



Cloud Hill Wind Farm

Technical Appendix 11.1 Private Water Supply Risk Assessment

August 2023

Project No.: 0669769

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1. INTRODUCTION AND BACKGROUND

1.1 Overview

Environmental Resource Management (ERM), on behalf of Cloud Hill Windfarm Ltd (The Applicant), have produced a Private Water Supply Risk Assessment (PWSRA) which contains an assessment relating to properties with Private Water Supplies (PWS) within the area surrounding Cloud Hill Wind Farm (the Proposed Development).

The Site entrance is located approximately 0.5 km south-west of Sanquhar, Dumfries and Galloway, the turbines and ancillary infrastructure will likely be located over 4.5 km from Sanquhar. The Site centre is located at NGR 274802, 606254, as shown in **Figure 1.2**.

This risk assessment forms **Technical Appendix 11.1** to the Cloud Hill Wind Farm Environmental Impact Assessment (EIA) Report **Chapter 11: Hydrology and Hydrogeology**.

1.2 Project Description

The Proposed Development will comprise of up to 11 turbines with a tip height up to 180 m and associated infrastructure, with a generation capacity exceeding 50 MW. The ancillary infrastructure will likely include access tracks, substation, electrical infrastructure, temporary construction compounds, a permanent met mast, BESS and up to three borrow pits.

1.3 Scope of Assessment

The assessment considers Private Water Supplies within 2km of the Project, indicated by the Private Water Supply Study Area shown on **Figure 11.1**.

The Site will be accessed by an existing access track, which will require upgrading in sections. This risk assessment forms part of the EIA Report, which will identify PWS with a potential connection to the Proposed Development and assess the potential impacts relating the construction and operation of the Proposed Development.

2. PRIVATE WATER SUPPLY RISK ASSESSMENT

2.1 Methodology

The ERM methodology for this PWSRA has been developed historically in conjunction with SEPA and reviewed by several Scottish local authorities. This includes:

- Identification of PWS through consultation with Dumfries and Galloway Environmental Health Office within 2 km of the Private Water Supply Study Area and review of other potential PWS identified using Ordnance Survey (OS) 1:25,000 raster mapping;
- Resident or property owner consultation via letter to those properties identified to be supplied by a PWS;
- A site walkover to verify location and type of PWS;
- Identify the source of water feeding the water supply and its catchment;
- Identify proposed infrastructure and construction activities within the catchment or in proximity to the water supply and its infrastructure (e.g. pipes) if required;
- Identify the potential effect on the water supply i.e. whether construction of the Proposed Development has the potential to change the quality and/or quantity of water at the receptor;
- Determine whether the PWS is at risk; and
- Outline mitigation techniques that will be implemented to minimise any potential impact of construction and operation on drinking water quality, if required.

Where conflicting information has been provided by the supply owner and local authority, information provided by the supply owner has been used.

2.1.1 Legislation and Guidance

The procedure for identifying and risk assessing PWS is based on the following legislation and guidance:

- The Water Quality (Scotland) Regulations 2010¹ (WQ Regulations);
- The Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017 ('the Regulations')²;
- The Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017 - Guidance for Local Authorities (v4.0)³;
- Water Environment (Controlled Activities) (Scotland) Regulations 2011⁴; and
- Scottish Environment protection Agency (SEPA) Land Use Planning System Guidance Note 31 2017 v3.0 (LUPS-GU31)⁵.

The PWSRA will assess the risk for all PWS which are located within the following categories outlined by SEPA LUPS-GU31 guidance:

- Groundwater abstractions within 100 m radius of all excavations less than 1 m in depth; and
- Groundwater abstractions within 250 m of all excavations deeper than 1 m.

2.2 Consultation

2.2.1 Identification of Private Water Supplies through Consultation

On 5th April 2022, a Freedom of information (FoI) request was submitted to Dumfries and Galloway Council (The Council) to acquire information on registered PWS located within a 2 km radius of the Project.

The FoI response from the Council provided data on all PWS located within the Council's area. The data was georeferenced by an ERM Hydrologist using ArcGIS Pro to identify those located within a 2 km buffer ('the PWS Study Area') of the Project. This process identified seven PWS within the Study Area, shown on **Figure 11.3** of Chapter 11. The seven properties identified through this consultation are:

- Glenglass Cottage;
- Cairnhill;
- Sheil;
- Glenmaddie;
- Polgown;

¹ The Water Quality (Scotland) Regulations 2010 [Online] Available at: <http://www.legislation.gov.uk/ssi/2010/95/contents/made> [Accessed 25/05/2023].

² UK Government (2017) The Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017. Available at: <http://www.legislation.gov.uk/ssi/2017/282/contents/made> [Accessed 25/05/2023].

³ DWQR (2019) The Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017: Guidance for Local Authorities Ver 4.0. Available at: <https://dwqr.scot/media/42030/the-water-intended-for-human-consumption-private-supplies-scotland-regulations-2017-guidance-v4-feb-2019-as-issued.pdf> [Accessed 25/05/2023].

⁴ UK Government (2011) The Water Environment (Controlled Activities) (Scotland) Regulations 2011. Available at: <http://www.legislation.gov.uk/ssi/2011/209/contents/made> Accessed on: [Accessed 25/05/2023].

⁵ SEPA (2017) Land Use Planning System (LUPS) SEPA Guidance Note 31 v3.0. Available at: <https://www.sepa.org.uk/library/content-search/?q=LUPS-GU31&LibGo=Search&page=1> [Accessed 25/05/2023].

- Old Barr; and
- Euchan Cottage.

Further information was brought to the assessment from the client who informed ERM that one additional property within the study area may be served by a PWS. This property is Euchan House.

Consultation with residents and landowners of the aforementioned properties with PWS was conducted on 5th July 2022. The consultation process was conducted by posting a letter and questionnaire to residents to obtain further information on the PWS supplying their property, as well as a corresponding map indicating the location of each PWS supply. The questionnaire and reasoning for each of the questions are outlined in **Table 1**.

Table 1: Resident Consultation Questionnaire and Reasoning

Question	Reasoning
Type of supply (with list of options)	Allows for identification of the likely PWS source water and provide an understanding of its potential connectivity to the Development and developing a source-pathway-receptor model. This allows for an initial level of sensitivity to be applied to the PWS source as part of the final risk assessment.
Use of supply	Aids in developing the source-pathway-receptor model and conceptual site model. Also, to attribute sensitivity for the final risk assessment. Also provides information on the likely volumes of water abstracted at the PWS.
Type of water treatment	Understanding of the baseline vulnerability of the source and existing protection measures in place.
Number of people supplied	Provides information on the likely volumes of water abstracted at the PWS. Also helps to attribute sensitivity for the final risk assessment. It is acknowledged that this number can vary, particularly if the PWS supplies a commercial property.
Number of livestock supplied	Provides information on the likely volumes of water abstracted at the PWS. Also, to attribute sensitivity for the final risk assessment. It is acknowledged that this number can vary seasonally.
Volume of water abstracted (m ³)	Allows for initial assessment on the catchment or 'zone of influence' of the water supply. This is the likely area the supply is draining water from. This informs an understanding of the PWS potential connectivity to the Development. For example, a large groundwater abstraction further from the Development may be hydrologically connected due to its larger zone of influence. A smaller abstraction, closer to the Development, may not be hydrologically connected because it has a very small zone of influence. It is acknowledged that this is often unknown or estimated by residents.
Any comment of the condition of your water supply	This informs an understanding of the existing level of vulnerability of the PWS and potential need for additional protection measures. For example, PWS that have previously been influenced by quantity reductions during drought periods may be more vulnerable than those who have not experienced this. Any information regarding previous water quality issues or quantity issues can inform an understanding of where the water is likely to be sourced from and the pathway it takes to get to the property.

2.3 Review of Properties Consulted

Table 2 below outlines the three properties consulted either by letter or visited during site walkovers.

Table 2: Properties with potential PWS within PWS Study Area

Property	Grid Reference	Distance from Project	Source Type	Comment
Glenglass Cottage	270864 606372	1.9 km west of the project	Source not located	Unoccupied and owned by Scottish Power. On inspection there was no evidence of a working PWS. PWS scoped out of further assessment.
Glenmaddie	274233 607191	0.15 km north and downslope of the project	The location of the source from coordinates provided by EHO indicates a groundwater source, potentially a spring source.	During the site visit, a potential spring intake was noted approximately 250 m south of the property. The location of this source was noted to be downslope of Development infrastructure. PWS scoped into further assessment
Polgown	271915 603829	1.1 km south-west and downslope of the project	Unknown	This property is in a separate hydrological catchment and is more than 250 m from Proposed Development infrastructure. PWS scoped out of further assessment.
Old Barr	276281 608515	0.4 km north and downslope of the project	N/A	Property confirmed to be on mains supply during consultation. PWS scoped out of further assessment.
Euchan Cottage	275718 608137	0.85 km north and downslope of the project	Unknown	During the site visit, the owner of the property was unsure if the property was connected to a PWS or main supply. Currently waiting for a response to the letter which was left at the property. PWS scoped into further assessment.
Euchan House	277075 609217	0.45 km north-west of the Site access tracks	Unknown	The site visit was unable to confirm whether the property has a PWS. Currently waiting for a response to the letter which was left at the property. PWS scoped into further assessment.
Sheil	274527 604069	1.18 km south of the Site access tracks	Unknown	This property is located downslope of Development infrastructure. PWS scoped into further assessment.
Cairnhill	276588 608155	11 m north and downslope of the Development	N/A	This property is confirmed to be connected to a Scottish Water mains supply. PWS scoped out of further assessment.

Of these eight properties, five were scoped out from further assessment (Old Barr, Glenglass, Polgown, Glenmaddie and Cairnhill) with three properties to be considered further within the risk assessment.

2.4 Site Visit

Following consultation, a hydrological site walkover focusing on properties that may have potential hydrological connectivity to the Project was carried out on 19th October 2022. The properties of Glenglass, Glenmaddie, Polgown, Euchar Cottage and Euchar House were visited to inspect the supply, however no conclusive evidence could rule out the potential of PWS to these properties. The property of Old Barr was also visited, and the owner confirmed that the property was on mains supply.

3. RISK ASSESSMENT

3.1 Introduction

A PWSRA was undertaken in accordance with 'Guidance on Assessing the Impacts of Windfarm Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems'⁶. The summary of the risk assessment of properties with PWS within 2 km of the Proposed Development is provided in **Table 6**.

The risk assessment reviewed desk-based information associated with PWS, including geological maps, historical maps, and surface water catchments. Where locations of the PWS water source are provided, this detail was overlain with mapped infrastructure associated with the Project to inform an initial source-pathway-receptor model.

Following the initial desk-based review, PWS and associated properties are identified as potentially 'at-risk' or 'not at-risk' from the Project. The level of risk is attributed to each of the PWS based on the sensitivity level of the receptor (source water, distribution infrastructure and point of supply), the criteria of which is outlined in **Table 3**, combined with the level of magnitude of impact, for which the criteria is outline in **Table 4**.

The resultant level of risk is based on the risk matrix outlined in **Table 5**.

Table 3. Estimating the Sensitivity of Receptors

Sensitivity of Receptor	Definition
High	The hydrological receptor will support abstractions for public water supply, or private water abstractions which supply more than 25 people and / or 100 livestock (at any given point in the year) and/ or is used for the mass-production of food and drinks.
Medium	Hydrological receptor supports abstractions for PWS for limited agricultural use (at any given point in the year), or where mains water supply is available.
Low	The hydrological receptor does not support abstractions for public water supply or private water abstractions
Negligible	The receptor is resistant to change and is of little environmental value.

⁶ SEPA (2014) *Guidance on Assessing the Impacts of Windfarm Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems* [Online]. Available at: http://www.sepa.org.uk/media/143868/lupsqu31_planning_guidance_on_groundwater_abstractions.pdf [Accessed 21/10/2022].

Table 4. Magnitude of Change

Magnitude of Receptor	Description
High	A major permanent or long-term negative change to groundwater quality or available yield.
Medium	The yield of existing supplies may be reduced or quality slightly deteriorated.
Low	Any changes to quality, quantity or continuity do not result in a perceptible alteration to baseline conditions.
Negligible	No effect from Development to water quality, quantity or continuity on the basis of non-existent pathway in the 'source-pathway-receptor' model (this may be determined following avoidance and / or mitigation measures).

Table 5: Risk Matrix

Magnitude of Effect	Sensitivity of Resource or Receptor				
	Very High	High	Medium	Low	Negligible
High	Major	Major	Moderate	Moderate	Minor
Medium	Major	Moderate	Moderate	Minor	Negligible
Low	Moderate	Moderate	Minor	Negligible	Negligible
Negligible	Minor	Minor	Negligible	Negligible	Negligible

3.2 Identification of PWS

Further baseline information on the supplies and the hydrological and hydrogeological setting for each supply scoped into the assessment are outlined in **Table 6** below. This is based upon a desk-based risk assessment only, as no response to the private water supply questionnaires have been received to date and no access to the supply to confirm their locations.

Table 6: Scoped in Private Water Supplies

Grid Reference (of supply)	PWS Sheil	PWS Glenmaddie	PWS Euchar House	PWS Euchar Cottage
Distance to Infrastructure	1.2 km south and downslope of access tracks and hardstanding	865 m downslope of Site access tracks and hardstanding. 600 m north-west of T9, however this is hydrologically disconnected by Glen Burn.	0.5 km north-west of the Site access tracks	0.58 km north-west and downslope of upgraded access tracks.
Source of supply (type)	Unknown	Likely spring intake	Unknown	Unknown
Use(s)	Unknown	Unknown	Unknown	Unknown
PWS Type	Unknown	Groundwater – Spring	Unknown	Unknown

Grid Reference (of supply)	PWS Sheil	PWS Glenmaddie	PWS Euchar House	PWS Euchar Cottage
Surface Water Receptors	Stell Burn / Scaur Water	Glen Burn / Euchar Water	Barr Burn / Euchar Water	Glenmaddie Burn / Euchar Water
Bedrock Geology	Portpatrick Formation – Wacke	Kirkcolm Formation – Wacke	Kirkcolm Formation – Wacke	Scottish Lower Coal Measures Formation – Sedimentary Rock Cycles, Coal Measure Type
Superficial Deposits	Till, Devensian – Diamicton	Till, Devensian – Diamicton	Glaciofluvial Deposits – Gravel, Sand And Silt	Till, Devensian – Diamicton / Alluvium – Silt, Sand And Gravel
Hydrogeology	Low productivity aquifer. Highly indurated greywackes with limited groundwater in the near surface weathered zone and secondary fractures.	Low productivity aquifer. Highly indurated greywackes with limited groundwater in the near surface weathered zone and secondary fractures.	Moderately productive aquifer – multi-layered aquifer with low yields from sandstones. Higher yields where mined but poor quality water, including high iron and fluoride.	Low productivity aquifer. Highly indurated greywackes with limited groundwater in the near surface weathered zone and secondary fractures.
Groundwater Classification	Poor			

3.3 Potential Hydrogeological connectivity

3.3.1 Introduction

The sections below provide a review of potential hydrogeological connectivity between the Development and each supply. The conceptual site model (source, pathway, receptor) approach is outlined below:

- **Source** – pollutants or sediment from the site during construction or during operation phases (should drainage system fail, however, this is very unlikely);
- **Pathway** – during the operational phase, as the Proposed Development includes a drainage system, any run-off would capture, treat, and discharge run-off to the nearest watercourse in line with the Drainage Assessment. During the construction phase (prior to drainage installation) the potential pathways would include:
 - Run-off via overland flow; and
 - Infiltration into the underlying superficial and bedrock aquifers.
- **Receptor** – the PWS is considered as a receptor within this assessment.

The potential impacts to each supply are also considered for the substation (the Proposed Development).

3.3.2 PWS Sheil

Information provided by EHO reports that a PWS may present at the property of Sheil. A review of baseline conditions shows the underlying superficial geology consist of low permeability glacial till. A large watercourse, Scaur Water, flows west to east between the infrastructure and the property. The location of the PWS in relation to the Project is shown in Plate 3.1.

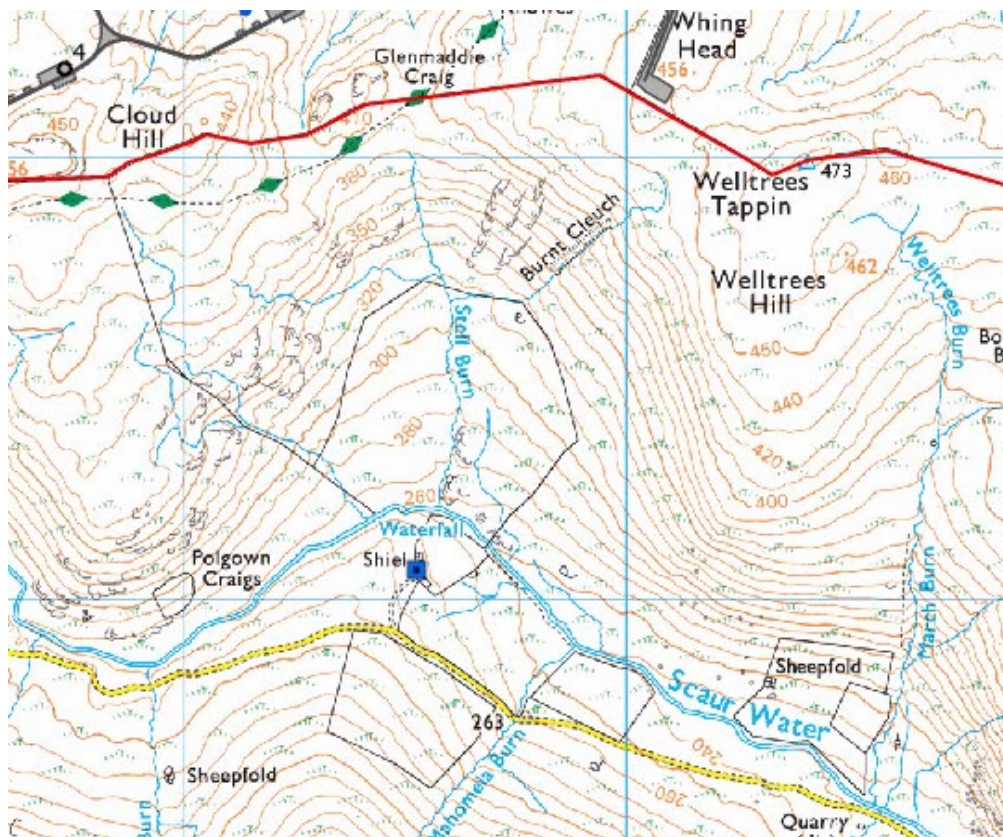
As the location of the property is south of Scaur Water, it is unlikely that the source would be located north of the river given the large size of the watercourse. Should the supply be groundwater fed, it would likely be located south of Scaur Water which would act as a disconnecting feature. Additionally, the source would be located more than 250 m from all Proposed Development infrastructure which

would lie outside of the zone of influence, as indicated by SEPA LUPS-GU31⁷. Likewise, should the source be surface water fed, it would most likely be situated south of Scaur Water and therefore hydrologically disconnected from the Proposed Development. On the basis that PWS Sheil is hydrologically disconnected from the Proposed Development, there would be no pathway for pollutants to reach the receptor (PWS) and therefore, there is no potential for impacts from the Proposed Development.

3.3.2.1 *Impacts from development*

This PWS is likely to be hydrologically disconnected from the Proposed Development and therefore, there will be no potential impacts from the Proposed Development.

Plate 3.1 Map of PWS Sheil (grid reference: NS 74527 04069) (blue marker) in relation to the development.



3.3.3 *PWS Glenmaddie*

Information provided by EHO reports that a PWS may present at the property of Glenmaddie. A review of baseline conditions shows the underlying superficial geology consist of low permeability glacial till. Glen Burn, a tributary of Euchar Water, flows north and is positioned approximately 55 m east of the PWS source. The location of the PWS in relation to the Project is shown in Plate 3.2.

The location of the source was provided by EHO and ERM were advised to verify this. During a PWS inspection undertaken by ERM, no resident was available, however the coordinates provided by the EHO matched the location of what appeared to be a spring intake tank. Given this, it was concluded that PWS Glenmaddie is likely served by a groundwater source as opposed to a surface water

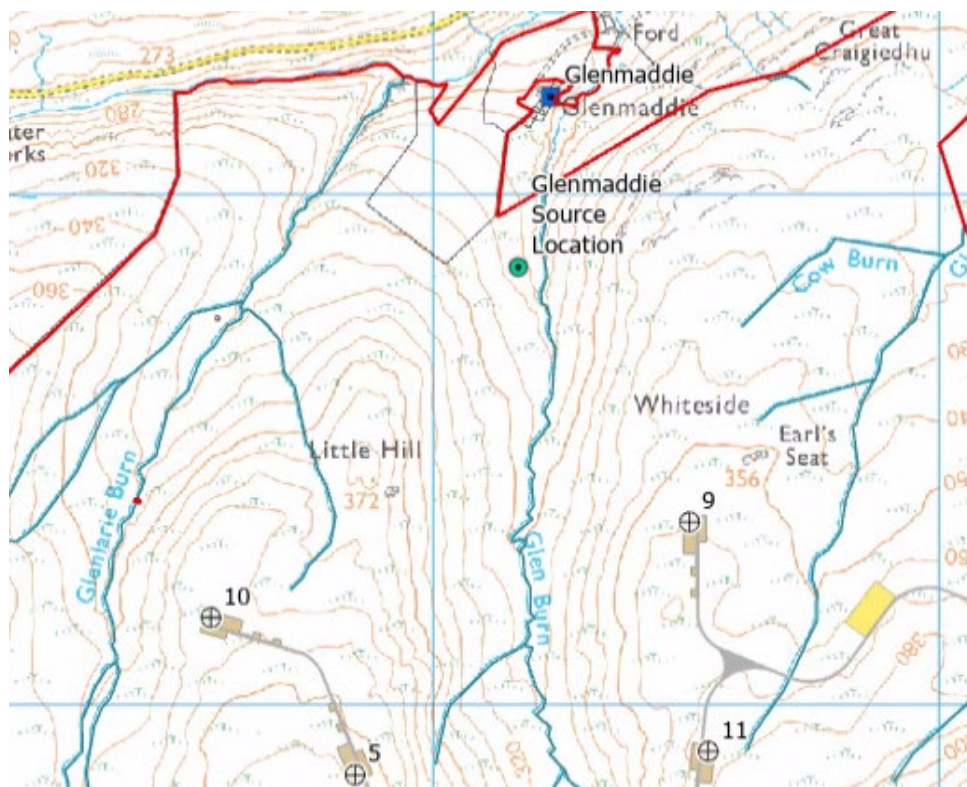
⁷ SEPA (2017) Land Use Planning System: SEPA Guidance Note 31 - Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems [Online] Available at: <https://www.sepa.org.uk/media/144266/lups-gu31-guidance-on-assessing-the-impacts-of-development-proposals-on-groundwater-abstractions.pdf> (Accessed: 04/04/2022).

source. The closest Development infrastructure to this source is T9 which is located approximately 600 m south-east of the source. However, the source hydrologically disconnected from this turbine by Glen Burn which flows north, passing between the source and T9. The location of the source is also downslope of the access tracks and hardstanding between T5 and T10. However, the distance between infrastructure and the source is approximately 865 m. Therefore, the source is located more than 250 m from all Proposed Development infrastructure which would lie outside of the zone of influence, as indicated by SEPA LUPS-GU31. As the source is outside of the zone of influence of the Proposed Development, it is considered to be hydrologically disconnected. On this basis, there would be no pathway for pollutants to reach the receptor (PWS) and therefore, there is no potential for impacts from the Proposed Development.

3.3.3.1 Impacts from the Development

This PWS is hydrologically disconnected from the Proposed Development and therefore, there will be no potential impacts from the Proposed Development.

Plate 3.2 Map of PWS Glenmaddie (grid reference: NS 74169 06857) (blue marker – property, green marker - source) in relation to the development.



3.3.4 PWS Euchan House

The property location was provided to ERM by Cloud Hill Wind Farm Ltd as a property which was potentially served by a PWS. This property was not registered with the EHO and no consultation responses were received to verify the presence of a PWS, the source type or location. Therefore, a conservative approach has been taken to assume the property is served by a PWS. The PWS property is located 0.5 km north-west of new access tracks to be constructed as part of the Proposed Development.

While the location of the potential source is unknown, the location of the property being supplied would indicate that the source would be located north of Euchan Water. This is due to large size of the river, the width of which is approximately 10 m. While the supply type is also unknown, should the

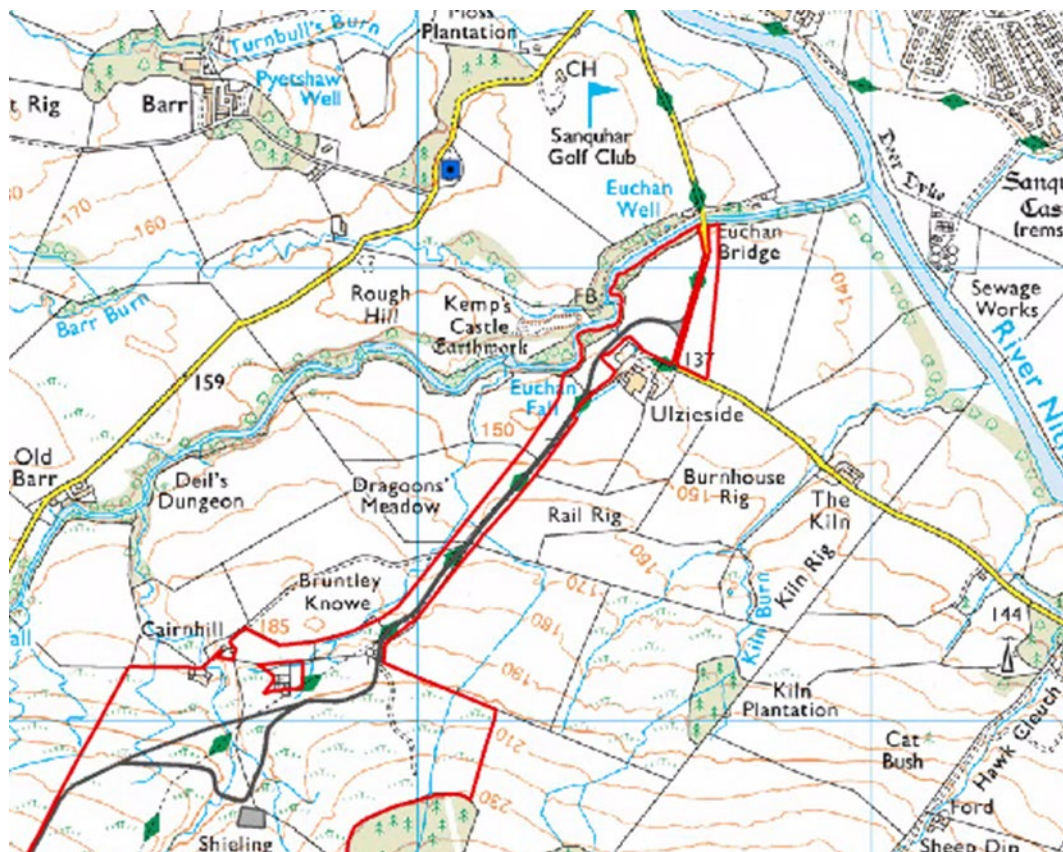
assumption be made that the PWS is groundwater fed (borehole or spring), the intervening Euchar Water will sever the hydrogeological connection between the source and Proposed Development infrastructure. Should the source be surface water fed, the intake location will also likely be severed by Euchar Water and hydrologically disconnect the PWS from the Proposed Development. Therefore, on the basis that PWS Euchar House is hydrologically disconnected from the Proposed Development, there would be no pathway for pollutants to reach the receptor (PWS) and therefore, there is no potential for impacts from the Proposed Development.

It should be noted that the property 'Old Barr', also located on the same street, approximately 1 km south-west, is connected to a mains supply which may indicate this property is also connected to a mains supply.

3.3.4.1 Impacts from development

This PWS is likely to be hydrologically disconnected from the Proposed Development and therefore, there will be no potential impacts from the Proposed Development.

Plate 3.3 Map of PWS Euchar House (grid reference: NS 77074 09217) (blue marker) in relation to the development.



3.3.5 PWS Euchar Cottage

Information supplied by the EHO indicated that this property does not have a registered PWS although due to the location of the property, it may be served by a PWS. During the site visit, the occupant was unsure whether the property was connected to a PWS and to date no further response to consultation has been received. It should be noted that the property 'Old Barr', located on the same street, approximately 680 m north-east, is connected to a mains supply which may indicate this property is also connected to a mains supply. However, as no consultation response has been

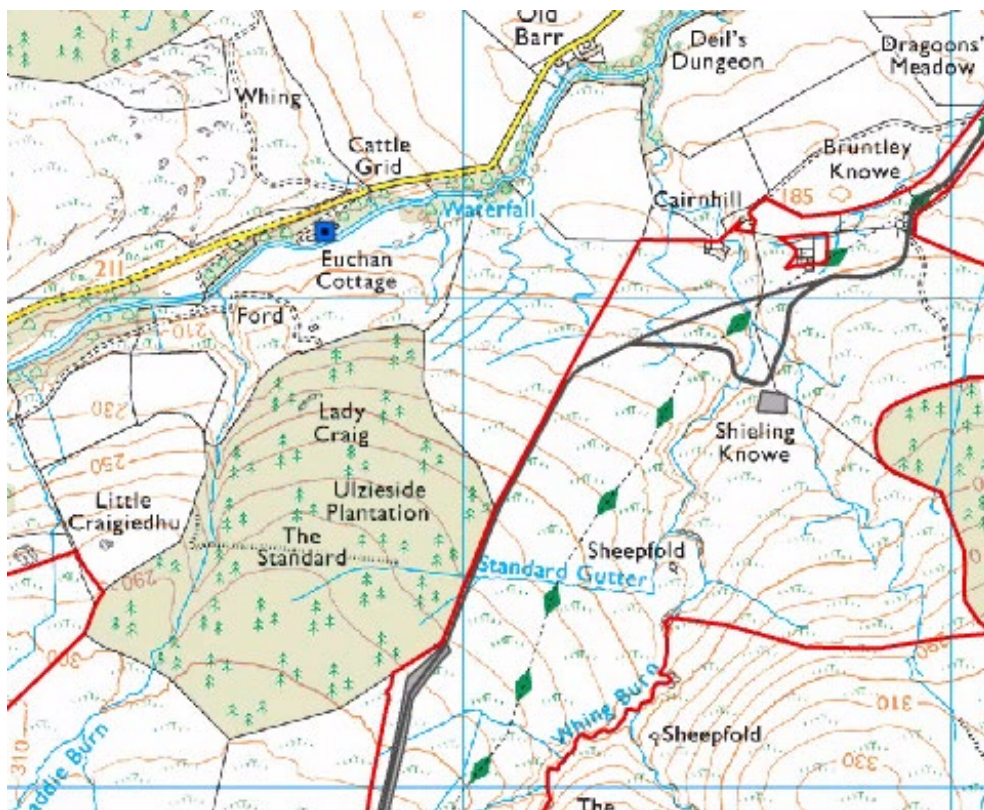
received to confirm this, a conservative approach will be taken and it will be assumed that Euchan Cottage is served by a PWS.

The property is located north of Euchan Water, a large watercourse approximately 10 m in width with a moderate flow rate. Given the large size of this watercourse, it is unlikely the source is located south of the river. On this basis, should the supply be fed by a groundwater source (borehole or spring), it will be located more than 250 m from Proposed Development infrastructure and disconnected by Euchan Water. Similarly, should the supply be surface water fed from an intake north of Euchan Water, the source will be hydrologically disconnected by Euchan Water. Therefore, on the basis that PWS Euchan Cottage is hydrologically disconnected from the Proposed Development, there would be no pathway for pollutants to reach the receptor (PWS) and therefore, there is no potential for impacts from the Proposed Development.

3.3.5.1 Impacts from development

This PWS is likely to be hydrologically disconnected from the Proposed Development and therefore, there will be no potential impacts from the Proposed Development.

Plate 3.4 Map of PWS Euchan Cottage (grid reference: NS 75719 08137) (blue marker) in relation to the development.



3.4 Summary

A review of the baseline conditions and information supplied by EHO and Cloud Hill Wind Farm Ltd for the private water supplies at Sheil, Euchan House and Euchan Cottage in relation to the Proposed Development confirms there is no potential for hydrological or hydrogeological connectivity. A summary of the risk assessment for each supply based on the criteria outlined in Tables 3, 4 and 5 are detailed below. As no information was received regarding the PWS at these properties, a conservative approach has been taken and the assumption has been made that all supplies are of 'High' sensitivity.

Table 7: Risk Assessment

Private Water Supply	Sensitivity	Magnitude	Mitigation	Residual Risk
PWS Sheil	High	Negligible	No additional mitigation required.	Negligible
PWS Glenmaddie	High	Negligible	No additional mitigation required.	Negligible
PWS Euchar House	High	Negligible	No additional mitigation required.	Negligible
PWS Euchar Cottage	High	Negligible	No additional mitigation required.	Negligible

4. PROVISION OF MEASURES TO MINIMISE THE IMPACT ON DRINKING WATER QUALITY DURING CONSTRUCTION

The PWSRA, carried out through desk-based assessment and a site visit identified Sheil, Glenmaddie, Euchar House and Euchar Cottage as potentially sensitive drinking water receptors within 2 km of the Project. However, this risk assessment has shown there to be no hydrological or hydrogeological connection to the Proposed Development.

Industry good practice measures will be implemented to protect the water environment should any additional drinking water supplies be identified during the pre-construction phase. Full details of water management measures and mitigation will be provided in the Water Construction and Environmental Management Plan (CEMP) (**Technical Appendix 11.2**) for the Proposed Development following verification of the supply locations.

5. SUMMARY

The PWSRA identified eight properties within 2km which may have a PWS, with four of these properties scoped out of further assessment due to their lack of hydrological connectivity.

The PWSRA concludes that potential PWS at Sheil, Glenmaddie, Euchar House and Euchar Cottage are not hydrologically connected to the Site due to topography and hydrological features which sever any potential pathway from the Site to the PWS.

On this basis, this PWSRA concludes that there is no potential for these three supplies to be hydrologically connected to the Proposed Development, and therefore there will be no potential effects from the Proposed Development to the PWS water quality, quantity, or continuity, on the basis of a potential pathway in the 'source-pathway-receptor'.

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