

Annex M - Private Water Supply Risk Assessment

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ARCUS

CRARAE SUBSTATION

**ANNEX M
PRIVATE WATER SUPPLY RISK ASSESSMENT**



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1 INTRODUCTION AND BACKGROUND

1.1 Overview

Arcus Consultancy Services Limited (Arcus), on behalf of SSEN, 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 Crarae Substation (the Development).

The Project is located approximately 1.7 km north-west of Minard, with access via the existing forestry tracks which begin from the A816, north of Lochgilphead. This Project is located within the Argyll and Bute Council (ABC) area. The location of the site is shown on **Figure 1.1** within the Environmental Appraisal.

This risk assessment forms **Annex M** to the Crarae Environmental Appraisal **Chapter 6: Hydrology, Hydrogeology and Geology**.

1.2 Project Description

The Applicant proposes to construct a new 275 kV electricity substation (known as the Proposed Development) in addition to the construction of a section of new overhead line (OHL) and three new towers (known as the Associated Development) to make connections in the vicinity of the existing Crarae substation (located at National Grid Reference 197189 698030). This upgrade is required for the existing substation to current specification and standards and provide reinforcement to the existing network which will support the continued generation of renewable energy.

The new substation and accompanying infrastructure aspects (the Proposed Development) will be subject to Town and Country Planning, while the OHL Tie ins and accompanying towers (the Associated Development) will be submitted for Section 37 consent.

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 6.1**.

The Project will be accessed by an existing forestry access track to the south which is regularly used for operational activities. Aspects of these access tracks will require upgrading in sections, at the time of reporting the locations of these upgrades are to be confirmed. This risk assessment forms part of the Environmental Appraisal, which will identify private water supplies with a potential connection to the project and assess the potential impacts relating the construction and operation of the Project.

1.4 Drainage Impact Assessment

The Drainage Impact Assessment (**Annex K**) provides information on the surface water drainage options for the Project. Following infiltration testing, the underlying geology was determined to be of low permeability with drainage to be discharged to a nearby watercourse, in accordance with the SuDS hierarchy. The proposed surface water drainage scheme details an attenuation pond downslope of the site, with drainage discharged via a piped filter system with an outflow to the nearest watercourse.

2 PRIVATE WATER SUPPLY RISK ASSESSMENT

2.1 Methodology

The Arcus 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 ABC 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 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 12th November 2021, a Freedom of information (FoI) request was submitted to Argyll and Bute Council (ABC) to acquire information on registered PWS located within a 2 km radius of the Project.

¹ The Water Quality (Scotland) Regulations 2010 [Online] Available at: <http://www.legislation.gov.uk/ssi/2010/95/contents/made> [Accessed 11/03/2022].

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 11/03/2022].

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 11/03/2022].

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 11/03/2022].

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 11/03/2022].

The FoI response from ABC provided data on all PWS located within the ABC area. The data was georeferenced by an Arcus Hydrologist using ArcGIS Pro to identify those located within a 2 km buffer ('the PWS Study Area') of the Project. This process identified six PWS within the Study Area, shown on **Figure 6.5** of Chapter 6. The six properties identified through this consultation are:

- Kennels Cottage;
- Kilmichaelbeg;
- Limekiln;
- Nursery Cottages;
- Tigh Na Coille; and
- Garvarchy Farm.

Consultation with residents and landowners of the aforementioned properties with PWS was conducted on 10th December 2021 with a follow up letter sent on 4th March 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 (m³)	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.

Question	Reasoning
Any comment of the condition of your water supply	<p>This informs an understanding of the existing level of vulnerability of the PWS and potential need for additional protection measures.</p> <p>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.</p> <p>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.</p>

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
Kennels Cottage	198270 696895	1.85 km south-east and downslope of the Project	No	Property confirmed to be on mains supply during consultation. PWS scoped out of further assessment.
Kilmichaelbeg	195546 693401	1.04 km south and downslope of the Site access tracks	Unknown	Potential for hydrological connectivity via an unnamed watercourse which flows south, under access tracks in close proximity to property. PWS scoped into further assessment
Limekiln	196831 695623	1.12 km east of the Site access tracks	Unknown	Potential PWS is hydrologically disconnected from Development by topography and Auchgoyle Burn. Disconnected from access tracks due to intervening topography. PWS scoped out of further assessment.
Nursery Cottages	195748 693833	0.69 km south and downslope of the Site access tracks	Unknown	Potential for hydrological connectivity via an unnamed watercourse which flows south, under existing access tracks in close proximity to property. PWS scoped into further assessment
Tigh Na Coille	196190 694760	48 m north of the Site access tracks	Unknown	Due to the unknown nature of access tracks upgrades in this location and the exact location of PWS source, there is potential for hydrological connectivity. PWS scoped into further assessment.

Property	Grid Reference	Distance from Project	Source Type	Comment
Garvachy Farm	196967 697477	412 m south-east and downslope of the Site	Groundwater	Location of supply unknown but potentially located from Proposed Development. PWS scoped into further assessment.

Of these six properties, two were scoped out from further assessment (Limekiln and Kennels Cottage) with Kilmichaelbeg, Nursery Cottages, Tigh Na Coille and Garvachy Farm to be considered further within the risk assessment.

2.4 Site Visit

Following consultation with ABC and SSEN, a hydrological site walkover focusing on properties that may have potential hydrological connectivity to the Project was carried out on 15th March 2022. The property at Garvachy Farm was visited to inspect the supply, however, no access was available at the time of survey.

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' – whilst this guidance is primarily for windfarm developments, the principles outlined within assessment of impacts to new infrastructure projects can be used for reference⁶. The summary of the risk assessment of properties with PWS within 2 km of the 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.

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/lupsgu31_planning_guidance_on_groundwater_abstractions.pdf [Accessed 07/01/2022].

Sensitivity of Receptor	Definition
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.

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 in to 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 Garvachy Farm	PWS Kilmichaelbeg	PWS Nursery Cottages	PWS Tigh Na Coille
Distance to Infrastructure	412 m south-east and downslope of the Site (based on data provided by ABC).	1.04 km south of access tracks (based on data provided by ABC).	0.69 km south of access tracks (based on data provided by ABC).	48 m north of access tracks (based on data provided by ABC).

Grid Reference (of supply)	PWS Garvachy Farm	PWS Kilmichaelbeg	PWS Nursery Cottages	PWS Tigh Na Coille
Source of supply (type)	Groundwater (based on previous EIA report)	Unknown	Unknown	Unknown
Use(s)	Unknown	Unknown	Unknown	Unknown
PWS Type	Unknown	Unknown	Unknown	Unknown
Surface Water Receptors	Auchgoyle Burn / Unnamed watercourse	Unnamed watercourses adjacent	Unnamed watercourses adjacent	Unnamed ponds to east
Bedrock Geology	Ardrishaig phyllite formation - semipelite, calcareous and dalradian supergroup - metagabbro and metamicrogabbro . Mull dyke-swarm - basalt and microgabbro	Ardrishaig phyllite formation - semipelite, calcareous	Ardrishaig phyllite formation - semipelite, calcareous. Mull dyke-swarm - basalt and microgabbro	Ardrishaig phyllite formation - semipelite, calcareous and dalradian supergroup - metagabbro and metamicrogabbro. Mull dyke-swarm - basalt and microgabbro
Superficial Deposits	Till Devensian (Diamicton)			
Hydrogeology	Low productivity aquifer. Small amounts of groundwater in near surface weathered zone and secondary fractures.			
Groundwater Classification	Good			

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 Project 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 Development) as well as the overhead line upgrades (the Associated Development).

3.3.2 PWS Garvachy Farm

Information provided by EHO reports a PWS present at Garvachy Farm. This correlates with information provided Technical Appendix 2.3: Watercourse Crossings and Private

Water Supplies of the 'OHL Inveraray to Crossiag' EIA report, which states the source of the PWS to be groundwater. Arcus have been unable to gain further details of the PWS such as source type, location due to the lack of consultation response.

A review of baseline conditions show the underlying superficial geology consist of low permeability glacial till. A watercourse flows north-east to south-west between the infrastructure and the property. The location of the PWS in relation to the Project is shown in Plate 3.1.

Assuming the supply is groundwater fed (spring or borehole), there is potential for a complete pollutant pathway as the Project is located upslope of the property, and therefore a likely supply location. The grid reference provided indicates the location of the property of Garvachy Farm (i.e. not the intake location).

On the assumption the PWS source is groundwater fed and is upslope of the property, the PWS has the potential to be impacted by the substation development and/or the OHL development as discussed in Sections 3.3.2.1 and 3.3.2.2.

3.3.2.1 Impacts from substation development

The potential sources of pollution from the Site infrastructure which includes the earthworks associated with permanent new access tracks, temporary works and peat storage areas area and the substation building, where excavation depths are likely to exceed 1 m depth. As a conservative (worst case) assumption, the shortest distance between infrastructure and the property is 412 m, therefore the potential location of the PWS intake located between these locations may be with 250 m of the infrastructure.

Based on the information provided, the location of the PWS source is unknown but has the potential to be located up downslope and within 250 m of the infrastructure with an elevation decrease of up to 20 m. Therefore there is a potential pollutant pathway between the development and a potential supply intake location.

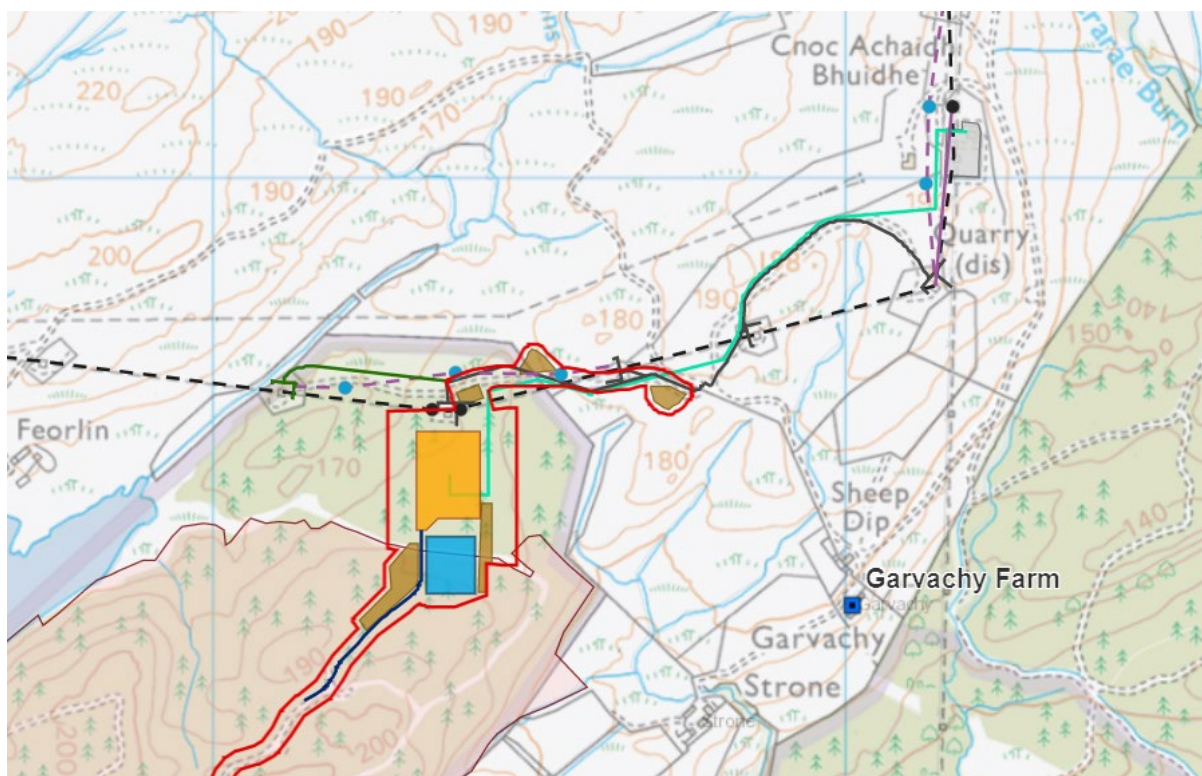
3.3.2.2 Impacts from OHL development

The potential sources of pollution from the OHL development infrastructure includes the earthworks associated with new overhead line including towers located north of the new substation platform, which are likely to be exceed over 1m depth. The shortest distance between tower infrastructure and the property is 690 m, the location of the PWS intake will be between this distance but may be with 250 m of the towers and located downslope.

The underlying superficial geology consist of till and as stated in the drainage impact assessment, this geology has a low permeability. A watercourse flows north-east to south-west between the infrastructure and the property.

Based on the information provided, the location of the PWS source is unknown but has the potential to be located up downslope and within 250 m of the infrastructure with an elevation decrease of up to 20 m. Therefore there is a potential pollutant pathway between the development and a potential supply intake location.

Plate 3.1 Map of PWS Garvachy Farm (grid reference: NR 97013 97321) (blue marker) in relation to Substation platform (orange box), temporary works area (blue box), access track (navy blue line), tower locations (black circles) and overhead line (solid purple line following existing OHL route).



3.3.3 Kilmichaelbeg

3.3.3.1 Impacts from substation development

The supply location was provided by ABC, with no consultation response to verify the source type or location. The PWS property is located 1.04 km south of the existing access tracks, along a section of tracks which has been identified for upgrade.

This PWS is not located directly downslope of the access tracks, however, a watercourse flows from the southern section of the access tracks and passes in close proximity to the PWS. Whilst there is unlikely to be any groundwater connectivity due to the intervening topography and watercourses, there is a potential pollutant pathway via an unnamed watercourse at Birdfield which flows south towards Kilmichaelbeg should the supply at the property be fed by this surface watercourse.

3.3.3.2 Impacts from OHL development

As the property is located over 2 km from the OHL development, effects relating to the Associated Development can be scoped out.

Plate 3.2 Map of PWS Kilmichaelbeg, PWS Nursery Cottages and PWS Tigh Na Coille (blue marker) in relation to existing access tracks (red line boundary)



3.3.4 Nursery Cottages

Information on the location of this PWS was supplied by the EHO, with no response received to any further consultation.

3.3.4.1 Impacts from substation development

The location of the PWS source is to be verified, assuming the PWS is adjacent to the property and located 0.69 km south and downslope of the existing access tracks. Due to the intervening topography and surface watercourses, there is unlikely to be a hydrogeological connection. However, an unnamed watercourse flows from the southern section of the access tracks and passes in close proximity to the PWS. As information such as PWS source location and type is unknown, there is potential for hydrological connectivity, and a complete pollutant pathway between the project and the PWS if this supply is fed from this burn.

3.3.4.2 Impacts from OHL development

As the property is located over 2 km from the OHL development, effects relating to the Associated Development can be scoped out.

3.3.5 Tigh Na Coille

Information on the location of this PWS was supplied by the EHO, with no additional information received during consultation.

The exact location of the PWS source has not been verified, however the property is located 48 m north and upslope of the forestry access track. There is potential for the supply to be spring fed from the steep slopes above, as well as other groundwater sources with nearby surface water features also a potential source.

Any excavations associated with the track upgrade may have the potential to impact local groundwater flow and quality, with the potential for hydrological connectivity. Therefore there is potential for a complete pollutant pathway between the project and the PWS.

3.3.5.1 Impacts from OHL development

As the property is located over 2 km from the OHL development, effects relating to the Associated Development can be scoped out.

3.4 Summary

A review of the baseline conditions and information supplied by EHO and SSEN for the private water supplies at Garvachy farm, Kilmichaelbeg, Nursery Cottages and Tigh Na Coille in relation to the Project confirms there is potential for hydrological or hydrogeological connectivity for all four supplies. A summary of the risk assessment for each supply based on the criteria outlined in Tables 3, 4 and 5 are detailed below.

Table 7: Risk Assessment

Private Water Supply	Sensitivity	Magnitude	Mitigation	Residual Risk
PWS Garvachy Farm	High	Medium	Surface water quality monitoring outlined in WCEMP for all four supplies. Further consultation to be carried out to update assessment.	Minor
PWS Kilmichaelbeg	High	Low		Minor
PWS Nursery Cottages	High	Low		Minor
PWS Tigh Na Coille	High	Low		Minor

Further consultation work and site surveys will be required to determine the source location and type for each property, to update this assessment in relation to potential impacts and potential mitigation required.

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

The desk-based PWSRA identified Garvachy farm, Kilmichaelbeg, Nursery Cottages and Tigh Na Coille as potentially sensitive drinking water receptors within 2 km of the Project.

Industry good practice measures will be implemented at the Project 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) (**Annex N**) for the Project following verification of the supply locations.

5 SUMMARY

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

The PWSRA concludes that the PWS at Garvachy Farm is potentially hydrologically connected to the Project due to the location from the Project, topography and hydrological features which provides a pathway from the Project to the PWS.

This PWSRA concludes that the PWS at Kilmichaelbeg, Nursery Cottages and Tigh Na Coille are potentially hydrologically connected to the access tracks requiring upgrade for this Project.

On this basis, this PWSRA concludes that there is potential for four supplies to be hydrologically connected to the development, and therefore there will be potential effects from the Development to the PWS water quality, quantity or continuity, on the basis of a potential pathway in the 'source-pathway-receptor' model. Mitigation outlined within the WCEMP (**Annex N**) including good practice measures during construction and the provision of a Water Quality Monitoring Plan to be agreed with stakeholders prior to construction.