of the land between Coalburn village and the Poniel Water is restored opencast land and the landforms are not natural. Coal bings make a distinct impression in this area as there are no other significant hills in the area.

54. Between the Poniel and Douglas Waters, the proposed route passes around the flanks of a group of hills located to the west of the proposed route. As a result, the land slopes up to the west and generally down to the east, towards the Douglas Water. The hills immediately west of the proposed route include Arkney Hill (375 m AOD), Rob's Hill (345 m AOD) and Longhouse Hill (338 m AOD). The proposed route crosses the Douglas Water approximately 1 km west of Glespin village.

55. From the Douglas Water, the land rises gently as the proposed route travels south up the Kennox Water valley. This section is largely restored opencast land and has a number of ponds and flooded voids present, the largest of which is near the south-western end on the lower slopes of Hareshaw Hill.

7.4.7 Hydrogeology

56. The proposed route is underlain predominantly by moderately productive aquifers including the Inverclyde, Clackmannan, Scottish Coal Measures, Lanark and Strathclyde Groups. These formations are varied as they consist principally of multi-layered cycles of sandstones, siltstones and mudstones. The siltstones and mudstones typically have low flow, with the sandstones and (where present) limestones having higher flows (Scottish Government, 2021; BGS, 2021). The highest yields are often associated with mining; however the water quality is often poor. The primary mechanism of groundwater flow is through fractures and other discontinuities, with siltstone and mudstone beds often acting as aquitards.

57. The superficial deposits covering the majority of the proposed route have a range of potential permeabilities, and their productivity depends on their local composition and connectivity. Any pockets of sand and gravel-rich material within the diamicton till and alluvium are likely to have higher permeability, whereas areas of clay and silt would have low or negligible permeability.

58. The more extensive peat bodies in the area would also hold significant amounts of groundwater; however, flow within peat is typically very slow and likely to contribute only limited baseflow to local burns. Significant flow can occur through subsurface drainage structures such as peat pipes where these are present. Peat pipes were not identified within any of the project surveys and most of the peat bodies present along the proposed route are small in area.

59. Regional groundwater flow would tend to mimic the natural topography, flowing east towards the topographical low of the Douglas Water.

7.4.7.1 Groundwater Vulnerability

60. Groundwater vulnerability classes range from 1 (vulnerable to conservative pollutants in the long term when continuously and widely discharged/leached) to 5 (vulnerable to most pollutants, with rapid impact in many scenarios) (Dochartaigh *et al*., 2011). The groundwater in the northern half of the proposed route has been assigned vulnerability classes 3 and 4a. The southern half of the proposed route has been classified as a range of classes, likely to reflect local variability in superficial deposits and the area's mining history, but primarily class 4.

61. Vulnerability class 3 is described as 'Vulnerable to some pollutants; many others significantly attenuated'. Vulnerability class 4 is subdivided into 4a, defined as 'May have low permeability soil; less likely to have clay present in superficial deposits', and 4b, defined as 'More likely to have clay present in superficial deposits'.

7.4.8 Groundwater-Dependent Terrestrial Ecosystems

62. Groundwater-dependent terrestrial ecosystems (GWDTE) have been assessed separately. Details are provided in **Appendix 8.2 National Vegetation Classification and Groundwater Dependent Terrestrial Ecosystems Report** and a summary is included in **Chapter 8: Ecology and Biodiversity**.

7.4.9 Hydrology

63. The proposed route lies almost entirely across two watercourse catchments: the Douglas Water and the River Nethan. The catchment areas are shown on **Figure 7.5**.

64. Most of the proposed route is located within the Douglas Water catchment, draining roughly north-east. This catchment covers the proposed route from Kennoxhead right up to the north side of Auchlochan No. 9 bing north of Coalburn. The main watercourses within this catchment area are the Douglas Water and its tributaries including the Kennox Water and the Poniel Water.

65. The Nethan Water catchment drains the north-western part of the proposed route and the section of proposed route from Auchlochan No. 9 bing to Coalburn Substation. The main watercourse in this catchment is the Nethan Water, which flows north-east.

66. The catchment wetness index (PROPWET) for the two main proposed route catchments is 0.690-0.710, indicating the proposed route is wet for 69-71% of the time. The area has a relatively low base flow index (BFI HOST19) of 33-38%, indicating that groundwater contribution is of comparatively limited importance to proposed route watercourses. The standard percentage runoff (SPR HOST) is 42-46%, indicating that 42-46% of the rainfall within the area is converted to surface runoff from rainfall events. Soils have a limited capacity to store rainfall or to allow water to infiltrate; thus, soils with a high SPR HOST would quickly saturate, leading to rapid runoff. This means that watercourses are likely to be 'flashy' with a quick response to rainfall.

67. Catchment statistics are derived from the Flood Estimation Handbook Web Service (CEH, 2021). Full catchment statistics are provided in **Table 7.8**. Catchment statistics have only been provided for the main catchments within the proposed route.

Catchment Name	Catchment Wetness Index (PROPWET)	Base Flow Index (BFI HOST19)	Standard Percentage Runoff (SPR HOST)	Area %
Douglas Water	0.710	0.380	42.26%	92.6%
River Nethan	0.690	0.328	46.27%	7.4%

Table 7.8: Proposed route catchment statistics

7.4.9.1 Watercourse Catchments

Douglas Water

68. The Douglas Water provides the main drainage to the proposed route, draining broadly north-east and parallel to the A70. Downstream of the proposed route the Douglas Water forms a tributary to the River Clyde This catchment has a total area of 168 km^2 and drains 84.1 % of the proposed route. The majority of the proposed OHL and associated access tracks and laydown areas lie within this catchment.

69. This catchment is primarily rough open moorland, commercial forestry and agricultural land used primarily for grazing, with large mining and wind farm footprints. This catchment has been heavily impacted by mining. The lower catchment has more agricultural land and the upper catchment has more open moorland. Tributaries within this catchment have been modified by opencast mining and for agriculture and forestry.

70. The main tributaries to the Douglas Water providing drainage to the proposed route are the Kennox Water and the Poniel Water.

71. The Kennox Water drains the southern proposed route flowing north-east to join the Douglas Water just west of Glespin. The Kennox Water has a significantly incised channel in places and much of its route has been affected by opencast mining. A section of this watercourse has been designated a Site of Specific Scientific Interest (SSSI); see **Section 7.4.12** for more information.

72. The Poniel Water and its tributaries drains the north-central part of the proposed route, flowing mainly west-south-west to east-north-east to join the Douglas Water downstream of the proposed route on the eastern side of the M74. The main channel of the Poniel Water shows significant incising and much of its route has been affected by opencast mining.

73. A number of smaller tributaries to the Douglas Water also provide drainage to the proposed route. Many of these show incising of channels, particularly in their headwater regions around the Hagshaw Hill area.

74. A number of tributaries to the Douglas Water provide drainage to the proposed route. These tributaries, although many are quite small, show some incising of the channels, particularly in the headwater regions around the hills in the central proposed route.

River Nethan

75. The River Nethan catchment has a total area of 59 km^2 and drains 15.1 % of the proposed route. The northernmost part of the proposed OHL and associated access tracks lie within this catchment. Downstream of the proposed route, the River Nethan eventually joins the River Clyde, downstream of the Douglas Water confluence.

76. The upper part of the catchment is primarily commercial woodland and open moorland land uses, with some agricultural land. The lower part of the catchment is primarily agricultural land use, with some woodland (particularly around watercourses) and urban areas. Within the proposed route, the catchment is primarily agricultural land use with some open woodland. There is evidence that tributaries within this catchment have been modified for agricultural and commercial forestry purposes, through channel straightening and drainage ditches.

77. The River Nethan has a highly incised channel, in particular at the base of Warlaw Hill in the northern section of the proposed route.

7.4.9.2 Water Quality

Surface Waterbodies

78. SEPA's Water Classification (SEPA, 2021a) and Water Environment Hubs (SEPA, 2021b) have been consulted to determine the existing baseline water quality for the main watercourses and waterbodies within the proposed route. The details are summarised in **Table 7.9**.

79. All the surface watercourses within the proposed route form tributaries to the River Clyde. The two reaches of the Clyde which form receiving watercourses are also detailed in **Table 7.9**.

Waterbody Name	Status		Pressures
Douglas Water ID 10094	**Condition in 2014**	Overall: Good Water flows & levels: High Physical condition: Good Water quality: Good	None
	Classification in 2018	Overall: Good Biology (fish): High Hydromorphology: Good	
Glespin Burn ID 10096	**Condition in 2014**	Overall: Good Water flows & levels: High Physical condition: High Water quality: Good	None
	Classification in 2018	Overall: Moderate Biology (fish): High Hydromorphology: Good	
Poniel Water ID 10097	**Condition in 2014**	Overall: Moderate Water flows & levels: High Physical condition: Moderate Water quality: Moderate	2014 assessments indicated that there are elevated concentrations of manganese in the water body. Cause not identified.
	Classification in 2018	Overall: Moderate Biology (fish): High Hydromorphology: Good	
Nethan Water ID 10080	**Condition in 2014**	Overall: Good Water flows & levels: High Physical condition: Good Water quality: Good	None
	Classification in 2018	Overall: Moderate Biology (fish): High Hydromorphology: Good	
Duneaton Water ID 10113	**Condition in 2014**	Overall: Good Water flows & levels: High Physical condition: Good Water quality: Good	Barrier to fish migration giving an overall condition of poor. As of 2018 overall condition is good.
	Classification in 2018	Overall: Good Biology (fish): High Hydromorphology: Good	
River Clyde (Potrail Water to Mouse Water) ID 10042	**Condition in 2014**	Overall: Moderate Water flows & levels: Moderate Physical condition: Good Water quality: Good	Freedom from invasive species: invaded by North American signal crayfish Water flows and levels: water storage for hydroelectricity generation
	Classification in 2018	Overall: Moderate Biology (fish): High Hydromorphology: Moderate	
River Clyde (Mouse Water to Strathclyde Loch outflow) ID 10919	**Condition in 2014**	Overall: Moderate Water flows & levels: Good Physical condition: Good Water quality: Moderate	Water quality: diffuse source pollution from rural sources, and point source discharges from waste water disposal
	Classification in 2018	Overall: Good Biology (fish): High Hydromorphology: Good	

Table 7.9: Baseline surface water quality status, summarised

Groundwater

80. Scotland's Environment groundwater classification map (Scottish Government, 2021) was consulted for groundwater quality information. The Douglas Coalfield north and south groundwater bodies, which have been outlined to cover the region around Coalburn and Glespin, have both been classified as 'Poor' due to pollution from legacy mining. The surrounding area, part of the Lesmahagow groundwater body, has been classified as 'Good'.

7.4.10 Private Water Supplies

81. A number of private water supplies (PWS) have been identified within the proposed route. Information in this section has been provided by South Lanarkshire Council's Environmental Health Department.

82. PWS are present in two notable clusters: one in the north-western part of the proposed route and a second cluster around Glespin in the southern part of the proposed route. Details of identified PWS within 2 km of the proposed route are provided in **Table 7.10** and locations are shown on **Figure 7.6**.

Supply Name	Source Location	Source Type	Properties Served	Linkage?
Kennoxhead	277147 624404	Surface water	None, just livestock	Yes - located 430 m downstream of the proposed underground cable
Cleugh	276663 624565	Probably surface water	One?	Yes – located 75 m downstream of the proposed underground cable
Kennox	279644 626930	Unknown, possibly surface water	One	Property is 330 m downslope from the proposed development. Source location unknown, possibly at risk
Inches	279352 627760	Probably surface water	One	None – located upstream of the proposed development
Earlsmill	281260 627784	Unknown, possibly groundwater	One	None – located in separate sub-catchment from the proposed development

Supply Name	Source Location	Source Type	Properties Served	Linkage?
Carmacoup/ Parishholm	280215 627958	Unknown, possibly groundwater	Two	Properties are 115 m downslope from the proposed development. Source location unknown. Possibly at risk
Andershaw	281160 628003	Unknown, possibly groundwater	One	None – located in separate sub-catchment from the proposed development
Viaduct	277471 628016	Probably surface water	One?	None – located upstream of the proposed development
Hazel	281648 628665	Unknown, possibly groundwater	One, possibly also livestock	Property is 875 m downslope from the proposed development. Source location unknown. Unlikely to be at risk as a result of distance
Hazelside Farm	281564 628760	Unknown, possibly groundwater	One, possibly also livestock	Property is 740 m downslope from the proposed development. Source location unknown. Unlikely to be at risk as a result of distance
Carmacoup Bridge	279656 629150	Probably surface water	One	None – located upstream of the proposed development
Todlaw/ Cumberhead	278794 635132	Probably groundwater	Two	None – located in separate sub-catchment from the proposed development
North Bankend	278496 635333	Probably groundwater	One	None – located in separate sub-catchment from the proposed development
South Greystone	280153 638256	Probably groundwater	One	None – located in separate sub-catchment from the proposed development
Stonehill L	280099 638279	Probably groundwater	One	None – located in separate sub-catchment from the proposed development

Table 7.10: Details of private water supplies within or near the proposed route

83. PWS registers are dependent on information provided to the Council by property owners or tenants and as a result the information is often incomplete or out of date. Information only covers water supply for domestic use and does not include any water demand for livestock. Typically only the properties served are identified, with the source location and type not recorded as is the case here.

84. The property at Kennoxhead was visited as part of the site walkover. The water supply for this property appears to be used only to provide water for livestock, with no supply requirement for human consumption.

7.4.11 Flood Risk

85. SEPA's Indicative Flood Map (SEPA, 2021c) was consulted to gain an overview of the likelihood of flooding within the proposed route. Flood risk is shown to be relatively minor within the proposed route, with some localised regions of surface water (pluvial) and river (fluvial) flood risk.

86. River flooding within the proposed route is largely confined to the main watercourse channels, notably the flood plain around the Douglas Water from the M74 down to Glespin which has a high likelihood of flooding, defined as having a 10% chance of a flooding in any given year. To the north-east of Coalburn there is region of high flooding likelihood along the Coal Burn watercourse. Additionally, there are a few small isolated locations of high fluvial flood risk scattered across the proposed route, mainly associated with small watercourses, ponds or lochans.

87. There are small areas at high risk of surface water flooding scattered across the proposed route, particularly to the south-west of Coalburn and within the areas of the former opencast workings at Glespin and Dalquhandy.

88. To the north of Coalburn on the very northern boundary of the proposed route, the region surrounding Lesmahagow has been classified as an area potentially vulnerable to flooding.

89. The proposed route has minimal risk of flooding from any source. The only identified flood risk along the proposed route is river flooding along the banks of the Douglas Water near Glespin, to a limited extent along the Windrow Burn in the centre of the proposed route, and along the Poniel Water. In all cases, the identified flood risk is confined to the watercourse channel and adjacent floodplain areas.

7.4.12 Designated Sites

90. Designated sites of relevance to geology, hydrogeology and hydrology that are located within 2 km of the proposed route are identified within **Table 7.11**. Details are provided in **Figure 7.7**. Data were collated from NatureScot (2021) and the Joint Nature Conservation Committee (JNCC, 2021). Designated sites reviewed include SSSIs, Special Areas of Conservation (SAC) and Ramsar sites (internationally recognised wetlands). Geological Conservation Review (GCR) sites have also been included for completeness; these do not have a statutory designation but are considered to be important for geological understanding and many are also protected as SSSIs. Special Protection Areas (SPA) have not been included as their designations relate to biological species rather than habitats and are not, as a result, directly relevant to geology, hydrogeology, hydrology and soil conditions.

91. There are five designated sites within 2 km of the proposed route, of which four have designations of relevance to geology, hydrogeology, soils, peat or hydrology. The fifth site, Miller's Wood SSSI, is designated for biological reasons.

Site Name(s)	Qualifying Features Relating to Geology, Hydrogeology, Soils, Peat & Hydrology	Distance from Proposed Route	Linkage?
Coalburn Moss SAC & SSSI	Lowland raised bog	0.00 km E	Located adjacent to the proposed route
Muirkirk Uplands SSSI	Blanket bog	0.5 km NW	None – SSSI is located upslope of the proposed development
Kennox Water SSSI & GCR	Geological: stratigraphy – Lower Carboniferous strata	0.6 km SE	Unlikely - located downslope of the proposed development
North Lowther Uplands SSSI (includes the Bail Hill GCR site)	Geological: mineralogy of Scotland Biological: upland assemblage including blanket bog, wet and dry heath, acid grassland	1.7 km S	None – SSSI & GCR are located in a separate catchment

Table 7.11: Designated sites related to geology, hydrogeology, soils, peat or hydrology within 2 km of the proposed route

92. Coalburn Moss SAC and SSSI is one of the largest sites of bog-moss-dominated vegetation in the Central Belt of Scotland and is one of the best examples of lowland raised bog in the United Kingdom. It is currently in Favourable Maintained and Unfavourable Recovering condition for different parts of the designation.

93. The Muirkirk Uplands SSSI covers two large upland areas located west of the proposed development. A small part of the southern area lies within 2 km of the proposed route. It is currently in Unfavourable condition.

94. The Kennox Water SSSI and GCR occupies a 2 km section of the Kennox Water channel where exposures of Lower Carboniferous bedrock is exposed. It is currently in a Favourable Maintained condition.

95. The North Lowther Uplands SSSI and Bail Hill GCR covers a large upland area located south of the proposed development. A small part of the north-western area lies within 2 km of the proposed route. It is currently in an Unfavourable No Change or Unfavourable Declining condition for different parts of the designation. The GCR site has not been monitored for condition.

7.5 Influence on Design

96. The importance of hydrology, hydrogeology, geology and soils has been recognised throughout the development design process. Key constraints that have had a considerable influence on design are:

- Peatland areas;
- Watercourses and waterbodies;
- Designated sites with a hydrological or peatland designation;
- PWS and public water supply infrastructure; and
- Mining and mineral extraction.

97. During scoping of the proposed route it was identified that the Coalburn Moss, located south of the Coalburn Substation, would require the proposed OHL to run further west away from the SAC/SSSI to avoid damage to the protected area. Areas of peatland and boggy conditions, particularly near Middlemuir Road (Coalburn) and Chapel Hill (southernmost section of the route), would require careful micrositing to avoid the very boggy sections where sunken fences were observed.

98. Watercourse crossings have been minimised as far as possible, within the constraints for OHL route design, other environmental and existing infrastructure constraints. Most crossings are of small watercourses, drainage channels and watercourse headwater channels. All crossings for construction access tracks would be temporary.

99. Where possible, designated sites with a hydrological linkage have been avoided for any proposed infrastructure. The Kennox Water SSSI/GCR is located downslope of the proposed development; however, its designation for geological features means that it would not be affected by any works as it is at least 700 m distant from all earthmoving activities. Coalburn Moss SAC/SSSI lies very close to Coalburn Substation, the required connection point for the proposed OHL. The proposed development has been carefully designed to avoid any direct contact with the SAC/SSSI and works are located downstream or in separate subcatchments wherever possible.

100. The region has a long mining history and the proposed route passes through several DHR Areas. Careful design and, if required, construction-phase micrositing of OHL infrastructure away from mine shafts and adits would ensure minimal effects while passing through these areas.

101. Potentially sensitive wetland habitats have been avoided where possible. Other constraints including ecology, forestry felling, visual impact and existing infrastructure were important considerations that required balancing with peatland, hydrology, designated sites and mining.

7.6 Predicted Impacts

7.6.1 Development Characteristics

102. The construction phase of the proposed development would involve a number of different elements. **Chapter 1 to 4** of the EIAR describes the proposed development elements in detail. The elements with particular relevance to geology, hydrogeology, hydrology and soils are as follows:

- Construction of temporary access routes and watercourse crossings;
- Excavation during installation of wood poles;
- Creation of laydown areas and construction compounds;
- Temporary welfare facilities including water supply and foul water disposal; and
- Excavation, handling and temporary storage of peat and soils.

103. During operation of the proposed development, activities with particular relevance to geology, hydrogeology, hydrology and soils are as follows:

- Impact to ground conditions for maintenance access; and
- Surface water drainage management.

7.6.2 Effects During Construction

7.6.2.1 Physical Changes to Overland Drainage and Surface Water Flows

104. Changes to overland drainage patterns would arise principally from construction of temporary stone access tracks (where required), wood pole installation, installation of the sections of underground cable and reinstatement of the worked area.

105. Where possible, access would make use of low ground pressure plant and/or temporary tracks using trackway panels and bog mats. Some areas that are unsuitable for trackway panels and bog mats are likely to require use of sections of temporary stone tracks. These stone track sections may require temporary shallow trackside drainage to maintain integrity of the track surface.

106. Any required trackside drainage would be no longer or deeper than necessary to provide the required track drainage. If required, cross-drains would be installed at an appropriate frequency to minimise concentration of flows across the track. Preventive measures to avoid flows between sub-catchment areas such as cross slopes would be implemented to minimise changes to the hydrological regime.

107. Watercourses that must be crossed by temporary access tracks would have new crossing structures installed. All necessary permissions required for watercourse crossing works would be obtained prior to commencement of associated works.

108. Following installation of the proposed OHL and underground cables, all temporary access tracks and associated drainage infrastructure would be removed and the ground reinstated to natural pre-development conditions.

109. The typical excavation footprint for the installation of wood poles is 3 m^2 and excavations are typically 2 m in depth. Excavations for underground cables would be short in length and would remain open for as short a time as practicable. Excavations would be undertaken using standard best practice, with every effort to cause the least disturbance possible to the surrounding area and minimise the effect on surface water flows. Excavation machinery would avoid tracking over drains/small watercourses except at designated crossing locations, and excavated material would be stored at least 10 m away from all drains or watercourses to avoid obstruction.

110. The receptor, proposed route surface watercourses, is considered to be of **Moderate** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be of **Slight**. The likelihood of effect is considered to be **Likely**.

111. The effect of physical changes to overland drainage from construction works is assessed as **Minor**, temporary and adverse.

7.6.2.2 Particulates and Suspended Solids

112. All proposed development work involving earthmoving operations would generate loose sediment, which could potentially gain access to surface watercourses and waterbodies through entrainment in surface runoff. This could potentially have an adverse effect on downstream watercourses through damage to fish spawning habitat and changes to dissolved oxygen and nutrient levels. Surface water from areas surrounding the temporary track, laydown and hardstanding areas, cable trenches and wood pole excavations would be prevented from entering watercourses by appropriate use of peripheral bunding, silt fencing and cut-off drains. These would also be used to help divert clean water around and away from the working areas.

113. During excavation works for laydown and construction compound areas, silt fencing and/or bunding would be installed on the downhill side of the excavation, to prevent inadvertent discharge of silty water into any watercourses.

114. All engineering works adjacent to watercourses, including temporary track construction and installation of watercourse crossings, would have appropriate sediment control measures established prior to any groundworks. Vegetation would be retained along watercourse banks to act as additional protection.

115. Minor in-stream works would be required for crossings of minor watercourses. This work would be undertaken using a temporary dam to control flow while culvert pipes are installed. Over-pumping would only be used if flow conditions require.

116. Construction activities would be restricted during periods of wet weather, particularly for any work occurring within 20 m of a watercourse or within areas of identified deeper peat, to minimise mobilisation of sediment in heavy rainfall. The following 'stop' conditions are recommended to guide construction activity (CH2M & Fairhurst, 2018):

'Stop' rule	Requirements
High intensity rainfall	Rainfall during construction greater than 10 mm per hour
Long duration rainfall	Rainfall in the preceding 24 hours greater than 25 mm
7-day cumulative rainfall (1)	Preceding 7 days of rainfall greater than 50% of the monthly average
7-day cumulative rainfall (2)	Preceding 7 days of rainfall greater than 50 mm

Table 7.12: Recommended 'stop' conditions for earthmoving activities

117. Any water collecting within excavations would be pumped out prior to further work in the excavation. This water may require treatment to remove suspended solids prior to discharge to ground.

118. Vegetation cover would be re-established as quickly as possible as part of the reinstatement works around wood pole foundations and following removal of temporary tracks. This would be achieved by re-laying of excavated turves where practicable, with use of additional methods such as hydroseeding and/or use of a biodegradable geotextile considered if necessary.

119. All necessary permissions relating to construction works, plus accompanying Pollution Prevention Plans (PPPs), would be obtained prior to any construction work beginning. All the management and control measures, including emergency response procedures, would be set out in a CEMP produced by the appointed Contractor prior to any works beginning. The CEMP would be a live document and would be updated as required throughout construction.

120. A water quality monitoring programme would be established at key locations around the proposed route. Monitoring would begin prior to any construction works, to allow pre-construction baseline quality to be determined.

121. The receptor, proposed route surface watercourses, is considered to be of **Moderate** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be **Slight**. The likelihood of effect is considered to be **Likely**.

122. The effect of particulates and suspended solids from construction works is assessed as **Minor**, temporary and adverse.

7.6.2.3 Water or Soil Contamination from Fuels, Oils or Foul Drainage

123. Spillage of fuels, oils or waste water from welfare facilities could have an adverse effect on surface water and soil quality. Major spillages could have a widespread influence on watercourses if direct entry into flowing water occurred.

124. Oil and fuel storage and handling within the proposed development would be undertaken following published guidance, in particular *Guidance on Pollution Prevention 2 – Above ground oil storage tanks* (SEPA, 2018) and in compliance with the *Water Environment (Oil Storage) (Scotland) Regulations 2006*. The details would be contained in the CEMP and are summarised as follows:

- Risk assessments would be undertaken and all Hazardous Substances and Non-Hazardous Pollutants that would be used and/or stored within the proposed development would be identified. Hazardous substances likely to be used within the proposed development include oils, fuels, hydraulic fluids and anti-freeze. No non-hazardous pollutants have been identified as likely to present. Herbicides would not be used;
- All deliveries of oils and fuels would be supervised;
- All storage tanks would be located within impermeable, bunded containers where the bund is sufficient to contain 110% of the tank's capacity. For areas containing more than one tank, the bund would be sufficient to contain 110% of the largest tank's capacity or 25% of the total capacity, whichever is the greater;
- Any valve, filter, sight gauge, vent pipe or other ancillary equipment would be located within the containment area;
- Waste oil would not be stored within the proposed route but would be removed to dedicated storage or disposal facilities;
- Management procedures and physical measures would be put in place to deal with spillages, such as spill kits and booms;
- Maintenance procedures and checks would ensure the minimisation of leakage of fuels or oils from plant;
- Refuelling and servicing would be undertaken in a designated area with adequate precautions in place, including an impermeable surface lipped edges to contain any contaminants; and
- Where vehicle maintenance is necessary in the field owing to breakdown or accident, additional precautions would be taken to contain contaminants, such as spill trays or absorbent mattresses.

Foul Drainage Provision

125. Foul drainage would be required for the site welfare facilities. It is anticipated that the welfare facilities would have a suitably sized holding tank which would be emptied by tanker and removed from site for disposal at a suitably licensed facility.

Spillage and Emergency Procedures

126. The Spillage and Emergency Procedures would form part of the CEMP and would be prominently displayed at the site office. All site staff would be trained in their application. The Procedures document would incorporate guidance from all relevant SEPA Guidance Notes.

127. In the event of any spillage or discharge that has the potential to be harmful to or to pollute the water or soil environment, all necessary measures would be taken to remedy the situation. These measures would include:

- Identifying and stopping the source of the spillage;
- Containing the spillage to prevent it spreading or entering watercourses, by means of suitable material and equipment;
- Absorbent materials, including materials capable of absorbing oils, would be available to mop up spillages. These would be in the form of oil booms and pads and, for smaller spillages, quantities of proprietary absorbent materials. Sandbags would also be readily available for use to prevent spread of spillages and to create dams if appropriate;
- Where an oil/fuel spillage may have soaked into the ground, the contaminated ground would be excavated and removed from the area by a licensed waste carrier to a suitable landfill facility;
- The emergency contact telephone number of a specialist oil pollution control company would be displayed within the site office; and
- Sub-contractors would be made aware of the guidelines for handling of oils and fuels and of the spillage procedures at the proposed development.

128. SEPA would be informed of any discharge or spillage that may be harmful or polluting to the water environment. Written details of the incident would be forwarded to SEPA no later than 14 days after the incident, in line with SEPA's requirements.

129. A water quality monitoring programme would be established at key locations around the proposed development. Monitoring would begin prior to any construction works, to allow pre-construction baseline quality to be determined.

130. The receptor, proposed route surface watercourses, is considered to be of **Moderate** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be **Moderate**. The likelihood of effect is considered to be **Unlikely**.

131. The receptor, proposed route soils, is considered to be of **Low** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be **Moderate**. The likelihood of effect is considered to be **Unlikely**.

132. The effect of water and soil contamination from fuels, oils or foul drainage from construction works is assessed as **Minor**, temporary and adverse.

7.6.2.4 Changes in or Contamination of Water Supply to Vulnerable Receptors

133. Vulnerable receptors that have the potential to be affected by development works have been identified. These include one designated site and five PWS.

Designated Sites

134. One designated site has potential hydrological links to the proposed route and proposed works.

135. Coalburn Moss SAC and SSSI is located immediately south of Coalburn Substation and is a short distance east of the proposed route. The integrity of the SAC/SSSI has been protected by moving the proposed route to the west, away from the Moss towards Johnshill farm. However, the proposed route is located within 100 m of the SAC/SSSI between Johnshill farm and the Coaburn Collector Substation.

136. As a raised bog, Coalburn Moss sits a few metres higher than the surrounding land. In addition, the proposed OHL route lies downstream of the Moss except for the short section immediately prior to connecting into the substation. Protection measures would be installed for the entire section of works between Johnshill and Coalburn Substation prior to any groundworks taking place. These would take the form of bunding and silt fencing to provide a two-stage system of protection. The working corridor would be clearly demarcated in this area to prevent inadvertent incursion by plant or personnel into the Moss area.

137. The proposed laydown area within 100 m of Coalburn Moss SAC/SSSI would not be used to store any potentially hazardous material, such as fuels or oils, and this location would not include welfare provision for site staff as a result of the proximity to the designated site.

138. Coalburn Moss is considered to be of **Very High** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be **Slight**. The likelihood of effect is considered to be **Unlikely**. The effect of changes in or contamination of water supply to Coalburn Moss is assessed as **Minor**, temporary and adverse.

Private Water Supplies

139. Five PWS have been identified that have potential to be at risk from the proposed development, defined as being within 250 m of the proposed route or with a probable source location directly downstream from the proposed route.

140. Carmacoup and Parishholm supplies, at Longhouse near Glespin, are located approximately 115 m downslope from the proposed route. The supply properties have been given the same grid reference, but it is assumed there are two separate properties, possibly with two separate supply sources. The properties are not located near an obvious source of surface water so may have a groundwater source (well or borehole), most likely to be within the alluvial deposits alongside the Douglas Water.

141. The PWS at Kennox is located within the area of opencast workings. This property is approximately 330 m downslope from the proposed route. Groundwater supplies within the opencast workings are likely to be highly disrupted and potentially contaminated as a result of mining activity, so it is likely that the supply for Kennox is taken from the Kennox Water upstream of the property. Any changes in quality of the Kennox Water through sediment release or other pollution event could affect the PWS for this property.

142. The PWS at Kennoxhead and Cleugh are both located downstream of the proposed underground cable section of the proposed route. The supply at Kennoxhead is approximately 430 m distant from the proposed underground cable route, and the supply at Cleugh is 75 m distant.

143. During the site visit, it was not possible to identify any PWS infrastructure at Kennoxhead and it is possible this supply is used only for livestock.

144. The PWS at Cleugh is considered to be at risk as a result of its close proximity to the proposed underground cable route.

145. The five PWS locations would be surveyed prior to any construction works taking place to determine whether they are still in active use for drinking water and to identify their source location. Any sources identified as potentially at risk following site verification would have additional protection measures put in place. These would include bunding between all construction areas and any potential downslope pathways to the PWS source with at least two lines of silt fencing in addition to the bunding. At-risk PWS sources would also be monitored for the duration of all construction works in the area upslope of the source. Monitoring would begin at least one month prior to construction works taking place within 500 m of the PWS source and would continue for at least two months following reinstatement of all works within 500 m of the PWS source. Monitoring of the source would be undertaken daily while construction works are active within 500 m of the source. Full details of the required monitoring would be provided within the PPP prepared to accompany the Construction Runoff Permit for the proposed development.

146. The PWS are considered to be of **High** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be **Slight**. The likelihood of effect is considered to be **Unlikely**.

147. The effect of changes in or contamination of water supply to PWS from construction works is assessed as **Minor**, temporary and adverse.

7.6.2.5 Increased Flood Risk

148. The proposed development infrastructure has minimal risk of flooding from any source. The only identified risk of flooding along the proposed route is river flooding along the banks of significant watercourses. This includes along the Douglas Water near Glespin, to a limited extent along the Windrow Burn in the central part of the proposed route, and along the Poniel Water. All storage and vehicle maintenance areas would be located in areas with no identified flood risk. Precautions would be established for required works within areas identified as at risk of flooding, including limiting works that take place in areas of high flood risk during wet weather or where heavy rainfall is forecast, ensuring that all plant and vehicles are stored in areas with no flood risk, and completing works in high flood risk areas in as short a time as practicable to minimise the length of time that excavations remain open.

149. All installed drainage infrastructure would be temporary and would only be installed in areas where drainage is necessary to allow installation of wood poles and access for stringing of the proposed OHL. Drainage infrastructure would be fully removed and reinstated to pre-construction conditions as soon as practicable following installation of the proposed OHL.

150. The receptors, proposed development infrastructure and areas downstream of the proposed development, are considered to be of **High** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of any increased flood risk is considered to be **Negligible**. The likelihood of effect is considered to be **Unlikely**.

151. The effect of increase in flood risk resulting from the construction works is assessed as **Negligible**.

7.6.2.6 Modification to Groundwater Flow Paths

152. Physical changes to the shallow subsurface as a result of all excavation work have the potential to interrupt shallow groundwater flow paths. This would include works required for construction compounds and laydown areas, cable trenches, wood pole excavations and temporary stone tracks.

153. The superficial deposits are noted to be largely without groundwater, although some groundwater would be present within the peat bodies and occasionally in parts of the glacial till. There is likely to be some groundwater flow via fracture networks within the bedrock and intergranular flow associated with sandstone beds.

154. Excavations for wood pole foundations would be small and discrete, with no potential for connections between them that might affect groundwater flow within the area.

155. The cable trench at the Coalburn end is anticipated to be of minimal length and depth, sufficient to allow connection into the proposed OHL at Coalburn. This section is unlikely to form a preferential flow path for groundwater.

156. The proposed section of underground cable trench at Kennoxhead is approximately 3.2 km in length and as a result has the potential to form a preferential pathway for groundwater flow. It is anticipated that the proposed underground cable would require bedding on a permeable substrate such as sand to provide protection, and this would increase the potential for groundwater flow along the trench. In order to minimise in-trench groundwater flow, clay bunds or alternative impermeable barriers would be placed within the trench for every 0.5 m change in elevation along the trench. Additional bunds may be required if areas of higher permeability are encountered during the trench excavation.

157. The proposed development area groundwater receptor is considered to be of **Moderate** sensitivity. With appropriate design constraints and mitigation measures in place, as described, the magnitude of effect is considered to be **Slight**. The likelihood of effect is considered to be **Unlikely**.

158. The effect of modification to groundwater flow paths from construction works is assessed as **Negligible**.

7.6.2.7 Soil and Peat Erosion and Compaction

159. Construction activity including plant and vehicle movements, soil stripping and stockpiling would affect the nature of the proposed route soils.

160. Plant movements would act to compact soils through movements over unstripped ground. All activity requiring removal, transport and stockpiling of soils would have potential to lead to soil erosion and loss of structure, resulting in overall soil degradation.

161. Soil stripping would be undertaken with care and would be restricted to as small a working area as practicable. Topsoil would be removed and laid in a storage bund, up to 2 m in height, on unstripped ground adjacent to the working area. It would be attempted to retain the turf layer vegetation-side-up where possible, although ground conditions may make this challenging. Subsoils and superficial geological deposits would be removed subsequently and laid in storage bunds, also up to 2 m in height, clearly separated from the topsoil bund. Care would be taken to maintain separate stockpiles for separate soil types in order to preserve the soil quality.

162. Limited smoothing or 'blading' of stockpiled soils and catotelmic peat would be undertaken to help shed rainwater and prevent ponding of water on the stockpile. Bunds on notably sloping ground would have sediment control measures installed near the base, on the downslope side, to collect and retain any sediment mobilised by rainfall.

163. Only tracked or low ground pressure vehicles would be permitted access to unstripped ground. Where access is required for non-tracked or normal ground pressure vehicles, this would make use of trackway panels or bog mats to minimise any compaction to the soils.

164. Should prolonged periods of dry weather occur, a damping spray would be employed to maintain surface moisture on the soil and peat bunds. This would help to maintain vegetation growth in the turves and to retain the soil structure.

165. All traffic routes would be clearly demarcated, and vehicles would not be permitted access outwith these areas.

166. Where excavation is required in peat, acrotelmic peat (the uppermost 0.5 m) would be removed as for the topsoil. It would be attempted to retain the acrotelm vegetation-side-up where possible, although ground conditions may make this challenging. The underlying catotelmic peat would be stored in bunds up to 1 m in height. Catotelmic peat is sensitive to handling, and loses its internal structure easily, so would be transported as short a distance as possible to its storage location.

167. The proposed route crosses a small area of Class 1 peatland (<300 m total length) in the northern part of the route at Muirburn, near Coalburn. All access in this section would be undertaken using trackway panels or bog mats and low ground pressure/tracked vehicles to minimise disturbance to the peat. Excavation works would be restricted to foundation excavations for the wood poles and all excavated peat would be used in excavation reinstatement for the foundations.

168. The receptor, proposed route soils, is considered to be of **Moderate** sensitivity. The magnitude of effect is considered to be **Slight**. The likelihood of effect is considered to be **Likely**.

169. The receptor, proposed route peat, is considered to be of **High** sensitivity. The magnitude of effect is considered to be **Slight**. The likelihood of effect is considered to be **Likely**.

170. The effect of soil and peat erosion and compaction from construction works is considered to be **Minor**, temporary and adverse.

7.6.2.8 Mining and Development High Risk Areas

171. Construction activity within the DHR areas, particularly plant and vehicle movement, track construction and excavation may alter the existing mining legacy conditions and lead to exposure of hazards associated with these areas. Construction within DHR areas can be associated with hazards including:

- Subsidence and collapse of mine entries and shallow mine workings;
- Unrecorded mine entries, soughs (mine water drainage) and workings;
- Emission of noxious or asphyxiating mine gases created by natural or human intervention;
- Spontaneous combustion of coal on exposure to atmospheric conditions;
- Impoundment, unconsented discharge or uncontrolled release of mine water;
- Mine water recovery and rise;
- Pollution incidents resulting from mine water and contaminated shaft fill;
- Settlement associated with opencast mine backfill;
- Failure of slopes and tips comprising colliery spoil or waste; and
- Mining-related fissures and fault reactivation.

172. As no excavations are expected to be deeper than 5 m, only the near-surface mining legacy structures such as shallow mine workings, mine entries and vents would be affected.

173. During the walkover survey, vents were observed in the high-risk development area south of Middlemuir Road, Coalburn. A proposed laydown area and the proposed OHL route pass the through the vented area which could release potentially noxious or asphyxiating mine gases.

174. As part of the initial works, targeted non-intrusive and intrusive ground investigation would be undertaken in the DHR areas to identify the sub-surface conditions along the proposed route. The investigation would confirm if any mine entries, shafts or vents are below or adjacent the proposed route and working area and help to inform any micrositing by avoiding the sub-surface structures. Work close to vents or mine entries would require the appropriate monitoring for mine gases.

175. The receptor, proposed development infrastructure, is considered to be of **High** sensitivity. With appropriate mitigation measures in place, including use of pre-construction ground investigation, the magnitude of effect is considered to be **Slight**. The likelihood of effect is considered to be **Unlikely**.

176. The receptor, construction site staff, is considered to be of **Very High** sensitivity. With appropriate mitigation measures in place, including use of pre-construction ground investigation and suitable gas monitoring, the magnitude of effect is considered to be **Slight**. The likelihood of effect is considered to be **Unlikely**.

177. The effect of damage to proposed development infrastructure or harm to construction site staff from work in mining and DHR areas is assessed as **Minor**, temporary and adverse.

7.6.3 Effects During Operation

7.6.3.1 Physical Changes to Overland Drainage and Surface Water

178. No additional changes to overland drainage and surface water flows are anticipated during the operational phase. There is no permanent drainage infrastructure associated with the proposed development. Any access required for maintenance purposes would be undertaken using bog mats or trackway panels and, where possible, tracked or low ground pressure vehicles.

179. The receptor, proposed route surface watercourses, is considered to be of **Moderate** sensitivity. The magnitude of effect is considered to be **Negligible**. The likelihood of effect is considered to be **Unlikely**.

180. The effect of physical changes to overland drainage from operational works is assessed as **Negligible**.

7.6.3.2 Particulates and Suspended Solids

181. No groundworks would be required during the operational phase of the proposed OHL except in the unlikely event that a wood pole requires replacement. Any access required for maintenance purposes would be undertaken using bog mats or trackway panels and, where possible, tracked or low ground pressure vehicles. Any emergency replacement works would make use of suitable sediment control measures including silt fencing and bunding to manage sediment generated during the works.

182. The receptor, proposed route surface watercourses, is considered to be of **Moderate** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be **Slight**. The likelihood of effect is considered to be **Unlikely**.

183. The effect of release or particulates or suspended solids from operational works is assessed as **Negligible**.

7.6.3.3 Water Contamination from Fuels, Oils or Foul Drainage

184. The risk of water contamination from fuels or oils is considerably lower during operation than during construction as there are significantly decreased levels of activity on site and most potential pollutants would have been removed. Vegetation management would be undertaken by physical cutting rather than use of herbicide, except if required for control of invasive species.

185. The spillage and emergency procedures, as set out above, would remain in force throughout the operational phase for all maintenance works.

186. The receptor, proposed route surface watercourses, is considered to be of **Moderate** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of effect is considered to be **Negligible**. The likelihood of effect is considered to be **Unlikely**.

187. The effect of water contamination from fuels or oils from operational works is assessed as **Negligible**.

7.6.3.4 Changes in or Contamination of Water Supply to Vulnerable Receptors

188. Only minor works would take place within the proposed route during the operational phase, to allow necessary maintenance activities for the proposed development. Works on the proposed route beside Coalburn Moss would be minimal as only a short section of the proposed OHL is located in this area.

189. Works adjacent to identified PWS are not likely to be required, as the proposed underground cable would be underground in this location. Any works requiring access to the cable would be accomplished via the access bays and no additional excavation would be required. Should use of potentially polluting materials be required, these would be handled in compliance with the procedures set out above.

190. Coalburn Moss is considered to be of **Very High** sensitivity. The magnitude of effect is considered to be **Negligible**. The likelihood of effect is considered to be **Unlikely**.

191. The PWS are considered to be of **High** sensitivity. The magnitude of effect is considered to be **Negligible**. The likelihood of effect is considered to be **Unlikely**.

192. The effect of changes in or contamination of water supply to vulnerable receptors from operational works is assessed as **Negligible**.

7.6.3.5 Increased Flood Risk

193. There would be no long-term change to the ground surface in terms of impermeable areas as all constructed surfaces would be removed and reinstated following construction. There would be no change to post-development runoff from the existing conditions.

194. The receptors, proposed development infrastructure and areas downstream of the proposed development, are considered to be of **High** sensitivity. The magnitude of effect is considered to be **Negligible**. The likelihood of effect is considered to be **Unlikely**.

195. The effect of increase in flood risk resulting from the operational phase is assessed as **Negligible**.

7.6.3.6 Modification to Groundwater Flow Paths

196. No additional changes to groundwater flow paths are anticipated in the operational phase. Maintenance required for the proposed OHL would have minimal effects on groundwater flows.

197. The proposed route groundwater receptor is considered to be of **Moderate** sensitivity. The magnitude of effect is considered to be **Negligible**. The likelihood of effect is assessed as **Unlikely**.

198. The effect of modification to groundwater flow paths from operational works is assessed as **Negligible**.

7.6.3.7 Soil Erosion and Compaction

199. There are no soil stripping or stockpiling activities planned for the operational phase.

200. Monitoring and maintenance work of the proposed OHL would require occasional vehicle access. This would be considerably reduced from the construction phase. Any access required for maintenance purposes would be undertaken using bog mats or trackway panels and, where possible, tracked or low ground pressure vehicles particularly in any areas of soft or boggy ground.

201. The receptor, proposed route soils, is considered to be of **Moderate** sensitivity. The magnitude of effect is considered to be **Slight**. The likelihood of effect is considered to be **Unlikely**.

202. The receptor, proposed route peat, is considered to be of **High** sensitivity. The magnitude of effect is considered to be **Slight**. The likelihood of effect is considered to be **Unlikely**.

203. The effect of soil erosion and compaction from operational works is considered to be **Negligible**.

7.6.3.8 Mining and Development High Risk Areas

204. No additional changes to mining or DHR areas are anticipated in the operational phase. The hazards and effects on the proposed development from the DHR areas would have been identified and mitigated during the construction phase. Any maintenance work should use information gathered during the construction phase to minimise risk while working in these areas.

205. The receptor, proposed development infrastructure, is considered to be of **High** sensitivity. With appropriate mitigation measures in place, the magnitude of effect is considered to be **Slight**. The likelihood of effect is considered to be **Unlikely**.

206. The receptor, maintenance staff, is considered to be of **Very High** sensitivity. With appropriate mitigation measures in place, the magnitude of effect is considered to be **Slight**. The likelihood of effect is considered to be **Unlikely**.

207. The effect of damage to the proposed development infrastructure or harm to maintenance staff from work in mining and DHR areas

7.6.4 Indirect and Secondary Effects

208. No indirect or secondary effects relating to proposed route geology, hydrogeology, hydrology and soils have been identified.

7.6.5 Cumulative Effects

209. A number of existing developments, developments in construction and developments with planning consent have been identified in the nearby area that require consideration for cumulative effects with relation to the proposed development.

210. In the northern part of the proposed route around Coalburn substation, there are multiple OHLs connecting into the substation. In addition, a number of existing OHLs run adjacent to Coalburn Road from the substation south to Glaikhead (north of Coalburn).

211. In the central area around Douglas West and Poniel, there are several additional OHLs mainly running northwards parallel to the western edge of Long Plantation from the substation near Douglas West. An additional OHL crosses the lower slopes of Arkney Hill to the north-west from the substation.

212. In addition to existing OHLs, there are several existing and consented wind farms within the nearby area. These are:

- Hagshaw Hill wind farm (26 turbines), currently undergoing repowering;
- Hagshaw Hill Extension wind farm (20 turbines);
- Galawhistle wind farm (22 turbines);
- Nutberry wind farm (6 turbines);
- Broken Cross wind farm (6 turbines);
- Middlemuir wind farm (15 turbines);

- Andershaw wind farm (11 turbines);
- Johnshill Farm (two turbines)
- Five operational single turbines – Holmhead Farm, Yonderton Farm, Low Whiteside Farm, JJs Farm, Birkhill Commercial Park;
- Cumberhead wind farm (approved with 11 turbines);
- Dalquhandy wind farm (approved with 15 turbines);
- Douglas West wind farm (approved with 15 turbines);
- Kennoxhead wind farm (approved with 19 turbines);
- Stockhill farm (approved with two turbines);
- Poniel wind farm (approved with three turbines); and
- Three consented single turbines (North Bankend Farm, Low Whiteside Farm, Auldton Heights).

213. Three additional wind farms are currently in planning. These are Douglas West Extension (13 turbines), Kennoxhead wind farm extension (8 turbines) and Glentaggart wind farm (5 turbines).

214. The effects on hydrology, hydrogeology, geology and soils from the existing OHLs, and construction associated with wind farms are considered to be additive rather than synergistic.

7.6.5.1 Geology

215. Effects on geology are very localised. As a result, there are no cumulative effects relating to geology from the proposed development.

7.6.5.2 Hydrogeology

216. The proposed route passes through shared hydrogeological units with the developments mentioned above. As the existing OHLs are in their operational phase, they exhibit negligible effects on groundwater. The current construction at Hagshaw Hill and Kennoxhead wind farms may add to the construction effects of the proposed development with respect to modification to shallow groundwater flow paths and contamination from fuel and oils. Assuming that appropriate spillage controls are used at all developments and given that the aquifer systems are designated as low to moderately productive aquifers, the cumulative effects on hydrogeology across the proposed route are considered to be **Minor**, temporary and adverse.

7.6.5.3 Soils

217. Effects on soils and peat are comparatively localised and do not extend beyond the proposed route. As the proposed development has a very small excavation footprint, and assuming that all construction and operation works at all developments abide by good practice with relation to soil and peat handling and storage, no cumulative effects relating to soils and peat are anticipated.

7.6.5.4 Hydrology

Potential Hydrological Cumulative Effects during Construction

218. It is assumed that best practice construction methods would be used for all other developments within the proposed route.

219. The proposed development shares the Douglas Water catchment with Hagshaw Hill and Hagshaw Hill Extension, Nutberry, Galawhistle, Broken Cross and Andershaw wind farms and individual turbines at Hazelside, Birkhill Commercial Park and JJs Farm. In addition, the consented wind farms at Kennoxhead, Douglas West and Dalquhandy and small developments at Poniel, Middlefield Farm and Auldtonheights all lie within the Douglas Water catchment. The wind farms at Kennoxhead Extension, Douglas West Extension and Glentaggart are also in the Douglas Water catchment.

220. Assuming that construction works are ongoing at Hagshaw Hill/Hagshaw Hill Extension for the repowering works, and for the consented developments at Kennoxhead, Douglas West, Dalquhandy, Poniel, Middlefield Farm and Auldtonheights, at the same time as construction activity for the proposed OHL, there would be cumulative effects in relation to sediment, pollution and water management on the Douglas Water catchment. Assuming that all developments follow best practice, construction methods and put in place appropriate sediment, pollution and water management controls, the cumulative effects on the Douglas Water catchment are anticipated to be **Minor**, temporary and adverse.

221. The proposed development shares the River Nethan catchment with Nutberry wind farm and individual turbines at Yonderton Farm, Holmhead Farm, Low Whiteside Farm and Johnshill Farm. In addition, the consented Cumberhead and Dalquhandy wind farms and individual turbines at Stockhill Farm, North Bankend Farm and Low Whiteside Farm also lie within the River Nethan catchment. The length of proposed OHL within the River Nethan catchment is 1.7 km and, in an area, distant from all the operational and consented wind turbine developments except for the two turbines at Johnshill Farm. Assuming that the proposed development adheres to best practice construction methods including sediment, water and pollution management controls, **no cumulative effects** are anticipated within the River Nethan catchment.

Potential Hydrological Cumulative Effects during Operation

222. Operational activity within the proposed development and all the various nearby wind farms and existing OHLs would be very much reduced from the construction phase. Construction at consented wind farm developments may continue into the proposed development's operational phase of work. For the proposed development, any activity within the operational phase would be very small scale and associated only with ongoing maintenance of the proposed OHL. Assuming that all developments follow best practice for management of sediment, pollution and surface water, the cumulative effects on the watercourses in the proposed route would be **Negligible**.

7.6.6 Mitigation

223. While outlined and accounted for within the assessment above, this section provides a detailed summary of the mitigation that would be adopted for the proposed development.

7.6.6.1 Mitigation by Design

224. All excavation works have been kept to a practical minimum by good site design. Incursion into areas of peatland has been kept to a practical minimum by careful design and would be further reduced by pre-construction peat depth surveys and local micrositing in order to minimise disruption to peatland ecosystems and hydrology.

225. Careful design and, if required, micrositing of the proposed OHL away from mine shafts and vents would ensure minimal effects while passing through DHR areas.

226. Temporary access would be gained by use of trackway panels and bog mats, with sections of temporary stone tracks only used where necessary. Temporary stone access tracks may require localised temporary trackside drainage to help maintain integrity of the track surface while the tracks are in use.

7.6.6.2 Mitigation Commitments

Soils and Peat

227. Soil stripping would be undertaken with care and would be restricted to as small a working area as practicable. The requirement for soil stripping would be minimised by use of trackway panels and bog mats for temporary access where possible, and use of temporary stone tracks only where trackway panels and bog mats are not suitable.

228. Topsoil would be removed and laid in a storage bund, up to 2 m in height, on unstripped ground adjacent to the working area. Where possible, the turf layer would be maintained vegetation-side uppermost, although ground conditions may make this challenging. Care would be taken to maintain separate stockpiles for separate soil types in order to preserve the soil quality.

229. For work within areas of peat, acrotelmic peat (the uppermost 0.5 m) would be removed as for the topsoil. As with topsoil, where possible the acrotelm would be maintained vegetation-side uppermost, although ground conditions may make this challenging. The underlying catotelmic peat would be stored in stockpiles up to 1 m in height. Catotelmic peat is sensitive to handling, and loses its internal structure easily, so would be transported as short a distance as possible to its storage location. Excavation of catotelmic peat would be limited by careful infrastructure design.

230. All soil and peat stockpiles would be left with rough, unsmoothed surfaces to minimise soil loss from rainfall erosion. Stockpiles on sloping ground would have sediment control measures installed near the base, on the downslope side, to collect and retain any sediment mobilised by rainfall. Soils and peat would be stored for as short a time as practicable, in order to minimise degradation through erosion and desiccation.

231. Should prolonged periods of dry weather occur, a damping spray would be employed to maintain surface moisture on the soil and peat stockpiles. This would help to maintain vegetation growth in the turves and to retain the soil structure.

232. Construction work would make use of current best practice guidance relating to developments in peatland areas. A risk management system, such as a geotechnical risk register, would be compiled and maintained at all stages of the project and developed as part of the post-consent detailed design works, and would be updated as new information becomes available.

233. Micrositing would be used to avoid possible problem areas identified during ground investigation or other detailed design works. This would be assisted by additional verification of peat depths, to full depth, in any highlighted areas where construction work in peatland is required. Trackside drainage would be installed alongside temporary stone tracks in accordance with published good practice documentation and would be minimised in terms of length and depth in order to minimise concentration of flows.

234. Construction activities as specified in the CEMP produced by the appointed Contractor would be restricted during periods of wet weather, particularly for any work occurring within 20 m of a watercourse or within areas of peatland. Careful track design and use of trackway panels and bog mats to minimise requirement for temporary stone tracks would ensure that the volume and storage timescale for excavated materials would be minimised as far as practicable during construction works.

235. Vegetation cover would be re-established as quickly as possible on temporary track verges and cut slopes, by re-laying of excavated peat acrotelm, to improve slope stability and provide erosion protection. Additional methods, including hydroseeding and/or use of a biodegradable geotextile, would be considered, if necessary, in specific areas.

Surface Watercourses, PWS and Groundwater

236. A PPP would be established for the proposed route which would outline the detailed methods for dealing with watercourse, PWS and groundwater pollution risk. The PPP would accompany any required applications for authorisation under the Controlled Activities Regulations (CAR).

237. Silt fencing or appropriate alternative sediment control protection would be installed on the downhill side of excavations to prevent inadvertent discharge of silty water into or towards any site watercourse.

238. All engineering works adjacent to watercourses and PWS, including temporary access tracks and watercourse crossing structures, would have appropriate sediment control measures established prior to any groundworks.

239. Vegetation would be retained along watercourse banks to act as additional protection to the watercourses.

240. A water quality monitoring programme would be established. Details would be agreed with SEPA but are anticipated to include at least the following:

- Visual checks for entrained sediment;
- In situ measurements of pH, temperature, specific conductivity.

241. In-situ measurement of turbidity and dissolved oxygen may be recommended for locations with particular sensitivity, such as upstream of PWS sources. Monitoring adjacent to Coalburn Moss SAC is recommended owing to its designated status but other water quality monitoring locations would be identified post-consent by SPEN's environmental advisor in consultation with South Lanarkshire Council's Environmental Health Department.

242. During construction, the monitoring would be undertaken by the Environmental Clerk of Works or suitably experienced alternative individual. Any change from baseline conditions of pH and/or specific conductivity would potentially indicate an incident and additional investigation would be required in order to identify the origin of the change. Control locations, intended to help differentiate between incidents arising within the proposed development area and incidents that are unrelated to the proposed development, would be identified by SPEN's environmental advisor as part of the monitoring programme.

243. All works through and adjacent to wetland areas would be supervised by the Environmental Clerk of Works. This aspect would be informed by the GWDTE assessment (please refer to **Appendix 8.2 National Vegetation Classification and Groundwater Dependent Terrestrial Ecosystems Report**).

Drainage Infrastructure

244. Trackside drainage would be no longer or deeper than necessary to provide the required temporary track drainage.

245. Cross-drains under tracks would be installed at an appropriate frequency to mimic natural drainage patterns and to minimise concentration of flows.

246. All required licences for watercourse crossings and construction site works would be in place prior to works on site beginning.

247. All temporary drainage infrastructure would be established on a running-basis ahead of excavation works. This includes temporary bunding and cut-off drains around hardstanding and laydown areas. Where possible, trackside drainage would be laid up to 20 m ahead of temporary track construction works on a running basis.

248. Temporary water control measures would be implemented as necessary adjacent to areas of excavation, notably the construction compounds and laydown areas. These measures are likely to take the form of temporary settlement ponds or filter drains. Details would be provided within the PPP(s) required for the Construction Runoff Permit and suitability would be determined following appropriate on site soil tests.

249. Earthmoving activity would be restricted during periods of wet weather, particularly for work occurring within 20 m of a watercourse or within areas of peatland, to minimise mobilisation of sediment in heavy rainfall. The 'stop' conditions provided in **Table 7.12** are recommended to guide all earthmoving activity at all stages of the project.

Development High Risk Areas

250. Mitigation for the proposed route through the DHR areas would be provided by pre-construction non-intrusive and intrusive ground investigation works to identify and delineate at-risk areas.

251. Non-intrusive techniques such as near-surface geophysics would be used to identify any sub-surface structures below the proposed route that have not been identified through the desk study and to ground-truth structures identified as part of the desk study. There are several methods that can be used to detect sub-surface voids, including Ground Penetrating Radar, gravimetry measurements, seismic measurements and electromagnetic methods measuring changes in resistivity. With the non-intrusive techniques identifying sub-surface structures, the proposed route can be microsited away from potential hazards or intrusive techniques can be targeted for further investigation.

252. Intrusive techniques would typically include trial pits, drilling of boreholes into superficial material, bedrock and mine voids, and groundwater and mine gas sampling and monitoring. Once the conditions below the proposed route have been identified, any required remediation works would be established to mitigate any identified hazards. Remediation techniques could include capping and stabilisation of mine shafts, grouting old works and gas control measures.

7.7 Summary of Effects

This assessment is based on a site-specific risk assessment method following recommended environmental impact assessment techniques. Potential effects, both positive and negative, long-term or temporary, adverse or beneficial, to the geological, hydrogeological and hydrological regime have been considered. These effects are summarised in **Table 7.13**.

Effect	Phase	Assessment consequence	Effect significance
Physical changes to overland drainage and surface water flows	Construction	Minor, temporary, adverse	Not significant
	Operation	Negligible	Not significant
Particulates and suspended solids	Construction	Minor, temporary, adverse	Not significant
	Operation	Negligible	Not significant
	Construction	Minor, temporary, adverse	Not significant

Effect	Phase	Assessment consequence	Effect significance
Water contamination from fuels, oils, concrete batching or foul drainage	Operation	Negligible	Not significant
Changes in or contamination of water supply to vulnerable receptors	Construction	Minor, temporary, adverse	Not significant
	Operation	Negligible	Not significant
Increased flood risk	Construction	Negligible	Not significant
	Operation	Negligible	Not significant
Modification to groundwater flow paths	Construction	Negligible	Not significant
	Operation	Negligible	Not significant
Soil erosion and compaction	Construction	Minor, temporary, adverse	Not significant
	Operation	Negligible	Not significant
Mining and DHR areas	Construction	Minor, temporary, adverse	Not significant
	Operation	Minor, temporary, adverse	Not significant
Hydrology, hydrogeology, geology and soils cumulative effects	Construction	Minor, temporary, adverse	Not significant
	Operation	Negligible	Not significant

Table 7.13: Summary of Effects

7.8 References

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