CALEDONIA
Offshore Wind Farm

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Volume 5 Proposed Development (Onshore)

Chapter 6 Hydrology and Hydrogeology

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Acronyms and Abbreviations

AEP	Annual Exceedance Probability
BGS	British Geological Society
CAR	Controlled Activities Regulations
CEMP	Construction Environmental Management Plan
CIRIA	Construction Industry Research and Information Association
CIEA	Cumulative Effects Impact Assessment
CO_2	Carbon Dioxide
DMRB	Design Manual for Roads and Bridges
DWPA	Drinking Water Protected Area
EIAR	Environmental Impact Assessment Report
EMP	Environmental Management Plan
EQS	Environmental Quality Standard
EU	European Union
FRA	Flood Risk Assessment
FRCP	Flood Risk and Coastal Protection
FRMP	Flood Risk Management Plan
GDWPA	Ground Drinking Water Protected Area
GIS	Geospatial Information System
GPP	Guidance for Pollution Prevention
GWDTE	Ground Water Dependent Terrestrial Ecosystem
LDP	Local Development Plan
LPD	Local Plan District

MLWS	Mean Low-Water Springs
NGR	National Grid Reference
NIEA	Northern Ireland Environment Agency
NPF4	National Planning Framework 4
NRW	Natural Resources Wales
NVC	National Vegetation Classification
ONEC	Onshore Export Cable Corridor
OnTI	Onshore Transmission Infrastructure
OS	Ordnance Survey
PAN	Planning Advice Notes
DE	Design Envelope
PWS	Private Water Supply(ies)
RBMP	River Basin Management Plans
RLB	Red Line Boundary
SAC	Special Area of Conservation
SEPA	Scottish Environmental Protection Agency
SNH	Scottish Natural Heritage
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
SUDS	Sustainable Drainage System
UKCP18	UK Climate Projections 2018
WFD	Water Framework Directive

Executive summary

This chapter of the Onshore Environmental Impact Assessment Report (EIAR) assesses the potential effects from the Proposed Development (Onshore) on hydrology and hydrogeology. This includes the direct, indirect, cumulative and in-combination effects.

The onshore receptors most sensitive to hydrology and hydrogeology impacts include surface watercourses and waterbodies, groundwater bodies that underlie the study area, potable water supplies that directly depend on water resources, and other waterbodies or water dependent features, such as Groundwater-Dependent Terrestrial Ecosystem (GWDTE) areas. Examples of sensitive receptors throughout the study area include springs, wells and Private Water Supplies (PWS); the Inverboyndie designated bathing water catchment; surface and groundwater Drinking Water Protected Areas (DWPAs), and Water Framework Directive (WFD) classified watercourses such as the River Deveron.

For the construction phase of the Proposed Development (Onshore) potential impacts include changes to surface water and groundwater quality due to an increased chance of pollution, increased sediment mobilisation and an alteration of drainage patterns. Construction may also cause changes to surface water and groundwater quantity and hydromorphology characteristics due to changes in water catchment dynamics and pathways. These have the ability to impact sensitive receptors in the study area.

For the operational phase of the Proposed Development (Onshore), potential impacts include increased flood risk (pluvial and fluvial) to people and property due to an increase in hardstanding areas associated with the Onshore Substations. Operational impacts to surface water and groundwater quantity may occur due to permanent changes in water catchments and pathways and the introduction of a barriers to natural overland flow. Permanent changes to watercourses to facilitate the Onshore Export Cable Corridor (ONEC) or any upgrades to watercourse crossings may result in permanent impacts on hydromorphological quality of the water features within the study area.

The impacts associated with decommissioning of the Proposed Development (Onshore) are assumed to be equal to or lesser than those identified for the construction stage.

The assessment of potential effects has taken into account embedded mitigation, including the measures included in the Outline Construction Environmental Management Plan (CEMP). These include pollution prevention mitigation and surface water management plans (including temporary cutoff drains or bunds to be placed upslope side of the working area to minimise water runoff interacting with exposed soil and reroute surface water away from the construction area), a suitable floodplain compensation strategy for works impacting the floodplain, avoidance of placement of construction compounds and stockpiles in flood zones and the use of trenchless techniques, such as Horizontal Directional Drilling (HDD), for all WFD and salmonid watercourses.

Following the assessment, no significant effects on any hydrological or hydrogeological receptors are predicted. As such, no secondary mitigation measures are considered to be required.

Overall, no significant residual effects to identified receptors are predicted, either for the Proposed Development (Onshore) alone or cumulatively with other plans or developments.

6 Hydrology and Hydrogeology

6.1 Introduction

6.1.1.1 This chapter of the Onshore Environmental Impact Assessment Report (EIAR) identifies sensitive water environment receptors and potential impacts associated with the construction, operation and decommissioning of the of the Proposed Development (Onshore).

6.1.1.2 Specifically, this chapter considers the potential impacts landward of Mean Low-Water Springs (MLWS) of the Onshore Transmission Infrastructure (OnTI) and assesses the potential for likely significant effects on water environment receptors.

6.1.1.3 For the purposes of this chapter, the water environment is considered to comprise:

- Surface water features within the study area;
- Groundwater contained within aquifer units that underlie the study area;
- Other water bodies or water dependent features, such as Ground Water Dependent Terrestrial Ecosystem's (GWDTE's) that may potentially be affected; and
- The aspects of potable water supply that directly depend on water resources (for example, private wells).

6.1.1.4 This chapter is supported by the following Technical Appendices:

- Volume 7E, Appendix 6-1: Assessment of Value;
- Volume 7E, Appendix 6-2: Groundwater-Dependent Terrestrial Ecosystem Assessment;
- Volume 7E, Appendix 6-3: Private Water Supply Assessment;
- Volume 7E, Appendix 6-4: Watercourse Crossing Inventory;
- Volume 7E, Appendix 6-5: Consultation Summary;
- Volume 7E, Appendix 6-6: Hydrology and Hydrogeology Figures: and
- Application Document 6: Outline Drainage Impact Assessment.

6.1.1.5 Associated effects on terrestrial ecology and ornithology are considered in Volume 5, Chapter 3: Terrestrial Ecology and Biodiversity, and effects on ground conditions and water quality arising from existing land contamination are considered in Volume 5, Chapter 7: Geology, Soils and Contaminated Land.

6.2 Legislation, Policy and Guidance

6.2.1 Legislative and Regulatory Context

6.2.1.1 Volume 1, Chapter 2: Legislation and Policy of this EIAR sets out the policy and legislation associated with the Proposed Development.

6.2.1.2 Legislation and policy that relate to the water environment assessment are identified and described in Table 6-1.

Table 6-1: Legislation and policy

Relevant Legislation and Policy	Description
Water Environment and Water Services (Scotland) Act (WEWS Act) 2003) (Scottish Parliament, 2003a[1]) (transposes 2000/60/EC Water Framework Directive (WFD) (European Union, 2000[2]).	Aims to provide an integrated framework for the protection and restoration of the water environment through the delivery of actions set out in River Basin Management Plans.
The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended) (Scottish Parliament, 2011a[3]).	Controls engineering works in the vicinity of inland surface waters as well as point source discharges, abstractions, and impoundments, supporting implementation of the WFD (2006/60/EC).
The Flood Risk Management (Scotland) Act 2009 (Scottish Parliament, 2009a[4])	Sets out the requirement of the lead local authority for each Local Plan District to publish a Local Flood Risk Management Plan[i] (FRMP), allowing for coordination and cooperation between organisations like Scottish Environmental Protection Agency (SEPA), Scottish Water, and the local authorities.
The Reservoirs (Scotland) Act 2011 (Scottish Parliament, 2011b[5])	Ensures increased protection to the public from the risk of flooding from reservoirs, while also ensuring that reservoir owners are fairly treated through a proportionate system.

[i] The North East FRMP covers the Proposed Development (Onshore).

Relevant Legislation and Policy	Description
The Environmental Liability (Scotland) Regulations 2009 (Scottish Parliament, 2009b[6]) (transposes the EU Environmental Liability Directive (2004/35/EC))	The Environmental Liability Directive is based on the 'polluter pays' principles and requires EU member states to impose obligations and liabilities on operators whose activities cause or threaten environmental damage. Environmental damage specifically includes land contamination where there is a significant risk of adverse effects to human health. Operators are required to take preventative, as well as remedial measures.
The Private Water Supplies (Scotland) Regulations 2006 (Scottish Parliament, 2006[7])	Aims to maintain the provision of clean drinking water from private sources.
The Water Intended for Human consumption (Private Supplies) (Scotland) Regulations 2017 (Scottish Parliament, 2017[8])	Aims to maintain the provision of clean drinking water from private sources for supplies which provide water to less than 50 persons or less than $10m^3$ a day. The Regulations transpose the Drinking Water Directive exemption (for supplies which provide water to less than 50 persons or less than $10m^3$ a day) and replace The Private Water Supplies (Scotland) Regulations 2006 with respect to Type A supplies.
The Nature Conservation (Scotland) Act 2004 (Scottish Parliament, 2004[9])	Covers the protection of wildlife and the conservation and enhancement of natural features. It provides for the designation of Sites of Special Scientific Interest (SSSIs), including those applied to geological or geophysical features. There have been some changes to the 2004 Act through The Wildlife and Natural Environment (Scotland) Act 2011.
The Land Reform (Scotland) Act 2003 (Scottish Parliament, 2003b[10])	Empowers local authorities to make byelaws for the conservation or enhancement of natural or cultural heritage, which includes geological and physiographical features.

Relevant Legislation and Policy	Description
National Planning Framework 4 (NPF4) (Scottish Government, 2023[11]).	Forms a part of the terrestrial planning framework. The NPF4 sets out national planning policy requirements. Specific policies for hydrology and hydrogeology include: ▪ NPF4 Policy 22: intends to strengthen resilience to flood risk by promoting avoidance as a first principle and reducing the vulnerability of existing and future development to flooding.
Aberdeenshire Local Development Plan (LDP) 2023 (Aberdeenshire Council, 2023[12]).	At the local level, the Aberdeenshire Local Development Plan (LDP) contains policies of relevance to the water environment assessment. Specific policies related to hydrology and hydrogeology include: ▪ Policy PR1 Protecting Important Resources; ▪ Policy C4 Flooding; and ▪ Policy RD1 Providing suitable services.
Groundwater Protection Policy (SEPA, 2009[16])	Aims to provide a sustainable future for Scotland's groundwater resources by protecting legitimate uses of groundwater and providing a common SEPA framework to protect groundwater quality by minimising the risks posed by point and diffuse sources of pollution and maintain the groundwater resource by authorising abstractions and by influencing developments, which could affect groundwater quantity.

6.2.2 Guidance

6.2.2.1 The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended): A Practical Guide (SEPA, 2024[13]), sets out practical advice on Controlled Activities Regulations (CAR) and which activities are regulated by SEPA.

6.2.2.2 A number of SEPA position statements, guidance notes, and best practice guidance are relevant to this assessment:

- Engineering in the water environment: good practice guide - river crossings (SEPA and Natural Scotland, 2010[14]);
- Culverting of Watercourses (SEPA, 2015[15]);
- Groundwater Protection Policy for Scotland (Natural Scotland, 2009[16]);
- Engineering in the Water Environment Good Practice Guide, Temporary Construction Methods (SEPA, 2009[17]);
- Environmental Quality Standards and Standards for Discharges to Surface Waters (SEPA, 2020a[18]);
- SEPA Guidance Note 31: Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems (SEPA, 2017a[19]); and
- SEPA Flood Risk and Land Use Vulnerability Guidance (SEPA, 2024[20]).

6.2.2.3 Due reference has been made to the SEPA guidance for preventing pollution (SEPA and Northern Ireland Environment Agency (NIEA), 2023[21]), working on or near water (SEPA, Natural Resources Wales (NRW) and NIEA, 2018[22]), and for managing pollution incidents (SEPA, NRW and NIEA, 2021[23]).

6.2.2.4 Construction Industry Research and Information Association (CIRIA) guidance used for the assessment includes:

- Control of Water Pollution from Construction Sites – Guide to Good Practice (SP156) (Murname, E. *et al.*, 2002[24]);
- Control of Water Pollution from Construction Sites – Guidance for Consultants and Contractors (C532) (Masters-Williams, H. *et al.,* 2001[25]);
- Control of Water Pollution from Linear Construction Projects – Technical Guidance (C648) (Heap, A. Murname, E. and Swain, A., 2006[26]);
- Control of Water Pollution from Linear Construction Projects – Site guide (C649) (Heap, A. Murname, E. Swain, and A., 2006b[27]);
- Environmental good practice on site (C692) (Audus, I. Charles, P. and Evans, S., 2010[28]);
- Groundwater control: design and practice (second edition) (C750) (Preene, M. Roberts, T.O.L. Powrie, W., 2016[29]);
- The SuDS Manual (C753) (Woods Ballard, B. *et al.*, 2015[30]); and
- Guidance on the construction of SuDS (C768) (Illman, S. and Wilson, S., 2017[31]).

6.2.2.5 There are a number of Planning Advice Notes (PANs) published by the Scottish Government that have been considered throughout this assessment:

- PAN 51: Planning, Environmental Protection and Regulation (Scottish Executive Development Department, 2006[32]);

- PAN 1/2013: Environmental Impact Assessment (Scottish Government, 2013[33]);
- PAN 61: Planning and Sustainable Urban Drainage Systems (Scottish Government, 2001[34]);
- Flood Risk: Planning Advice (Scottish Government, 2015[35]); and
- PAN 79: Water and Drainage (Scottish Government, 2006[36]).

6.3 Stakeholder Engagement

6.3.1 Overview

6.3.1.1 The Scoping Report was submitted to Aberdeenshire Council in December 2022 who then circulated the report to relevant consultees. A Scoping Opinion was received from Aberdeenshire Council on 1 February 2023. Relevant comments from the Scoping Opinion specific to the water environment are provided in Volume 7E, Appendix 6-5: Consultation Summary.

6.3.1.2 Volume 7E, Appendix 6-5: Consultation Summary also provides detail on additional consultation undertaken with SEPA and Aberdeenshire Council and additional feedback received.

6.4 Baseline Characterisation

6.4.1 Study Area

6.4.1.1 The study area includes surface water and groundwater features within a 1km radius of the OnTI RLB (presented on Figure 6-1 within Volume 7E, Appendix 6-6: Hydrology and Hydrogeology Figures) and is based on the 'source-pathway-receptor' pollutant linkage principle. This 1km study area is extended to 3km for the PWS desk-based review. The assessment of GWDTE reflects the Phase 1 habitat survey study area, 250m from the OnTI RLB as detailed in Volume 5, Chapter 3: Terrestrial Ecology and Biodiversity.

6.4.1.2 For direct effects on surface water, the study area includes the geographical extent of the OnTI RLB and all surface water features, including watercourses, surface water abstractions and flood zones within 1km, where features may have hydrological connectivity to the Proposed Development (Onshore).

6.4.1.3 For groundwater, the study area includes the geographical extent of the OnTI RLB and all groundwater features which include underlying aquifers, source protection zones, springs, groundwater abstractions and GWDTEs

within 1km where features have hydrological connectivity to the Proposed Development (Onshore).

6.4.1.4 For flood risk, the study area includes all watercourses that will potentially be crossed by the OnTI, and watercourses receiving run-off from the Onshore Substations via its drainage design, as well as the Onshore Substation Site itself.

6.4.2 Data Sources

6.4.2.1 The baseline describes the existing condition of surface waters, groundwater and flood risk within the study area. The value of each water feature identified has been determined based on the attributes and indicators of quality listed in Table 6-9 and is detailed in Volume 7E, Appendix 6-1: Assessment of Value. Further details in regards the methodology are outlined in Section 6.5.

Desk Study

6.4.2.2 The following data sources were used to compile the baseline conditions:

- Observations from site walkover surveys;
- Ordnance Survey (OS) mapping;
- SEPA Water Environment Hub (SEPA, 2021[37]);
- SEPA Water Classification Hub (SEPA, 2020[38]);
- SEPA Future Flood Maps (SEPA, 2023c[39]);
- The River Basin Management Plan for Scotland 2021 - 2027[40];
- SEPA Flood Maps (SEPA, 2020[41]);
- British Geological Society (BGS) Mapping;
- Centre of Ecology and Hydrology National River Flow Archive;
- Scotland's Environment Map (Scottish Government, 2022[42]);
- SEPA Data publication (SEPA, 2023b[43]);
- Volume 7E, Appendix 7-2: Peat Survey Reports; and
- Aberdeenshire Council PWS database.

6.4.2.3 The key receptors and constraints are presented on the figures associated with this chapter (contained within Volume 7E, Appendix 6-6: Hydrology and Hydrogeology Figures and Volume 7E, Appendix 6-3, Annex 1: Private Water Supply Figures (Confidential)):

- Figure 6-1: Surface Water Features;
- Figure 6-2: Groundwater Features;
- Figure 6-3: Potential Ground Water Dependent Terrestrial Ecosystems (GWDTEs);

- Figure 6-4: Fluvial and Coastal Flood Risk;
- Figure 6-5: Pluvial Flood Risk; and
- Figure 6-6: Private Water Supplies (Confidential) (in Volume 7E, Appendix 6-3, Annex 1: Private Water Supply Figures (Confidential)).

Site Specific Surveys

Site Walkover Survey

6.4.2.4 Site walkover surveys to identify and classify features relevant to the assessment within the OnTI RLB were undertaken between 30 October 2023 and 2 November 2023. The visits focused on supplementing the knowledge gained from desk-based sources for surface water, groundwater, and flood risk receptors to gain a good overall understanding of the hydrological and hydrogeological regime within the OnTI RLB. Due to land access constraints, the wider study area was not included in the site walkover survey.

6.4.2.5 The weather conditions for the week of surveying were predominately overcast and windy, with moments of passing sunshine, clouds, and scattered showers. The wind speeds recorded during the week ranged between 3 and 16mph, with the average temperature sitting at approximately 7 degrees Celsius. The heaviest rainfall was experienced on the third day of the survey (1 November 2023).

6.4.2.6 In the two weeks leading up to the site survey, the area experienced substantial precipitation. This was predominantly due to the area being impacted by Storm Babet (19– 21 October 2023). Regions adjacent to the study area received amber and red weather alerts due to strong winds and heavy rainfall. Most of the watercourses surveyed had elevated water levels as a consequence of this.

6.4.2.7 Data was collected on mobile phones in the field with georeferenced data points and photographs inputted to the project Geospatial Information System (GIS) database. Data collected included the type of watercourse, approximate width and depth dimensions, velocity of the current, any existing flora, composition of the bedding, state of the banks, and the volume of water present.

Watercourse Crossing Inventory

6.4.2.8 Surveys within the OnTI RLB were completed to supplement the desk based available information. Surveys were focused on watercourses and surface water-groundwater interactions within the OnTI RLB. A site walkover survey for the water environment was carried out from 30 October – 2 November 2023, in part to identify existing and potential new crossing locations. Potential locations of new crossings were visited during the site walkover, as well as all watercourses that can be seen on OS 1:50,000 mapping. Characterisation of the watercourse was recorded (such

as the bed width, channel depth, bed substrate and bankside vegetation) and photographs were taken. A total of 39 potential crossings were identified from desk-based maps and features identified in the field.

6.4.2.9 The watercourse crossing inventory is presented in Volume 7E, Appendix 6-4.

6.4.3 Baseline Description

Designated sites

6.4.3.1 Within the study area, there are no internationally important designated sites that have hydrological or hydrogeological qualifying features.

6.4.3.2 The study area is within the Aberdeenshire, Banff, Buchan and Moray Nitrate Vulnerable Zone.

6.4.3.3 Inverboyndie Bathing Water Designated Area is outwith the study area, however it is hydrologically connected. The bathing water catchment intersects with the OnTI RLB and the study area and is hydrologically connected.

6.4.3.4 Drinking Water Protected Areas (DWPA) are designated under the WFD and are where raw water is abstracted from rivers, reservoirs and groundwater. The designation serves to target action to address pollution so that extra treatment of raw water can be avoided. The study area contains a DWPA (Surface Water) associated with the River Deveron - Turriff - tidal limit and Idoch Water waterbodies. The study area is located entirely within a Groundwater Drinking Water Protected Area (GDWPA).

6.4.3.5 There are no shellfish protected waters within the study area.

Surface water

WFD catchments

6.4.3.6 The study area is within the North East WFD basin district. A number of large river and coastal waterbodies are located in the study area, including Banff Coastal in the north, River Deveron in central study area, and the south of the study area contains the River Ythan and River Deveron catchments.

6.4.3.7 There are eight surface river waterbody catchments within the study area that have been assigned a WFD classification, which, along with their tributaries, are considered to be potential surface water receptors within the study area. WFD surface waterbodies are detailed in Table 6-2, and presented on Figure 6-1 within Volume 7E, Appendix 6-6: Hydrology and Hydrogeology Figures.

Table 6-2: WFD classified surface waterbodies within the study area

WFD Waterbody Name (Code)	Location	2020 Overall WFD Status[ii]
Boyndie Burn (UKSC023055)	Located in the north of the study area, east of Boyndie, and flows northward.	Moderate ecological potential (heavily modified waterbody)
Burn of Brydock (UKSC023156)	Located in the north of the study area. Flows east to the north of Fattahead.	Good
River Deveron – Turriff - tidal limit (UKSC023155)	Located in the northern central area of the study area, from Turriff to Banff. Flows north.	Good
Burn of King Edward (UKSC023160)	Located in the north-east of the study area and flows west. It is made up of a number of tributaries.	Moderate ecological potential (heavily modified waterbody)
Idoch Water (UKSC023161)	Located in the south of the study area. Idoch Water has a number of tributaries that flow west through New Byth, Crossfields, and Hatton Castle.	Moderate ecological potential (heavily modified waterbody)
River Ythan – Upper catchment above Fyvie (UKSC023233)	Located in south-west of the study area. River Ythan has a number of tributaries that flow through Kirktown of Auchterless, Inverythan, and Tifty.	Moderate ecological potential (heavily modified waterbody)
Burn of Stonehouse (UKSC023236)	Located in the south of the study area and flows south through Millbrex and Gight.	Good ecological potential (heavily modified waterbody)
Little Water / Black Burn (UKSC023237)	Located in the east of the south of the study area and flows south through Balthangie to Ardo.	Moderate ecological potential (heavily modified waterbody)

[ii] 2020 is the most recent classification year that has been published.

Watercourses

6.4.3.8 There are 25 named watercourses located in the study area which are presented in Table 6-3, and presented on Figure 6-1 within Volume 7E, Appendix 6-6: Hydrology and Hydrogeology Figures.

Table 6-3: Named watercourses within the study area

Watercourse Name	Location
Burn of Asleid	Located in the south of the study area, adjacent to the Onshore Substation Site. Flows north-west to south-east.
Burn of Auchenbadie	Located in the north / central study area, north-east of King Edward. Flows east to west into the River Deveron.
Burn of Bachlaw	Located in the northeast of the study area, between Mid Culbeuchly and Alvah. Flows north-east to south-east.
Burn of Balquholly	Located in the south of the study area, south-east of Howe of Teuchar. Flows northward until it joins the Burn of Turriff.
Burn of Boyndie	Located in the north / central study area, east of Boyndie, and flows northwards.
Burn of Brydock	Located in north in the central study area. Flows east to the north of Fattahead.
Burn of Burnside	Located in the south / central study area, north-east of Turriff. Flows north to south.
Burn of Greens	Located in the south of the study area, west of New Deer. Flows north to south.
Burn of Kiminity	Located in the south / central study area, north-east of Turriff. Flows north to south.
Burn of Kinbate	Located in the centre of the study area, north of Turriff. Flows east to west.
Burn of King Edward	Located in the north / central study area. Flows from east to west, falling into the River Deveron about 4 miles from Banff.
Burn of Kinminty	Located in the north central study area. Flows south until it enters the Mill Dam of Burnside, after which it assumes the name of Burn of Burnside.
Burn of Monquhitter	Located in the south of the study area, east of Turriff. Flows north-east to south-west.
Burn of Muiryfold	Located in the centre of the study area, slightly north-east of Turriff. Flows in a south westerly direction.

Watercourse Name	Location
Burn of Stonehouse	Located in south of the study area and flows south through Millbrex and Gight.
Craigston Burn	Located in the north / central study area, south of Banff. Flows north-west to south-east.
Crossfields Stripe	Located in the centre of the study area, north of Turriff. Flows east to west into the Burn of King Edward.
Glen Burn	Located in the centre of the study area, adjacent to the A947, north of Turriff. Flows in a westerly direction until it joins the Burn of Kinbate.
Idoch Water	Located in the south / central study area, south-east of Turriff. Flows in a north westerly direction into the Idoch Water.
Lenshie Burn	Located in the south / central study area, east to south-east of Turriff. Flows in a westerly direction.
Little Water	Located in the centre of the study area, south of Banff. Flows in a south westerly direction.
River Deveron	Located in east of the study area and flows south from Balthangie to Ardo in the south of the study area.
Theif's Pot	Located in the northern central area of the study area from Turriff to Banff and flows north.
Tifty Burn	Located in the centre of the study area, south of Banff. Flows in a southerly direction.
Whitehill Pot	Located in the south of the study area, south-east of Turriff. Flows in a westerly direction, falling into the River Ythan about half a mile north of Fyvie Castle.

6.4.3.9 In addition to the watercourses detailed in Table 6-3, there are artificial agricultural and forestry drainage features, ponds, dams, and small tributaries throughout the study area. These sub-features, where present on 1:25,000 scale OS mapping have been given a standard naming convention and are presented in Volume 7E, Appendix 6-1: Assessment of Value and shown on Figure 6-1 within Volume 7E, Appendix 6-6: Hydrology and Hydrogeology Figures.

Surface water catchments

6.4.3.10 There are three main catchments within the study area, Banff Coastal in the north, River Deveron across the majority of the study area, and River Ythan in the south.

Banff Coastal

6.4.3.11 The Banff Costal waterbody is a waterbody located in the very north of the study area, largely populated by small watercourses that do not drain into larger catchments and instead flow directly into the coastal waters. Within the study area key pressures on this catchment's watercourses include modifications to bed and banks, such as reprofiling and straightening, as a result of urban and rural land uses which have contributed to the downgrading of physical condition.

River Deveron

6.4.3.12 The Deveron catchment (SEPA, 2008[44]) is affected by a range of pressures, with alterations to beds and banks, diffuse source pollution and pressures from abstraction contributing to downgrading of ecological status. The alterations to beds and banks relate largely to agriculture, but some issues with forestry, urban development and road culverting have also been noted. Similarly, while much of the diffuse pollution is linked to agriculture, some forestry and sewage pollution also contribute. A smaller number of water bodies are affected by point source pollution from sewage treatment and other discharges. The abstraction pressures in the Deveron catchment are largely linked to whisky production or drinking water supply.

6.4.3.13 The River Deveron is an important fishery for salmon, sea trout, and brown trout, which is conserved and maintained through a Fisheries Management Plan (The Deveron, Bogie and Isla Rivers Charitable Trust, 2020[45]). The catchment has also been selected by the Atlantic Salmon Trust as a catchment-scale salmon restoration project (Atlantic Salmon Trust, 2024[46]).

6.4.3.14 The Deveron catchment has been categorised as a priority catchment for diffuse pollution and is being managed under the Rural Diffuse Pollution Plan for Scotland (SEPA, 2017b[47]).

River Ythan

6.4.3.15 The River Ythan catchment is located in the southern section of the study area. The upper areas of this catchment, within the study area, are noted to have been subject to modifications to bed and banks as a result of urban and rural land uses and to diffuse pollution from rural sources (such as agriculture) which have contributed to the downgrading of physical condition and water quality condition respectively. Diffuse pollution has resulted in large quantities of nutrients accumulated within the water environment and land which have limited natural conditions for aquatic plants and animals, and can also impact groundwater.

Salmonid watercourses

6.4.3.16 Aquatic ecology surveys have been completed for the OnTI RLB to determine which watercourses have the potential to support salmonid species. Watercourses that are Salmonid Rivers have been determined through the following sources:

- Fisheries Survey Data[48], including information on river flows, vegetation diversity and spawning habitat; and
- NatureScot - Maps Marine Scotland[49].

6.4.3.17 Watercourses identified directly on the NatureScot Maps, were concluded to be 'confirmed' Salmonid Rivers. Watercourses that were directly adjacent to the Salmonid Rivers, where no obstruction to flow occurred, as well as where detail in the Fisheries Survey Data included potential salmon habitat features, were concluded to be probable Salmonid Rivers. This probable conclusion was made as it could not be excluded that salmon may use these watercourses. Further details of the survey methodology and results are presented in Volume 5, Chapter 3: Terrestrial Ecology and Biodiversity.

6.4.3.18 The identified 'salmonid rivers' within the study area are:

- Boyndie Burn (confirmed);
- Burn of Monquitter (confirmed);
- River Deveron (confirmed);
- Unnamed Tributary of River Deveron 5 (probable); and
- Burn of Balquholly (probable).

6.4.3.19 These watercourses are shown on Figure 6-1 within Volume 7E, Appendix 6-6: Hydrology and Hydrogeology Figures.

Reservoirs and lochs

6.4.3.20 There are no lochs designated under WFD within the study area.

6.4.3.21 There is one reservoir within the study area, Brackens (RES/R/1128471), which is a covered reservoir and is located outside the OnTI RLB, east of Turriff.

Coastal waters

6.4.3.22 The north of the study area interacts with the intertidal coastal zone of the North Sea, landward of MLWS. This incorporates the coastal WFD waterbodies of Findochty to Knock Head (UKSC200497) and Banff and MacDuff (UKSC200498) which were associated with Good overall WFD status in 2019.

Groundwater

Bedrock geology

6.4.3.23 BGS mapping shows that the study area is underlain by a wide variety of bedrock types, including the following prominent groups:

- Psammite;
- Pelite;
- Metamicrogabbro;

- Amphiboilite;
- Metagabbro;
- Semipelite;
- Conglomerate;
- Sandstone;
- Mudstone; and
- Siltstone.

6.4.3.24 These are presented in Figure 7-3 within Volume 7E, Appendix 7-3: Geology, Soils and Contaminated Land Figures, and discussed in greater detail in Volume 5, Chapter 7: Geology, Soils and Contaminated Land.

Superficial deposits

6.4.3.25 The bedrock is overlain by superficial deposits comprising predominantly of Devensian – Diamicton Till, with occasional areas of glaciofluvial deposits containing gravel, sand, and silt, as well as alluvium deposits composed of silt, clay, sand, and gravel. The glaciofluvial and alluvium deposits are typically found in higher concentrations near bodies of water and floodplains.

6.4.3.26 Additionally, some small pockets of peat are located in the south of the study area. Further details on peat within the OnTi RLB are presented in Volume 7E, Appendix 7-2: Peat Survey Reports.

6.4.3.27 These are presented in Figure 7-2 within Volume 7E, Appendix 7-3: Geology, Soils and Contaminated Land Figures.

6.4.3.28 Further detail is outlined in Volume 5, Chapter 7: Geology, Soils and Contaminated Land.

Aquifers

6.4.3.29 The majority of the study area is underlain by low productivity aquifers (BSG, 2023[50]). The central area of the study area has a section of moderate productivity aquifers, which is related to the Middle and Lower Old Red Sandstone, which are presented on Figure 7-3 within Volume 7E, Appendix 7-3: Geology, Soils and Contaminated Land Figures.

WFD groundwater bodies

6.4.3.30 The study area contains a number of WFD groundwater bodies, which are detailed in Table 6-4.

Table 6-4: WFD groundwater bodies within the study area

Waterbody Name (code)	Location	Current Overall WFD Status[iii]
Banff (150632)	Located in the west of the study area.	Good
Banff Coastal (150753)	Located in the north of the study area.	Good
Huntly (150671)	Located in the north and central sections of the study area.	Good
Turriff (150600)	Located in the south and central sections of the study area.	Good
Mintlaw (150655)	Located in the east of the study area.	Good
Ellon (150676)	Located in the south of the study area.	Poor[iv]
New Byth (150454)	Located in the south of the study area.	Good
Fyvie Castle (150483)	Located in the south of the study area.	Good

Springs and wells

6.4.3.31 1:25,000 scale OS mapping indicates that there are 87 wells within the study area, of which six are within the OnTI RLB, and 23 springs, of which five are within the OnTI RLB. Further details are provided in Volume 7E, Appendix 6-1: Assessment of Value and locations are presented in Figure 6-2 within Volume 7E, Appendix 6-6: Hydrology and Hydrogeology Figures.

GWDTEs

6.4.3.32 National Vegetation Classification (NVC) surveys, as detailed in Volume 5, Chapter 3: Terrestrial Ecology and Biodiversity, were completed where Phase 1 surveys identified sensitive habitats. The surveys recorded presence of M20 *Eriophorum mire* and M23 *Juncus-Galium* rush-pasture in the south of the OnTI RLB, within proximity to the Onshore Substation Site.

6.4.3.33 Community M23 *Juncus-Galium* rush-pasture is predominantly found on wet, moderately acid to neutral peaty and mineral soils, in the lowlands and upland fringes and considered to be high to moderately groundwater dependant[51,19]. Community M20 *Eriophorum* mire is conservatively considered to have low dependence on groundwater[51] as it is a type of blanket mire most commonly found on ombrogenous (dependent on rain

[iii] 2019 is the most recent available data.
[iv] Poor status is associated with the Nitrate Vulnerable Zone in the area, elevated levels of nitrate in the groundwater stemming from diffuse pollution.

for its formation) peat on bogs that have been subjected to disturbance events like fire or grazing.

6.4.3.34 Further details on GWDTE are provided in Volume 7E, Appendix 6-2: Groundwater-Dependent Terrestrial Ecosystem Assessment, Volume 7E, Appendix 7-2: Peat Survey Reports and locations are presented on Figure 6-3 within Volume 7E, Appendix 6-6: Hydrology and Hydrogeology Figures.

Flood risk

6.4.3.35 SEPA Flood Maps (SEPA, 2020) identify areas of flooding and classify the risk of flooding into three categories:

- High likelihood: Each year the area has a 10% chance of flooding;
- Medium likelihood: Each year the area has a 0.5% chance of flooding; and
- Low likelihood: Each year the area has a 0.1% chance of flooding.

6.4.3.36 The following sub-sections provide a high-level summary of flood risk within the study area.

Coastal

6.4.3.37 Coastal flooding is the result of coastal waters inundating dry and low-lying areas which are not usually found to be underwater.

6.4.3.38 The north of the study area, along the north Aberdeenshire coast, is within an area of 'high' likely coastal flood risk area which follows the coastline for most of the study area. The level change between the coastline and the upper cliff is significant, and so it is expected that the coastal flood zones are within the intertidal area and do not impact the higher elevation areas of the study area.

Fluvial flood risk

6.4.3.39 Fluvial flooding, also referred to as river-based flood risk, occurs when the water level in a river, lake, or stream rise and overflows onto neighbouring land.

6.4.3.40 Areas of flood risk from rivers which is of 'medium' and 'high' likelihood within the study area appear to be largely confined to natural watercourses and their floodplains, with the largest extents in the lower catchment areas. Figure 6-4 (see Volume 7E, Appendix 6-6: Hydrology and Hydrogeology Figures) presents fluvial flood risk within the study area.

6.4.3.41 Flood risk associated with the Burn of Boyndie and Unnamed Tributary of Burn of Boyndie 5 is associated with a floodplain of 260m at its widest point according to SEPA mapping[41]. Within the OnTI RLB this floodplain covers a 100m wide strip of land to the north of the Burn of Boyndie.

6.4.3.42 The Burn of Brydock and Burn of Stonieley have a small floodplain of high and medium risk, that follows the watercourse closely and appears to be

confined to the low elevation areas adjacent to the north of the river channel.

6.4.3.43 The River Deveron has a large area of high and medium flood risk associated with it, creating a floodplain of up to 400m in some reaches. Within the OnTI RLB, the floodplain is approximately between 13m and 280m, centred on the River Deveron. The area of broadleaved woodland plantation between the River Deveron and Unnamed Tributary of the River Deveron 5 is a large area of floodplain as it appears from the flood risk mapping to be a storage area in times of high flows.

6.4.3.44 Within the study area to the north-east of the OnTI RLB, Burn of Edward has a consistent floodplain of high and medium flood risk along its length, and its tributaries such as the Craigston Burn.

6.4.3.45 In the southern portion of the study area, the Burn of Monquhitter has a floodplain of 110m at its widest point within the OnTI RLB which is evenly distributed on either side of the watercourse channel.

6.4.3.46 There is a small area of high and medium flood risk associated with the Burn of Asleid adjacent to the Onshore Substation Site.

6.4.3.47 Outwith the areas associated with the watercourses detailed above, the majority of the OnTI RLB is not within a fluvial flood risk zone.

Pluvial flood risk

6.4.3.48 Pluvial flooding, also referred to as surface water flooding, occurs when extreme weather events create a flood independent of watercourses or waterbodies.

6.4.3.49 Small pockets of 'high' and 'moderate' pluvial flood risk areas are located across the study area, likely to be associated with farm drainage, topographical low points and coinciding with areas associated with fluvial flooding. Figure 6-5 (see Volume 7E, Appendix 6-6: Hydrology and Hydrogeology Figures) presents pluvial flood risk within the study area.

6.4.3.50 Areas with increased risk of surface water flooding are concentrated around Ladysbridge in the north of the study area, the Kind Edward and Fintry area where there are a number of low-lying areas, and pockets in the south of the study area around Corsehill.

Groundwater

6.4.3.51 Groundwater flooding is caused by water rising up from underlying rocks or flowing from springs. Groundwater is generally a contributing factor to flooding rather than the primary source and can be associated with the productivity of an aquifer.

6.4.3.52 Areas likely to be influenced by groundwater flooding are located across the north of the study area following the northern coastline. There are additional localised areas near Turriff and Ardo, associated with Middle Old Red Sandstone deposits.

Reservoir

6.4.3.53 Reservoir inundation risk areas are based on the adverse consequences of an uncontrolled release of water and show the area of land that is likely to be flooded in the event of an uncontrolled release of water from a reservoir.

6.4.3.54 Woodside Reservoir, Turriff, is located outside the study area to the west, however it has the potential to inundate areas around the north of Turriff and following the River Deveron from the reservoir source to Banff in the east of the study area. Areas where the River Deveron is located within the study area are therefore at risk from reservoir flooding.

6.4.3.55 Brackens Reservoir which is a covered reservoir and is located approximately 425m outside the OnTI RLB, within the east of the study area. The associated inundation areas flow west to Turriff and north to Cotburn.

Licensed abstractions

6.4.3.56 SEPA records (SEPA, 2024[52]) confirm there are 10 licenced abstractions within the study area. None are within the OnTI RLB. All of the abstractions are related to agricultural activities and are a mix of fixed intakes and mobile plant. Details of the abstraction records are presented in Table 6-5.

Table 6-5: SEPA licenced abstractions

Authorisation ID	National Grid Reference	Description
CAR/L/1010790	NJ 62463 61677	Gairnieston Farm, Mobile Abs (Point F) from Burn of Boyndie
CAR/L/1009898	NJ 62980 62564	Mill of Laithers, Abs (F) from Burn of Boyndie
CAR/L/1010560	NJ 65392 58805	Gairnieston Farm, Abs (Point A) from Burn of Brydock.
CAR/L/1010200	NJ 69344 58261	Raffanshaugh, Mobile Abs (Point G Auchenbadie) from River Deveron
CAR/L/1010152	NJ 71219 57238	Raffanshaugh, Mobile Abs (Point A) from Burn of King Edward
CAR/L/1010152	NJ 71952 56216	Raffanshaugh, Abs (Point B) from Burn of King Edward
CAR/L/1009943	NJ 74936 54974	Gairnieston Farm, Mobile Abs (Point E) from Craigston Burn
CAR/L/1009776	NJ 75001 53151	Auldtown of Carnousie Farm U/S Mbl Abs (F) from Burn of Kinminty @ Kinminty Cott

Authorisation ID	National Grid Reference	Description
CAR/L/1010795	NJ 79164 46654	Darnabo Farm, Mobile Abs (2) from Burn of Balquholy, Fyvie, Turriff
CAR/L/1010670	NJ 84340 44848	Meikle Blackhills Farm, Mobile Abs from Little Water (Point B)

Private water supplies

6.4.3.57 An initial assessment of the presence of PWS within the 3km study area, using records provided by Aberdeenshire Council found 502 records within the study area. The records provided appear to be the addresses that are served by a PWS and not the source point of the supply. The supply types recorded include boreholes, wells and springs. A number of supply sources are recorded as unknown.

6.4.3.58 Within the risk buffer of 250m of the OnTI RLB, there are 44 PWS receptors. Details of these are reported in Volume 7E, Appendix 6-3: Private Water Supply Assessment and presented on Figure 6-6 within Volume 7E, Appendix 6-3, Annex 1: Private Water Supply Figures (Confidential).

Assessment of value

6.4.3.59 The assessment of value of water environment receptors within the study area is reported in detail within Volume 7E, Appendix 6-1: Assessment of Value.

6.4.4 Future Baseline

6.4.4.1 It is possible that the baseline description outlined in Section 6.4.3 may be subject to modification in the future as a result of any upcoming developments within or proximate to the Proposed Development (Onshore).

6.4.4.2 Volume 7A, Appendix 7-1: Cumulative Impact Assessment Methodology provides details of the reasonably foreseeable project or development that are assumed to be fully built and in use by the time the Proposed Development (Onshore) construction starts from Q3 2027. The following reasonably foreseeable project or development are assumed to make up the future baseline of relevance for the water environment during construction and operation are set out in Table 6-6.

Table 6-6: Developments assumed to make up the future baseline

Planning reference	Description	Part of construction future baseline?	Part of operation future baseline?
APP/2023/1454	Green Volt Offshore Wind Farm, laying of underground cables and erection of substation.	No	Yes
APP/2023/2040	Denhead Solar Farm. Formation of 25MW Solar Farm, Siting of Substation, CCTV, Erection of Security Fencing, Formation of Access and Associated Infrastructure.	Yes	Yes

6.4.4.3 APP/2023/2040 is expected to be complete and operational in advance of the Proposed Development (Onshore) and therefore this reasonably foreseeable project or development has been included as part of the future baseline and considered within this topic assessment. Application APP/2023/1454 is considered within the Cumulative Assessment within Section 6.8.

6.4.4.4 Implementation of reasonably foreseeable project or development APP/2023/2040 may result in additional pressures to surface water and groundwater quality and quantity at a catchment scale during construction and reduce the water environments ability to absorb any change, as the impacts identified in Section 6.5.2 are multiplied within the catchment. During operation APP/2023/2040 and APP/2023/1454 are not expected to influence the future baseline in a significant way, there will be an increase of hardstanding areas associated with the foreseeable developments however their embedded mitigation will comply with best practice standards to manage water discharge to greenfield rates and any development within a floodplain should include suitable flood compensation storage areas in the design.

6.4.4.5 In addition to these developments, climate change may cause changes to the existing baseline, as described in Volume 6, Chapter 3: Climate Change Resilience. Given the potential for changes in precipitation patterns, seasonality, temperature, sea level and extreme weather events, there may be a variety of impacts on the surface water and groundwater receptors within the area, including:

- Sea level: Current climate change predictions show that mean sea level and storm frequency and intensity are expected to rise in the future.

The convergence of these factors would heighten the probability and intensity of coastal flooding, resulting in changes to coastal environments with saltwater infiltrating freshwater aquifers. As a result, the availability of water for uses like human consumption and natural systems may be affected; and,

- Changes in precipitation patterns: Altered precipitation patterns can result in changes to the accessibility of water resources, alongside variations in surface water flow and groundwater recharge. Fluvial and pluvial flooding events may increase in severity and frequency, particularly during winter, although effects could be highly localised.

6.4.4.6 SEPA Future flood maps[39] take into account the potential effects of climate change for a single future climate scenario based on available predictions of river flows and sea levels for the 2080s. The maps have been used to assess future risk to the project from flood risk, and to establish future floodplains of rivers. Across the study area, the mapping indicates that there is a minor increase in flood risk in the future scenario.

6.4.4.7 The WFD Regulations have an objective of achieving 'good' WFD status by 2027 for all WFD waterbodies with a classification. It is assumed that this objective will be achieved, which would increase the water quality for some watercourses within the study area.

6.4.4.8 Climate change also poses a threat to areas of peatland within the study area, detailed in Volume 5, Chapter 7: Geology, Soils and Contaminated Land.

6.4.4.9 It is important to note that the future baseline is a projection with a range of possible conditions, and therefore is subject to uncertainty associated with the available projections. Across the lifetime of the Proposed Development (Onshore), it is considered likely that the future baseline will be broadly comparable to the existing baseline described in Section 6.4.3.

6.4.5 Data Gaps and Limitations

Private water supplies

6.4.5.1 PWS details were provided by Aberdeenshire Council following a data request. Aberdeenshire Council acknowledge that there are data gaps (such as source or locations of supplies) which may result in some inaccuracies in the data provided.

6.4.5.2 Furthermore, for the majority of the PWS identified by Aberdeenshire Council, information given about the type, user, and purpose of the supply was limited. Therefore, the following assumptions have been made:

- The location information provided is assumed to be for the user property itself and not the actual location of the source;

- The PWS have been assumed to supply residents and are therefore of local significance; and
- The source of the PWS have been assumed to be within the same land parcel as the provided recorded grid reference.

6.4.5.3 However, this is not considered to unduly affect the robustness of the assessment presented within this chapter, given that a conservative approach has been undertaken.

6.4.5.4 Further surveys will be required at detailed design to collect further data on PWS and abstractions within areas of potential impact.

GWDTE

6.4.5.5 The identification of GWDTE was reliant on the NVC survey results, and so data limitations associated with those surveys apply. Details of any limitations and assumptions for surveys undertaken are outlined in Volume 5, Chapter 3: Terrestrial Ecology and Biodiversity and Volume 7E, Appendix 7-2: Peat Survey Reports.

6.5 EIA Approach and Methodology

6.5.1 Overview

6.5.1.1 This section outlines the methodology for assessing the likely significant effects on surface water and groundwater receptors from the construction, operation and decommissioning of the Proposed Development (Onshore).

6.5.2 Impacts Scoped in to the Assessment

6.5.2.1 The Onshore Scoping Report was submitted to Aberdeenshire Council in December 2022. The Scoping Report set out the overall approach to assessment and allowed for the refinement of the Proposed Development (Onshore) over the course of the assessment. The proposed scope of the assessment is set out in Table 6-7.

Table 6-7: Hydrology and hydrogeology scope of assessment

Potential Impact	Phase	Nature of Impact
Surface water quantity		
Changes to catchments and pathways may alter existing surface water flows with potential impacts on abstractions and PWS.	Construction, decommissioning, operation	Direct

Potential Impact	Phase	Nature of Impact
Permanent impacts to catchment surface water caused by the introduction of a barrier to natural overland flow.	Operation	Direct
Surface water quality		
Increased pollution entering the watercourses from mobilised suspended solids and spillage of fuels or other harmful substances that may migrate to surface water receptors.	Construction, decommissioning	Direct
Impacts to local land drainage structures, that may alter existing drainage patterns within catchments and provide potential pathways for pollution.	Construction, decommissioning	Direct
Permanent impact to the hydromorphological and ecological quality of water features associated with works within or in close proximity to water features.	Operation	Direct
Hydromorphology		
Impacts to the hydromorphological and ecological quality of watercourses associated with works within or in close proximity to watercourses, including physical change to the watercourses and longer-term changes associated with sediment deposition.	Construction, decommissioning	Direct
Flood risk		
Risk of flooding to the Proposed Development (Onshore) due to placement within a flood risk zone.	Construction, decommissioning, operation	Direct
Increased flood risk to people, land and property elsewhere caused by an	Operation	Direct

Potential Impact	Phase	Nature of Impact
increase in hardstanding and modification on landscape and increased number of watercourse crossings.		
Groundwater levels, flows and quality		
Impacts on local groundwater and groundwater resources. Changes to groundwater levels, flows and quality arising from construction activities primarily dewatering earthworks and intrusive investigation works creating new flow paths for groundwater.	Construction, decommissioning	Direct
Permanent impacts to catchment groundwater flows caused by the introduction of a barrier to natural overland flow.	Operation	Direct
GWDTE		
Permanent changes in groundwater spring flows availability for GWDTEs due to dewatering effects.	Operation	Direct
Direct loss to GWDTEs	Operation	Direct

6.5.3 Impacts Scoped out of the Assessment

6.5.3.1 During EIA Scoping, there were no impacts scoped out of assessment. Some impacts are only relevant to certain stages of the Proposed Development (Onshore). In the absence of detailed information regarding decommissioning works, and unless otherwise stated, the impacts during the decommissioning of the Proposed Development (Onshore) are considered comparable with, or likely less than, those of the construction stage.

6.5.4 Assessment Methodology

6.5.4.1 The project-wide generic approach to assessment is set out in Volume 1, Chapter 7: EIA Methodology. The assessment methodology for water environment for the EIAR is consistent with that provided in the Scoping Report.

6.5.4.2 A qualitative assessment methodology was used to assess the magnitude of the potential impacts, using guidance from NatureScot (NatureScot, 2013[53]) and the Design Manual for Roads and Bridges (DMRB) LA 113 (DMRB, 2020a[54]) and LA 104 (DMRB, 2020b[55]). The DMRB guidance offers comprehensive and customised methodologies for water environment assessments, which have been utilised to create matrices to inform the assessments. Additionally, the NatureScot guidance has been employed to guide the overall approach and professional judgement cases. The assessment of effects considers environmental impacts of the construction, operation, and decommissioning phases of the Proposed Development (Onshore) as well as the environmental impacts in the absence of the Proposed Development (Onshore).

Assessment of significant effects

6.5.4.3 The methodology for assessing effects uses the following steps:

- Development and definition of a study area (Section 6.4.1);
- Identification of potential receptors within the study area to form baseline conditions, based on the features outlined in Table 6-8, as per Table 3.69 of DMRB LA 113[54];
- Assessment of value of each of these receptors, shown in Table 6-9, as per Table 3.70 of DMRB LA 113[54], reported in Volume 7E, Appendix 6-1: Assessment of Value;
- Assessment of the potential magnitude of any construction, operation, or decommissioning impact on the receptors, shown in Table 6-10, as per Table 3.71 of DMRB LA 13[54]; and,
- Assessment of the overall significance of any effects on receptors due to impacts, shown in Table 6-11, as per Table 3.8.1 of DMRB LA 104[55].

6.5.4.4 The significance of effect is determined by a combination of the identified value of the receptor with the estimated magnitude of the impact, considering embedded and essential mitigation. For the purpose of this assessment, significance of moderate and above is defined as a likely significant effect.

6.5.4.5 Impact magnitude and receptor value are defined within DMRB LA103 (DMRB, 2020c[56]) Table 3.2N and Table 3.4N. They interact to facilitate a judgement of significant of effect, using professional judgement and the matrix set out in Table 6-11.

6.5.4.6 The significance of the potential effects will be defined by considering the value of the receptors and the potential effect of potential impacts that may occur.

Identification of receptors

6.5.4.7 To identify hydrological and hydrogeological receptors within the study area, a desk-based review of potential receptors within the study area (defined in Section 6.4.1) and site walkovers and investigations including a Watercourse Crossing Inventory and PWS Inventory (detailed in Section 6.4.3) were completed. The identification was based on the features outlined in Table 6-8, which is taken from Table 3.69 of DMRB LA 113[54].

Table 6-8: Attributes and indicators of quality for water features

Feature	Attribute	Indicator of quality	Possible measure
Watercourse	Water supply/quality	Amount used for water supply (potable) Amount used for water supply (industrial/ agricultural) Chemical water quality	Location and number of abstraction points Volume abstracted daily WFD chemical status
	Dilution and removal of waste products	Presence of surface water discharges Effluent discharges	Daily volume of discharge (treated/untreated)
	Recreation	Access to river Use of river for recreation	Length of river used for recreation (fishing, water sports) Number of clubs
	Value to economy	Value of use of river	Length of river used for recreation commercially Number of people employed Length of riverbank developed Length of river fished commercially
	Conveyance of flow	Prescence of watercourses	Number and size of watercourses, natural, artificial or heavily modified water body Number of watercourses artificially managed to control flow/levels
	Biodiversity	Biological water quality	Fisheries quality
		Fisheries quality	Fish status, as defined in the WFD
Floodplain	Conveyance of flow	Presence of floodplain Flood flows	Developed area within extent of floodplain affected, as

Feature	Attribute	Indicator of quality	Possible measure
			determined from hydraulic modelling Flood risk Mean annual flood
Groundwater	Water supply/quality	Amount used for water supply Amount used for water supply (industrial/ agricultural)	WFD groundwater quantitative and chemical status Catchment Abstraction Management Strategy (CAMS) status Location and number of abstraction points Volume abstracted daily and use (potable most important) Location and grade of Source Protection Zone
	Soakaway	Presence of soakaways or other discharges to the ground	Location, type and number of discharge points. Daily volume discharged
	Vulnerability	Groundwater vulnerability	Classification of aquifer vulnerability
	Economic value	Extent of use for abstractions	Number of people employed Cost of alternatives
	Conveyance of flow	Presence of groundwater supported watercourses Potential for groundwater flooding Groundwater interception by road structures or drainage	Changes to groundwater recharge, levels or flows Number and size of watercourses fed by baseflow
	Biodiversity	Presence of GWDTE	Changes to groundwater recharge, levels or flows. Status or classification of wetland including GWDTE under WFD
Lakes, ponds and reservoirs	Recreation	Access Use for recreation	Area used for recreation (fishing, water sports) Number of clubs

Feature	Attribute	Indicator of quality	Possible measure
	Water supply/quality	Amount used for water supply (potable) Amount used for water supply (industrial/agricultural) Chemical water quality	Volume abstracted daily WFD chemical status
	Dilution and removal of waste products	Presence of surface water discharges Effluent discharges	Daily volume of discharge (treated/untreated)
	Value to economy	Extent of employment	Number of people employed
	Biodiversity	Biological water quality	WFD ecological status
		Fisheries quality Populations of birds	Fish status, as defined in the 2000/60/EC[2] Assemblages or number of species of UK biodiversity Action plan or birds of conservation concern

Assessment of value

6.5.4.8 The value of each water environment feature within the study area (defined in Section 6.4.1) was determined according to the DMRB criteria set out in Table 3.70 of DMRB LA 113[54], and as shown in Table 6-9.

Table 6-9: Estimating the value of water environment attributes

Value	Criteria	Attribute	
Very High	Nationally significant attribute of high importance	Surface water	Watercourse having a WFD classification shown in a River Basin Management Plans (RBMP) and Q95 (flow exceeded 95% of the time) ≥1.0 m3/s Site protected/designated under UK legislation (Special Area of Conservation, Special Protection Area, SSSI), Ramsar site, salmonid water) /Species protected by UK legislation Ecology and Nature Conservation
		Groundwater	Principal aquifer providing a regionally important resource and/or supporting a site protected under UK legislation Ecology and Nature Conservation Groundwater locally supports GWDTE Source Protection Zone I (inner zone)
		Flood risk	Essential infrastructure or highly vulnerable development
High	Locally significant attribute of high importance	Surface water	Watercourse having a WFD classification shown in a RBMP and Q95 <1.0m3/s Species protected under UK legislation Ecology and Nature Conservation
		Groundwater	Principal aquifer providing locally important resource or supporting a river ecosystem Groundwater supports a GWDTE Licensed abstraction Source Protection Zone II (outer zone)
		Flood risk	More vulnerable development
Medium	Of moderate quality and rarity	Surface water	Watercourses not having a WFD classification shown in a RBMP and Q95 >0.001m3/s
		Groundwater	Aquifer providing water for agricultural or industrial use with limited connection to surface water Source Protection Zone III (total catchment)
		Flood risk	Less vulnerable development
Low	Lower quality	Surface water	Watercourses not having a WFD classification shown in a RBMP and Q95 ≤0.001m3/s
		Groundwater	Unproductive strata

Value	Criteria	Attribute	
		Flood risk	Water compatible development

Magnitude of impact

6.5.4.9 The approach used to assess magnitude of impacts on water environment features considers the change to the receptor. This considers the severity of impact of the Proposed Development (Onshore) together with the vulnerability of the receptor to change.

6.5.4.10 Table 6-10 summarises the potential magnitude of any construction or operation impact on the receptor. Table 3.71 of DMRB LA 113[54] has been adapted to remove specific attributes linked to highways methodologies such as Highways England's Water Risk Assessment Tool and accidental spillage assessments, which are not relevant to the Proposed Development (Onshore).

Table 6-10: Estimating the Magnitude of an Impact on an Attribute

Magnitude	Criteria	Attribute	
Major adverse	Results in loss of attribute and/or quality and integrity of the attribute	Surface water	Loss or extensive change to a fishery Loss of regionally important public water supply Loss or extensive change to a designated nature conservation site Reduction in water body WFD classification
		Groundwater	Loss of, or extensive change to, an aquifer Loss of regionally important water supply Loss of, or extensive change to GWDTE or baseflow contribution to protected surface water bodies Reduction in water body WFD classification Loss or significant damage to major structures through subsidence or similar effects
		Flood risk	Increase in peak flood level (>100mm)
Moderate adverse	Results in effect on integrity of attribute, or	Surface water	Partial loss in productivity of a fishery Degradation of regionally important public water supply or loss of major commercial/industrial/agricultural supplies

Magnitude	Criteria	Attribute	
	loss of part of attribute		Contribution to reduction in water body WFD classification
		Groundwater	Partial loss or change to an aquifer Degradation of regionally important public water supply or loss of significant commercial/industrial/agricultural supplies Partial loss of the integrity of GWDTE Contribution to reduction in water body WFD classification Damage to major structures through subsidence or similar effects or loss of minor structures
		Flood risk	Increase in peak flood level (>50mm)
Minor adverse	Results in some measurable change in attributes, quality or vulnerability	Surface water	Minor effects on water supplies
		Groundwater	Minor effects on an aquifer, GWDTEs, abstractions and structures
		Flood risk	Increase in peak flood level (>10mm)
Negligible	Results in effect on attribute, but of insignificant magnitude to affect the use or integrity	The proposed project is unlikely to affect the integrity of the water environment.	
Minor beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring	Surface water	n/a
		Groundwater	Reduction of groundwater hazards to existing structures Reductions in waterlogging and groundwater flooding
		Flood risk	Creation of flood storage and decrease in peak flood level (>10mm)
Moderate beneficial	Results in moderate improvement of attribute quality	Surface water	Contribution to improvement in water body WFD classification
		Groundwater	Contribution to improvement in water body WFD classification Improvement in water body CAMS (or equivalent) classification

Magnitude	Criteria	Attribute	
			Support to significant improvements in damaged GWDTE
		Flood risk	Creation of flood storage and decrease in peak flood level1 (>50mm)
Major beneficial	Results in major improvement of attribute quality	Surface water	Removal of existing polluting discharge or removing the likelihood of polluting discharges occurring to a watercourse. Improvement in water body WFD classification
		Groundwater	Removal of existing polluting discharge to an aquifer or removing the likelihood of polluting discharges occurring Recharge of an aquifer. Improvement in water body WFD classification
		Flood risk	Creation of flood storage and decrease in peak flood level (>100mm)
No change			No loss or alteration of characteristics, features, or elements; no observable impact in either direction.

Significance of effect

6.5.4.11 By combining the magnitude of impact and the value of each water environment feature, an assessment has been made of the significance of effect. The possibility and extent of successful mitigation is then considered, and the residual effect reported. The resultant effects may be either negative (adverse), positive (beneficial) or neutral, depending on the nature of the impact.

6.5.4.12 In accordance with Table 3.8.1 of DMRB LA 104[55], the significance of effect upon the receptor is assessed using the matrix in Table 6-11: Significance matrix. Effects are defined on a nine-point scale (very large beneficial, large beneficial, moderate beneficial, slight beneficial, neutral, slight adverse, moderate adverse, large adverse or very large adverse).

6.5.4.13 Where the matrix suggests more than one likely outcome, for instance slight or moderate, professional judgement has been used in conjunction with Table 6-11 to arrive at a robust conclusion.

Table 6-11: Significance matrix

Magnitude of Impact	Environmental Value				
	Very high	**High**	**Medium**	**Low**	**Negligible**
Major	**Very large**	**Large or very large**	**Moderate or large**	Slight or **moderate**	Slight
Moderate	**Large or very large**	**Moderate or large**	**Moderate**	Slight	Neutral or slight
Minor	**Moderate** or large	Slight or **moderate**	Slight	Neutral or slight	Neutral or slight
Negligible	Slight	Slight	Neutral or slight	Neutral or slight	Neutral
No change	Neutral	Neutral	Neutral	Neutral	Neutral

6.5.4.14 For the purpose of this assessment, significance of moderate and above will be defined as a likely significant effect. Significant effects are presented in bold in Table 6-11.

6.5.4.15 All assessments follow a source – pathway – receptor approach, under which, for there to be a risk of impact to the hydrological or hydrogeological environment, a source, pathway, and receptor all have to be present to create a pollutant linkage or create a linkage based on natural processes. In the context of this chapter, pollutant sources are those associated with the construction, operation and decommissioning of the Proposed Development (Onshore), and the receptors are the receiving water environment.

6.5.5 Approach to Cumulative Effects

6.5.5.1 The Cumulative Impact Assessment (CIA) assesses the impact associated with the Proposed Development (Onshore) together with other relevant plans, projects and activities. Cumulative effects are therefore the combined effect of the Proposed Development (Onshore) in combination with the effects from a number of different projects, on the same receptor or resource.

6.5.5.2 The approach to the CIA for the water environment follows the process outlined in Volume 1, Chapter 7: EIA Methodology.

6.5.5.3 The list of relevant developments for inclusion within the CIA is outlined in Volume 7A, Appendix 7-1: Cumulative Impact Assessment Methodology.

6.5.5.4 Developments which are located within 1km of the OnTI RLB have the potential to result in a cumulative effect with the water environment. Developments which are either operational or in the decommissioning

stage are considered to be part of the baseline and are not considered within the assessment.

6.5.6 Embedded Mitigation

6.5.6.1 Where possible, mitigation measures will be embedded into the design of the Proposed Development (Onshore).

6.5.6.2 Where embedded mitigation measures have been developed into the design of the Proposed Development (Onshore) with specific regard to the water environment, these are described in Table 6-12. The impact assessment presented in Sections 6.7, and 6.9 take into account this embedded mitigation.

Table 6-12: Embedded mitigation

Code	Mitigation Measure	Securing Mechanism
M-39	An Outline Construction Environmental Management Plan (CEMP) has been produced and included alongside the EIAR to support the Planning Permission in Principle (PPP) (Volume 7, Appendix 10: Outline Construction Environment Management Plan). The Outline CEMP includes measures on pollution prevention, noise control, biosecurity, and waste management. The Outline CEMP will then be developed further through the final design process and this will result in a detailed CEMP being submitted for discharge. The CEMP will be implemented to avoid, minimise or mitigate effects on the environment during the construction and decommissioning phases of the Proposed Development (Onshore).	Detailed CEMP secured through a condition attached to the PPP.
M-43	Any works impacting the floodplain (areas of Flood Zones 2 and 3) will be accompanied by a suitable floodplain compensation strategy, where necessary subject to consultation with SEPA and Aberdeenshire Council Flooding team, to include measures to manage the impacts of loss of floodplain storage or conveyance.	Outlined within the Outline CEMP and secured by condition attached to the PPP.
M-44	Any works within or alongside watercourses will be designed to ensure no significant detrimental impact on flow conveyance and no localised or catchment wide impacts on flood risk; this will include any watercourse diversions, or any culverting required as a result of the permanent works.	Outlined within the Outline CEMP and secured by condition attached to the PPP.
M-45	Any permanent watercourse diversions will be designed to ensure continuity of conveyance and floodplain utilisation such that there is no significant detrimental impact on the wider catchment.	Outlined within the Outline CEMP and secured by condition attached to the PPP.
M-46	A surface water and groundwater monitoring plan will be developed for any works that could affect quality or quantity of surface waters, groundwater aquifers or groundwater dependent waterbodies or habitats. This will be agreed with SEPA and be implemented pre, during, and post construction	Outlined within the Outline CEMP and secured by condition attached to the PPP.

Code	Mitigation Measure	Securing Mechanism
M-47	Design of culverts will adhere to guidance outlined in the SEPA position statement on culverting of watercourses (WAT-PS-06-02).	Outlined within the Outline CEMP and secured by condition attached to the PPP.
M-50	Works will be carried out in accordance with permitting requirements, including the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended)	Outlined within the Outline CEMP and secured by condition attached to the PPP.
M-51	The location of the Sustainable Drainage System (SuDS) pond for the Onshore Substations has been designed to be located outside of the floodplain (flood zone 2 and 3)	Design Principles and mitigation proposals outlined within the EIAR supporting the PPP application.
M-52	Trenchless techniques, such as Horizontal Directional Drilling (HDD)[v], will be the preferential crossing methodology for all WFD watercourses and salmonid watercourses.	Outlined within the Outline CEMP and secured by condition attached to the PPP.
M-53	The existing watercourse crossing for the Onshore Substations used by the residential receptor to west of the Onshore Substation will be retained and reused, and if upgraded will not increase or reduce the size of the culvert. If changes to the culvert size are required, a Flood Risk Assessment (FRA) will be completed on the proposed design.	Outlined within the Outline CEMP and secured by condition attached to the PPP.
M-55	The selection of the Onshore Substation Site was influenced by prioritising avoidance of potential peatland, wells, watercourses and potential GWDTE.	The OnTI RLB within the PPP and accordance with mitigation measures identified within the EIAR submitted with the PPP.
M-56	The Onshore Substations are set back at least 10m from the Burn of Asleid to minimise any impact on the watercourse.	The OnTI RLB within the PPP and accordance with mitigation measures

[v] Trenchless crossing techniques hereafter referred to as 'HDD' in this chapter of the EIAR.

Code	Mitigation Measure	Securing Mechanism
		identified within the EIAR submitted with the PPP.
M-57	Onshore Substations drainage will be designed to discharge at greenfield rates or better to avoid any increase in flood risk to third party land.	Outlined within the Outline Drainage Impact Assessment (Application Document 6) and secured by condition attached to the PPP for a detailed Drainage Strategy.
M-58	SEPA Future Flood Maps will be used in the development of design, and to determine placement of construction compounds outside the flood risk areas.	Outlined within the Outline CEMP and secured by condition attached to the PPP.
M-59	Climate change projections on precipitation will be taken into consideration through the drainage design strategy.	Outlined within the Outline Drainage Impact Assessment (Application Document 6) and secured by condition attached to the PPP for a detailed Drainage Strategy.
M-60	The ONEC and Onshore Substation Site will aim to avoid known/confirmed positions of PWS source points and infrastructure by 250m, and where this is not achievable a protection plan will be implemented.	Outlined within the Outline CEMP and secured by condition attached to the PPP.
M-61	The drainage design for the Onshore Substation Site will consult a suitably qualified hydromorphologist if any outfalls are required into a WFD classified watercourse. Outfalls will be set back from the watercourse banks and an open channel used to connect the outfalls to the watercourse. This will allow for any natural migration of the river channel and limit damage to and from outfalls.	Outlined within the Outline Drainage Impact Assessment (Application Document 6) and secured by condition attached to the PPP for a detailed Drainage Strategy.

6.6 Key Parameters for Assessment

6.6.1.1 Volume 1, Chapter 4: Proposed Development Description (Onshore) details the parameters of the Proposed Development (Onshore) using the Rochdale Envelope approach. This section identifies those parameters during construction, operation and decommissioning relevant to potential impacts on the water environment.

6.6.1.2 The worst-case assumptions with regard to the water environment are summarised in Table 6-13.

6.6.2 Proposed Development (Onshore) Phasing

6.6.2.1 As described in Volume 1, Chapter 5: Proposed Development Phasing, three possible construction programme scenarios have been identified for the Proposed Development (Onshore).

6.6.2.2 The assessment of impacts presented in this chapter considers the sequential construction scenario. This scenario represents the worst case for the water environment and the receptors identified within this chapter, as it will require two distinct construction periods, with up to 5 years between them. This has the potential to cumulatively increase the magnitude of potential impacts as the receiving environment will be disturbed, begin to recover, and then experience another disturbance event. Two construction periods also increase the risk of accidental pollution incidents as there will be longer combined length of construction.

6.6.2.3 The worst-case assumptions with regard to the consideration of construction scenarios are also summarised in Table 6-13.

Table 6-13: Worst case assessment scenario considered for each impact as part of the assessment of likely significant effects

Potential Impact	Assessment Parameter	Explanation
Construction		
Increased pollution entering the watercourses from mobilised suspended solids and spillage of fuels or other harmful substances that may migrate to surface water and groundwater receptors.	**Landfall Site and ONEC** 4 x HDD works located within an area of the following indicative dimensions of 464m (L) x 17.2m (D) (as a maximum) at the Landfall Site for the Onshore Export Cable Circuits. HDD works will be carried out over two construction periods (i.e., 2 x HDD ducts installed in phase 1 followed by a subsequent 2 x HDD ducts installed in phase 2). 1 x temporary Landfall Site construction compound approximately 20,000m^2 required for either construction phases. 4 x Transition Joint Bays (TJBs) installed two at a time over two construction phases. 4 x Onshore Export Cable Circuits installed predominantly using Open Cut Trench (OCT) apart from at sensitive crossings where HDD will be used. Installed two at a time over two construction phases. Total ONEC of approximately 37km and an Onshore Export	Potential increased sediment supply due to construction earthworks, excavations and storage of topsoil and materials. Aligns with the sequential construction scenario.

Potential Impact	Assessment Parameter	Explanation
	Cable Route (i.e., the working corridor) of up to 100m wide. 2 X Onshore Grid Connection Cable Circuits to connect the Onshore Substations to the Grid Connection Point at the existing New Deer Substation (for Phase 1), located within an Onshore Grid Connection Cable Route (i.e., the working corridor) of up to 100m wide. 4 x construction compounds (maximum 3750m^2 per primary compound) and 1 x haul road for each construction phase. **Onshore Substations** 2 x construction and electrical commissioning of Onshore Substations over two construction periods. 2 x construction compounds over two construction periods (One for each phase).	
Risk of flooding to the Proposed Development (Onshore) due to placement within a flood risk zone.	HDD platforms situated in flood risk areas beside watercourses. OnTI construction works required within the floodplain.	It may be unavoidable that some works will be required within the floodplain.

Potential Impact	Assessment Parameter	Explanation
Impacts to the hydromorphological and ecological quality of watercourses associated with works within or in close proximity to watercourses, including physical change to the watercourses and longer-term changes associated with sediment deposition.	Open cut crossings are intended to be used on all watercourses apart from WFD and Salmonid watercourses. Temporary crossing culverts to be used across the OnTI RLB.	The detailed design of watercourse crossings is not available, open cut crossings are assumed for the majority of watercourses. In the absence of detailed construction haul roads and temporary crossings, a worst case has been assumed.
Impacts to local land drainage structures, that may alter existing drainage patterns within catchments and provide potential pathways for pollution.	Permanent diversion of water runoff paths will be required, exact locations not known at this point. Permanent changes to overland drainage patterns associated with excavations for cable trenches, Onshore Substations, construction of compounds and laydown areas, and soil stripping.	Some diversion of surface water will be required to construct the OnTI safely.
Changes to catchments and pathways may alter existing surface water and groundwater flows with potential impacts on abstractions and PWS.	Onshore Export Cable Route is within 250m of a potential PWS source.	Permanent diversion of water runoff paths affecting downstream receptors such as PWS and abstractions. Cable trenches create new pollution pathways that impact PWS and abstractions. It may not be possible to move the OnTI away from abstractions and PWS, as the Onshore Export Cable Route within the OnTi RLB is unknown so a worst case assumption has been used. Changes to pathways may result in a permanent loss of PWS and abstractions.

Potential Impact	Assessment Parameter	Explanation
Impacts on local groundwater and groundwater resources. Changes to groundwater levels, flows and quality arising from construction activities primarily dewatering earthworks and intrusive investigation works creating new flow paths for groundwater.	4 x Onshore Export Cable Circuits installed predominantly using OCT apart from at sensitive crossings where trenchless techniques, such as HDD, will be used. Installed two at a time over two construction phases. ONEC length of approximately 37km and an Onshore Export Cable Route (i.e., the working corridor) of up to 100m wide.	Permanent diversion of water runoff and subsurface flow paths affecting downgradient groundwater resources. Changes to pathways may result in a permanent loss of PWS and abstractions. The Onshore Export Cable Route creates new pollution pathways that impact groundwater quality.
Operation		
Risk of flooding to the Proposed Development (Onshore) due to placement within a flood risk zone.	The Onshore Substation Site is not located within a river or surface water flood zone.	This has been secured within the embedded mitigation measures identified within the EIAR and secured through the PPP. The Onshore Substation Site will have appropriate drainage and SuDs.
Changes to catchments and pathways may alter existing surface water and groundwater flows with potential impacts on abstractions and PWS.	Onshore Export Cable Route (i.e., the working corridor) of up to 100m wide. Onshore Export Cable Route is potentially within 250m of an active PWS.	Permanent diversion of water runoff paths affecting downstream receptors such as PWS and abstractions. Changes to pathways may result in a permanent loss of PWS and abstractions. Onshore Export Cable Route trenches create new pollution pathways that impact active PWS and abstractions. It may not be possible to move the OnTI away from active PWS at detailed design.

Potential Impact	Assessment Parameter	Explanation
Permanent impact to the hydromorphological and ecological quality of water features associated with works within or in close proximity to water features.	Onshore Export Cable Route (i.e., the working corridor) of up to 100m wide. Open cut crossings to be used on all watercourses apart from WFD and Salmonid watercourses. Temporary crossing culverts creating upstream impoundment and not being able to accommodate peak flows.	The detailed design of watercourse crossings is not available, open cut crossings are assumed for the majority of watercourses. In the absence of detailed construction haul roads and temporary crossings, worst case has been assumed.
Permanent impacts to catchment surface water and groundwater caused by the introduction of a barrier to natural overland flow.	Onshore Export Cable Route (i.e., the working corridor) of up to 100m wide. The presence of cable trenches will lead to long-term changes in the subsurface flow patterns. The Onshore Substations and associated drainage will interrupt existing flows and drainage patterns.	It is not possible to avoid trenching and the presence of the Onshore Substations. Detailed land drainage surveys have not been completed at this stage of the design.
Permanent changes in groundwater and spring flow availability for GWDTEs due to dewatering effects.	Onshore Export Cable Route (i.e., the working corridor) of up to 100m wide. Onshore cable trenches are within 250m of potential GWDTE. It is anticipated that the majority of the works will be no deeper than 1.5m below ground surface and will therefore have limited impact on shallow groundwater. Deeper groundworks relating to HDD, including those planned for the River	It may not be possible to move the OnTI away from GWDTE, as the final Onshore Export Cable Route is unknown conservative assumptions used.

Potential Impact	Assessment Parameter	Explanation
	Deveron, may exceed 1.5m below the ground surface.	
Increased flood risk to people and property elsewhere caused by an increase in hardstanding and watercourse crossings.	Concrete foundations covering 100,000m^2 are required for the Onshore Substations. Drainage for the Onshore Substations will be designed to discharge at greenfield rates or better. SuDS pond will be located outwith the floodplain.	Greenfield rates are the required standard for new development and will be required to secure planning. The SuDS pond located outwith the floodplain. This has been secured within the embedded mitigation measures identified within the EIAR and secured through the PPP
Decommissioning		
In the absence of detailed information regarding decommissioning works, it is assumed that all above ground infrastructure will be removed and all in ground infrastructure will be left in situ. Therefore, the impacts during the decommissioning of the OnTI are considered comparable with, or likely less than, those of the construction stage.		

6.7 Potential Effects

6.7.1.1 Based on the OnTI RLB and Design Envelope (DE), there is the potential for the Proposed Development (Onshore) to impact upon the receiving hydrological and hydrogeological environment during construction, operation and decommissioning.

6.7.1.2 This assessment of likely significant effects presented below takes into consideration embedded mitigation.

6.7.2 Construction

Surface water quantity

6.7.2.1 The introduction of construction water management and drainage may divert water between surface water catchments. This potential interruption and diversion of flow may lead to a reduction or loss of water supply to abstractions, springs and watercourses and potential degradation of habitat. The transfer of water from one catchment to another potentially affects resource availability further down-gradient in the confined aquifers.

6.7.2.2 Excavation of the cable trenches, earth bunds, construction compounds, and development of the Onshore Substations could create a barrier for springs that feed into the surface watercourses, and redirection of flows to a different catchment could reduce catchment areas and change the flow regime within receiving surface waters. This may also have consequential effects on aquatic ecology.

6.7.2.3 Construction works may require abstractions from surface water features to provide a source of water for processes such as dampening down/dust suppression or for the HDD process. The abstraction of water from watercourses has the potential to cause effect on the quantity of water of the receptor, impacting on the hydromorphology processes and biodiversity.

6.7.2.4 Embedded mitigation includes the implementation of a CEMP, this will outline surface water management plans which will include temporary cutoff drains or bunds to be placed upslope side of the working area to minimise water runoff interacting with exposed soil and reroute surface water away from the construction area.

6.7.2.5 Temporary water storage ponds will be required periodically along the working corridor, to store collected water and appropriately treat it prior to discharge. Water will be pumped out of the ponds for discharge on the downslope side of the working corridor as necessary, within the same catchment that the water was collected from to maintain total volumes within the catchment.

6.7.2.6 Following installation of the cables, the working corridor and associated drainage infrastructure will be removed, and the ground reinstated to natural pre-development conditions.

6.7.2.7 Any abstractions from watercourses would be subject to securing the appropriate licences prior to abstraction.

6.7.2.8 Watercourses and surface water catchments within the study area have mixed value, ranging from 'low' value agricultural drains and small tributaries to the River Deveron as a WFD and salmonoid river, with 'very high' value.

6.7.2.9 The OnTI cable trench and restoration works will be staggered throughout the construction stage, and thus no widespread or prolonged impact to receptors is likely to occur. Considering embedded mitigation measures, it is likely that the magnitude of impact from changes to surface water quantity is negligible.

6.7.2.10 Given the negligible magnitude of impact, for receptors of very high and high value, the overall effect of temporary changes in surface water quantity during construction is considered to be slight adverse. For those receptors considered to be of medium and low value, the overall effect of temporary changes in surface water quantity during construction is considered to be neutral. Both slight and neutral effects are considered to be not significant in EIA terms.

Surface water quality

6.7.2.11 Working in, on or adjacent to watercourses and their floodplains may affect surface water quality through the accidental discharge of fine sediments or chemicals, including hydrocarbons. Work to construct the OnTI will require cable trenches, open cut watercourse crossings and HDD, which all could also create additional sources of sediment and pollutants, including HDD drilling mud.

6.7.2.12 Where works require groundwater control measures, such as local groundwater level reduction or removal of the water from the excavation (dewatering), the discharge of removed groundwater into surface watercourses may affect the quality of the receiving watercourses, primarily through sediment release but also if the removed groundwater is contaminated.

6.7.2.13 Stockpiling of construction materials and excavated spoil may create a new source of sediment that could contaminate or pollute surface waters if they are not stored correctly, due to risk of washout. These contaminants and pollutants may include fuels, oils, chemicals and concrete. Removal of topsoil or hardstanding and exposure of underlying soils to increased rainwater infiltration may result in pollutants leaching into the underlying aquifer.

6.7.2.14 Discharge of water from construction works may also distribute contaminants and pollutants to surface water receptors or their catchments. It may also create an accumulation of these substances where soakaway basins are used.

6.7.2.15 The effect of these activities can cause significant damage to watercourses and waterbodies. Embedded mitigation in the form of a CEMP will be employed which will detail appropriate construction drainage and pollution prevention controls. All construction will follow best practice guidance such as the SEPA Pollution Prevention Guidelines and CIRIA guidance (detailed in Section 6.2.2).

6.7.2.16 Watercourse crossings will be minimised within the detailed design, and construction compounds and all storage of materials will be place outside of the floodplain. Drilling muds from HDD works will be appropriately treated before disposal or any release of water into the environment, they will not be directly discharged into the environment, as secured in the CEMP.

6.7.2.17 A surface water management plan will be developed at detailed design, which will contain information such as monitoring locations for sensitive watercourses, trigger values based on Environmental Quality Standards (EQS's) and appropriate actions to be taken to pause works and begin restorative actions.

6.7.2.18 Watercourses and surface water catchments within the study area have mixed value, ranging from 'low' value agricultural drains and small tributaries to the River Deveron as a WFD and salmonoid river, with 'very high' value. The DWPA is considered to be of very high value and the bathing water catchment feeds into a high value receptor.

6.7.2.19 The OnTI installation and restoration works will be staggered throughout the construction stage, and thus no widespread or prolonged impact to receptors is likely to occur. Coupled with the embedded mitigation, it is likely that the magnitude of impact from changes to surface water quality is negligible.

6.7.2.20 Given the negligible magnitude of impact, for receptors of very high and high value, the overall effect of temporary changes in surface water quality during construction is considered to be slight adverse. For those receptors considered to be of medium and low value, the overall effect of temporary changes in surface water quality during construction is considered to be neutral. Both slight and neutral effects are considered to be not significant in EIA terms.

Hydromorphology

6.7.2.21 Construction on watercourses such as cable trenching, temporary crossings, and permanent diversions, may result in the permanent loss of hydromorphological features and ecological value, and impact on water quality. The construction works may also result in the loss of

geomorphological features and habitat niches within the affected channel and potentially downstream.

6.7.2.22 Such physical/morphological changes to watercourses can be associated with changes in sediment deposition and erosion (river processes) and are likely to have localised impacts on the watercourse features and water quality. Additionally, the introduction of haul roads and set down areas into the floodplain have the potential to introduce foreign materials to the system, and to create a barrier in the floodplain that disrupts flow pathways in the event of a flood. Construction compounds and set down areas will be located outside of the flood plain, as is outlined in the CEMP.

6.7.2.23 Watercourses and surface water catchments within the study area have mixed value, ranging from 'low' value agricultural drains and small tributaries to the River Deveron as a WFD and salmonoid river, with 'very high' value.

6.7.2.24 Embedded mitigation for WFD watercourses includes the use of HDD for the cable circuit crossings, this mitigation reduces the impact magnitude of changes to hydromorphology to negligible as there is no direct interaction with the watercourse. Non WFD watercourses will experience temporary changes to hydromorphology during construction as a result of the OCT techniques likely to be used, with a slight adverse impact magnitude.

6.7.2.25 Taking the very high value of the WFD receptors and the negligible magnitude of impact, the overall effect of temporary changes in hydromorphology during construction is considered to be slight adverse and not significant in EIA terms. Non WFD receptors with low to high value are considered to experience minor adverse impacts, concluding in a slight adverse overall effect, not significant in EIA terms.

Groundwater quantity

6.7.2.26 Construction works may locally reduce the rate of recharge to aquifers where the runoff is managed and then discharged. This has the potential to reduce the flow available to springs and groundwater features. Construction activities may lead to a reduction or cessation of spring flow and baseflow supplying watercourses and PWS within the study area.

6.7.2.27 Where works would require groundwater control measures for example, local groundwater level reduction or removal of the water from the excavation (dewatering), this could locally reduce groundwater levels and divert flow. This risk would depend on the time of year as flows and levels would vary in an aquifer of this nature. This water may also be connected to spring systems which feed into local watercourse baseflows and agricultural irrigation. The impact of temporary dewatering on groundwater resources would be local to the excavations and last for the duration of the works only.

6.7.2.28 Where impacts are potentially more significant (for example, where springs may feed GWDTE), further detailed survey and assessment will be undertaken for the Approval of Matters Specified in Conditions (AMSC) application at detailed design stage.

6.7.2.29 The OnTI comprises structures such as the Onshore Substations which will require appropriate foundation design which may include piled foundations. Such below ground structures may act as barriers to shallow groundwater flow and they may provide more vertical downward pathways for perched/shallow groundwater flow into the deeper aquifer.

6.7.2.30 A groundwater management plan will be developed at detailed design, which will contain information such as dewatering plans, design of HDD and monitoring of potential GWDTEs, appropriate actions to be taken to pause works and begin restorative actions, should there be an impact to groundwater identified. Coupled with the temporary and localised nature of the effects, it is likely that the magnitude of impact from changes to groundwater quantity is negligible.

6.7.2.31 Taking the very high value of the groundwater receptors and the negligible adverse magnitude of impact, the overall effect of temporary changes in hydromorphology during construction is considered to be slight and not significant in EIA terms.

Groundwater quality

6.7.2.32 Ground investigations and pilling boreholes may create pathways to sensitive aquifers through relatively low permeability formations. New flow pathways for pollution may also be created by the cable trenches, allowing polluted waters to enter water bodies not previously impacted by pollution. There may be localised effects upon groundwater quality within an aquifer.

6.7.2.33 Discharge of water from construction works may also distribute contaminants and pollutants to other parts of the aquifer and create an accumulation of these substances where soakaway basins are used without appropriate treatment. Embedded mitigation through the CEMP includes pollution prevention practices, and suitable treatment prior to discharge of any construction generated water, and placement of clay bunds or alternative impermeable material will be included for every 0.5m change in elevation along the length of the cable trench, to minimise in-trench groundwater flow.

6.7.2.34 The study area and OnTI RLB is located entirely within a GDWPA. The scale of construction and the low productivity aquifers that underly the majority of the study area, indicate that any changes to the GDWPA within the study area will be localised as discussed above. However, a major incident could have a more widespread effect. With appropriate mitigation measures in place, like the groundwater management plan within the CEMP the magnitude of the impact is considered to be 'negligible'.

6.7.2.35 The GDWPA is considered to be of very high value due to its potential to be a regionally important resource.

6.7.2.36 Taking the 'very high' value of the study area GDWPA and the 'negligible' magnitude of the impact, the overall effect of temporary changes to GDWPAs during construction is considered to be slight adverse and not significant in EIA terms.

Private Water Supplies

6.7.2.37 There are 44 identified PWS located within 250m of the OnTI RLB, with limited information available on the type or location of the source. Therefore, the assumption is that each PWS serves local residences, and the source is located within the same land parcel as the record. In addition, a number of wells and springs were identified from OS mapping, but it is not known if these are in active use or for what type of activity.

6.7.2.38 There is a potential risk of contamination through direct interaction with the PWS source or associated infrastructure, overland flow, shallow groundwater flow, and spillage or pollution upslope from the source. As the final Onshore Export Cable Route is still to be confirmed, it is possible that the cable trenches or Onshore Substation will be located within 250m of or will directly interact with any PWS sources within the OnTI RLB.

6.7.2.39 At detailed design, landowner surveys will be required to gain further understanding of the location of the source and type of source used for the PWS that have been identified in Volume 7E, Appendix 6-3: Private Water Supply Assessment. Further assessment will then be required to establish if there is a pathway for impact on the quantity or quality of supply. Further information on the Onshore Export Cable Route, Onshore Substations and excavation depths following refinement of the design will also be used to assess potential impacts to potential PWS at detailed design.

6.7.2.40 Required mitigation will be developed at detailed design, based on the outcomes of the assessment of impact. Where a licensed or unlicensed supply, has the potential to be impacted, a protection plan shall be developed for that source and any associated infrastructure. For temporary impacts during construction mitigation may include a PWS monitoring programme, pollution response plan for PWS incidents, and in the event of a loss of PWS, the creation of a suitable alternative source of water for the duration of construction works. For permanent impacts, if protection and repairs are not possible, a new network connection, alternative water supply or replacement source (designed to current guidance) shall be provided.

6.7.2.41 Embedded mitigation will be followed, such as avoidance of interaction with PWS where possible. However, if required, any construction works required within 250m of any PWS source will be subject to source monitoring, and

alternative sources of potable water provided if required. Therefore, the magnitude of impact of the works is considered to be negligible.

6.7.2.42 The PWS within the study area are receptors that cannot be modified without altering their function. As a result, this, along with their perceived importance to the local community, they are considered to be of 'high' value.

6.7.2.43 Taking the high value of the PWS and the negligible magnitude of the impact, the overall effect during construction is considered to be slight adverse, and therefore not significant in EIA terms.

GWDTE

6.7.2.44 As the Onshore Export Cable Route is still to be confirmed, it is possible that the cable trenches will be located within 250m of the areas identified as potential GWDTE. Therefore, the implementation of the OnTI may have the capacity to modify the current hydrogeological conditions, which in turn could have an effect on habitats that have the potential to sustain GWDTEs. Embedded mitigation will be followed, with an assessment of GWDTE habitats provided in Volume 7E, Appendix 6-2: Groundwater-Dependent Terrestrial Ecosystem Assessment.

6.7.2.45 The potential GWDTEs have been assessed specifically within the context of the OnTI, considering the local bedrock and superficial geology, peat distribution, water environment and site observations. Most of the habitats have been assessed as relying on rainwater, surface water, surface runoff and/or shallow groundwater, with mitigation measures outlined within the CEMP.

6.7.2.46 GWDTEs in the study area are considered to have low to moderate groundwater dependency and are not considered sensitive to groundwater alterations as a result of the OnTI. However, due to the conservative nature of the assessment, all potential GWDTEs are considered to be of 'high' value.

6.7.2.47 Proposed Development (Onshore) activities will be carried out in alignment with the mitigation set out in the CEMP, which will include measures such as pollution prevention, minimising earthworks adjacent to GWDTEs, and placing of clay bunds or alternative impermeable material will be included for every 0.5m change in elevation along the length of the cable trench, to minimise in-trench groundwater flow. Any significant disruptions to GWDTE's during the construction phase will be minimised. Therefore, the magnitude of impact here will be considered 'negligible'.

6.7.2.48 Given the 'high' value of the receptors and the 'negligible' magnitude of impact, the overall effect of temporary changes to potential GWDTEs during construction is considered to be slight adverse, and therefore not significant in EIA terms.

Flood Risk

Fluvial Flood Risk

6.7.2.49 The construction phase has the potential to impact fluvial flood risk due to the presence of construction works within a floodplain. Such activities may temporarily affect the floodplain by modifying flood flows and reducing its ability to absorb water if the compounds are impermeable, leading to an increase in flood risk at the site or in other areas. Embedded mitigation is in place to avoid any temporary storage areas within the floodplain, and to limit construction compounds within the floodplain as far as practically possible. Where construction compounds are needed to be placed within the floodplain, for example for HDD, then flood warnings and additional processes, such as alert systems, emergency access and egress plans, will be established. Any requirements for floodplain compensation, subject to agreement with SEPA and Aberdeenshire Council flood team, will be included. The design of the Onshore Substation Site avoids any elements being within the floodplain, and so no floodplain compensatory storage mitigation is anticipated to be needed.

6.7.2.50 Undertaking construction activities in areas that drain to watercourses has the potential to escalate the rate and volume of runoff, which in turn can heighten the risk of blockages in watercourses. This can impede the flow of water and result in an increased likelihood of flooding. Additionally, modifications to ground levels, temporary increases in impermeable area, and vegetation clearance works may augment the possibility of surface water flooding.

6.7.2.51 Effective land drainage is crucial in mitigating the risk of localised flooding, nourishing fields, and sustaining nearby surface water resources. Any affected land drainage elements will be duly maintained, restored, or compensated as necessary, as outlined within the project CEMP.

6.7.2.52 The properties and infrastructure downstream of the study area are considered to be of 'high' value. The Proposed Development (Onshore) construction may be vulnerable to flooding and is considered to be of 'high' value. Any change to flood risk in the study area, with appropriate mitigation measures in place, will be negligible. Therefore, the magnitude of impact is considered to be 'negligible'.

6.7.2.53 Given the high value of properties and infrastructure outside the OnTI RLB, and the negligible magnitude of the impact, the overall effect on fluvial flood risk during construction is considered to be slight adverse, and not significant in EIA terms.

Pluvial Flood Risk

6.7.2.54 Construction activities that increase the non-permeable area within the OnTI RLB, such as construction compounds, have the potential to increase pluvial flood risk. Additionally, modifications to ground levels and

vegetation clearance works may augment the possibility of surface water flooding.

6.7.2.55 Surface water generated across the OnTI RLB will be managed by construction drainage (including suitably sized temporary settlement and drainage basins, drainage ditches and culverts). These would be installed early in the construction period as per the CEMP which would manage surface flooding to ensure that flood risk does not increase as a result of the Proposed Development (Onshore). Where land drainage from agriculture is encountered during construction, actions will be taken to divert the flow to an appropriate location, such as the construction drainage network or cross connect field drains. Prior to completion of the OnTI, these field drains will be reinstated to the original locations, where practically possible, or to a suitable alternative discharge point determined by pre-construction surveys.

6.7.2.56 The properties and infrastructure within the study area are considered to be of 'high' value. The Proposed Development (Onshore) may be vulnerable to flooding and is considered to be of 'high' value. Any change to pluvial flood risk in the study area, with appropriate mitigation measures in place, will be negligible. Therefore, the magnitude of impact is considered to be 'negligible'.

6.7.2.57 Given the high value of properties and infrastructure outside the OnTI RLB, and the negligible magnitude of the impact, the overall effect on pluvial flood risk during construction is considered to be slight adverse, and not significant in EIA terms.

Groundwater Flood Risk

6.7.2.58 The excavation and installation of cables, as well as the creation of permanent diversions, have the potential to alter the flow of water from springs and within pockets of groundwater. As a result, this may lead to localised changes in the patterns of groundwater flooding.

6.7.2.59 It is anticipated that the majority of the works will be no deeper than 1.5m below ground surface and will therefore have limited impact on shallow groundwater. Deeper groundworks relating to HDD, including those planned for the River Deveron, may exceed 1.5m below the ground surface. These works will be very limited in area and any effects are considered to be localised.

6.7.2.60 The linear nature of the Onshore Export Cable Route indicates that the trench could form a preferential flow path for shallow groundwater or near surface flow, particularly in areas where the cable crosses up or down notable slopes. Embedded mitigation will be followed, with measures within the CEMP such as over pumping trenches that experience influx of groundwater, for the time that it is present. Trenches will be infilled as soon as practically possible to restore baseline conditions. It should also be noted that the construction works will be staggered, meaning the entire

Onshore Export Cable Route will not be worked on at once, but rather on a rolling basis. As such, this will ensure that there will be no widespread or prolonged impacts throughout construction. Properties and infrastructure outside of the OnTI RLB that are vulnerable to flooding are considered to be of 'high' value. The Proposed Development (Onshore) may be vulnerable to groundwater flooding and is considered to be of 'high' value. The linear shallow construction of the Onshore Export Cable Corridor, paired with the embedded mitigation proposed, means that it is likely that the magnitude of impact from any changes to groundwater flood risk is 'negligible'.

6.7.2.61 Given the high value of receptors and the negligible magnitude of the impact, the overall effect of temporary changes in groundwater flood risk is considered to be slight adverse, and therefore not significant in EIA terms.

Reservoir Inundation Risk

6.7.2.62 During construction, the Proposed Development (Onshore) may be at risk of inundation from an uncontrolled release of water from a reservoir. Woodside Reservoir is located outside the study area to the west, and has the potential to inundate areas around the north of Turriff and following the River Deveron from the reservoir source to Banff in the east of the study area. Any construction areas adjacent to the River Deveron may be adversely affected by reservoir flooding.

6.7.2.63 Similar mitigation measures are applied for reservoir inundation risk as they are for fluvial flood risk to make sure the Proposed Development (Onshore) and receiving environment are not impacted by such an event. Reservoir inundation is also very rare, with reservoirs being frequently monitored and maintained, and so the likelihood of such an event is low. The magnitude of impact is therefore considered to be negligible.

6.7.2.64 The Proposed Development (Onshore) may be vulnerable to flooding and is considered to be of 'high' value.

6.7.2.65 Given the high value of the Proposed Development (Onshore), and the negligible magnitude of the impact, the overall effect on reservoir inundation flood risk during construction is considered to be slight adverse, and not significant in EIA terms.

6.7.3 Operation

Surface Water Quantity

6.7.3.1 Alteration of ground elevations and changes in surface water flood flow pathways may result in the modification of surface water flows. Wherever possible, the design will maintain existing catchments.

6.7.3.2 The introduction of a barrier to natural overland flow paths such as introduction of embankments may have permanent impacts on catchment

dynamics for surfaced water. This may result in a reduction or loss of water supply to downstream receptors, including abstractions, rivers and wetland, and the potential loss of aquatic habitat (which may be permanent).

6.7.3.3 It is not anticipated that permanent surface structures will be in place to facilitate the Landfall Site or Onshore Export Cable Route as a result of the Proposed Development (Onshore). The design of the Onshore Substations drainage will be so that discharge rates are maintained at greenfield runoff rates. Therefore, it is expected that operational impacts to surface water quantity will be of negligible magnitude.

6.7.3.4 Watercourses and surface water catchments within the study area have mixed value, ranging from 'low' value agricultural drains and small tributaries to the River Deveron as a WFD and salmonoid river, with 'very high' value.

6.7.3.5 Given the negligible magnitude of impact, for receptors of very high and high value, overall effect of operational changes in surface water quantity is considered to be slight adverse. For those receptors considered to be of medium and low value, the overall effect of operational changes in surface water quantity is considered to be neutral. Both slight and neutral effects are considered to be not significant in EIA terms.

Surface Water Quality

6.7.3.6 Surface water quality is significantly less impacted by fuel or oil contamination during operation compared to the construction phase as there will be significantly decreased levels of activity within the OnTI RLB and most potential pollutants will have been removed. Lubricants, oils, diesel generator associated with operational maintenance and maintenance vehicles fuels may remain present in small quantities.

6.7.3.7 The surface water from the Onshore Substations and associated infrastructure will be managed by the implementation of a surface water drainage system. This will consist of various SuDS methods to safeguard the surrounding water environment. The installed drainage will direct the water to the SuDS pond for final treatment and storage before the water is then discharged at a rate that will mimic the existing greenfield runoff rate.

6.7.3.8 The pollution of surface watercourses may result in potential loss of aquatic habitat. This may, in turn, result in impacts on the amenity and economic value of surface water bodies. Surface water abstractions have the potential to be impacted if their water source is polluted, their catchment reduced and are no longer appropriate for the abstraction requirement.

6.7.3.9 Watercourses and surface water catchments within the study area have mixed value, ranging from 'low' value agricultural drains and small tributaries to the River Deveron as a WFD and salmonoid river, with 'very high' value.

6.7.3.10 Any change to surface water quality within the study area, ensuring the appropriate mitigation outlined within the CEMP is in place, is considered to be of a 'negligible' magnitude of impact.

6.7.3.11 Given the negligible magnitude of impact, for receptors of very high and high value, the overall effect of operational changes in surface water quality is considered to be slight adverse. For those receptors considered to be of medium and low value, the overall effect of operational changes in surface water quality is considered to be neutral. Both slight and neutral effects are considered to be not significant in EIA terms.

Hydromorphology

6.7.3.12 Culverts have the potential to impact watercourses by causing local shading, reducing river habitat connectivity and inducing hydromorphological change. Embedded mitigation has avoided the need for any permanent new watercourse crossings within the design of the Proposed Development (Onshore). Maintaining access to East Swanford south-west of the Onshore Substation Site will retain the existing crossing and therefore no change is expected to hydromorphology. If the existing culvert is not suitable for reuse, then a new culvert will be designed to comply with SEPA culverting guidance and consult with a suitably qualified hydromorphologist. The replacement culvert will mirror the same size of the existing culvert or provide betterment and therefore the magnitude of impact is considered to be negligible.

6.7.3.13 New outfall structures within a watercourse can alter local channel cross section and induce local bank or bed erosion, as well as reduce the available natural bank and riparian habitat area. The drainage design for the Onshore Substations will be informed by a suitably qualified hydromorphologist if any outfalls are required into a WFD classified watercourse. Outfalls will be set back from the watercourse banks and an open channel used to connect the outfalls to the watercourse. This will allow for any natural migration of the river channel and limit damage to and from outfalls.

6.7.3.14 Watercourses and surface water catchments within the study area have mixed value, ranging from 'low' value agricultural drains and small tributaries to the River Deveron as a WFD and salmonoid river, with 'very high' value.

6.7.3.15 Any change to hydromorphology within the study area, ensuring the appropriate mitigation outlined within the CEMP is in place, is considered to be of a 'negligible' magnitude of impact.

6.7.3.16 Given the negligible magnitude of impact, for receptors of very high and high value, the overall effect of operational changes in hydromorphology is considered to be slight adverse. For those receptors considered to be of medium and low value, the overall effect of operational changes in

hydromorphology is considered to be neutral. Both slight and neutral effects are considered to be not significant in EIA terms.

Groundwater Quantity

6.7.3.17 Deep excavations may result in changes to the natural groundwater regime and modify the flow at springs, reduce yield from abstraction wells or reduce baseflow contribution to watercourses. It is anticipated that the majority of excavations will not be greater than 1.5m and where this may increase for HDD it will be very localised and temporary disruption. Therefore, the impact on subsurface flow patterns is considered to be negligible.

6.7.3.18 A change in the rate of recharge of aquifers due to change in ground surface cover and introduction of new drainage systems may also result in a reduction or loss of water supply to abstractions, springs, watercourses, and the potential loss of aquatic habitat (which may be permanent), and potential GWDTEs, which may be adversely impacted by changes in groundwater levels or quality. The ONEC will be restored to its original land cover, and this will be maintained during operation. The Onshore Substations drainage will be designed to retain existing catchment flow volumes.

6.7.3.19 No additional changes to groundwater flow paths are anticipated in the operation and maintenance stage. Changes to groundwater quantity during operation are considered to be of negligible impact magnitude.

6.7.3.20 Taking the 'high' value of the aquifers and GDWPA and the 'negligible' magnitude of the impact, the overall effect of changes to groundwater quality during operations is considered to be slight adverse and not significant in EIA terms.

Groundwater Quality

6.7.3.21 The risk to groundwater quality is considerably lower during operation and maintenance than during construction as there are significantly decreased levels of activity at within the OnTI RLB and most potential pollutants have been removed. Lubricants, oils, diesel generators required for operational maintenance and maintenance vehicle fuels will remain present in small quantities. Hence, the magnitude of any operational impacts here can be considered 'negligible'.

6.7.3.22 GDWPA's within the study area continue to have very limited ability to absorb change without significantly altering their present character. The receptor is of regional importance and therefore is considered to be of 'high' value.

6.7.3.23 Taking the 'high' value of the receptors and the 'negligible' magnitude of the impact, the overall effect of changes to groundwater quality during

operations is considered to be slight adverse and not significant in EIA terms.

Private Water Supplies

6.7.3.24 The PWS within the study area are receptors that cannot be modified without altering their function. As a result, this, along with their perceived importance to the local community, they are considered to be of 'high' value.

6.7.3.25 Permanent modification of flow paths due to the OnTI may impact on the quantity of water available from the source supplying the PWS. The OnTI drainage will be designed so that water is retained within the same catchments wherever possible, and replacement sources for PWS which could be lost or significantly impacted as a result of the Proposed Development (Onshore) will be provided, as detailed in the CEMP. As a result, it is considered that the magnitude of impact will be 'negligible'.

6.7.3.26 Given the high value of the PWS in the study area and the negligible magnitude of the impact, the overall effect on PWS during operation of the Proposed Development (Onshore) will be slight adverse, and therefore not significant in EIA terms.

GWDTE

6.7.3.27 GWDTEs in the study area are considered to have low to moderate groundwater dependency and are not considered sensitive to groundwater alterations as a result of the OnTI. However, due to the conservative nature of the assessment, all potential GWDTEs are considered to be of 'high' value.

6.7.3.28 It is not anticipated that there will be permanent loss of GWDTE as a result of the OnTI, as the location of the potential GWDTE and embedded mitigation measures such as avoidance and drainage catchments will be similar to baseline conditions. As a result, the magnitude of impact is anticipated to be 'negligible'.

6.7.3.29 Given the 'high' value of the receptors and the 'negligible' magnitude of impact, the overall effect of operation to potential GWDTEs is considered to be slight adverse, and therefore not significant in EIA terms.

Flood Risk

Fluvial Flood Risk

6.7.3.30 Development within the floodplain may affect flood flow conveyance, resulting in increased flood risk to the OnTI and to people and property elsewhere on third party land. A change in flood flow pathways may impact on properties and aquatic environments within, and associated with, flood zones.

6.7.3.31 Embedded mitigation includes the commitment to placing all permanent surface infrastructure outside of high and medium flood risk zones. The Onshore Substations have been designed so that the footprint and SuDS pond will not take land from the floodplain, and therefore there should be no change in the flood storage provided by the baseline environment.

6.7.3.32 The properties and infrastructure downstream of the study area have very limited ability to cope with increased flood risk. Therefore, the receptor is considered to be of 'high' value. Any change to flood risk in the OnTI RLB with appropriate mitigation measures in place, will be negligible. Therefore, the magnitude of impact is considered to be 'negligible'.

6.7.3.33 Taking the 'high' value properties and infrastructure, and the 'negligible' magnitude of the impact, the overall effect on fluvial flood risk during operation is considered to be slight adverse, and not significant in EIA terms.

Pluvial Flood Risk

6.7.3.34 During operation, the cable circuits are considered to be flood resilient infrastructure and therefore the potential impact is in regards the Onshore Substations.

6.7.3.35 An increase of impermeable surface caused by the Onshore Substations may have an impact on the surface water and dynamics of watercourse catchments. This has the potential to increase surface water runoff and the risk of pluvial flooding. The drainage design for the Onshore Substations will take this into account.

6.7.3.36 Drainage will remain in place during the Proposed Development (Onshore) operation and maintenance around all long-term infrastructure such as the Onshore Substations and permanent access tracks. The drainage design will have appropriate storage, to enable it to maintain greenfield runoff rates. Therefore, the impact is considered to be negligible.

6.7.3.37 A monitoring and maintenance programme for the drainage infrastructure will be implemented to ensure that it remains fully operational and in good condition. Where practicable, routine maintenance will be undertaken during dry weather, to help ensure that drainage operation during wet weather is fully functional.

6.7.3.38 Taking the 'high' value properties and infrastructure, and the 'negligible' magnitude of the impact, the overall effect on pluvial flood risk during operation is considered to be slight adverse, and not significant in EIA terms.

6.7.4 Decommissioning

6.7.4.1 In the absence of detailed information regarding decommissioning works, it is assumed that all above ground infrastructure will be removed and all in

ground infrastructure will be left in situ. Therefore, the impacts during the decommissioning of the OnTI are considered comparable with, or likely less than, those of the construction stage. The assessment of effects presented in Section 6.7.2 is assumed to be applicable to the effects caused by decommissioning activities.

6.7.4.2 The most appropriate method of decommissioning and the handling and disposal of materials will be undertaken in agreement with the relevant authorities at the time. Any applicable new legislation or guidelines published prior to decommissioning will be taken into account in relation to any design of mitigation prior to decommissioning occurring.

6.8 Cumulative Effects

6.8.1 Overview

6.8.1.1 The list of developments identified for assessing cumulative effects is presented in Volume 7A, Appendix 7-1: Cumulative Impact Assessment Methodology. In Table 6-14 the potential for cumulative effects with each of these developments is examined, and an assessment of the cumulative effects presented where appropriate.

Table 6-14: Hydrology and hydrogeology cumulative effects

Development	Potential for significant cumulative effects	Comments
Green Volt Offshore Wind Farm, laying of underground cables and erection of substation APP/2023/1454 (the Green Volt Application)	No	The proposed cable corridor of the Green Volt Application is primarily outside of the study area There is a small section over overlap in the south of the study area around the Onshore Substation Site. The receiving catchments of the works for the Green Volt Application are different to the Proposed Development (Onshore). With the construction mitigation proposed as part of the Proposed Development (Onshore) and best practice construction mitigation implemented and maintained by all developments, it is considered that there would be no change to the significance of effects reported in this chapter in Section 6.7. The Green Volt Application substation is located adjacent to the Onshore

Development	Potential for significant cumulative effects	Comments
		Substation Site, with some intersection of the OnTI RLB; however, it is considered that with the implementation of suitable drainage strategies, discharge rates, and appropriate flood risk mitigation (if required) there would be no change to the significance of effects reported in this chapter concerning flood risk.
Stromar Offshore Wind Farm Onshore Infrastructure Stromar Offshore Wind Farm Limited Pre-application stage (the Stromar Application)	No	The onshore scoping area for the Stromar Application is primarily outside of the study area. There is some overlap of the study area and the Stromar Onshore scoping area around Howe Of Teuchar to Greens. The final landfall, cable corridor and substation locations are not yet known, however the onshore scoping area is located east of the Landfall Site, and majority of the ONEC will not interact with the Stromar Application. The substation for Stromar is anticipated to be located at Greens, north-east of the Onshore Substation Site, however there is potential for the substation development areas to be adjacent to each other given the current extent of search area in the Stromar Application. The receiving catchments of the works are different to those of the Proposed Development (Onshore). With the construction mitigation proposed as part of the Proposed Development (Onshore) and best practice construction mitigation implemented and maintained by both developments, it is considered that there would be no change to the significance of effects reported in this chapter in Section 6.7. The proposed Stromar substation is likely to be located at Greens, north-east of the Onshore Substation Site. As the final location for Stromar is not known, there is the potential for adjacent development. However, with

Development	Potential for significant cumulative effects	Comments
		the implementation of suitable drainage strategies, discharge rates, and appropriate flood risk mitigation (if required) there would be no change to the significance of effects reported in this chapter concerning flood risk.
Beauly to Blackhillock to New Deer to Peterhead 400kv Connection Pre-application stage (herein after referred to as the Beauly Application)	No	The Beauly Application intersects with a small section of the OnTI RLB. However, with the construction mitigation proposed as part of the Proposed Development (Onshore) and best practice construction mitigation implemented and maintained by both developments, it is considered that there would be no change to the significance of effects reported in this chapter in Section 6.7. The Beauly Application would comprise an overhead powerline, and therefore there would be no issues regarding watercourse crossings. It is therefore considered that there would be no change to the significance of effects reported in this chapter in Section 6.7. The Beauly Application is located within OnTI RLB; however, it is considered that with the implementation of suitable drainage strategies, discharge rates, and appropriate flood risk mitigation (if required) there would be no change to the significance of effects reported in this chapter concerning flood risk.

6.9 In-Combination Effects

6.9.1.1 In-combination impacts occur through the inter-relationship with another EIAR topic that may lead to different or greater environmental effects than in isolation.

6.9.1.2 There is also the potential for in-combination impacts resulting from onshore and offshore works. These are identified within Volume 6, Chapter 5: Intertidal Assessment and are therefore not repeated here.

6.9.1.3 The potential in-combination effects for water environment receptors resulting from effects between Proposed Development (Onshore) works are described below.

6.9.2 In-Combination effects between Proposed Development (Onshore) works

In-Combination between environmental topics

6.9.2.1 The potential in-combination effects identified for hydrology and hydrogeology receptors relate to impacts on surface and groundwater quality during construction. In addition to the potential effects identified in this chapter, the release of contamination as a result of disturbance of contaminated soils, and general increase in sedimentation due to soil disturbance may also occur. The assessment of contamination risk and impact on soils is further detailed in Volume 5, Chapter 7: Geology, Soils and Contaminated Land.

6.9.2.2 Potential in-combination effects with aquatic ecology (Volume 5, Chapter 3: Terrestrial Ecology and Biodiversity) may also occur as disturbance of aquatic ecology during construction in a number of forms. Additionally, any permanent changes to watercourses or upgrades to watercourse crossings that are present during construction may impact on the hydrogeology of the watercourse and impact on aquatic ecology or mammals that partially rely on rivers such as otter (*Lutra lutra*) and water vole (*Arvicola amphibius*).

6.9.2.3 As there are no significant effects on the water environment identified within this chapter's assessment, it is considered that any in-combination effects on the receptors identified in Volume 7E, Appendix 6-1: Assessment of Value from other environmental topics within the EIAR would not result in a different or greater environmental effect than has already been identified.

6.10 Mitigation Measures and Monitoring

6.10.1.1 As part of the Proposed Development (Onshore) design process, measures have been proposed to reduce the potential for impacts on hydrology and hydrogeology. These include measures which have been incorporated as part of the Proposed Development (Onshore) design (referred to as 'embedded mitigation') and measures which will be implemented regardless of the impact assessment (referred to as 'tertiary mitigation'). As there is a commitment to implementing these measures, they are considered inherently part of the design of the Proposed Development (Onshore) and have therefore been considered in the assessment

presented in Section 6.7 (i.e. the determination of magnitude and therefore significance assumes implementation of these measures).

6.10.1.2 An Outline Construction Environmental Management Plan (CEMP) has been produced and included alongside the EIAR to support the planning application in principle (Volume 7, Appendix 10: Outline Construction Environment Management Plan).

6.10.1.3 The Outline CEMP will then be developed further with submission of AMSC applications and supporting CEMP at a later date.

6.10.1.4 The CEMP will include Proposed Development (Onshore) mitigation/monitoring measures and commitments and detail standard construction industry practice to reduce impacts during construction.

6.10.1.5 Further surveys will be required at detailed design to collect further data on PWS, abstractions and local drainage that are within areas of potential impact.

6.10.1.6 It is not anticipated at this stage that there will be land raising, long term or permanent storage of materials within areas shown on SEPA Flood Maps or encroachment of permanent infrastructure within 0.5% AEP for surface and river flood risk areas. As outlined in Volume 7E, Appendix 6-5: Consultation Summary, should these embedded mitigation measures change at detailed design, a FRA may be required for the AMSC application, Aberdeenshire Council and SEPA will be consulted on the scope.

6.10.2 Monitoring

6.10.2.1 A monitoring programme will be developed through consultation with relevant stakeholders. Details of the monitoring programme have not yet been confirmed as this will be undertaken once final design and Onshore Export Cable Route is known post-consent. Potential monitoring identified includes:

- Monitoring of PWS that are likely to be impacted prior to construction commencing to establish baseline conditions and during construction. Monitoring will commence a minimum of six months before construction starts in the catchment of each PWS.
- Long-term drainage infrastructure around Onshore Substations and permanent access tracks will have a monitoring and maintenance programme established, to include regular visual inspection of drainage infrastructure to check for blockages, debris or damage that may impede flow.
- At detailed design, a surface water and groundwater monitoring plan developed for any works could affect quality or quantity of surface waters, groundwater aquifers or groundwater dependent waterbodies or

habitats. This will be agreed with SEPA and be implemented pre, during, and post construction.

6.11 Residual Effects

6.11.1.1 The assessment presented in Section 6.7 concludes no significant effects on the water environment, after embedded mitigation has been taken into account. Therefore, the residual effects are the same as reported in Section 6.7 and summarised in Table 6-15.

6.12 Summary of Effects

6.12.1.1 Table 6-15 presents a summary of the significant effects assessed within this EIAR, any mitigation required, and the residual effects are provided.

Table 6-15: Summary of effects

Impact	Magnitude	Sensitivity of Receptor	Significance	Mitigation Measures	Residual Effect
Construction					
Surface water quantity	Negligible	Very High/High	Slight adverse	No additional mitigation is required above embedded mitigation.	Slight adverse
		Medium/Low	Neutral	No additional mitigation is required above embedded mitigation.	Neutral
Surface water quality	Negligible	Very High/High	Slight adverse	No additional mitigation is required above embedded mitigation.	Slight adverse
		Medium/Low	Neutral	No additional mitigation is required above embedded mitigation.	Neutral
Hydromorphology	Negligible Minor Adverse	Very High	Slight adverse	No additional mitigation is required above embedded mitigation.	Slight adverse
		High - Low	Slight adverse	No additional mitigation is required above embedded mitigation.	Slight adverse
Groundwater quantity	Negligible	Very High	Slight adverse	No additional mitigation is required above embedded mitigation.	Slight adverse

Impact	Magnitude	Sensitivity of Receptor	Significance	Mitigation Measures	Residual Effect
Groundwater quality	Negligible	Very High	Slight adverse	No additional mitigation is required above embedded mitigation.	Slight adverse
PWS	Negligible	High	Slight adverse	No additional mitigation is required above embedded mitigation.	Slight adverse
GWDTE	Negligible	High	Slight adverse	No additional mitigation is required above embedded mitigation.	Slight adverse
Fluvial flood risk	Negligible	High	Slight adverse	No additional mitigation is required above embedded mitigation.	Slight adverse
Pluvial flood risk	Negligible	High	Slight adverse	No additional mitigation is required above embedded mitigation.	Slight adverse
Groundwater flood risk	Negligible	High	Slight adverse	No additional mitigation is required above embedded mitigation.	Slight adverse
Operation					
Surface water quantity	Negligible	Very High/High	Slight adverse	No additional mitigation is required above embedded mitigation.	Slight adverse

Impact	Magnitude	Sensitivity of Receptor	Significance	Mitigation Measures	Residual Effect
		Medium/Low	Neutral	No additional mitigation is required above embedded mitigation.	Neutral
Surface water quality	Negligible	Very High/High	Slight adverse	No additional mitigation is required above embedded mitigation.	Slight adverse
		Medium/Low	Neutral	No additional mitigation is required above embedded mitigation.	Neutral
Hydromorphology	Negligible Minor Adverse	Very High	Slight adverse	No additional mitigation is required above embedded mitigation.	Slight adverse
		High - Low	Slight adverse	No additional mitigation is required above embedded mitigation.	Slight adverse
Groundwater quantity	Negligible	Very High	Slight adverse	No additional mitigation is required above embedded mitigation.	Slight adverse
Groundwater quality	Negligible	Very High	Slight adverse	No additional mitigation is required above embedded mitigation.	Slight adverse
PWS	Negligible	High	Slight adverse	No additional mitigation is required above embedded mitigation.	Slight adverse

Impact	Magnitude	Sensitivity of Receptor	Significance	Mitigation Measures	Residual Effect
GWDTE	Negligible	High	Slight adverse	No additional mitigation is required above embedded mitigation.	Slight adverse
Fluvial flood risk	Negligible	High	Slight adverse	No additional mitigation is required above embedded mitigation.	Slight adverse
Pluvial flood risk	Negligible	High	Slight adverse	No additional mitigation is required above embedded mitigation.	Slight adverse
Decommissioning					
Refer to the construction assessment, effects considered to be equal or lesser to construction effects.					

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