MORAY WEST
OFFSHORE WINDFARM

# Onshore Transmission Infrastructure Environmental Impact Assessment (EIA)

Moray Offshore Windfarm (West) Limited

## Chapter 5 Hydrology, Hydrogeology and Geology

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| Acronyms | |
|---|---|
| **Acronym** | **Expanded Term** |
| AC | Aberdeenshire Council |
| ACM | Asbestos containing material |
| AEP | Annual Exceedance Probability |
| AOD | Above Ordnance Datum |
| BGS | British Geological Society |
| CAR | Water Environment (Controlled Activity) (Scotland) Regulations 2011 (as amended) |
| CEH | Centre for Ecology and Hydrology |
| CIRIA | Construction Industry Research and Information Association |
| CO | Conservation objective |
| COSHH | Control of Substances Hazardous to Health |
| DTM | Digital Terrain Model |
| DWPA | Drinking Water Protection Area |
| EU | European Union |
| FEH | Flood Estimation Handbook |
| FRA | Flood Risk Assessment |
| FRR | Flood Risk Receptor |
| GBR | General Binding Rules |
| GPP | Guidance for Pollution Prevention |
| GWDTE | Groundwater dependent terrestrial ecosystem |
| LDP | Local Development Plan |
| LNCS | Local Nature Conservation Site |
| LPD | Local Plan District |
| LUPS – GU31 | SEPA Land Use Planning Guidance Note 31 Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and GWDTE |
| MC | Moray Council |
| MLWS | Mean Low Water Springs |
| NGR | National Grid Reference |
| NPF3 | National Planning Framework 3 |
| NVC | National Vegetation Classification |
| O & M | Operations and Maintenance |
| OnTI | Moray West Onshore Transmission Infrastructure |
| OS | Ordnance Survey |
| PAB | Planning application boundary |

| Acronyms | |
|---|---|
| **Acronym** | **Expanded Term** |
| PIRP | Pollution Incident Response Plan |
| PPG | Pollution Prevention Guidance |
| PPP | Planning Permission in Principle |
| PWS | Private Water Supply |
| RBMP | River Basin Management Plan |
| SEPA | Scottish Environment Protection Agency |
| SFRA | Strategic Flood Risk Assessment |
| SNH | Scottish Natural Heritage |
| SPP | Scottish Planning Policy |
| SSSI | Site of Special Scientific Interest |
| SuDS | Sustainable Drainage Systems |
| WEWS | Water Environment and Water Services (Scotland) Act |
| WFD | Water Framework Directive |
| WTW | Water Treatment Works |

| Glossary of terms | |
|---|---|
| **Term** | **Definition** |
| Made Ground | The BGS describes made ground as *"man-made deposits such as embankments and spoil heaps on the natural ground surface"*, the British Standards Institution (BSI) in BS 5930 defines made ground as *"anthropogenic ground in which the material has been placed without engineering control and/or manufactured by man in some way, such as through crushing or washing, or arising from an industrial process"*. Both definitions are applicable and in practice made ground typically includes ground where imported fill materials or waste have been deposited, and reworked natural materials. |

# 5 Hydrology, Hydrogeology and Geology

## 5.1 Introduction

5.1.1.1 This chapter considers the potentially significant effects on the hydrological, hydrogeological and geological environment associated with the construction, operation and decommissioning of the Moray West Onshore Transmission Infrastructure (OnTI). The chapter also identifies preliminary mitigation measures that will be necessary to prevent, reduce or offset potentially significant effects from the OnTI if required and is supported by the following Technical Appendices:

- Technical Appendix 5.1: Phase 1 Geo Environmental Desk Study;
- Technical Appendix 5.2: Groundwater Dependent Terrestrial Ecosystem (GWDTE) Assessment; and
- Technical Appendix 5.3: Detailed Hydrological and Hydrogeological Information.

5.1.1.2 This chapter is also supported by the following figures:

- Figure 5.2.1 – Hydrological Study Area;
- Figure 5.3.2 – Detailed Hydrological and Hydrogeological Features;
- Figure 5.3.3 – GWDTE Typology;
- Figure 5.3.4 – GWDTE Superficial Geology; and
- Figure 5.3.5 – GWDTE Solid Geology.

5.1.1.3 This chapter has been prepared by Guy Douglas (Member of Chartered Institution of Water and Environmental Management), Senior Consultant within the Water Management department of Wood Environment & Infrastructure Solutions UK Limited who has over 6 years' experience in hydrology consultancy. Guy's MSc is in Hydrology and Climate Change and he also holds a bachelor's degree with hons in Physical Geography. Additional input (geology and contaminated land) has been provided by Lynne Gemmell PIEMA (Practitioner Member of Institute of Environmental Management and Assessment), Senior Consultant within the Remediation and Ground Engineering department of Wood Environment & Infrastructure Solutions UK Limited. Lynne has over 10 years' experience in contaminated land consultancy and holds a MSc in Environmental Studies.

## 5.2 Approach to Assessment

### *5.2.1 Planning Policy and Legislative Context*

**National Planning Policy**

5.2.1.1 The approach to national planning policy in Scotland is set out in Chapter 4: Planning Policy Context. In particular, National Planning Framework 3 (NPF3) and Scottish Planning Policy (SPP) are discussed are discussed in Section 4.4.3.

5.2.1.2 SPP advises that land with Low to Medium Risk with an Annual Exceedance Probability (AEP) of coastal or watercourse flooding between 0.1 % to 0.5 % will be suitable for most development. It also advises that a Flood Risk Assessment (FRA) may be required at the upper end of the probability (close to 0.5%) and for 'essential infrastructure' and the 'most vulnerable' land uses classified under Scottish Environment Protection Agency (SEPA) Land Use Planning System guidance (SEPA, 2017).

5.2.1.3 SPP advises that land with Medium to High Risk with an AEP of coastal or watercourse flooding greater than 0.5 % is generally not suitable for most vulnerable uses and additional development in undeveloped or sparsely developed areas, unless a location is essential for operational reasons, e.g. for utilities infrastructure.

5.2.1.4 In relation to surface water flooding, SPP states that infrastructure and buildings should generally be designed to be free from surface water flooding in rainfall events where the AEP is greater than 0.5 %.

5.2.1.5 SPP stipulates that planning applications must take into account the probability of flooding and the risks from all sources (coastal, fluvial, pluvial, groundwater, sewers, and blocked culverts), taking account of the predicted effects of climate change (Scottish Government, 2014). SPP notes that development should be located away from functional flood plains and medium to high risk areas. It also notes that where appropriate flood management measures should be undertaken to reduce flood risk, and that development avoid an overall increase in the probability of flooding elsewhere.

**Local Planning Policy**

5.2.1.6 At the local level, both the Aberdeenshire and Moray Local Development Plans (LDPs) contain policies of relevance to the assessment.

5.2.1.7 The Aberdeenshire Council (AC) LDP (2017) Policy C4 identifies that "if development is to be permitted on land assessed as at a medium to high risk of flooding it should be designed to be flood resilient and use construction methods to assist in the evacuation of people and minimising damage. It must not result in increased severity of flood risk elsewhere through altering flood storage capacity or the pattern and flow of flood waters". It also states that "maintenance of buffer strips must also be provided for any water body. These measures may also be required in areas of potentially lower risk of flooding (AEP above 0.001%) or in coastal areas below the 10 m contour should local evidence demonstrate a heightened risk". Lastly the policy notes that "Sustainable Drainage Systems (SuDS) principles apply to all sites".

5.2.1.8 The Moray Council (MC) LDP (2015), Policy EP5 Surface Water Drainage: SuDS states that "Surface water from development should be dealt with in a sustainable manner that has a neutral effect on the risk of flooding" and that, "the method of dealing with surface water should avoid pollution and promote habitat enhancement and amenity". Policy EP6 Waterbodies requires that "any impact on water quality, water quantity, physical form (morphology), river hydrology, sediment transport and erosion, nature conservation, and fisheries can be adequately mitigated". It also states that MC "operates a presumption against the culverting of watercourses and any unnecessary engineering work in the water environment" and that "a buffer strip of at least 6 m between any new development and all water features is required". EP7 requires that an "assessment must demonstrate that any risk from flooding can be satisfactorily mitigated without increasing flood risk elsewhere".

5.2.1.9 Further details regarding the planning policy that has been taken into account during this assessment are provided in Chapter 4: Planning Policy and Context.

**Legislation and Regulation**

5.2.1.10 The 2000/60/EC Water Framework Directive (WFD), which is transposed into Scottish law by the Water Environment and Water Services (Scotland) Act (WEWS Act) 2003 (Scottish Executive, 2003) aims to classify surface waters according to their ecological status, and sets targets for restoring / improving this status. Under the WFD (2006/60/EC), the status of water is assessed using a range of parameters including chemical, ecological, physical, morphological and hydrological measures to give a holistic assessment of aquatic ecological health. Furthermore, there is a requirement under the WFD (2006/60EC) that natural waterbodies must attain at least 'good ecological status' by 2027.

5.2.1.11 In addition to the WEWS Act, the Water Environment (Controlled Activity) (Scotland) Regulations 2011 (as amended) (Scottish Government, 2013) (CAR) 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) in Scotland. There are three levels of authorisation under CAR: General Binding Rules (GBR); Registration; and Licence (either simple or

complex). The level of authorisation increases as the activity poses a higher risk of impact on the water environment. The level of authorisation under CAR for the OnTI will depend on the activities proposed. Design will be informed by the guidance provided in The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended); A Practical Guide (SEPA, 2018). This includes set standards for the storage of oil, to ensure leaking or spilt oil does not enter controlled waters. It also includes notice procedures where SEPA considers the works, precautions or other steps to minimise risks to the water environment.

5.2.1.12 The Flood Risk Management (Scotland) Act 2009 requires the lead local authority for each Local Plan District (LPD) to publish a Local Flood Risk Management Plan. The act outlined a framework for coordination and cooperation between all organisations including SEPA, Scottish Water and the local authorities. SEPA has separated Scotland into 14 LPDs for flood risk management purposes.

5.2.1.13 The Environmental Liability (Scotland) Regulations 2009 transpose the European Union (EU) Environmental Liability Directive (2004/35/EC). The Environmental Liability Directive is based on the 'polluter pays' principle 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.

5.2.1.14 The Nature Conservation (Scotland) Act 2004 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.

5.2.1.15 The Land Reform (Scotland) Act 2003 (as amended) empowers local authorities to make byelaws for the conservation or enhancement of natural or cultural heritage, which includes geological and physiographical features.

5.2.1.16 The Control of Asbestos Regulations 2012 are also relevant to the construction works as these regulations require prevention or reduction of exposure to asbestos. For construction works where asbestos may be encountered the key requirement is under Section 11 (2): Where it is not reasonably practicable for the employer to prevent the exposure to asbestos of any such employee employed by that employer, the measures must include, in order of priority, the design and use of appropriate work processes, systems and engineering controls and the provision and use of suitable work equipment and materials in order to avoid or minimise the release of asbestos and the control of exposure at source, including adequate ventilation systems and appropriate organisational measures.

**Other Relevant Plans, Policies and Guidance**

5.2.1.17 To help fulfil the aims of the WFD (2000/60/EC), a planning process called river basin planning is being used to manage the water environment. This involves production of a River Basin Management Plans (RBMPs) for the Scotland river basin district and supplementary catchment summaries, which outline how the water environment will be managed and improved to meet WFD (2006/60/EC) objectives. Information from the 2015 Scotland RBMP (Scottish Government, 2015) has been utilised for this assessment and consideration has also been given to the requirements of the WFD (2006/60/EC).

5.2.1.18 AC is the lead local authority for the North East Local Plan District (LPD06). LPD06 covers the Deveron catchment group, which includes the River Isla and the confluences close to Keith. The Local Flood Risk Management Plan for 2016 – 2022 (AC, 2016b) identifies the River Isla to the north of Keith near Newmill (Potentially Vulnerable Area 06/06) as a floodplain storage area. The plan also identifies other areas which are situated within other surface water catchments which discharge into the Banff Coastal catchment at Portsoy (e.g. Potentially Vulnerable Area 06/02).

5.2.1.19 The AC SFRA covers the Banff and Buchan areas and provides mapping which displays SEPA flood risk mapping (SEPA, 2017). MC is currently preparing a SFRA which will be issued as part of its 2020 LDP (MC, 2017).

5.2.1.20 Table 5.2.1 lists the guidance which has been taken into account during the assessment.

**Table 5.2.1: Guidance and Best Practice**

| Topic | Sources of Information |
|---|---|
| SEPA Position Statements | WAT – PS – 06 – 02: Culverting of Watercourses (SEPA, 2015).<br>No 19. Groundwater Policy for Scotland (SEPA, 2009a).<br>WAT – SG – 25: Engineering in the Water Environment Good Practice Guide, River Crossings (SEPA, 2010).<br>WAT – SG – 29: Engineering in the Water Environment Good Practice Guide, Temporary Construction Methods (2009b).<br>Netregs Guidance for Pollution Prevention (Netregs, 2017).<br>SEPA Flood Risk and Land Use Vulnerability Guidance (2017a). |
| Other guidelines | BS6031:2009 Code of Practice for Earth Works.<br>Construction Industry Research and Information Association (CIRIA) C741 Environmental Good Practice on Site (CIRIA, 2015a).<br>CIRIA C532 Control of Water Pollution from Construction Sites (CIRIA, 2001).<br>CIRIA C689 Culvert Design and Operation Guide (CIRIA, 2010).<br>CIRIA C753 SuDS Manual (CIRIA, 2015b).<br>CIRIA C648 Control of Water Pollution from Linear Construction projects: Technical Guidance (CIRIA, 2006).<br>Department for Food, Environment and Rural Affairs (Defra) Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (Defra, 2009).<br>Constructed tracks in the Scottish Uplands, 2nd Edition (Scottish Natural Heritage [SNH], 2015).<br>Netregs Guidance for Pollution Prevention (GPPs) (Netregs, 2017).<br>Pollution Prevention Guidance (PPG) Notes. |

### *5.2.2 Scope of Assessment*

5.2.2.1 The following potential effects were scoped into the assessment as presented in the Environmental Impact Assessment (EIA) Scoping Report (Moray Offshore Windfarm (West) Limited (Moray West), June 2017):

- Effects on water quality of surface watercourses and dependant abstractions from mobilised sediment and contaminated runoff during construction, operation and maintenance and decommissioning;
- Effects on water quality of local groundwater and any dependant abstractions from infiltration of mobilised sediment and contaminated runoff during construction, operation and maintenance and decommissioning;
- Changes in river baseflow and groundwater availability for GWDTEs due to dewatering during construction and operation and maintenance;
- Changes in patterns and rates of infiltration and runoff from ground disturbance / installation of substation foundations during construction, operation and maintenance and decommissioning;

- Volumetric displacement of surface floodwaters from soil stockpiles and land take during construction, operation and maintenance and decommissioning;
- Changes in watercourse conveyance from watercourse crossings during construction;
- Effects on watercourse morphology from watercourse crossings and development in close proximity to watercourses during construction;
- Loss of carbon rich peat soils during construction;
- Loss or damage to sensitive geological sites during construction; and
- Loss of or damage to agriculturally valuable soils during construction.

5.2.2.2 It was proposed that the hydrological and hydrogeological study area be defined as the WFD surface water catchments within which the OnTI will be located, with the geological study area including the planning application boundary (PAB) plus 500 m. In addition to a desk study and a site walkover to gather baseline data, a limited peat probing exercise was proposed to be undertaken in areas where the potential for peat is evident, as determined by a review of geological mapping and observations of vegetation typically indicative of the presence of peat. This was to be at regular intervals (tentatively 100 m) along the onshore cable corridor.

5.2.2.3 A qualitative assessment methodology was proposed, supported by the following:

- Preparation of a FRA, with the scope to be determined with SEPA once the location of the PAB was known;
- Preparation of a Phase 1 Geo-environmental Desk Study; and
- The use of Phase 1 habitat survey data, and National Vegetation Classification (NVC) survey data if available, to identify potential GWDTEs that might be affected by the OnTI. If 'true' GWDTEs or groundwater abstractions are likely to be affected by the OnTI, a risk assessment will be undertaken in accordance with SEPA Guidance Note 31 (LUPS – GU31) (SEPA, 2017d).

5.2.2.4 Scoping responses of relevance to the hydrology, hydrogeology and geology were received from several consultees. Those from Scottish Water, SNH and MC are summarised in Table 5.2.2, along with Moray West's response and where this can be found within the EIA Report. A Scoping response from SEPA was superseded by further consultation, as summarised in Sections 5.2.2.5 to 5.2.2.6.

**Table 5.2.2: Summary of Scoping Opinion and Moray West Reponses**

| Date | Consultee | Issue Raised | Moray West Approach |
|---|---|---|---|
| 12/07/17 | SNH | There is potential for landfall works to adversely impact the nationally important hard – rock (Dalradian) interest of the Cullen to Stake Ness Coast SSSI, through physical damage and / or by obscuring outcrops (except in relatively small areas of sandy bays where this interest does not exist).<br>SNH recommends that the EIA includes a clear assessment of potential impacts on the geological interest of the SSSI. | With regard to the final Onshore Landfall Area within the Cullen and Stake Ness SSSI, a detailed / focused NVC survey will be undertaken prior to detailed design, as outlined in Section 5.4 on additional mitigation. This will identify geological features, including outcropping rock and its condition, as well as identifying vegetation types. The results of the NVC survey will inform the location of the works and construction techniques to ensure the most sensitive areas are avoided and any negative effects on the SSSI are |

| Table 5.2.2: Summary of Scoping Opinion and Moray West Reponses | | | |
|---|---|---|---|
| **Date** | **Consultee** | **Issue Raised** | **Moray West Approach** |
| | | | mitigated. Detailed consultation will be undertaken with SNH and a method statement drawn up. |
| | | We refer Moray West to the National Coastal Change Assessment which provides Scotland – wide historical analysis of sea- level and coastal changes – www.dynamiccoast.com. This is highly relevant to ensure that the landfall installation remains suitably protected throughout its design life in the context of predicted sea level rise and changing coastal sediment supply. | The referenced analysis from www.dynamiccoast.com (Scottish Government and SEPA, 2017) indicates that relative to the 1993 recorded level, there will be coastal accretion within Sandend Bay by 2050 and therefore there is limited risk of sea level rise impacting upon the integrity of the landfall installation at this location. |
| 29/06/17 | Scottish Water | The Burn of Davidson, the River Deveron, the Herricks Springs and Burns intakes and the Shenwell Springs catchments lie within the Scoping Study Area. These areas are designated as Drinking Water Protected Areas (DWPAs) under Article 7 of the WFD. It is essential that water quality and water quantity in these locations are protected. As springs can be very sensitive sources, it is requested that the transmission infrastructure is located outwith and at a distance from the catchments of the Herricks Springs and Burns intakes and the Shenwell springs (there will be some uncertainty in relation to the exact catchment boundaries of the springs shown). | Further consultation with Scottish Water has confirmed that the PAB avoids the Shenwell Springs catchments. Small sections of the Herricks Burn and Spring catchment are within the PAB. A 100 m buffer within which no infrastructure or construction activities will be permitted is proposed. Further information is presented in Sections 5.3.7 and 5.4. |
| | | The location of Scottish Water assets (including water supply and sewer pipes, water and waste treatment works etc.) should be confirmed through obtaining detailed plans from our Asset Plan providers. All Scottish Water assets potentially affected by the development should be identified, with particular consideration to access roads and pipe crossings. | The location of Scottish Water assets will be confirmed at the detailed design stage, following the receipt and inspection of plans. This requirement has been included as embedded mitigation measure (see Section 5.4.2.9). |
| | | No refueling or storage of fuel or hazardous materials should take place within the drinking water catchment area. If this can be demonstrated to be impracticable, then the appropriate SEPA PPGs should be followed and 50 m buffers should be applied to all surface watercourses, groundwater borehole abstraction points and springs. Oil storage should be in | Embedded mitigation in Section 5.4.2.9 ensures that no refueling will occur within the Herricks Spring and Burn and Shenwell Burn DWPAs. In addition, no refueling will take place within 50 m of all other tributary watercourses feeding the River Deveron DWPA. |

| Table 5.2.2: Summary of Scoping Opinion and Moray West Reponses | | | |
|---|---|---|---|
| **Date** | **Consultee** | **Issue Raised** | **Moray West Approach** |
| | | accordance with The Water Environment (Oil Storage) Regulations (Scotland) 2006. | |
| | | Waste storage, concrete preparation and all washout areas should not be within the drinking water catchment area. If this can be demonstrated to be impracticable then this should be in dedicated areas 50 m from a watercourse and designed to be contained and to prevent escape of materials / runoff to the environment. | Embedded mitigation measures in Section 5.4.2 ensure that no concrete preparation / washout will occur within the Herricks Springs and Burn and Shenwell Springs DWPAs. No concrete preparation / washout will occur within 50 m of all other tributary watercourses feeding the River Deveron DWPA. |
| | | Welfare / waste water facilities should preferably be located outside the drinking water catchment. If not practicable, then portable toilets should be used and waste disposed of offsite. Alternatively, secondary treatment and soakaways should be used and, if required, a sampling chamber installed and sampling programme agreed. | Embedded mitigation measures in Section 5.4.2 ensure that no welfare / waste water facilities will be located within the identified Herricks Spring and Burn and Shenwell Burn DWPAs. Welfare / waste facilities will not be located within 50 m of the tributary watercourses feeding into the River Deveron DWPA. The treatment and disposal techniques for waste water will be determined by the appointed Contractor in agreement with SEPA / Scottish Water during the detailed design stage. These drainage arrangements will be put forward within the submission of a substation surface water drainage strategy, (see Section 5.6). |
| | | Any proposed abstractions for activities such as welfare facilities or concrete batching plants should be detailed in the EIA Report. | The locations of construction compounds will not be determined until the detailed design stage. Section 5.4.2.9 identifies that relevant construction activities will adhere to the principles of the CAR, outlined in the SEPA CAR practical guide (2018). Consultation with SEPA on requirements for CAR authorisations will be undertaken by the appointed Contractor during the detailed design process for the OnTI. This will include all proposed abstractions. |
| | | Where peatland might be affected, the EIA report should include an assessment on the potential release of colour and dissolved organic carbon quality as a result of changes to hydrology and / or physical | In agreement with SEPA, a targeted peat probing survey has been undertaken in areas where deep peat may occur as identified through a desk based assessment and Phase 1 habitat survey. Data |

| Table 5.2.2: Summary of Scoping Opinion and Moray West Reponses | | | |
|---|---|---|---|
| **Date** | **Consultee** | **Issue Raised** | **Moray West Approach** |
| | | disturbance. This should cover the construction and post construction phases.<br>Excavations and ground disturbance in areas of deep peat (>0.5 m) should be avoided. | from the peat probing survey is presented in Technical Appendix 5.1. Limitations to the peat survey are discussed in Section 5.3.11.2.<br>Only one small area of peat was found within the PAB. Data from the survey will inform detailed design of the OnTI and avoid / limit the excavation of any peat. Section 5.4.2.9 includes peat management measures as embedded mitigation. |
| | | Where possible, access tracks in the drinking water catchment should be floating with adequate provision for maintaining existing drainage patterns.<br>Exposed soils and peat can release sediment, colour and dissolved organic carbon. The use of geotextiles, turf replacement and / or reseeding, should be undertaken as soon as possible.<br>Restoration of any degraded peat should be considered for areas within the drinking water catchment. | Measures in Section 5.4.2 will ensure there are no proposed access tracks within the Shenwell Burn and Herricks Spring and Burn DWPA catchments. Initial peat depth survey results indicate that peat deposits are minimal (i.e. < 0.5m) within the River Deveron DWPA, and therefore the utilisation of floating tracks is unlikely to be necessary.<br>Embedded mitigation measures for peat restoration have been put forward in Section 5.4.2.9. |
| | | An assessment of any forestry activity, including felling, planting or other activity, likely to affect the drinking water catchment should be included in the ES. Any specific mitigation measures should be identified and incorporated into a Construction Environmental Management Plan for the site prior to works commencing. | No felling is currently planned. If the cable circuits are routed through plantations, Horizontal Directional Drill (HDD) techniques will be used, or the cable circuits will be installed in existing rides (see Section 5.4.2). |
| | | Depending on the vulnerability of the Public Water Supply, a water sampling programme may be required. This should assess the baseline water quality for a minimum of one year prior to any activities commencing onsite. | The PAB avoids the Shenwell Springs catchments. Small sections of the Herricks Burn and Spring catchment are within the PAB. A 100 m buffer within which no infrastructure or construction activities will be permitted is proposed.<br>Given the large coverage of the River Deveron DWPA, the PAB could not avoid the tributary headwater watercourses. An additional mitigation measure has been provided for provision of a water quality monitoring programme for the tributary |

| Table 5.2.2: Summary of Scoping Opinion and Moray West Reponses | | | |
|---|---|---|---|
| **Date** | **Consultee** | **Issue Raised** | **Moray West Approach** |
| | | | watercourses feeding the River Deveron DWPA (see Section 5.6). |
| 08/08/17 | Moray Council | The EIA Report should identify all required / proposed measures to mitigate against the effects of flooding during both construction and operation phases of the development. The precise cable route and onshore substation location being as yet undetermined means that details of specific mitigation or flood prevention cannot be specified. | Proposed measures have been specified in Section 5.4.2 and Section 5.4.2.9 to help mitigate against potential effects of flooding. |

## Consultation

### Scottish Environment Protection Agency

5.2.2.5 SEPA's Scoping response (11 July 2017) contained a number of requirements that necessitated the availability of a detailed design for the OnTI. As Moray West is seeking Planning Permission in Principle (PPP) for the OnTI, further consultation with SEPA was undertaken to agree how these requirements might be met in the absence of the necessary design information. Moray West's proposed approach was set out in a letter dated 08 December 2017; SEPA approved the proposed approach by e-mail on 18 December 2017.

5.2.2.6 The proposed approach can be summarised as followed:

- Site layout – Exact locations for access tracks, excavations, buildings, borrow pits, pipelines, cabling, site compounds, laydown areas, storage areas and any other built elements will be determined at the detailed design stage, once PPP has been granted and the required site investigations undertaken. The EIA Report will contain figures showing the PAB in relation to water environment features and constraints with the appropriate buffers applied. The location of the onshore substation site will be identified, as will the associated permanent access arrangements;
- Engineering activities in the water environment – The EIA Report will confirm those watercourses to be crossed and the likely crossing methods, which will follow SEPA guidelines. Detailed information on the required engineering works will not be available until the detailed design stage, once PPP has been granted and the required site investigations undertaken. Commitments will be made within the EIA Report regarding the appropriate undertaking of abstraction and dewatering activities in line with SEPA guidance;
- FRA – No detailed FRA will be undertaken in support of the application for PPP. For the EIA Report, a desk based source-pathway-receptor assessment (informed by a site visit) will be undertaken investigating potential flood risk to third party land downstream of the onshore substation site, and to the site itself. Should this initial assessment indicate the requirement for a detailed FRA, Moray West will consult SEPA, MC and AC on the intended approach at the detailed design stage, prior to construction;
- Peat and other carbon rich soils – Any peat depth survey will be targeted only, as guided by a desk based study. Peat probing will be completed on an approximate 100 m x 100 m grid for the target areas;

- GWDTEs – 'Potential GWDTEs' will be identified using Phase 1 habitat survey data (following LUPS – GU31). The EIA Report will include a desk based assessment of each potential GWDTEs using the Phase 1 habitat types. This will review information on topography, drainage, geology and hydrogeology to determine the likelihood of the habitats being truly groundwater dependant. Any National Vegetation Classification (NVC) surveys or qualitative / quantitative risk assessment work will be undertaken at the detailed design stage;
- Groundwater abstractions – Data gathered on groundwater abstractions will be considered in the EIA Report. However, any detailed risk assessment work will be undertaken as part of the detailed design of the OnTI, once the likely route of the cable circuits becomes apparent;
- Forestry removal and waste – The EIA Report will identify the location of any felling if considered likely and include a commitment to the appropriate timber management measures should felling be proposed as part of the detailed design of the OnTI;
- Pollution prevention and environmental management – A schedule of best practice and mitigation commitments for the OnTI will be provided within the EIA Report. This section will summarise the mechanisms by which these commitments will be actioned and monitored; and
- Contaminated land – The PAB is beyond 1 km from the former Radar station at Crannoch Hill as identified by SEPA. Effects on the former Radar station will not be considered in the EIA report.

**Scottish Natural Heritage**

5.2.2.7 The final PAB includes a stretch of the Cullen to Stake Ness Coast SSSI at the Onshore Landfall Area. It is currently proposed that the installation of infrastructure at the Onshore Landfall Area will require some works within this designation (see Chapter 2: The Proposed Development regarding the installation of the offshore export cable circuits). MW has developed a number of design principles developed to mitigate any potentially significant effects that may result from these works. These were issued to SNH by e-mail (17 May 2018); SNH agreed that the principles are adequate by e-mail (22 May 2018).

### *5.2.3 Data Gathering*

**Study Area**

5.2.3.1 The Planning Application Boundary (PAB) for the OnTI is situated within the River Isla Catchment and Banff Coastal Catchment as identified within the Scotland RBMP (Scottish Government, 2015). The hydrological and hydrogeological study area has been defined by the surface water catchments that are intersected by the PAB in order to capture sources, pathways and receptors for all potential effects. The process for defining the study area has been defined by the following two steps:

- The sub catchment areas for the respective tributaries of the River Isla Catchment (Burn of Paithnick; Burn of Drum; Burn of Ardrone; unnamed tributaries at Stripeside; Auchorities; and a tributary of Burn of Cairnie) and Banff Coastal Catchment (Scattery Burn; Burn of Deskford; and Burn of Fordyce) intersected by the PAB have been captured by their limited extents and the potential for direct hydrological and hydrogeological effects; and
- Due to the larger spatial extent of the River Isla channel downstream of the PAB, and to take into account its limiting influence on flow conveyance and dilution, the study area has been restricted to the part of the PAB where it intersects the River Isla watercourse channel, plus additional extents spanning 500 m upstream and 2 km downstream respectively.

5.2.3.2 The study area and the relevant hydrological features within the catchments are outlined on Figure 5.2.1.

**Desk Study / Field Survey**

5.2.3.3 The baseline conditions for the assessment were established through consultation with the relevant statutory and non-statutory bodies, as well as detailed desk studies and site visits.

5.2.3.4 Site visits were carried out on the 30 October to the 3 November and 14 to the 17 November 2017. These covered the main hydrological and hydrogeological features within the study area including all indicative watercourse crossing locations within the PAB, and the proposed onshore substation site. They also included a targeted peat probing survey within the PAB (see Section 5.3.11.2 regarding survey coverage limitations to be addressed prior to detailed design).

5.2.3.5 Table 5.2.3 provides information on the data requirements and sources that have been used to establish the range of baseline conditions within the study area.

**Table 5.2.3: Data Requirements and Sources**

| Topic | Data Requirement | Source of Information |
|---|---|---|
| Topography | Confirm surface water catchments. | 5 m Digital Terrain Model (DTM) data.<br>1:25,000 Ordnance Survey (OS) mapping. |
| Surface water hydrology | Describe surface water hydrology.<br>Describe hydromorphological conditions.<br>Collate all hydrological flow data for the study area watercourses.<br>Identify ephemeral and artificial drainage channels. | 1:10,000 OS raster data.<br>Site visits.<br>Centre of Ecology and Hydrology (CEH) Flood Estimation Handbook (FEH) web service (CEH, 2017). |
| Climate | Identify annual average rainfall and monthly patterns in rainfall. | Met Office website (2017), Banff & Keith rain gauge data. |
| Designated conservation sites | Identify designated sites of hydrological, geological or hydrogeological interest within study area. | SNHi SiteLink (2017) website. |
| Water quality | Identify existing catchment pressures (e.g. point source and / or diffuse pollution issues). | SEPA (2017b) Water Environment Hub.<br>Scottish Government (2015), River Basin. Management Plan for the Scotland River Basin District. |
| Water resources | Identify all private water supply (PWS) abstractions within study area catchments, and within 250 m of excavations >1 m depth and within 100 m of excavations <1 m depth.<br>Identify Scottish Water Drinking Water Protection Areas (DWPAs). | MC PWS information (received August 2017).<br>AC PWS information (received August 2017).<br>Scottish Water DWPA information (received November 2017).<br>Landmark (2017 and 2018) Envirocheck Report identifying SEPA registered licensed discharges. |
| Flood risk | Identify flood risks in line with the Flood Risk Management (Scotland) Act 2009 and SPP (2010). | SEPA (2017c) Flood Risk Management Map.<br>AC (2017) Flood Risk Information. |
| Geology and hydrogeology | Describe the underlying bedrock and superficial geology.<br>Establish underlying aquifer properties and potential pollution risks across study area. | 1:50,000 British Geological Society (BGS) Geological Map (BGS, 2017a).<br>BGS (2011), User Guide: Groundwater Vulnerability (Scotland) GIS dataset, Groundwater Science Programme, Version 2.<br>Phase 1 habitat survey. |

| Table 5.2.3: Data Requirements and Sources | | |
|---|---|---|
| **Topic** | **Data Requirement** | **Source of Information** |
| | Establish if potential GWDTEs are situated in areas conducive for groundwater (see Appendix 5.2). | |
| Soil and peat coverage | Identify the likely presence and distribution of peat deposits.<br>Where potential peat deposits are identified, a peat probing exercise has been undertaken to determine peat thickness. | BGS 1:50,000 scale superficial geology mapping (http://mapapps.bgs.ac.uk/geologyofbritain/home.html)<br>Macaulay Institute for Soil Research, Aberdeen Soil Survey of Scotland Staff (1970-1987). Soil maps of Scotland (partial coverage) at a scale of 1:25 000.<br>James Hutton Institute, April 2018, 1:25,000 Soil Map (partial cover) – updates the above 1970-1987 map.<br>Phase 1 Habitat Survey 2017.<br>Peat probing exercise carried out during the site visits in October and November 2017. |
| Made ground / land contamination | Provide information on land quality at areas identified through desk based research as having potential for land contamination. | Site visits in October and November 2017.<br>Phase 1 geoenvironmental desk study. |

### *5.2.4 Evaluation of Effects*

5.2.4.1 The assessment of effects has followed the following stages:

- Evaluation of the sensitivity of the receptors within the study area;
- Evaluation of the potential impacts of the OnTI on receptors;
- Identification of possible measures to help protect sensitive hydrological, geological and hydrogeological features; and
- Evaluation of the potential significance of likely effects by consideration of the sensitivity of the receptors within the study area, the potential magnitude of these impacts, and the significance of effects.

5.2.4.2 The significance of the potential effects from the OnTI has been defined by taking into account two main factors; the sensitivity of receptors within the receiving environment and the potential magnitude of impacts. The approach is based on SNH (2013) guidance.

**Sensitivity of Receptor**

5.2.4.3 The sensitivity of the receiving hydrological, geological and hydrogeological environment is defined by the baseline quality, as well as its potential for substitution, as defined in Table 5.2.4.

| Table 5.2.4: Summary of Value and Sensitivity Criteria for Hydrology, Geology and Hydrogeology Receptors | | | |
|---|---|---|---|
| **Receptor Sensitivity** | **Criteria** | **Receptor Type** | **Example** |
| High | Features of very high quality or rarity with little potential for substitution. | Designated conservation sites / WFD waterbodies | - Conditions supporting sites with international conservation designations (e.g. Special Area of Conservation, Special Protection Area and Ramsar sites), where the designation is based |

| Table 5.2.4: Summary of Value and Sensitivity Criteria for Hydrology, Geology and Hydrogeology Receptors | | | |
|---|---|---|---|
| **Receptor Sensitivity** | **Criteria** | **Receptor Type** | **Example** |
| | | | specifically on hydrological, geological or hydrogeological features.<br>- High condition WFD waterbodies. |
| | Water resources supporting human health and economic scale at a regional level. | Water resources | - Regionally important public surface water supplies, including DWPAs. |
| | Features with a very high vulnerability to flooding. | Flood risk | - SEPA Land Use Vulnerability Classification (SEPA, 2017a) development categories defined as 'Essential Infrastructure' including essential transport infrastructure, and 'Most Vulnerable' which need to be operational and accessible at all times and during flooding. Service types include ambulance stations, hospitals, fire stations, and emergency dispersal points. |
| Moderate | Feature of a high quality or rarity. | Designated conservation sites / WFD waterbodies | - Conditions supporting sites with national conservation designations (e.g. SSSI or National Nature Reserve) where the designation is based specifically on hydrological, geological or hydrogeological features, or where the ecosystem is considered to be highly groundwater dependent.<br>- Receptor WFD water body currently attaining at least good condition / potential. |
| | Water resources supporting human health and economic activity at local scale. | Water resources | - Local Public Water Supplies and associated DWPAs.<br>- Licensed non Public Water Supply abstractions or permitted discharges which are large relative to available resource, or where water quality is a critical issue (e.g. industrial process water). |
| | Features with a high vulnerability to flooding. | Flood risk | - SEPA Land Use Vulnerability Classification (SEPA, 2017a) categories defined as 'Highly Vulnerable'. Development types include buildings used for dwelling houses, hostels and hotels and landfill / waste management sites for hazardous waste. |
| Low | Feature of a moderate quality or rarity with some potential for substitution. | Designated conservation sites / WFD waterbodies | - Sites with local conservation designations where the designation is based specifically on hydrological, geological or hydrogeological features, or where the ecosystem is considered to be moderately groundwater dependent. |

| Table 5.2.4: Summary of Value and Sensitivity Criteria for Hydrology, Geology and Hydrogeology Receptors | | | |
|---|---|---|---|
| **Receptor Sensitivity** | **Criteria** | **Receptor Type** | **Example** |
| | | | - Receptor WFD water body currently attaining a status / potential of moderate or lower. |
| | Water resource supporting human health and economic activity at household / individual business scale. | Water resources | - Licensed non Public Water Supply abstractions which are small relative to available resource, or where raw water quality is not important (e.g. cooling water) spray irrigation.<br>- Unlicensed potable surface water abstractions (e.g. private domestic water supplies). |
| | Features with a moderate to low vulnerability to flooding. | Flood risk | - Land use types defined as 'Least Vulnerable' in the SEPA Land Use Vulnerability Classification (SEPA, 2017a) (e.g. most business premises types). |
| Negligible | Feature of a low quality or rarity with potential for substitution. | WFD waterbodies | - Receptor is a water feature which is not classified for by SEPA for WFD monitoring purposes. Ecosystems with no groundwater dependency.<br>- Existing land drainage systems. |
| | Water resources do not support human health and of only limited economic benefit. | Water resources | - Unlicensed non-potable water abstractions (e.g. livestock supplies).<br>- Licensed discharge infrastructure (e.g. septic tanks and soakaways etc.). |
| | Features that are resilient to flooding. | Flood risk | - Land use types which are defined as 'Water Compatible uses' under the SEPA Land Use Vulnerability Classification (SEPA, 2017a) (e.g. flood control infrastructure, water transmission infrastructure). |

**Magnitude of Impact**

5.2.4.4 The magnitude of impact in respect of hydrological, geological and hydrogeological receptors is summarised in Table 5.2.5.

| Table 5.2.5: Summary of Hydrology, Geology and Hydrogeology Magnitude of Impact | | | |
|---|---|---|---|
| **Magnitude** | **Criteria** | **Receptor Type** | **Example of Negative Impact** |
| High | Results in major change to feature, such that its use / integrity is affected. | Designated conservation sites / WFD waterbodies | Deterioration in river flow regime, morphology or water quality, leading to sustained, permanent or long-term breach of relevant conservation objectives (COs), non-temporary downgrading of WFD status (including downgrading of individual WFD elements), or resulting in the inability of the water body to attain |

| Table 5.2.5: Summary of Hydrology, Geology and Hydrogeology Magnitude of Impact | | | |
|---|---|---|---|
| **Magnitude** | **Criteria** | **Receptor Type** | **Example of Negative Impact** |
| | | | good status in line with the measures identified in the RBMP.<br>Total loss or major alteration to key functions of geological features or GWDTEs. |
| | | Water resources | Complete loss of licensed water resource or severely reduced resource availability and / or quality, permanently compromising the ability of water users to exercise licensed rights.<br>Complete loss of non-licensed resource water resource or severely reduced resource availability and / or quality. |
| | | Flood risk | Change in baseline flood risk resulting in potential loss of life or major structural damage to property and infrastructure. |
| Moderate | Results in noticeable change to feature, such that its use / integrity is affected to some degree and in some circumstances. | Designated conservation sites / WFD waterbodies | Deterioration in river flow regime, morphology or water quality, leading to periodic, short term and reversible breaches of relevant COs, or potential temporary downgrading of WFD status (including potential temporary downgrading of individual WFD elements or ability to achieve future WFD objectives).<br>Partial loss or alteration to key functions of geological features or GWDTEs. |
| | | Water resources | Moderate reduction in licensed water resource availability and / or quality, which may compromise the ability of water users to exercise licensed rights on a temporary basis or for limited periods. Moderate reduction in non-licensed water resource availability and / or quality. |
| | | Flood risk | Change in baseline flood risk resulting in potential for moderate / internal damage to property and infrastructure. |
| Low | Results in minor change to feature, such that its use / integrity remains largely unaffected in most circumstances. | Designated conservation sites / WFD waterbodies | Measurable impact on river flow regime, morphology or water quality, but remaining generally within COs, and with no short term or permanent change to WFD status (of overall status or element status).<br>Short term and transitory alteration to the function of geological features or GWDTEs. |
| | | Water resources | Minor reduction in resource availability and/or quality, but unlikely to affect the ability of water users to exercise licensed rights. |
| | | Flood risk | Change in baseline flood risk resulting in potential for minor / external damage to property and infrastructure. |
| Negligible | Results in little or no change to feature | Designated conservation sites / WFD waterbodies | No measurable impact on river flow regime, morphology or water quality and no consequences in terms of COs or WFD designations. |

| Table 5.2.5: Summary of Hydrology, Geology and Hydrogeology Magnitude of Impact | | | |
|---|---|---|---|
| **Magnitude** | **Criteria** | **Receptor Type** | **Example of Negative Impact** |
| | | Water resources | No measurable change in licensed water resource availability or quality and no change in ability of water users to exercise licensed rights.<br>No measurable change in licensed water resource availability or quality. |
| | | Flood risk | Increased frequency of flood flows, but which does not pose an increased risk to people, property and infrastructure. |

5.2.4.5 Further to the definitions of sensitivity and magnitude provided in Table 5.2.4 and 5.2.5 respectively, it is recognised that professional judgement is required in the assessment process to take account of the following parameters:

- Whether the impact is positive, neutral or negative;
- The extent of the impact (i.e. the area over which the change occurs in relation to the spatial extent of the receptor in question);
- The duration of the impact (the time for which the change is expected to last prior to recovery or replacement of the resource or feature);
- The degree of reversibility of the impact (i.e. whether it is permanent or temporary); and
- The timing and frequency of the impact in relation to any temporally sensitive features of the receptor.

**Significance of Effect**

5.2.4.6 The significance of potential effects on hydrology, geology and hydrogeology receptors is derived by considering both the sensitivity of the receptor and the magnitude of the impact acting upon it, as summarised in Table 5.2.6. Effects are graded in severity from major through moderate and minor to negligible, and can be positive, negative, or neutral. Potentially significant effects are those of major or moderate severity.

5.2.4.7 The assessment addresses changes in receptor sensitivity associated with both the current and future baseline conditions. The results of the assessment will state when the sensitivity has been adjusted to reflect the future baseline. Furthermore, the potential effect assessment in Section 5.5 assumes that embedded mitigation measures, and design mitigation will be implemented (Section 5.4). A subsequent residual assessment of effects is carried out in Section 5.7 following the incorporation of additional mitigation measures in Section 5.6.

| Table 5.2.6: Significance of Effects | | | | |
|---|---|---|---|---|
| **Sensitivity / Value of Receptor** | **Magnitude of Impact** | | | |
| | **Negligible** | **Low** | **Moderate** | **High** |
| **Negligible** | Negligible | Negligible | Negligible | Minor |
| **Low** | Negligible | Negligible | Minor | Moderate |
| **Moderate** | Negligible | Minor | Moderate | Major |
| **High** | Minor | Moderate | Major | Major |

## 5.3 Baseline Conditions

### *5.3.1 Topography and Climate*

5.3.1.1 The elevation throughout the PAB ranges from 0 m at Mean Low Water Spring (MLWS) adjacent to Redhaven (National Grid Reference [NGR]356166 866195) to approximately 325 m AOD along the western foot of Meikle Balloch Hill (NGR 345828 849187). The topography generally undulates across the slopes of low lying hills, including Cotton Hill, Lurg Hill, Meikle Balloch Hill, Hill of Greenwood and Caird's Hill from the Onshore Landfall Area to the onshore substation site.

5.3.1.2 Rainfall data were obtained from the Met Office from its rain gauges at their Banff and Keith Climate Stations which are respectively situated approximately 13 km to the east and 2.2k m to the West of the closest points of the PAB (Met Office, 2017). Based on these data the average annual rainfall recorded between 1981 and 2010 was 705.1 mm at Banff and 883.6 mm at Keith.

5.3.1.3 Chart 5.3.1 provides the average monthly rainfall which has been recorded at each station during the 1981 – 2010 period. This information indicates that the periods of highest rainfall in a typical year are expected between September and December during the autumn and early winter.

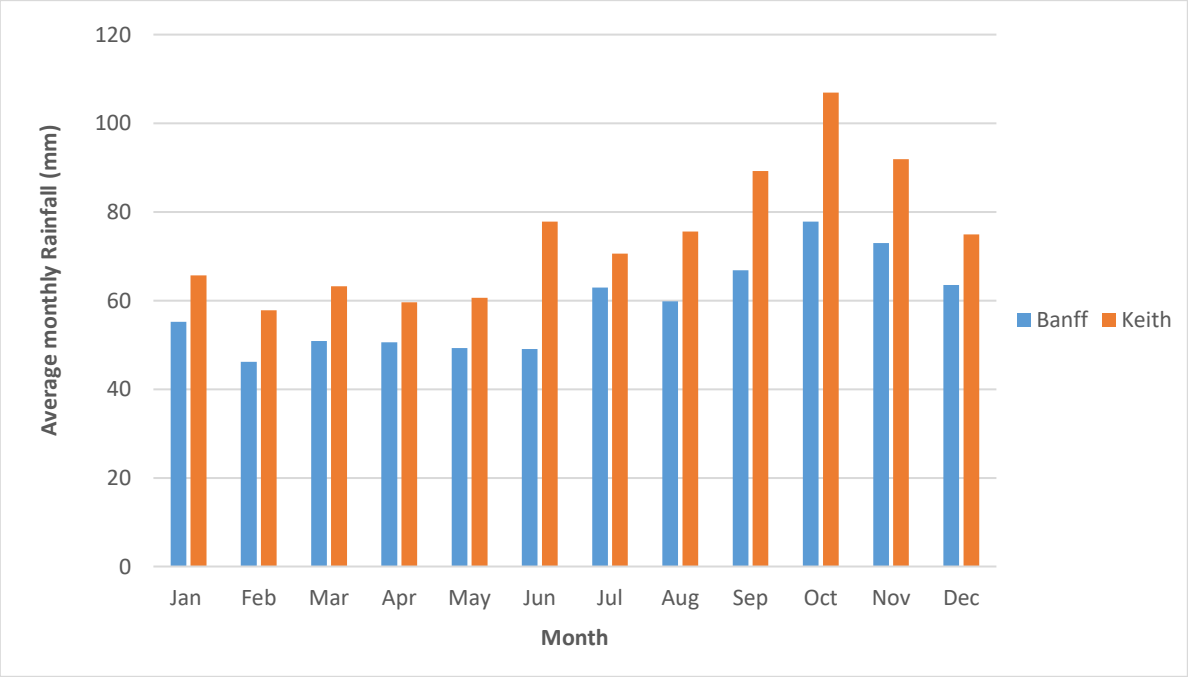


**Chart 5.3.1: Average Monthly Rainfall**

### *5.3.2 Surface Water Catchments*

5.3.2.1 The PAB is situated within the Banff Coastal and River Isla catchments within the RBMP area of the Scotland River Basin District. The following paragraphs describe the hydrological characteristics identified within these catchments and their respective tributaries; which are shown in Figures 5.3.1 and 5.3.2

**Banff Coastal Catchment**

5.3.2.2 The Banff Coastal catchment comprises of a range of tributary watercourses which drain the northern part of the PAB, and discharge into the Moray Firth. The tributary watercourses which have their sub catchment boundaries within the PAB are the Burn of Deskford, the Burn of Fordyce, and the Scattery Burn, as described in the following sections.

*Burn of Deskford*

5.3.2.3 The Burn of Deskford is approximately 14.8 km in length, and flows in a north-westerly direction from its sources at Lurg Hill and Greenhill, joining the Broxy Burn to form Burn of Cullen which discharges into Cullen Bay. From Lurghill (NGR 350038 857995) the main tributary headwater channel is the Hoggie Burn which crosses the PAB before discharging into the Burn of Deskford downstream of the Mains of Skeith (NGR 350361 860663). From the Greenhill Plantation, the main tributaries are Linn Burn and Herds Burn which cross the PAB and join the Burn of Deskford at Kirktown of Deskford (NGR 351274 861857) and Carestown (NGR 351402 862177) respectively. There are a number of other headwaters which are fed via modified forestry ditches in between the Lurghill, Greenhill and Cotton Hill forestry plantations. The Burn of Deskford has an approximate catchment area of 32.2 $km^2$.

*Burn of Fordyce*

5.3.2.4 The Burn of Fordyce is approximately 7.2 km in length, and flows in a north-easterly direction from its source on the eastern slopes of Cotton Hill, towards Sandend Bay. There are a number of groundwater springs and wells identified in the upper part of the catchment, on the eastern side of Cotton Hill and Towie Wood, and in the vicinity of Newton. Burn of Fordyce emerges from seepage slopes at NGR 352735 861512 near Viewfield within the PAB. The main channel crosses the PAB at two main locations, at its headwaters to the north of Viewfield (NGR 353674 861878), and approximately 1.5 km downstream to the west of Breach (NGR 354913 863133). The land use within this area is predominantly used for arable agriculture and, as a result, the channel planform has been straightened along some of the field boundaries. The Burn of Fordyce has an approximate catchment area of 12.1 $km^2$.

*Scattery Burn*

5.3.2.5 Scattery Burn is approximately 2.5 km in length, and flows in a north-easterly direction from its source on the eastern slopes of Towie Wood towards Sandend Bay. In the upper part of the catchment there are a number of modified field-edge drainage ditches which cross the PAB to the west of Potterstown (NGR 354933 864548). These drainage ditches join the main Scattery Burn channel at Dytach Bridge (NGR 354890 865579). The north-western corner of the PAB covers part of the catchment of the Scattery Burn, and several ditches cross the PAB feeding towards the Sandend Caravan Park alongside Seaview Road (NGR 355454 865891) prior to discharging into Sandend Bay (NGR 355527 866124).

**River Isla Catchment**

5.3.2.6 The River Isla is approximately 29 km in length, and flows in an easterly direction from its source near Loch Park to the north east of Dufftown (NGR 334765 842612) and discharges into the River Deveron (NGR 352996 847968). The River Isla crosses the PAB between Stripeside and Newton of Cantly, to the north-east of Keith. The tributary watercourses which have their sub catchment boundaries within the PAB are the Burn of Paithnick, Burn of Drum, two unnamed tributary

watercourses of the River Isla at Stripeside and Auchorties, and an unnamed tributary watercourse of the Burn of Cairnie.

*Burn of Paithnick*

5.3.2.7 The Burn of Paithnick is approximately 7.6 km in length, and flows in a southerly direction from its source to the south-west of the Lurg Hill towards its confluence with the River Isla. From Lurg Hill (NGR 350742 857443), the Burn of Croft and an unnamed tributary cross the PAB and join at the confluence of Bowie Burn at Burnend (NGR 348949 855849). The Burn of Bowie is fed by numerous agricultural field drains, forming the Burn of Paithnick downstream of the Mill of Paithnick (NGR 348387 853495). The Burn of Paithnick traverses within the Planning Application Boundary for approximately 2.3 km, prior to discharging into the River Isla (NGR 347255 851596). The main Burn of Paithnick river channel is generally meandering in planform with areas of erosion and deposition formed along a riparian corridor. The Burn of Paithnick has an approximate catchment area of 12.9 $km^2$.

*Unnamed Tributary of River Isla at Stripeside*

5.3.2.8 There is an unnamed tributary drainage ditch of approximately 0.9 km in length which has its source to the north of Stripeside, crossing the PAB south of the A96 (NGR 346614 851699) prior to its discharge into the River Isla. The unnamed tributary drainage ditch is heavily modified along the Stripeside field boundary and is ephemeral with intermittent flow.

*Unnamed Tributary of River Isla at Auchorties*

5.3.2.9 There is an unnamed tributary drainage ditch which is approximately 1.1 km in length, draining the south-western corner of the PAB near Auchorties. The drainage ditch partially crosses this area of the PAB and follows field boundaries towards its confluence with the River Isla at Braehead (NGR 342255 849515).

*Unnamed Tributary of River Isla at Gardenhead*

5.3.2.10 There is an unnamed tributary drainage ditch which is approximately 1.2 km in length, which has its source at Gardenhead, crossing the PAB south the railway line (NGR 347961, 850864) prior to its discharge into the River Isla.

*Unnamed Tributary of River Isla at Thornton*

5.3.2.11 There is an unnamed tributary ditch which is approximately 1.4 km in length, which partially crosses the eastern corner of the PAB near Thornton. The drainage ditch follows field boundaries and the A95 prior to its discharge with the River Isla (NGR 348318 851098).

*Burn of Drum*

5.3.2.12 The Burn of Drum is approximately 6.3 km in length, and flows in a north-westerly direction from its source from Meikle Balloch Hill and Hill of Greenwood towards its confluence with the River Isla (NGR 345625 851342). The headwater tributaries of the Burn of Drum comprise the Burn of Nethertown, Birken Burn, Herricks Burn, and Mill of Wood Burn which cross the Planning Application Boundary. The Burn of Netherton is fed by numerous drainage ditches which cross the PAB along field boundaries adjacent to the Marypark, Newtack, Greenwood and Backmuir properties and the A95. These drainage ditches have been heavily modified and are characterised by straightened channels due to the main land uses which are agriculture and forestry along the Hill of Greenwood. There is a surface water pond within the PAB which is fed by a forestry drainage ditch to the south of Greenwood (NGR 355540 846838). There is also an area of ombrotrophic bog marked by several surface water ponds adjacent to the south of the PAB at the Hill of Greenwood plantation (NGR 345616 847180).

5.3.2.13 The Birken Burn flows from the steep south-western slopes of the Meikle Balloch Hill via a sluice, prior to crossing the PAB adjacent to Birkenburn (NGR 345123 848405). The Birken Burn discharges

into the Burn of Tarnash at the Bridge of Tarnash. The Herricks Burn drains the western slopes of the Meikle Balloch Hill via two tributaries which converge at Herrockside immediately to the west of the PAB (NGR 345813 848934). The northern unnamed tributary supplies the Scottish Water Herricks Treatment Works which is situated immediately to the west of the PAB. This receptor is discussed within Sections 5.3.7.1 and 5.4.2. Herricks Burn subsequently crosses the PAB to the west of Herrockside (NGR 345646 849043) and discharges into the Burn of Tarnash to the north of Tarnash Farm. The Burn of Tarnash becomes the Burn of Drum to the north of the Bridge of Dannyduff.

5.3.2.14 The Mill of Wood Burn drains the north-western slopes of the Meikle Balloch Hill, crossing the PAB to the west of Crofts of Ardrone (NGR 345865 849953) via the Mill Wood gorge prior to discharge into the Burn of Drum. The Burn of Drum has an approximate catchment area of 14.4 $km^2$.

*Burn of Ardrone*

5.3.2.15 The Burn of Ardrone is approximately 1.1 km in length, draining the northern slopes of the Meikle Balloch Hill, and crossing the PAB to the west of Newton of Cantly (NGR 347031 850993) before discharging into the River Isla. The Burn of Ardrone has an approximate catchment area of 1.2 $km^2$.

*Unnamed Tributary of Burn of Cairnie*

5.3.2.16 There are several unnamed tributary drains of the Burn of Cairnie which flow in a southerly direction from the west of Pitlurg Wood and Whitehillock towards its confluence with the Burn of Cairnie (NGR 342934 845294).

5.3.2.17 During the site visit there were pools of standing water but no discernible flow identified within a ride within the Pitlurg Wood ditches (NGR 343759 845889). The other field drains shown on the 1:10,000 OS mapping along the fields at Whitehillock (NGR 344562 845690) were not visible during the site visit as there was no evidence of flow pathways identified at this location. The Burn of Cairnie joins the River Isla approximately 12 km downstream near Littlemill (NGR 351908 847558).

### *5.3.3 Geology*

5.3.3.1 The Phase 1 Geo Environmental Desk Study has identified areas of Made Ground and potential Made Ground within the PAB. The BGS 1:50,000 scale map for Portsoy (Scotland Sheet 96W, 2002) shows areas of Made Ground at the former Glasshaugh Railway Station (British Grid reference 355881, 865435) and associated dismantled railway line, and there are approximately thirty former quarries and mineral extraction pits throughout the PAB, some of which may have been infilled with waste or imported materials. Other areas of made ground are likely in developed areas within the PAB including the Aberdeen to Inverness railway line, former lime kilns, a former sheep dip, and at Blackhillock substation, as described in the Phase 1 Geo Environmental Desk Study.

5.3.3.2 The BGS 1:50,000 scale geology mapping shows that the PAB is underlain by a variable thickness of superficial deposits (locally absent at topographic highs and the coastal region) (2017a). The superficial deposits primarily comprise Diamicton Till, although very localised linear alluvial deposits and River Terrace deposits (undifferentiated sand, gravel, silt and clay) are shown along the approximate courses of the Burn of Deskford, Burn of Fordyce, Hoggie Burn, Burn of Paithnick and the River Isla. Along the coastline at Sandend to Mains of Glassaugh, the superficial geology from north to south is generally comprises: Marine Beach Deposits (gravel, sand and silt) at the coast; Raised Marine Deposits (gravel, silt and sand); and the Kirk Burn Silt Formation (clay, silt and sand). Small areas of peat are shown south of Bogtown, southeast of Cultain, and at Muirtown, southeast of Balnamoon.

5.3.3.3 SNH's Carbon and Peatland Map (2016) indicates that no Class 1 or Class 2 peat is present within the PAB. The 1:25,000 scale Soil Map of Scotland (2018) shows localised areas of peat south of the A98 road at Bogtown, at Chapel Hill, between Bossy Hillocks and Goukstone, and at Muirtown (corresponding to the area of peat shown onsite on the BGS 1:50,000 geology mapping, as

discussed above). Areas of peat identified within the PAB (as it was at the time of the peat probing exercise) shown on the Soil Map (previous edition, 1978 – 1987) and localised areas within the PAB where wetland habitats (marsh and marshy grasslands) were identified during the ecological Phase 1 habitat survey in 2017, were targeted for a peat probing during survey completed in November and December 2017. The survey found one area of peat located south of Cotton Hill and the Cultain Farm property at Fordyce. Peat was encountered up to a maximum thickness of 1.7 m.

5.3.3.4 The BGS Online Digital 1:50,000 scale Geology mapping viewer (2017a) shows the solid geology underlying the PAB to comprise, from approximately north to south, a series of metamorphic lithologies, including Grampian Group quartzite, Appin Group Graphitic Pelite, Calcareous Pelite, Cacsilicate-rock and Psammite deposits, Argyll Group Psammite, Semipelite and Pelite deposits, and localised Appin Group Metalimestone deposits. The metamorphic bedrock is locally intruded by igneous deposits including Neoproterozoic – Felsic rock, Ordovician to Silurian Ultramafitite and Mafic rock. These deposits are overlain by localised deposits of Devonian Middle Old Red Sandstone deposits, comprising conglomerate, sandstone, siltstone and mudstone. These deposits are variably faulted, with an extensive fault extending from the coast at Cullen towards a fault cluster to the north of Crossroads, predominantly trending north-west to south-east.

5.3.3.5 Outcrops of the metamorphic rocks along the Cullen to Stake Ness Coast, known as the Dalradian Supergroup, have been designated as a SSSI. SNH has identified development with planning permission and dumping / spreading / storage of materials as pressures upon the SSSI. Quarrying activity (limestone) has taken place within the SSSI at Boyne Bay (outside the PAB) since 1949, resulting in some of the unconsolidated rock which formed the scientific interest of the quarry being progressively removed and dumped over the cliffs. This activity has now stopped; however extraction of stone from the quarry continues. SNH's objectives for management of SSSI include maintaining unobscured outcrops of Dalradian rock for future research and study. SNH notes that generally, any works within the SSSI boundary which do not have a major effect on rock exposures will be considered compatible with the Earth Science interest. The condition of the Dalradian feature is classed by SNH as favourable – maintained, overall favourable. Further detailed information on the underlying geological characteristics is provided in Technical Appendix 5.1: Phase 1 Geoenvironmental Desk Study.

5.3.3.6 Scotland's Environment website (2017) lists one relevant Geological Conservation Review site, the Cullen Troup Head Banffshire Coast Site (GCR Number 2811), comprising the Dalradian formation, as described above, which is within the coastal area of the PAB.

5.3.3.7 AC has designated Cullen to Whitehills Coast as a Local Nature Conservation Site (LNCS). Within the PAB the designation largely matches the SSSI boundary for Cullen to Stake Ness Coast, with the exception that it also includes the beach at Sandend Bay west of the PAB. The designation is partially geological as it refers to the coastline's maritime grassland, steep cliffs and rocky intertidal shores and includes Old Red Sandstone cliffs and Boyne Quarry which has exposures of glacial and interglacial features (Boyne Quarry is not within the PAB).

### *5.3.4 Hydrogeology*

5.3.4.1 The BGS Online Digital 1:625,000 scale Hydrogeology viewer (2017b) indicates that most of the PAB is associated with the Appin Group Unit which typically has a limited groundwater yield apart from near surface weathered zones and within secondary factures. The emergence of groundwater is evident at a wetland underlain by a limestone formation adjacent to the Mill Wood SSSI. There is also a small number of springs and wells shown on hillslopes and flushes within each catchment.

5.3.4.2 There are also likely to be areas of localised groundwater contained within the relatively permeable superficial deposits of alluvium, sand and gravel along river corridors, and within the isolated pockets of peat situated upon shallow topography along the riparian corridor of Burn of Fordyce between the Knowles and Viewfield.

5.3.4.3 GWDTEs are wetlands which critically depend on groundwater flows and / or chemistries and are specifically protected under the WFD.

5.3.4.4 The assessment related to potential GWDTE covers an area extending to at least 250 m from the PAB. In order to identify these, analysis of the Phase 1 habitat survey (see Chapter 6: Ecology and Nature Conservation) findings were initially cross referenced in accordance with SEPA Land Use Planning Guidance Note 31 (LUPS – GU31) Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and GWDTE (2017d).

5.3.4.5 LUPS – GU31 states that assessment of potential GWDTE is required where these are situated within 100 m of excavations less than 1 m in depth, or within 250 m of excavations greater than 1m in depth. Based on this, all potential GWDTE within 250 m of the PAB have been considered.

5.3.4.6 The information presented in Technical Appendix 5.2: GWDTE Assessment evaluates if the groundwater conditions across the PAB are conducive to supporting GWDTEs. Each potential GWDTE has been assigned a compartment number or ID which is shown on Figure 5.3.3. The likely groundwater dependency for these potential GWDTE areas has been assessed through consideration of possible water supply mechanisms based on local topography, underlying geology and the potential for surface water contributions to habitats. This supporting information is displayed on Figure 5.3.4 and Figure 5.3.5 for reference. The information from the screening study in Technical Appendix 5.2 is summarised within Table 5.3.4 which notes each of the receptors being considered in this chapter.

### *5.3.5 Designated Conservation Sites*

5.3.5.1 The Scottish Geology website (2017) lists one Local Geodiversity Site at Bow Fiddle Rock at Portknockie which was formed by erosion of Cullen Quartzite Formation deposits (a metamorphic rock derived from sandstone) at the coast of the Moray Firth. This site is situated within a different catchment, and at 7 km west of the PAB it will not be impacted by the OnTI. This site has been scoped out of the assessment.

5.3.5.2 SNH Site Link (2017) indicates that the 344 ha area extending for much of the coast from Cullen to Stake Ness is classified as a SSSI, of which 30.7 ha is within the PAB. The site qualifies as a geological SSSI on the basis of the presence of exposed Dalradian (structural and metamorphic geology) and Quaternary (Quaternary geology and geomorphology) deposits. The SSSI is an important part of the longest continuous section across the strike of the Dalradian succession in Scotland, providing important information on the formation, stratigraphy and subsequent tectonic history and metamorphism of the succession underlying much of North East Scotland.

5.3.5.3 The Mill Wood SSSI is immediately west of the PAB within the Burn of Drum catchment (NGR 345096 848421). This woodland SSSI supports a rich assemblage of flora in places where the vegetation is associated with outcrops of base-rich rocks, including limestone. The Den of Pitlurg SSSI is situated approximately 150 m to the south of the PAB, within the unnamed tributary of the Burn of Cairnie catchment (NGR 344656 845344). The floor of the contains fen vegetation which is floristically very rich and part of an ancient woodland site.

5.3.5.4 However, information presented in the Chapter 6: Ecology and Nature Conservation and further analysis in Technical Appendix 5.2: GWDTE Assessment indicates that the Mill Wood SSSI and the Den of Pitlurg SSSI are not likely to be groundwater dependent, and both receptors have been scoped out of the assessment.

### *5.3.6 Water Framework Directive Classifications*

5.3.6.1 Across the PAB, there are 10 WFD waterbodies, comprising seven rivers and three groundwater waterbodies. Six waterbodies are assessed as being of Moderate or worse status overall, while four are as assessed as being of Good overall status (SEPA, 2017). Technical Appendix 5.3 presents further information on the WFD condition, the future objectives and associated mitigation

measures for each of these 10 waterbodies. The overall condition of each WFD waterbody is summarised in Section 5.3.10 to help inform determination of the baseline receptor sensitivity.

### *5.3.7 Water Resources*

*Public Water Supplies*

5.3.7.1 In its Scoping Opinion, Scottish Water stated that the catchments of the River Deveron, the Herricks Springs and Burn and Shenwell Spring have potential to lie within the PAB depending on its final location. These areas are designated as Drinking Water Protection Areas (DWPAs) under the WFD, and therefore Scottish Water require that potential negative effects on water quality and quantity from the OnTI are avoided. Scottish Water requested that the proposed infrastructure and associated activities are situated outside and at a distance from the Herricks Springs and Burn and Shenwell Springs DWPA catchments, given that this type of supply is particularly sensitive.

5.3.7.2 Figure 5.3.2 identifies that the Shenwell Springs catchment is situated outside and at a distance of approximately 350 m from the PAB. The western boundary of the Herricks Springs and Burns catchment partially overlaps with the PAB in two locations: to the south of Herrockside (NGR 345738 848669); and to the north of Crofts of Ardrone (NGR 346074 849988).

5.3.7.3 The wider River Deveron catchment has been identified by Scottish Water as a DWPA as it serves more than 50 persons with drinking water. It has been identified at risk of water quality deterioration due to pesticides, cryptosporidium and metaldehydes. SEPA is currently working with a range of stakeholders, including Scottish Water and landowners, to address these issues through work to reduce diffuse pollution, and to provide specific controls for metaldehyde. The PAB encompasses numerous tributary sub catchments within the River Deveron DWPA, including Burn of Paithnick, Burn of Drum, unnamed tributaries of the River Isla at Stripeside and Auchorties, and Burn of Cairnie as described above in Sections 5.3.2.1 to 5.3.2.15. The PAB also crosses a section of the River Isla watercourse channel.

*Private Water Supplies*

5.3.7.4 MC and AC were contacted regarding the presence of PWSs within the study area as defined in Section 5.2.3. This study area was identified to ensure that all registered sources were investigated to assess if they have potential hydrological and hydrogeological connections to the PAB. A total of 53 PWSs were identified within the study area, comprising 37 within the MC area, and 16 within the AC area, as shown in Figure 5.3.2. Each of these PWS are registered as being Type B, which are defined as being supplies serving only domestic premises with less than 50 persons supplied. AC provided a list of registered users though were not able to confirm the type or exact location of source supply. From the 53 PWSs identified in Technical Appendix 5.3, 40 are assessed as having a potential hydrological or hydrogeological connection to the PAB. The other 13 are assessed as not being connected and therefore have been scoped out of the assessment in Section 5.5.

*Licensed Abstractions and Discharges*

5.3.7.5 Landmark (2017 and 2018) provided details of the licensed abstractions and discharges within the PAB. The report identified a list of 33 SEPA licensed discharges which are situated within the PAB. Technical Appendix 5.3 provides details of each of the licensed discharges within the PAB and Figure 5.3.2 shows their respective locations.

### *5.3.8 Flood Risk*

5.3.8.1 A review of all sources of flood risk (fluvial, tidal, pluvial, groundwater and sewers) has been undertaken as required by SPP (2014). An assessment of existing sources of flood risk within the study area is presented below, and flood risk receptor (FRR) locations are shown on Figure 5.3.2.

**Fluvial Flood Sources**

5.3.8.2 The online indicative SEPA flood map (2017c) has been used to identify potential fluvial FRRs upstream and downstream of the PAB within the study area catchments. These are described in the following sections.

*Scattery Burn (FRR01)*

5.3.8.3 Sandend Caravan Park (FRR01) falls within the High Risk Flood Zone (10 % AEP) around the Scattery Burn meander bend, approximately 400 m to the north-east of the PAB.

*Burn of Fordyce (FRR02 – FRR05)*

5.3.8.4 Within the PAB, the local access road to the Breach dwelling (FRR02) is shown to be within the High Flood Risk Zone (10 % AEP). There are two dwellings (FRR03, FRR04) situated within the High Flood Risk Zone alongside West Church Rd within the PAB, south of Fordyce. In the Fordyce village centre, to the north of Bridge Street, there are several dwellings (FRR05) and a church (FRR06, NGR 355584 863901) situated within the High Risk Flood Zone, approximately 400 m to the north of the PAB crossing of the Burn of Fordyce.

*Burn of Deskford (FRR08 – FRR011)*

5.3.8.5 To the west, and approximately 400 m downstream of a ditch within the PAB, the Lower Craibstone Cottage (FRR07, NGR 349884 859392) is indicated to be within the High Risk Flood Zone (10 % AEP). There are several dwellings within the High Risk Flood Zone (10 % AEP) in Berrhillock including The Old Mill (FRR08) and others along Burnside Crescent (FRR09) in Berryhillock, approximately 900m downstream of the PAB crossing of Hoggie Burn. In Milton the local access road is shown to be in the High Flood Risk Zone (10 % AEP) and the dwellings at Bleachfield (FRR10) are within the Low Flood Risk Zone (0.1 % AEP), approximately 1.1 km downstream of the PAB crossing of Herds Burn. Several dwellings at Mill of Towie (FRR11) fall within the High Risk Flood Zone of Burn of Deskford (10 % AEP), approximately 1.5 km downstream of the PAB crossing of an unnamed forestry ditch.

*Burn of Paithnick*

5.3.8.6 Within the PAB at the Mill of Paithnick there is a dwelling (FRR12, NGR 348174 853811) falling within the High Risk Flood Zone (10 % AEP) of the Burn of Paithnick. To the west and downstream of the PAB, the local access tracks for Bogs of Paithnick (FRR13, NGR 348159 854266) and Burnside Mill (FRR14, NGR 348832 855370), at approximately 1 km and 300 m respectively, are shown to be within the High Flood Risk Zone (10 % AEP) of the Bowie Burn tributary.

*River Isla*

5.3.8.7 SEPA online flood risk mapping shows that the PAB crosses the floodplain of the River Isla. The High Risk Flood Zone (10 % AEP) is shown to extend to the north of the river channel between the River Isla channel and the A95 junction, approximately 180 m east of the confluence with the Burn of Pathnick (FRR15, NGR 347436 851735). The High Risk Flood Zone also encompasses local access tracks which link the Little Cantle and Meikle of Cantly dwellings and the Bridge of Grange (FRR16. NGR 347441 851470), located to the east and approximately 200 m downstream of the PAB crossing of the River Isla. Approximately 1.7 km downstream of the PAB crossing of the River Isla, the Haughs of Grange dwelling (FRR17, NGR 348873 850875) is shown to be within the Medium Flood Risk Zone (0.5 % AEP).

*Burn of Drum*

5.3.8.8 In the vicinity of Tarnash Farm, approximately 1.7 km downstream of the PAB, there are dwellings (FRR18, NGR 344330 849044) falling within the High Flood Risk Zone (10 % AEP) associated with the Burn of Drum.

**Tidal Flooding Sources**

5.3.8.9 SEPA online flood risk mapping shows that Sandend Caravan Park (FRR01, NGR 355505 866038) falls within the Low Flood Risk Zone (0.1 % AEP) for tidal flooding from Sandend Bay. The receptor at this location is shown to be protected from Medium and High Risk flood events.

**Surface Water Sources**

5.3.8.10 The SEPA flood risk map indicates that areas of surface water flood risk are largely coincident with the fluvial flood risk zones adjacent to watercourses. There are other small isolated pockets of surface water flood risk situated within localised depressions across the PAB. The forestry belts areas adjacent to the proposed onshore substation site (FRR19 NGR 344408 845479) fall within a High Flood Risk Zone (10 % AEP).

**Groundwater Sources**

5.3.8.11 SEPA flood risk mapping indicates that the study area is not at risk of groundwater flooding. Given the limited extent of groundwater in the vicinity, it is anticipated that groundwater flooding will be localised to relatively permeable areas (e.g. across alluvium, sand and river terraces) and localised areas of peat and groundwater springs. Examples include areas near the tributary headwaters of the Burn of Fordyce on the flanks of Cotton Hill and along the River Isla valley floor.

**Sewer Flooding**

5.3.8.12 Due to its predominantly rural character, it is anticipated that there are few sewer drainage networks within proximity to the PAB. These are likely to be largely based around Sandend, within the Scattery Burn catchment, and near to Keith, within the Burn of Drum catchment. However, in these areas, sewers are unlikely to constitute a significant source of flooding which can be distinguished from surface water flooding.

**Reservoir Flooding**

5.3.8.13 Two covered reservoirs associated with the Herricks Burn Water Treatment Works (WTW) at NGR 345554 847991 and NGR 345478 849767 are situated within the Burn of Drum catchment and both lie within the PAB. However, SEPA flood mapping of reservoir flooding indicates that neither of these constitute a significant existing source of flood risk.

### *5.3.9 Future Baseline*

5.3.9.1 Information regarding climate change was obtained from the UK Climate Projections (UKCP09, 2017) website. The UKCP09 is a climate analysis tool which features comprehensive projections for different regions of the UK. Based on a high emissions scenario, the central estimate climate information for the North of Scotland indicates mean winter temperatures could increase by approximately 1.8 °C and that mean summer temperatures could increase by approximately 2.4 °C by the 2050s. The central estimate also predicts that mean annual precipitation could be reduced by 1 %, with winter precipitation increasing by 13 % and summer precipitation reducing by 10 % before the 2050s.

5.3.9.2 Thus, in winter months there could be an increase in rainfall and reduction in snowfall. If climate change leads to drier summers there is potential for increased pressures on habitats supporting sensitive species as well as increased demand from water users. Current projections also indicate that summer storms are likely to be more intense and frequent and this may lead to more extreme flow values immediately following such events, with consequential flooding issues.

5.3.9.3 WFD waterbodies have an overall target of Good condition by 2027 unless a lower condition is justified by means of technical infeasibility or disproportionate cost. For the purposes of the assessment, all waterbodies outlined in Section 5.3.6 that are currently Moderate condition or less have been assumed to have reached Good condition during the operational phase, between 2027 and the 2050s in Table 5.3.4 below.

5.3.9.4 Changing land use in the form of changing agricultural land management practices, urban development, or development of industrial sites could cause changes to the hydrological, hydrogeological and geological conditions over time. These changes could result in changes patterns and rates of infiltration, changes in flow pathways and sources of sediment inputs, direct physical changes to WFD waterbodies, or the introduction or removal of sources of pollution. Although there is expected to be some diversification of agriculture within Moray and Aberdeenshire, the existing land uses are expected to remain largely unchanged during the lifecycle of the OnTI.

### *5.3.10 Identified Receptors*

5.3.10.1 A range of hydrological and hydrogeological and geological receptors have been identified that may be affected by the PAB. Table 5.3.4 summarises each of the receptors being considered in this chapter, with receptor sensitivity determined in accordance with the criteria provided in Table 5.3.1.

**Table 5.3.1: Identified Receptors**

| Receptor Type | Identified Receptor | Sensitivity | Rationale |
|---|---|---|---|
| WFD waterbodies | Good overall WFD condition for river and groundwater bodies – Burn of Drum (23177); Cairnie Burn (23172); Banff (150632); and Keith (150656). | Moderate | These waterbodies have Good WFD condition. |
| | Moderate or lower overall WFD condition for river and groundwater bodies – Deskford Burn (23050); Fordyce Burn (23052); Burn of Paithnick (23175); River Isla – Keith to Shiel Burn (23179); River Isla – Source to Keith (23181); and Cullen (150501). | Low (Construction)<br>Moderate (Operation) | These waterbodies are currently at Moderate or lower WFD condition. Predicted improvements in WFD condition to Good by or after 2027 mean that their sensitivity to the OnTI will increase over time. |
| GWDTEs | GWDTEs – 33, 36, 37, 56, 61, 65, 76, 95, 101, 113, 119, 125, 138, 141, and 143. | Moderate | Groundwater is considered likely to support wetland vegetation which is highly groundwater dependent. |
| | GWDTEs – 1, 2, 3, 8, 10, 11, 12, 13, 14, 15, 26, 27, 30, 34, 38, 39, 41, 46, 48, 49, 51, 54, 55, 59, 63, 64, 66, 67, 68, 78, 79, 81, 82, 83, 85, 87, 88, 89, 90, 91, 92, 97, 98, 99, 102, 104, 105, 109, 118, and 140. | Low | Groundwater is considered likely to support wetland vegetation which is moderately groundwater dependent. |
| Water resources | Scottish Water Public Water Supplies – River Deveron DWPA. | High | Regionally important Public Water Supplies. |
| | Scottish Water Public Water Supplies – Herricks Springs and Burn DWPA; and Shenwell Spring DWPA. | Moderate | Locally important Public Water Supplies and DWPAs. |

| Table 5.3.1: Identified Receptors | | | |
|---|---|---|---|
| **Receptor Type** | **Identified Receptor** | **Sensitivity** | **Rationale** |
| | **PWSs – unlicensed potable abstractions:**<br><br>Burn of Fordyce catchment – PWS 1, PWS2, PWS5, PWS6, PWS7, PWS8, PWS9, PWS10, PWS13, PWS14, and PWS15..<br><br>Burn of Deskford catchment – PWS17, PWS18, PWS20 and PWS21.<br><br>Burn of Paithnick catchment – PWS22, PWS24, PWS26 and PWS28.<br><br>Burn of Ardrone catchment – PWS31.<br><br>Burn of Drum catchment – PWS33, PWS34, PWS35, PWS36, PWS37, PWS38, PWS39 and PWS40.<br><br>Unnamed tributary of Burn of Cairnie – PWS41, PWS42 and PWS43.<br><br>Unnamed tributary of River Isla at Auchorties – PWS44, PWS45, PWS46, PWS47 and PWS48.<br><br>Unnamed tributary of River Isla at Gardenhead – PWS50.<br><br>River Isla – PWS52.<br><br>Unnamed tributary of River Isla at Thornton – PWS53. | Low | Unlicensed potable surface water and groundwater PWS abstractions with potential hydrological and hydrogeological connectivity to PAB. |
| | **Licensed discharges:**<br><br>Scattery Burn catchment: LD1, LD2, LD3 and LD4.<br><br>Burn of Fordyce catchment: LD5, LD6, LD7, LD8, LD9, and LD10. | Negligible | Potential for direct effects on the physical infrastructure for sewerage or agricultural discharge (e.g. septic tanks, soakaways etc.) arising from construction of the OnTI. |

| Table 5.3.1: Identified Receptors | | | |
|---|---|---|---|
| **Receptor Type** | **Identified Receptor** | **Sensitivity** | **Rationale** |
| | Burn of Paithnick catchment: LD11, LD12, LD13, LD14, LD15, LD16, LD17, LD18, LD19, LD20, LD21, and LD22, and LD23.<br><br>Burn of Ardrone catchment: LD24.<br><br>Burn of Drum catchment: LD25, LD26, LD27, LD28, LD29, LD30, LD31 and LD32.<br><br>Unnamed tributary of Burn of Cairnie: LD33. | | |
| Flood risk receptors | Scattery Burn catchment – Sandend Caravan Park (FRR01).<br><br>River Isla catchment – A95 mass transport route (FRR15) between Aviemore and Portsoy / Banff. | High | Land use types defined as 'Most Vulnerable' under Flood Risk and Land Use Vulnerability Guidance (SEPA, 2017a) which includes caravan parks and mobile homes.<br>Land use types defined as essential transport infrastructure (including mass transport routes that have to cross the area at risk). |
| | Burn of Fordyce catchment – West Church Road dwellings (FRR03, FRR04); and Fordyce centre dwelling (FRR05).<br><br>Burn of Desford catchment – Lower Craibstone dwelling (FRR07); Old Mill (FRR08) and Burnside Crescent (FRR09); Bleachfield (FRR10); and Mill of Towie dwelling (FRR11).<br><br>Burn of Paithnick catchment – Mill of Paithnick (FRR12).<br><br>River Isla catchment – Haughs of Grange Dwelling (FRR17).<br><br>Burn of Drum catchment – Tarnash Farm dwellings (FRR18). | Moderate | Land use types defined as 'Highly Vulnerable' under Flood Risk and Land Use Vulnerability Guidance (SEPA, 2017a) which includes buildings for dwellings. |
| | Burn of Fordyce catchment – Breach local access (FRR02); and Fordyce Church (FRR06).<br><br>Burn of Paithnick catchment – Bogs of Paithnick local access (FRR13); | Low | Land use types defined as 'Least Vulnerable' in the Flood Risk and Land Use Vulnerability Guidance (SEPA, 2017a) (e.g. financial, professional and other services, non-residential institutions not included in 'Most Vulnerable' and 'Highly Vulnerable' uses. Land and buildings used for forestry). |

| Table 5.3.1: Identified Receptors | | | |
|---|---|---|---|
| **Receptor Type** | **Identified Receptor** | **Sensitivity** | **Rationale** |
| | and Burnside Mill local access (FRR14).<br><br>River Isla catchment – Little Cantle, Meike of Cantly, Bridge of Grange local access (FRR16). | | |

### *5.3.11 Data Limitations*

5.3.11.1 AC provided only the locations of PWS users, with no details about the source of the abstraction (i.e. the records did not specify whether the abstraction was from surface water or groundwater). As such, the location information provided by AC is generally assumed to be for the user property itself and not the actual location of the source. As a result, the locations of the PWSs provided in Aberdeenshire have been treated as approximations as part of a cautious approach. However, this is not considered to unduly affect the robustness of the assessment presented within this chapter, given that a worst case scenario has been assessed for PWSs within the study area.

5.3.11.2 The PAB was amended after the 2017 peat probing survey was complete, and in addition the 1:25,000 Soil Map (partial cover) for Scotland was updated on 19th April 2018. The 2017 peat probing targeted twelve areas of potential peat comprised of: peat shown on BGS 1:50,000 scale superficial geology mapping; basin peats shown on the 1:25,000 scale Soil Map (partial cover) (previous edition, 1970-1987); and marsh/marshy grassland identified in the Phase 1 Habitat survey data for the previous PAB and 250m buffer. Eleven areas were surveyed and peat greater than 0.5m thick was confirmed in only one of them. The twelfth area (by Chapel Hill) could not be surveyed due to access restriction. A review of the updated 1:25,000 Soil Map, 1:50,000 BGS geology mapping and Phase 1 Habitat and Protected Species Field Map data where available for the current PAB indicates two additional areas of potential peat on the Soil Map, comprising: a linear area oriented roughly north to south between Bossy Hillocks and Goukstone, which corresponds to an area of marshy grassland identified by Phase 1 Habitat survey; and a linear area oriented roughly west to east between Bogtown and the A98 where additional Phase 1 Habitat survey in 2018 has identified an area of marsh/marshy grassland. The 2018 Phase 1 Habitat survey has also identified a small area of bare peat at the southwest side of Gallow Hill. The Soil Map also shows several areas of peaty soils (peat gleys and peaty podzols), the results of the 2017 peat probing in similar areas within the PAB (where there is no evidence of peat vegetation) indicate that the likelihood of peat being present in these areas is relatively low. Further desk based review and peat probe survey will be completed as outlined in 5.4.2.5 to ensure that any impacts on peat are minimised.

5.3.11.3 As noted in Chapter 6: Ecology and Nature Conservation, the Phase 1 habitat surveys undertaken in 2017 and 2018 were based on previous iterations of PAB plus 250 m buffers. The PAB considered within the EIA Report includes some locations that were not included within previous iterations, or covered by the 250 m survey buffers. While these locations are limited, it is considered that there may be further potential GWDTEs within 250 m of the PAB that have not been identified.

## 5.4 Embedded Mitigation

5.4.1.1 Appropriate mitigation measures are assumed to be incorporated into the OnTI's design to prevent or minimise potential negative effects as a result of the OnTI. Mitigation will also include the application of good practice working methods. The following design assumptions have been considered as part of the assessment.

### *5.4.2 Design Assumptions*

5.4.2.1 Given that the PAB is much wider than the proposed working width for installation of the onshore cable circuits (~30 m with wider locations where technical necessity dictates), there will be a notable degree of flexibility for micrositing of the route away from sensitive features such as GWDTEs and PWSs during the detailed design stage.

5.4.2.2 Scottish Water has requested that all proposed infrastructure and construction activities are sited outside of the approximate Herricks Springs and Burn and Shenwell Spring DWPA catchment areas. A 100 m buffer has been applied to both DWPA catchment boundaries to ensure that infrastructure and associated activities are not permitted any closer to the watercourses, springs and associated Herricks WTW. The catchment boundaries and buffers are displayed in Figure 5.2.1.

5.4.2.3 Different methods of installing the cable circuits will be employed when crossing watercourses. The method will depend on the importance of the feature, the results of ground investigation and consultations with SEPA. It is anticipated that sensitive watercourses will be crossed by trenchless HDD techniques where practicable, and that smaller or modified watercourses will more likely be crossed by open cut techniques.

5.4.2.4 Within areas of forestry plantation (e.g. Cotton Hill and Pitlurg Wood etc.) there will be no requirement for felling during construction as either HDD techniques will be used, or cable circuits will be installed in tracks and rides where the forestry is to be avoided.

5.4.2.5 The findings of the peat survey and additional desk based review for additional areas not previously surveyed will be utilised during detailed design of the OnTI in order to identify a route for the cable circuits that avoids peat deposits. In the event that peat (or potential peat as yet not surveyed) cannot be avoided, further peat probe surveying and micro-siting will be carried out to help minimise any impacts.

5.4.2.6 It has been assumed that a 'floating access track' will be designed and utilised in areas where the peat depth is greater than 1 m. In its simplest form, a floating access track is one constructed directly on top of peat, relying on in-situ peat for its support. In areas of shallow or no peat it has been assumed that a 'cut track' design will be utilised for which topsoil and peat will be stripped to expose a suitable foundation on which to build aggregate track.

5.4.2.7 Careful consideration will be given to siting infrastructure at sufficient distances from receptors to avoid any disruption to the quantity and quality of water availability serving each assessed PWSs. Further clarification on the source type, and indicative pipeline / abstraction locations of each assessed PWS will be sought from their registered owners (see Table 5.3.2, Figure 5.3.2). A detailed PWS risk assessment will be carried out to inform detailed design of the OnTI, prior to the commencement of construction. The detailed PWS risk assessment will be submitted to and approved by MC and AC and SEPA as appropriate.

5.4.2.8 Potential land contamination has been identified in localised areas within PAB in the Phase 1 Geo Environmental Desk Study. Consideration will be given in the detailed design to avoiding these areas. Prior to construction, targeted ground investigations will be completed on critical sections of the proposed cable circuit route and on the onshore substation site to provide information on the ground and groundwater conditions that will guide the temporary and permanent works design. This will include the collection of environmental samples if potential contamination is suspected or encountered. This will allow additional mitigation measures to be implemented if required.

5.4.2.9 Where they cannot be avoided through design, comprehensive NVC surveys will be undertaken of true GWDTEs to determine their exact nature and extent. The findings of the NVC surveys will further inform design of the OnTI to help avoid, minimise and quantify any impacts.

5.4.2.10 Similarly, regarding the protection of designated geology within the Cullen to Stake Ness Coast SSSI, a detailed NVC survey will be undertaken by a suitably qualified and experienced surveyor prior to detailed design. The NVC survey will inform the exact siting of any infrastructure and construction areas, as well as determine the installation methods. Detailed consultation with SNH will be undertaken and a detailed method statement prepared and agreed that will ensure the Dalradian rock exposure features of the SSSI are protected in accordance with SNH's management objectives for the site during construction of the OnTI and remain unaltered during its operation.

5.4.2.11 Cable circuits, if not suitably installed, have the potential to cause effects on the near surface soils associated with the generation of heat when under heavy or full load. Heating of soils could affect agricultural soils or peat by drying out the soil surrounding the cable circuits. These effects will be avoided through design of the cable circuits, the depth of installation and the selection and handling of backfill material (e.g. thermal properties of the material and compaction).

### *5.4.3 Construction Best Practice*

5.4.3.1 This assessment assumes the construction mitigation and control measures proposed within this section will be appropriately implemented by the Contractor. It is envisaged that these measures will be secured through planning conditions relating to the preparation of construction guidance documents / plans.

5.4.3.2 Engineering work and construction activities in, or near watercourses will adhere to the principles of the CAR, outlined in the SEPA CAR practical guide (2018). Consultation with SEPA on requirements for CAR authorisations will be undertaken by the appointed Contractor during the detailed design process for the OnTI. This will include all abstractions, discharges and engineering activities, such as watercourse crossings.

5.4.3.3 The CAR Regulations require that for a linear site over 5 km, a site CAR licence also needs to be in place and applications will be made at least four months prior to the commencement of works onsite.

5.4.3.4 The Contractor will be required to comply with the standard mitigation measures outlined in the paragraphs below:

- Measures to avoid, reduce or control pollution of surface water and groundwater will incorporate SEPA requirements and CIRIA guidelines for pollution control, including the Guidance for Pollution Prevention (GPP) (Netregs, 2017) detailed below:
    - PPG1 Understanding Your Environmental Responsibilities – Good Environmental Practices (July 2013);
    - GPP2 Above Ground Oil Storage Tanks;
    - GPP4 Treatment and disposal of wastewater where there is no connection to the public foul sewer;
    - GPP5 Works and maintenance near water;
    - PPG6 Working at construction and demolition sites (2012);
    - GPP8 Safe Storage and disposal of used oils;
    - GPP13 Vehicle washing and cleaning;
    - PPG18 Managing fire water and major spillages (December 1991);
    - GPP21 Pollution incident response planning;
    - PPG22 Dealing with spills (April 2011);
    - PPG26 Safe storage – drums and intermediate containers (May 2011).

  - CIRIA C741 Environmental Good Practice on Site (CIRIA, 2015a);
  - CIRIA C753 (2015) The SuDS Manual;
  - CIRIA C689 Culvert Design and Operation Guide (CIRIA, 2010);
  - CIRIA C532 (2001): Control of water pollution from construction sites; and,
  - CIRIA C648 (2006): Control of water pollution from linear construction projects – Style Guide.

- Work taking place within areas designated as SSSI will be completed in accordance with SNH (2011) Sites of Special Scientific Interest booklet for owners and occupiers of SSSIs – Operations within SSSIs.
- The risks from accidental spillages / leaks during handling and storage of chemicals, transformer oil and fuels will be mitigated by pollution prevention measures and good working practices, in accordance with the current guidelines referenced above;
- During refuelling, waste storage, concrete preparation and washout, 50 m buffers will be applied to all surface watercourses, groundwater borehole abstraction points and springs;
- A pre-construction site investigation to inform detailed design of the OnTI, which will include targeted investigation of areas where the potential for land contamination has been identified in the Phase 1 Geo Environmental Desk Study to inform the design of the temporary and permanent works. The Contractor will develop / adhere to procedures for dealing with unexpected land contamination if encountered during the construction phase.
- The access tracks will require culverting or temporary bridging over existing watercourses to allow continued working width access during construction. Where a temporary watercourse crossing is required, appropriate design will be implemented to ensure flood flow conveyance and sediment transfer conditions are commensurate with those prior to construction. Any temporary bridge or culvert required to facilitate construction of the OnTI will be removed within 12 months of the completion of construction activities;
- Culverting activities and construction of cable circuit crossings will take place during periods of normal to low flow conditions to avoid conveyance related flood risk effects. Sections of the channel will need to be isolated using barriers that span the whole width of the channel. Water will be extracted and diverted downstream by pumping methods before treatment to remove silt prior to downstream discharge. Before removing the barriers, accumulated silt will also be extracted and disposed of appropriately. The works will be programmed to minimise disruption to the free passage of fish and aquatic mammals. Timing will be agreed between the Contractor, SNH, the Deveron, Bogie, & Isla Rivers Charitable Trust and the River Deveron Salmon Fishery Board. The isolation works will be kept to as short a duration as possible, and screening will take place to prevent fish being drawn into the pump;
- Proposals will adhere to the guidance set out in the SEPA position statement on culverting of watercourses (WAT-PS-06-02). Closed culverts will normally only be justified for single track roads over small watercourses (<2 m in width), and for all other crossings, the use of span bridges and bottomless arch structures will be prioritised. The design of watercourse crossings will follow SEPA supporting guidance WAT -SG-25 (SEPA, 2015);
- The location of Scottish Water assets (including water supply and sewer pipes, water and waste treatment works etc.) will be confirmed through obtaining detailed plans from Scottish Water Asset Plan providers. All Scottish Water assets potentially affected by the OnTI will be identified, with particular consideration to access roads and pipe crossings;

- Site roads will be constructed from inert, non-metalliferous material, with low erodibility and low sulphide content;
- The main construction works will require several site compounds. A drainage strategy for each of the construction compounds will be prepared, utilising SuDS principles for new elements. Areas of construction compounds that are used for fuel storage, and plant maintenance and refuelling will be surfaced with fully impermeable materials to prevent any infiltration of contaminated runoff. Drainage from areas not served by existing drainage systems will be designed in accordance with SuDS principles to achieve pre-development rates. SuDS measures may include attenuation storage and / or infiltration trenches / soakaways;
- During excavation of the cable circuit trenches, topsoil will be stripped and stored along the access tracks. The excavation of soils and peat will be undertaken in such a manner to avoid cross contamination between distinct horizons and layers, where possible. The different horizons and layers will be kept and stored separately for use at a later date. Stockpiles will be present for the shortest practicable timeframe, with stockpiles being reinstated as the construction work progresses. Stockpiles which remain present for three months or longer will be carefully reinstated using seeding techniques. Peat will be stockpiled with due consideration for slope stability and excavated topsoils should be stored on geotextile mattering to a maximum of 1 m thickness. Soil stockpiles will be located at least 10 m from all watercourses. Stockpile gaps will be located at topographic low points to preserve existing flow paths.
- Any temporary onsite storage of excavated materials suspected or confirmed to be contaminated will be on impermeable sheeting, covered over and with adequate leachate / runoff drainage to prevent migration of contaminants from the stockpile. Materials will be segregated where possible to prevent cross-contamination occurring.
- The Phase 1 Geo Environmental Desk Study has identified that localised areas of Made Ground are likely to be present within the PAB. Made Ground has the potential to contain asbestos fibres, even if asbestos containing materials are not visually identified by site personnel. If asbestos is present (or suspected to be present) in soils and / or construction and demolition materials are encountered, the works will be carried out in accordance with the CL:AIRE industry guidance 'CAR-SOIL', which sets out how the legal requirements of the Control of Asbestos Regulations 2012 have been interpreted to apply to work with asbestos-contaminated soil and construction and demolition materials. Key requirements during construction projects include: to control and prevent the spread of asbestos; select work methods that reduce disturbance and prevent / minimise the release of fibres; designate / demarcate areas where asbestos is present and where asbestos work is being carried out and control access; carry out air monitoring. In the event that asbestos is confirmed (fibres in soil or presence of asbestos containing materials [ACMs]) asbestos works (assessment, delineation, removal and verification) shall be undertaken by a specialist asbestos contractor.
- If peat excavation is needed during construction, peat storage and handling will be carried out in accordance with SEPA's requirements laid out in their regulatory guidance (2012);
- In areas where there are pockets of peat and groundwater seepages / flush zones identified along the access tracks at the detailed design stage, the Contractor will utilise geotextiles beneath the track material to prevent the track from settling into the ground to help maintain sub-surface flow;
- Whilst the aggregate surfaces may support some infiltration, this is likely to be limited. Consequently, there is likely to be a requirement to manage locally displaced runoff. This will be managed by a combination of SuDS infiltration and attenuation measures, including soakaways, swales or attenuation storage, as appropriate to local conditions;

- All access tracks and working area construction materials will be removed at the end of construction, reinstated with material from the soil stockpiles (to a level slightly above natural ground level to allow for settlement), and reseeded or replanted;
- Cross drainage will be provided as necessary at topographic low points to avoid disrupting flow paths and to retain natural surface water flow routes;
- Dewatering of trench excavations will be carefully monitored and groundwater flow disruption and drawdown will be minimised as much as possible. The time any excavation is open will be kept to a minimum to minimise ingress of water and dewatering requirements.
- If water being pumped from excavations is suspected to be contaminated, appropriate measures will be taken, in accordance with the CAR Regulations, to prevent uncontrolled or unauthorised releases of this water to ground or to the water environment;
- Temporary cut off drains will be installed to prevent surface water and shallow groundwater ingress into excavations. Intercepted water will preferably be encouraged to infiltrate into the ground, mimicking natural flow patterns in accordance with the principles of SuDS. Where discharge of cut-off drains to watercourses is the only practical option, measures such as silt fencing, straw bales, below ground perforated pipes and / or Siltbusters® will be employed to moderate runoff rates, and promote settlement of suspended sediment;
- In accordance with the Aberdeenshire and Moray LDP policies, a minimum stand-off buffer will be applied so that no works will be undertaken within 6 m of any watercourse (other than where watercourse crossings are required).
- Details of the proposed HDD techniques will be discussed between the appointed Contractor and SEPA during the detailed design stage. The depth of the HDD will be such that the river bed is undisturbed and pressurised bentonite in the drill hole does not leak into watercourses;
- A number of factors will affect the choice of crossing method including: depth of water; available space; duration of works; bed conditions; accessibility; and potential ingress of water. The anticipated watercourse crossing method for ditch crossings and modified minor watercourses will be trenching. The exact and appropriate methodology to achieve open trench across each watercourse and temporary bridge arrangements will be decided by the appointed contractor, and in consultation with SEPA prior to construction;
- Different options are available for open cut watercourse crossings, but the dry open cut technique will generally be utilised. The dry open cut technique involves damming the watercourse upstream and downstream of the crossing, creating a dry area for a typical period of several days when the cable trench will be dug. Water is then pumped from where it has been impounded upstream and discharged downstream of the crossing area. Periods of low flow will be chosen wherever practicable. Pumped water high in suspended solids will be pumped out into a sediment trap before being discharged back into the watercourse downstream of the working area;
- Prior to construction, the cleaning of existing field ditches and culverts will be carried out to alleviate drainage blockages or restrictions. There will be an identification of existing infrastructure, such as drainage outfalls within watercourses, and any work required to avoid or improve existing outfalls.
- Potential main drains along field edges will be investigated and diverted as required. Interceptor or cut-off drains will be installed where there are frequent shallow drains crossing the proposed cable circuit route in order to minimise disruption to field drainage.
- During construction, a programme of visual inspections will be undertaken to ensure that the potential effects on the River Deveron DWPA are appropriately monitored. The visual inspection

points will be selected along tributaries of the River Isla (Section 5.3.2, Figures 5.2.1 and 5.3.2), and downstream of construction areas (Burn of Paithnick, Burn of Drum, Burn of Ardrone, Burn of Carnie). The results will be recorded and the information submitted to SEPA and Scottish Water. Proposals for visual inspections will be submitted to Scottish Water along with a summary of planned activities prior to construction.

- The Contractor will identify springs, wells, PWSs and any sewerage infrastructure including treatment plants, septic tanks, soakaways, interconnecting pipes and outfalls, that require appropriate protection. These features will be mapped and appropriate exclusion zones will be applied to ensure that construction methods do not disturb the physical infrastructure layout. All appointed Contractor staff will be given training to protect PWSs deemed to be at risk. This training will ensure that all staff know the locations of all at risk sources, the activities onsite that pose the highest risk to these sources, the likely consequences of a pollution incident and the emergency procedures that will be used in the event of an incident (including provision of alternative water supplies). In the event that a PWS is identified as being at risk of water quality deterioration, a comprehensive sampling programme will be agreed with the relevant local authority for the PWSs in question;
- Vulnerable construction infrastructure such as temporary welfare facilities (including fuel and chemical storage areas) will be located in areas of low flood risk;
- During construction, a specific Pollution Incident Response Plan (PICP) will be implemented. An Operations and Maintenance (O & M) Plan will also be provided with a PICP for implementation during the operational phase. This will include measures such as:
    - Fuel to be stored within secure bunded fuel tanks with an impermeable bund capacity of 110 % of the tank volume;
    - Chemicals to be stored in accordance with the Control of Substances Hazardous to Health (COSHH) Regulations (i.e. in a secure COSHH store including an impermeable storage area with secondary containment for spill management);
    - Suitable quantities of pollution control equipment such as sorbent pads, sorbent granules, booms or similar material to be readily available at the temporary construction compounds, onsite and at work areas at all times. All pollution control equipment will be regularly checked and replaced after an event;
    - Spillage kits will be positioned across the site and at vulnerable locations as required and staff will be trained in their use. The kits will be checked regularly and replaced after an event;
    - ‘Emergency Grab Packs’ or spill kits will be carried in site vehicles and mobile plant, with larger kits carried by fuel bowsers and by emergency vehicles;
    - All plant and equipment to be inspected before use onsite and maintenance and servicing records checked;
    - All static plant, such as pumps and generators, will have integral driptrays (and will be self-bunded) where possible. As a second preference, external drip trays will be checked daily;
    - Oil separators will be utilised to remove hydrocarbons from surface water runoff. These will be installed for those parts where fuel storage, plant maintenance and refueling activities take place;
    - Mobile plant will be maintained in good working order. Larger items of plant such as side-booms and excavators will undergo daily recorded inspections by a competent person (usually the operator) for any defects such as leaking hoses. Where defects are

evident, the item of plant will be removed from site immediately and serviced or replaced as soon as possible;

- No refueling of mobile plant will be undertaken within 10 m of a watercourse, or 50 m of a known groundwater abstraction or tributary of the River Deveron DWPA;
- Fuel and chemical storage will be located a minimum of 10 m away from a watercourse, or 50 m from a known groundwater abstraction or tributary of the River Deveron DWPA;
- Where vehicle wash facilities are provided, no chemicals or grit will be used and silt traps / oil interceptors will be installed in general accordance with PPG6: Working at Construction and Demolition Sites and GPP13: Vehicle Washing and Cleaning;
- Appropriate method statements will be put in place prior to undertaking maintenance of vehicles at designated areas in the temporary construction compounds only;
- For operations using concrete, grout and other cement-based products, mixing of concrete and designated contained concrete washout areas will be provided in accordance with good practice guidance at least 10 m from any watercourse or surface water drain, and 50 m from any tributary of the River Deveron DWPA to minimise the risk from pollution;
- Machinery which remains onsite will be kept more than 10 m from drains / watercourses, and 50 m from any tributary of the River Deveron DWPA overnight to minimise any risk of contamination;
- Construction waste / debris will be prevented from entering any watercourse; and
- A programme of inspections for routine checking and clearing of drainage systems will be put forward and implemented prior to installation;

- The ground excavated for the cable circuit ducts and joint bays will be reinstated to ensure that the local ground conditions will be as permeable pre-construction conditions.

## 5.5 Assessment of Potential Effects

5.5.1.1 This section sets out the assessment of potential effects upon hydrology, geology and hydrogeology that could result during the construction, operational, and decommissioning phases of the OnTI.

5.5.1.2 Effects from the individual infrastructure types will be the same across different catchments within the PAB. To avoid repetition, the assessment of potential effects has been undertaken for the two main infrastructure types, comprising the proposed cable circuits and associated underground infrastructure, and the onshore substation. Given the wide variety of potential receptors identified in Section 5.3.10, where receptor sensitivity values vary (e.g. for GWDTEs, WFD water bodies, and Public Water Supplies) the highest value has been specified for each identified potential effect. The assessed magnitude of impact remains the same for all identified receptors and therefore a worst case scenario has been considered.

5.5.1.3 Effects on hydrology, hydrogeology and geology will principally be associated with the construction phase as this will involve the greatest change from baseline conditions. Once constructed, the OnTI is expected to result in relatively limited effects. After the lifetime of the Moray West Offshore Wind Farm (assumed to be up to 50 years), it is possible that the onshore substation may be retained and not decommissioned. However, in accordance with the Scoping Report and Scoping Opinion, the most likely decommissioning scenario for the OnTI is also considered here. Decommissioning effects will be similar to construction phase effects, albeit of a lower magnitude as sub-surface infrastructure will be left in-situ.

5.5.1.4 Effects in relation to construction and operation of the OnTI are generally well known and based on sufficient information. The potential effects associated with the decommissioning phase of the OnTI are less certain and reasonable assumptions have been made.

### *5.5.2 Potential Construction Effects*

**Cable Circuits and Associated Infrastructure**

5.5.2.1 The construction phase includes all activities that are required to construct the cable circuits. This will comprise of the excavation of trenches for the installation of two underground cable circuits between the Onshore Landfall Area and the proposed onshore substation site. There will be another section of two underground cable circuits installed between the proposed onshore substation and the existing substation at Blackhillock. During construction, two separate parallel trenches and a number of joint bays will be excavated and backfilled to install the cable circuit. Access tracks will also be constructed to facilitate the movement of construction vehicles and plant.

5.5.2.2 The working width for cable circuit installation will be 30 m (widened in locations where there is a technical necessity), while the target excavation depth of the cable will be at least 1 m (to the top of the ducting). Access tracks will generally be installed with aggregate along the designated route, following initial topsoil stripping activities. Installation of the cable circuits, and possible the haul route / access tracks, will require watercourse crossings. The works will require a number of temporary site compounds, which will also require topsoil stripping to provide a suitable area. Construction compound areas will include storage of material / waste and equipment, and welfare facilities.

5.5.2.3 Regarding the Onshore Landfall Area within the Cullen to Stake Ness Coast SSSI, where there is potential for construction activities (including excavations, HDD launch / reception working areas, construction compounds including storage of material / waste and equipment, and welfare facilities, and use of temporary access tracks / roads) to have effects on the geological features of the SSSI, it is assumed that sensitive design, choice of installation techniques and best practice onsite will reduce the magnitude of these effects.

5.5.2.4 The PAB lies within all of the sub catchments within the Banff Coastal catchment and River Isla catchments identified in Section 5.3.2. Therefore, each of the identified ten WFD water bodies, and one geological conservation site has a potential connection to the cable circuits. From the water resource receptors, each of the 39 unlicensed potable PWS abstractions and three Public Water Supplies are assessed as having a potential connection to the cable circuits. Each of the 65 GWDTE receptors and 19 flood risk receptors are also assessed as having a potential connection. There are also 33 licensed discharges which have their physical infrastructure located within the PAB, and which could therefore be directly affected by construction activities.

5.5.2.5 Trenching is likely to be the most intrusive construction activity, which has the potential to temporarily disrupt infiltration and displace shallow groundwater levels serving sensitive receptors (Public Water Supplies / PWSs / GWDTEs).

5.5.2.6 In relation to GWDTEs, the majority of receptors which have been identified as having a high groundwater dependency (33, 36, 37, 56, 61, 65, 76, 95, 101, 113, 119, 125, 138, 141 and 143 ) are sparsely distributed, and it is anticipated that application of design buffers (informed by NVC surveys at the detailed design stage) will help to adequately minimise potential effects. GWDTE 141 is the largest of the potential GWDTEs, which has a high groundwater dependency and spans approximately two thirds of the width of the PAB, as shown in Figure 5.3.3. The extent of this potential GWDTE is based on the Phase 1 habitat survey, and it is considered that the actual extent will be smaller in size. This will be investigated further during the NVC surveys which will be carried out at the detailed design stage. Technical Appendix 5.2 has concluded that a shallow source of contribution to this habitat is unlikely, but that a local deeper source of groundwater may be

present. It has therefore been assessed as a receptor which is vulnerable to potential changes in groundwater quantity / quality.

5.5.2.7 Table 5.5.1 lists all of the potential effects associated with the construction of the cable circuits, and an indication is provided of the impact magnitude in accordance with the highest sensitivity definitions provided in Tables 5.2.4, 5.2.5 and 5.2.6. Impact magnitude, and hence the significance of potential effects, have been assessed on the assumption that the embedded design and best practice measures (Section 5.4) have been implemented as part of the OnTI.

| Table 5.5.1: Potential Effects During Construction of the Cable Circuits | | | | |
|---|---|---|---|---|
| **Receptor Type** | **Potential Effects** | **Highest Receptor Sensitivity Receiving Effect (where specified)** | **Magnitude of Impacts** | **Significance of Effect** |
| Cullen to Stake Ness Coast SSSI (geological and biological) | Damage to the qualifying Dalradian geological features. | Moderate (due to rarity / limited potential for substitution) | Low (minor change to feature such that its integrity remains largely unaffected) | Minor (Not Significant) |
| GWDTEs | Reduction of groundwater availability to support GWDTEs as a consequence of water quantity and / or quality effects. This could arise from dewatering of the trenched excavations for cabling, ground disturbance from the development of temporary access track and construction compound establishment, or leakages and spillages of fuels / chemicals onsite. | Moderate (e.g. GWDTE 141) | Moderate (short- term, reversible) | Moderate (Significant) |
| WFD Waterbodies | Ground disturbance and mobilisation of sediments / contaminants leading to silt laden or otherwise contaminated runoff entering watercourses. | Moderate (e.g. Burn of Drum WFD) | Low (short-term, temporary) | Minor (Not Significant) |
| | Potential for accidental contamination entering watercourses, associated with spillage or leakage of fuels, lubricants or other chemicals. This includes the potential for leakage of bentonite during HDD. | Moderate (e.g. Burn of Drum WFD) | Negligible (no measurable change) | Negligible (Not Significant) |
| | Changes to watercourse morphology as a result of works in or near watercourses (e.g. installation of cable and access track watercourse crossings). | Moderate (e.g. Burn of Drum WFD) | Low (short-term, temporary) | Minor (Not Significant) |
| Water resources Public Water Supplies (DWPAs) | Reduction of water availability to support existing surface water and groundwater abstractions as a consequence of water quantity and / or quality effects. This could arise from dewatering of the trenched excavations for cabling, ground | High (e.g. River Deveron DWPA) | Negligible (no measurable change) | Minor (Not Significant) |

| Table 5.5.1: Potential Effects During Construction of the Cable Circuits | | | | |
|---|---|---|---|---|
| **Receptor Type** | **Potential Effects** | **Highest Receptor Sensitivity Receiving Effect (where specified)** | **Magnitude of Impacts** | **Significance of Effect** |
| Water resources<br>PWSs | disturbance for the development of temporary access track / construction compound establishment, or the leakage / spillage of fuels and chemicals onsite. | Low | Moderate (short term, reversible) | Minor<br>(Not Significant) |
| Licensed discharges | Physical disruption to existing discharge infrastructure (e.g. septic tank soakaways or discharge outfalls) from trenching and temporary access track / compound establishment. | Negligible | Negligible (no measurable change) | Negligible (Not Significant) |
| Flood risk receptors | Changes in watercourse conveyance associated with temporary watercourse crossings. | High (e.g. A95) | Negligible (no measurable change) | Minor<br>(Not Significant) |
| | Volumetric displacement of flood water associated with the construction of temporary stockpiles and raised access tracks within floodplain areas. | High (e.g. A95) | Negligible (no measurable change) | Minor<br>(Not Significant) |
| | Changes in runoff rates and new flow pathways associated with ground disturbance and the development of temporary access tracks and construction compound areas. | High (e.g. A95) | Negligible (no measurable change) | Minor<br>(Not Significant) |
| | Increases in flow due to dewatering of excavations. | High (e.g. A95) | Negligible (no measurable change) | Minor<br>(Not Significant) |

**Onshore Substation**

5.5.2.8 Construction of the onshore substation will include the establishment of a temporary construction compound with associated storage and offices / welfare facilities, topsoil storage and the development of below ground earth grid and substation support structures. For the purposes of assessment, the onshore substation footprint is assumed to be approximately 60,000m$^2$. The foundations will necessitate excavations, and may require piling depending on ground conditions. Full ground investigations will be undertaken to inform this requirement.

5.5.2.9 The onshore substation site is predominantly located within the unnamed tributary of Burn of Cairnie sub-catchment as described in Section 5.3.2 and shown on Figure 5.3.2. Therefore, the Burn of Carnie, Burn of Drum and Keith WFD waterbodies have a potential connection to the site. Regarding water resource receptors, PWS 41, 42 and 43 (Brodie Cottage, Caravan Brodie Cottage and Whitehillock) are assessed as having a potential connection to the onshore substation site. Although the Shenwell Spring catchment is within the wider Burn of Cairnie catchment, there is no potential hydrological connection to the onshore substation site, given that it lies on the opposite side of several tributary burn valleys. Regarding potential GWDTEs, there is no connection between the onshore substation site and areas which have been assessed as having high or moderate groundwater dependency in Technical Appendix 5.2. Given that GWDTE 141 is situated upgradient and on the opposite side of the A96 to the onshore substation site, it is considered hydrologically disconnected and has not been assessed further.

5.5.2.10 Excavations or piling for the installation of the foundations are likely to be the most intrusive construction activities, which have the potential to temporarily disrupt infiltration and displace shallow groundwater levels serving receptors. The design of the foundations will be informed by ground investigation which will include geotechnical and environmental testing, as required, and based upon the findings of the Phase 1 Geo Environmental Desk Study.

5.5.2.11 Table 5.5.2 lists all of the potential effects associated with the construction of the proposed onshore substation, and an indication is provided of the magnitude of impact, in accordance with the highest sensitivity definitions provided in Tables 5.2.4, 5.2.5 and 5.2.6. The potential impacts, and therefore effect significance, have been assessed based on the assumption that the embedded design and best practice measures (Section 5.4) have been implemented as part of the OnTI.

**Table 5.5.2: Potential Effects During Construction of the Onshore Substation**

| Receptor Type | Potential Effects | Highest Receptor Sensitivity Receiving Effect (where specified) | Magnitude of Effects | Significance of Effect |
|---|---|---|---|---|
| WFD waterbodies | Ground disturbance and mobilisation of sediments or contaminants leading to silt laden or otherwise contaminated runoff entering watercourses. | Moderate (Burn of Cairnie WFD) | Low (short term, temporary) | Minor (Not Significant) |
| Water resources Public Water Supplies (DWPAs) | Reduction of water availability to support existing surface water and groundwater abstractions as a consequence of water quantity and / or quality effects. This could arise from piling for the laying of below ground substation | High (e.g. River Deveron DWPA) | Negligible (no measurable change) | Minor (Not Significant) |
| Water resources PWSs | | Low (PWSs 41, 42 and 43) | Moderate (short term, reversible) | Minor (Not Significant) |

| Table 5.5.2: Potential Effects During Construction of the Onshore Substation | | | | |
|---|---|---|---|---|
| **Receptor Type** | **Potential Effects** | **Highest Receptor Sensitivity Receiving Effect (where specified)** | **Magnitude of Effects** | **Significance of Effect** |
| | foundations, ground disturbance for the development of temporary access track / construction compound establishment, or the leakage / spillage of fuels and chemicals onsite. | | | |

5.5.3 *Potential Operational Effects*

**Cable Circuits and Associated Infrastructure**

5.5.3.1 The operational phase will include the maintenance and refurbishment (if / as required) during the lifespan of the OnTI. The cable circuits will be installed with protection and it is considered that their operation will largely be maintenance free (non-intrusive routine testing will be undertaken). Should damage or a fault occur, testing will identify its specific location so that any excavations or infrastructure replacement can be isolated.

5.5.3.2 Regarding infrastructure within the Cullen to Stake Ness Coast SSSI, it is assumed that design and construction of the OnTI will not significantly alter or cover any Dalradian rock exposures and that the development will be completed in accordance with SNH's management requirements for the site, therefore the OnTI will have no significant effects on this feature.

5.5.3.3 It has been assumed that the temporary access tracks and associated watercourse crossings utilised during construction will not be required during the operational phase. Should repairs be necessary, there could be potential for localised ground disturbance or potential for accidental contamination from machinery. Potential effects during operation are expected to be considerably reduced and limited in scale in comparison to the construction phase due to this targeted approach and temporary tracks and associated watercourse crossings are therefore not considered during the operational phase.

5.5.3.4 During the operational phase there will potential effects on the sub surface and groundwater flow pathway regime associated with the presence of protective PVC ducts and a selected granular surrounding material for thermal insulation around the buried cable circuits. The ducts will be covered by a plastic sheet and connected to concrete lined joint bays, which will be limited in extent and confined to locations alongside the road network. It has been assumed that the associated cable watercourse crossings are also likely to be similarly lined with a layer of impermeable material for protection against erosion.

5.5.3.5 Table 5.5.3 lists all of the potential effects associated with the operation and maintenance of the cable circuits, and an indication is provided of the magnitude of impact in accordance with the highest sensitivity definitions provided in Tables 5.2.4, 5.2.5 and 5.2.6. The impact magnitude, and therefore potential effects, has been assessed based on the assumption that the embedded design and O & M practices have been implemented as part of the OnTI. It should also be noted that the assessment of effects during operation assumes a future baseline where all of the WFD waterbodies have achieved their long term future objective of meeting good condition after 2027.

| Table 5.5.3: Potential Effects During Operation and Maintenance of the Cable Circuits | | | | |
|---|---|---|---|---|
| **Receptor Type** | **Potential Effects** | **Highest Receptor Sensitivity Receiving Effect (where specified)** | **Magnitude of Impacts** | **Significance of Effect** |
| GWDTEs | Reduction of groundwater availability to support GWDTEs as a consequence of water quantity and / or quality effects. This could arise from isolated cable repairs. | Moderate (e.g. GWDTEs 141) | Negligible (no measurable change) | Negligible (Not Significant) |
| | Diversion of sub surface land drainage flow pathways due to the permanent presence of limited below ground concrete lined joint bays and granular material around cable circuits. | Moderate (e.g. GWDTEs 141) | Low (changes will be isolated in extent with no change to function of GWDTE) | Minor (Not Significant) |
| WFD Waterbodies | Changes to watercourse morphology due to the permanent presence of erosion protection around cable crossings. Cable crossings may exacerbate downstream or upstream bank and bed erosion and sediment deposition. | Moderate (all waterbodies predicted to have 'Good' physical condition by 2027) | Low (permanent, measurable impact morphology or water quality, but remaining generally within COs, and with no permanent change to morphology element and overall WFD status) | Minor (Not Significant) |
| Water resources Public Water Supplies | Reduction of water availability to support existing surface water and groundwater abstractions as a consequence of water quantity and / or quality effects. This could arise from isolated cable repairs, or the leakage / spillage of fuels and chemicals from vehicles onsite. | High (e.g. River Deveron DWPA) | Negligible (no measurable change) | Minor (Not Significant) |
| Water resources PWSs | | Low | Negligible (short term, temporary) | Negligible (Not Significant) |

**Onshore Substation**

5.5.3.6 The onshore substation will not be permanently staffed. The frequency and duration of maintenance visits will be dependent on the manufacturer's recommendations relating to the equipment installed. Therefore, the type and scale effects will be similar to those described above for the operation and maintenance of the cable circuits. It has been assumed that access to the onshore substation will primarily be along existing transport routes along the A96 and the access track towards Whitehillock.

5.5.3.7 The drainage from the onshore substation and the presence of a below ground grid have potential to disrupt infiltration and displace shallow groundwater levels serving receptors. Table 5.5.4 lists all of the potential effects associated with the operation and maintenance of the onshore substation, and an indication is provided of the magnitude of impact in accordance with the highest sensitivity definitions provided in Tables 5.4, 5.5 and 5.6. The magnitude of impacts, and therefore potential effects, have been assessed based on the assumption that the embedded design and O & M practices have been implemented as part of the OnTI.

**Table 5.5.4: Potential Effects During Operation and Maintenance of the Onshore Substation**

| Receptor Type | Potential Effects | Highest Receptor Sensitivity Receiving Effect (where specified) | Magnitude of Impacts | Significance of Effect |
|---|---|---|---|---|
| WFD waterbodies | Changes in runoff rates and new flow pathways associated with the impermeable onshore substation footprint. | Moderate (Burn of Cairnie WFD) | Low (changes will be isolated in extent with no change to WFD receptor) | Minor (Not Significant) |
| Water resources Public Water Supplies | Reduction of water availability to support existing groundwater or surface water abstractions as a consequence of water quantity and / or quality effects. This could arise from the presence of a below ground grid, substation support structures and impermeable surfaces, or leakage or spillages from fuels / chemicals onsite. | High (e.g. River Deveron DWPA) | Negligible (no measurable change) | Minor (Not Significant) |
| Water resources PWSs | | Low (PWSs 41, 42 and 43) | Low (short term, temporary) | Negligible (Not Significant) |

### *5.5.4 Potential Decommissioning Effects*

5.5.4.1 Whilst the consent is in perpetuity, and the asset may be absorbed into the National Grid when the wind farm it serves reaches the end of its operational life, the scoping opinion required that consideration be given to decommissioning effects. At the decommissioning stage, it is anticipated that the cable circuits will be left buried in-situ. Table 5.5.6 lists all of the potential effects associated with the decommissioning of the cable circuits, and an indication is provided of the magnitude of impact in accordance with the highest sensitivity definitions provided in Tables 5.2.4, 5.2.5 and 5.2.6.

**Table 5.5.6: Potential Effects During Decommissioning of the Cable Circuits**

| Receptor Type | Potential Effects | Highest Receptor Sensitivity Receiving Effect (where specified) | Magnitude of Impacts | Significance of Effect |
|---|---|---|---|---|
| GWDTEs | Reduction of groundwater availability to support GWDTEs as a consequence of water quantity and / or quality effects. This could arise from isolated cable repairs. | Moderate (e.g. GWDTEs 141) | Negligible (no measurable change) | Negligible (Not Significant) |
| | Diversion of sub surface land drainage flow pathways due to the permanent presence of limited below ground concrete lined joint bays and granular material around cable circuits. | Moderate (e.g. GWDTE 141) | Low (changes will be isolated in extent and nature). | Minor (Not Significant) |
| WFD waterbodies | Changes to watercourse morphology due to the permanent presence of erosion protection around cable crossings. Cable crossings may exacerbate downstream or upstream bank and bed erosion and sediment deposition. | Moderate (all waterbodies predicted to have 'Good' physical condition by 2027) | Low (Permanent, measurable impact morphology or water quality, but remaining generally within COs, and with no permanent change to morphology element and overall WFD status). | Minor (Not Significant) |
| Water resources Public Water Supplies | Reduction of water availability to support existing surface water and groundwater abstractions as a consequence of water quantity and / or quality | High (e.g. River Deveron DWPA) | Negligible (no measurable change) | Minor (Not Significant) |

| Table 5.5.6: Potential Effects During Decommissioning of the Cable Circuits | | | | |
|---|---|---|---|---|
| **Receptor Type** | **Potential Effects** | **Highest Receptor Sensitivity Receiving Effect (where specified)** | **Magnitude of Impacts** | **Significance of Effect** |
| Water resources<br>PWSs | effects. This could arise from isolated cable repairs, or the leakage / spillage of fuels and chemicals from vehicles onsite. | Low | Low (short term, temporary) | Negligible<br>(Not Significant) |

5.5.4.2 It has been assumed that the onshore substation site will be cleared and surface level, with the foundations remaining in-situ. Table 5.5.7 lists all of the potential effects associated with the decommissioning of the onshore substation and an indication is provided of the magnitude of impact in accordance with the highest sensitivity definitions provided in Tables 5.2.4, 5.2.5 and 5.2.6.

| Table 5.5.7: Potential Effects During Decommissioning of the Onshore Substation | | | | |
|---|---|---|---|---|
| **Receptor Type** | **Potential Effects** | **Highest Receptor Sensitivity Receiving Effect (where specified)** | **Magnitude of Impacts** | **Significance of Effect** |
| WFD waterbodies | Ground disturbance and mobilisation of sediments or contaminants leading to silt laden or otherwise contaminated runoff entering watercourses. | Moderate (Burn of Cairnie WFD) | Low (short term, temporary) | Minor<br>(Not Significant) |
| Water resources<br>Public Water Supplies | Reduction of water availability to support existing groundwater or surface water abstractions as a consequence of water quantity and / or quality effects. This could arise from ground disturbance for the development of temporary access track / presence of a below ground grid, substation support structures or leakage or spillages from fuels / chemicals onsite. | High (e.g. River Deveron DWPA) | Negligible (no measurable change) | Minor<br>(Not Significant) |
| Water resources<br>PWSs | | Low (PWSs 41, 42 and 43) | Moderate (short term, reversible) | Minor<br>(Not Significant) |

## 5.6 Additional Mitigation and Enhancement Measures

5.6.1.1 The following measures are proposed in accordance with the requirement to minimise the potential effects of the OnTI as far as practicable. In particular, the first measure is proposed in order to help reduce the potentially significant effect on the quantity and quality of GWDTEs during the construction phase as identified in Section 5.5.

5.6.1.2 **Protection of GWDTEs** – As noted, further investigation is required at the detailed design stage. NVC surveys will be carried out to further qualify and refine the extents and nature of these Phase 1 habitats. This will in turn help inform the implementation of buffers to reduce potential impacts on potential GWDTEs. Careful consideration will be given to siting infrastructure at sufficient distances from receptors to avoid disruption to the function of the 'true GWDTEs'. Drainage strategies must also be drawn up by the Contractor in accordance with the best practice measures outlined in Section 5.4.3, to ensure that water pumped from excavations will be discharged to mimic natural flow conditions as closely as possible after being passed through SuDS features. The design proposals should be submitted to and approved by SEPA prior to construction.

5.6.1.3 **Surface Water Management Plan** – At the detailed design stage, the appointed Contractor will provide a detailed surface water management plan for the construction and operation of the cable circuits. This will include details of drainage plan proposals in accordance with SuDS principles and GPPs to ensure minimal disruption to the hydrological and hydrogeological regime. The plan will also include a schedule of watercourse crossing methodologies and proposed mitigation strategies for in channel works. The detailed plan will be prepared for the cable circuits and submitted to SEPA for approval.

5.6.1.4 **Onshore Substation Drainage Design** – At the detailed design stage the appointed Contractor will provide an onshore substation drainage strategy, which includes operational discharge requirements. This will include proposals for either licensed discharging or public sewer connections following liaison with SEPA and Scottish Water as appropriate. Drainage strategies are also to identify a suite of SuDS measures to be implemented during the operation of the OnTI. The below ground earth grid at the onshore substation will be surfaced with material which is at least as permeable as the topsoil which was removed during construction. These types of measures will be commensurate with local conditions, to ensure no impact upon the downgradient PWS groundwater abstraction and GWDTEs. The detailed drainage strategy will be submitted to SEPA and Scottish Water for approval.

5.6.1.5 **Piling Risk Assessment** – In the event that piling is selected for installation of the onshore substation foundations, a detailed piling risk assessment will be prepared at the detailed design stage. This will assess the hydrogeology, ground properties, and piling methodologies to estimate potential issues and direct design of any required remediation measures. The piling risk assessment will be submitted to SEPA for approval at the detailed design stage, prior to the commencement of construction.

## 5.7 Residual Effects

5.7.1.1 The summary assessment in Table 5.7.1 concludes that, following the application of additional mitigation measures as set out in Section 5.6, there will be no significant residual effects arising from the construction, operation and decommissioning of the OnTI.

5.7.1.2 Regarding the protection of GWDTEs, the measure to mitigate the reduction of groundwater availability to the **moderate sensitivity** GWDTE 141 will ensure an impact of **low magnitude** (short term and temporary). This will result in an effect of **minor significance** that will be **not significant** in EIA terms.

| Table 5.7.1: Summary of Assessment | | | | | | |
|---|---|---|---|---|---|---|
| **Potential Effect** | **Nature** | **Probability** | **Sensitivity of Receptor** | **Magnitude of Impact** | **Significance of Effect** | **Rationale** |
| **Construction (Cable Circuits)** | | | | | | |
| Cullen to Stake Ness Coast SSSI - Damage to the qualifying Dalradian geological features. | Long term / permanent | Possible | Moderate | Low | Minor (Not Significant) | Embedded design and best practice measures. |
| Reduction of groundwater availability to support GWDTEs as a consequence of water quantity and / or quality effects. | Short term/temporary | Possible | Moderate | Low | Minor (Not Significant) | The additional GWDTE protection measures include for the provision of appropriate design buffers and drainage requirements to help minimise effects. |
| WFD waterbodies - Ground disturbance and mobilisation of sediments / contaminants leading to silt laden or contaminated runoff entering watercourses. | Short term/ temporary. | Possible | Moderate | Low | Minor (Not Significant) | Embedded design measures and best practice measures are sufficient to minimise effects. |
| WFD waterbodies - Potential for accidental contamination | No measurable change. | Unlikely | Moderate | Negligible | Negligible (Not Significant) | Embedded design measures and best practice measures |

| Table 5.7.1: Summary of Assessment | | | | | | |
|---|---|---|---|---|---|---|
| **Potential Effect** | **Nature** | **Probability** | **Sensitivity of Receptor** | **Magnitude of Impact** | **Significance of Effect** | **Rationale** |
| entering watercourses, associated with spillage or leakage of fuels, lubricants or other chemicals. | | | | | | are sufficient to minimise effects. |
| WFD waterbodies - Changes to watercourse morphology as a result of works in or near watercourses (e.g. installation of cable and access track watercourse crossings). | Short term, temporary | Possible | Moderate | Low | Minor (Not Significant) | Embedded design measures and best practice measures are sufficient to minimise effects. |
| Water resources – Public Water Supplies - Reduction of water availability to support existing surface water and groundwater abstractions as a consequence of water quantity and / or quality effects. | No measurable change. | Unlikely | High | Negligible | Minor (Not Significant) | Embedded design measures and best practice measures (including visual watercourse inspection program for the River Deveron watercourses) are sufficient to minimise effects. |
| | Short term, reversible. | Possible | Low | Moderate | Minor (Not Significant) | Embedded design measures and best practice measures (including PWS |

| Table 5.7.1: Summary of Assessment | | | | | | |
|---|---|---|---|---|---|---|
| **Potential Effect** | **Nature** | **Probability** | **Sensitivity of Receptor** | **Magnitude of Impact** | **Significance of Effect** | **Rationale** |
| | | | | | | inspections, risk assessments and routing) are sufficient to minimise effects. |
| Water resources (licensed discharges) - Physical disruption to existing discharge infrastructure (e.g. septic tank, soakaways or discharge outfalls) from trenching and temporary access track / compound establishment. | No measurable change. | Unlikely | Negligible | Negligible | Negligible (Not Significant) | Embedded design measures and best practice measures (including identification of licensed discharge infrastructure) are sufficient to minimise effects. |
| Flood risk receptors - Changes in watercourse conveyance from temporary watercourse crossings;<br>Volumetric displacement of flood water; | No measurable change. | Unlikely | High | Negligible | Minor (Not Significant) (Not Significant) | Embedded design measures and best practice measures are sufficient to minimise effects. |

| Table 5.7.1: Summary of Assessment | | | | | | |
|---|---|---|---|---|---|---|
| **Potential Effect** | **Nature** | **Probability** | **Sensitivity of Receptor** | **Magnitude of Impact** | **Significance of Effect** | **Rationale** |
| Changes in runoff rates and new flow pathways; and<br>Increases in flow due to dewatering of excavations. | | | | | | |
| **Construction (Onshore Substation)** | | | | | | |
| WFD waterbodies - Ground disturbance and mobilisation of sediments or contaminants leading to silt laden or contaminated runoff entering watercourses. | Short term, temporary. | Possible | Moderate | Low | Minor<br>(Not Significant) | Embedded design measures and best practice measures are sufficient to minimise effects. |
| Water resources (Public Water Supplies) - Reduction of water availability to support existing surface water and groundwater abstractions as a consequence of water quantity and / or quality effects. | No measurable change. | Unlikely | High | Negligible | Minor<br>(Not Significant) | Embedded design measures and best practice measures (including visual watercourse inspection program for the River Deveron watercourses) are sufficient to minimise effects. |

| Table 5.7.1: Summary of Assessment | | | | | | |
|---|---|---|---|---|---|---|
| **Potential Effect** | **Nature** | **Probability** | **Sensitivity of Receptor** | **Magnitude of Impact** | **Significance of Effect** | **Rationale** |
| Water resources (PWS) - Reduction of water availability to support existing surface water and groundwater abstractions as a consequence of water quantity and / or quality effects. | Short term, reversible. | Possible | Low | Moderate | Minor (Not Significant) | Embedded design measures and best practice measures (including PWS inspections, risk assessments) are sufficient to minimise effects. |
| **Operation and Maintenance (Cable Circuits)** | | | | | | |
| GWDTE - Reduction of groundwater availability to support GWDTEs as a consequence of water quantity and / or quality effects. | No measurable change. | Unlikely | Moderate | Negligible | Negligible (Not Significant) | Cable circuit repairs will be isolated and targeted. Embedded design and O & M good practice measures will help minimise effects. |
| GWDTE - Diversion of sub surface land drainage flow pathways due to the permanent presence of concrete lined joint bays and granular material around cable circuits. | Permanent but isolated in nature. | Possible | Moderate | Low | Minor (Not Significant) | Effects will be minimised given the limited footprint and due to careful routing during the design phase. |

| Table 5.7.1: Summary of Assessment | | | | | | |
|---|---|---|---|---|---|---|
| **Potential Effect** | **Nature** | **Probability** | **Sensitivity of Receptor** | **Magnitude of Impact** | **Significance of Effect** | **Rationale** |
| WFD waterbodies - Changes to watercourse morphology due to the permanent presence of erosion protection around cable crossings. | Permanent but isolated in nature. | Possible | Moderate | Low | Minor (Not Significant) | Effects will be small scale in relation to waterbody scale due to limited footprint of bank and bed erosion protection. |
| Water resources (PWS) - Reduction of water availability to support existing surface water and groundwater abstractions as a consequence of water quantity and / or quality effects. | No measurable change. | Unlikely | High | Negligible | Minor (Not Significant) | Embedded design and O & M good practice measures will help minimise effects. |
| | Short term, temporary. | Possible | Low | Negligible | Negligible (Not Significant) | |
| **Operation and Maintenance (Onshore Substation)** | | | | | | |
| WFD waterbodies - Changes in runoff rates and new flow pathways associated with the impermeable onshore substation footprint. | Short term, temporary. | Possible | Moderate | Low | Minor (Not Significant) | Embedded design and O & M good practice measures, will help minimise effects |
| Water resources (PWS) - Reduction | No measurable change (DWPAs). | Unlikely | High | Negligible | Minor (Not Significant) | |

| Table 5.7.1: Summary of Assessment | | | | | | |
|---|---|---|---|---|---|---|
| **Potential Effect** | **Nature** | **Probability** | **Sensitivity of Receptor** | **Magnitude of Impact** | **Significance of Effect** | **Rationale** |
| of water availability to support existing groundwater or surface water abstractions as a consequence of water quantity and / or quality effects. | Short term, temporary (PWS 41, 42 and 43). | Possible | Low | Low | Negligible (Not Significant) | |
| **Decommissioning (Cable Circuits)** | | | | | | |
| GWDTE - Reduction of groundwater availability to support GWDTEs as a consequence of water quantity and / or quality effects. | No measurable change | Possible | Moderate (GWDTE 141) | Negligible | Negligible (Not Significant) | The additional GWDTE protection measures include for the provision of appropriate design buffers and drainage requirements to help minimise the effects. |
| GWDTE - Diversion of sub surface land drainage flow pathways due to the permanent presence of limited below ground concrete lined joint bays and granular material around cable circuits | Permanent but isolated in nature | Possible | Moderate (GWDTE 141) | Low | Minor (not significant) | The additional GWDTE protection measures include for the provision of appropriate design buffers and drainage requirements to help minimise the effects. |

| Table 5.7.1: Summary of Assessment | | | | | | |
|---|---|---|---|---|---|---|
| **Potential Effect** | **Nature** | **Probability** | **Sensitivity of Receptor** | **Magnitude of Impact** | **Significance of Effect** | **Rationale** |
| WFD waterbodies - Changes to watercourse morphology as a result of works in or near watercourses | Short term, temporary. | Possible | Moderate | Low | Minor (Not significant) | Embedded design measures and best practice measures are sufficient to minimise effects. |
| Water resources (PWS) - Reduction of water availability to support existing surface water and groundwater abstractions as a consequence of water quantity and / or quality effects. | No measurable change. | Unlikely | High | Negligible | Minor (Not significant) | Embedded design measures and best practice measures (including visual watercourse inspection program for the River Deveron watercourses) are sufficient to minimise effects. |
| | Short term, temporary. | Possible | Low | Low | Negligible (Not Significant) | Embedded design measures and best practice measures (including PWS inspections, risk assessments, and routing) are sufficient to minimise effects. |
| **Decommissioning (Onshore Substation)** | | | | | | |
| WFD waterbodies - Ground disturbance and mobilisation of | Short term, temporary | Possible | Moderate | Low | Minor (Not Significant) | Embedded design measures and decommissioning |

| Table 5.7.1: Summary of Assessment | | | | | | |
|---|---|---|---|---|---|---|
| **Potential Effect** | **Nature** | **Probability** | **Sensitivity of Receptor** | **Magnitude of Impact** | **Significance of Effect** | **Rationale** |
| sediments or contaminants leading to silt laden or otherwise contaminated runoff entering watercourses. | | | | | | mitigation measures are sufficient to minimise effects. |
| Water resources (PWS) - Reduction of water availability to support existing surface water and groundwater abstractions as a consequence of water quantity and / or quality effects. | No measurable change (DWPAs). | Unlikely | High | Negligible | Minor (Not Significant) | Embedded design measures and decommissioning mitigation measures (including visual watercourse inspection program for the River Deveron watercourses) are sufficient to minimise effects. |
| | Short term, reversible (PWS 41, 42 and 43). | Possible | Low | Moderate | Minor (Not Significant) | Embedded design measures and decommissioning mitigation measures (including PWS inspections, risk assessments) are sufficient to minimise effects. |

## 5.8 Assessment of Cumulative Effects

5.8.1.1 As noted in Chapter 3: The Environmental Impact Assessment Process, there are two other proposed developments within 5 km of the PAB, the potential effects of which could be significant when considered cumulatively with those of the OnTI. The other proposed developments are Aultmore Wind Energy Project and Lurg Hill Wind Farm:

- The consented Aultmore Wind Energy Project planning application boundary is situated within the Burn of Aultmore catchment, which is a tributary of the River Isla. The Aultmore Wind Energy Project and the proposed OnTI have a shared WFD body receptor, which is the River Isla Keith to Shiel Burn (23179). The worst case scenario for the OnTI and Aultmore Wind Energy Project is considered to be during the construction stage whereby potential effects have been predicted to be of **low magnitude** given that they will be limited and localised to an acceptable level for this **low sensitivity** receptor. Therefore, any potential cumulative effects are anticipated to be **not significant**.
- The proposed Lurg Hill Wind Farm planning application boundary is predominantly situated within the Burn of Deskford catchment. The proposed Lurg Hill Wind Farm and OnTI have a shared receptor, which is the Deskford Burn (23050). The worst case scenario for the OnTI and Lurg Hill Wind Farm is considered to be during the construction stage whereby potential effects have been predicted to be of **low magnitude** given that there will be no predicted change in WFD status for this **low sensitivity** receptor. Therefore, any potential cumulative effects are anticipated to be **not significant**.

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