Chapter 10: Water Quality (Onshore)

Co-financed by the European Union
Connecting Europe Facility

NorthConnect KS
Serviceboks 603, Lundsiden
N-4606 Kristiansand
Norway

Phone +47 38 60 70 00
Mail: post@northconnect.no
Web: www.northconnect.no

Contents

10 Water Quality (Onshore)

10.1 Introduction

This chapter covers the assessment of potential environmental impacts on onshore water quality, of the proposed NorthConnect HVDC cable. The chapter outlines the background description of the existing hydrological conditions of the area and the potential environmental effects of the construction and operations of the development are assessed. Based on the impact assessment, appropriate mitigation measures to minimise effects are identified. The scoping phase of the EIA scoped out the requirement to assess the impacts resulting from decommissioning of the onshore HVDC cable, due to no likely significant impacts upon terrestrial water quality.

10.2 Planning and Legislative Framework

10.2.1 National Policy

The basic premises for Managing Flood Risk and Drainage in the Scottish Planning Policy (SPP)(Scottish Ministers, 2014) are that:

'…the planning system should prevent development which would have a significant probability of being affected by flooding or would increase the probability of flooding elsewhere.'

'Infrastructure and buildings should generally be designed to be free from surface water flooding in rainfall events where the annual probability of occurrence is greater than 0.5% (1:200 years).' (Medium to High Risk – annual probability of coastal or watercourse flooding is greater than 0.5% (1:200 years)).'

'Surface water drainage measures should have a neutral or better effect on the risk of flooding both on and off the site, taking account of rain falling on the site and run-off from adjacent areas.'

In addition, the SPP regarding Valuing the Natural Environment states that:

'The planning system should promote protection and improvement of the water environment, including rivers, lochs, estuaries, wetlands, coastal waters and groundwater, in a sustainable and co-ordinated way'.

10.2.2 Local Policy

It is stated in Supplementary Guidance No. 8: Flooding and Erosion, as part of Policy 8 (Layout, Siting and Design of new development) of Aberdeenshire Local Development Plan (Aberdeenshire Council, 2011) that:

'The current policy approach involves a presumption against development on any land that is at risk from flooding (such as a functional floodplain), is required for long-term managed retreat from areas at risk of flood or is at risk from erosion. Exceptions may be permitted where it can be demonstrated through an appropriate technical assessment that there is neither a medium or high risk of flooding, or it is in a location where adequate existing flood prevention measures are in place.'

Also the local planning policy Safeguarding 1: Protection and conservation of the water environment, contained within the Aberdeenshire Local Development Plan, is deemed as relevant to the current development. The aims of the policy include:

'to support the implementation of the European Commission's Water Framework Directive (European Parliament & Council, 2000); to contribute to the Scotland District River Basin Plan (Scottish

Government, 2015); to promote the enhancement of the water environment and the creation of good quality riparian habitat; and to provide protection to Aberdeenshire's aquatic environment from new development that could result in unacceptable ecological impacts'.

10.2.3 Regulatory Framework

10.2.3.1 The Water Framework Directive / Water Environment and Water Service (Scotland Act 2003)

The EU Water Framework Directive (WFD) (European Parliament & Council, 2000) established a comprehensive legal framework for the protection, improvement and sustainable use of all water bodies across Europe. The remit of the WFD extends to all rivers, canals, lochs, estuaries, wetlands, coastal waters and groundwater. It requires the development of River Basin Management Plans to prevent deterioration of the status of water bodies and to achieve a 'good' status for surface waters and groundwaters within 15 years of the directive being implemented.

The WFD was transposed into Scottish Law through the Water Environment and Water Services (WEWS) (Scotland) Act 2003 (as amended). The core objective of the WEWS Act is to protect and improve Scotland's water environment. This includes preventing deterioration in the status of water bodies and, where possible, restoring surface waters and groundwater damaged by pollution, water abstraction, dams and engineering activities.

10.2.3.2 The EU Floods Directive / Flood Risk Management Act (Scotland 2009)

The Flood Risk Management (Scotland) Act 2009 (Scottish Government, 2009) transposes the EU Floods Directive (European Parliament & European Council, 2007) into Scottish law, and creates a new and more sustainable approach to assessing and managing flood risk management across Scotland.

Under this act flooding risk to a development must be assessed and mitigated if necessary. Furthermore, the downstream effects must also be considered, including increased flooding risks due to increased discharges arising from a development.

10.2.3.3 The Water Environment (Controlled Activities (Scotland)) Regulations 2011 (as amended)

The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended) (CAR) is intended to control activities which have the potential to cause pollution to the water environment. Such activities are controlled at three different levels depending on the potential risks and these are:

- General Binding Rules (GBRs) – cover low-risk activities for which there is no need to contact the Scottish Environment Protection Agency (SEPA). However, a person undertaking an activity controlled by the GBRs must abide by any rule in the regulations which is applicable to the activity;
- Registration – also covers low-risk activities, but those which may cause a cumulative risk to the water environment. Such activities must be registered with SEPA, who may impose conditions but only so far as to describe the activity; and
- Licensing – for higher risk activities which require site-specific rules, or where constraints on an activity are required. Such activities will be regulated through a CAR license which must be sought through SEPA.

10.2.3.4 The Control of Pollution Act 1974

Part 2 of the Control of Pollution Act (UK Government, 1974) defines a number of offences relating to water pollution. Specifically, section 30F states that:

'A person contravenes this section if he causes or knowingly permits any poisonous, noxious or polluting matter or any solid waste matter to enter any controlled waters.'

As such, any deliberate or reckless release of a pollutant into the water environment is an offence under the act and is liable to prosecution.

10.2.4 Guidance

Multiple Pollution Prevention Guidelines (PPGs) and Guidance for Pollution Prevention (GPPs) have been produced by SEPA in collaboration with other UK environmental protection agencies. These guidance's provide comprehensive environmental management across a range of areas. These include:

- PPG 1: Understanding your environmental responsibilities – good environmental practices (NIEA, SEPA, & Environment Agency, 2013);
- GPP 2: Above ground oil storage tanks (NIEA, SEPA, & Natural Resources Wales, 2017b);
- GPP 5: Works and maintenance in or near water (NIEA, SEPA, & Natural Resources Wales, 2017c);
- PPG 6: Working at construction and demolition sites (NIEA, SEPA, & Environment Agency);
- PPG 7: Safe storage – The safe operation of refuelling facilities (NIEA, SEPA, & Environment Agency, 2011a);
- GPP 8: Safe storage of and disposal of used oils (NIEA, SEPA, & Natural Resources Wales, 2017a);
- PPG 18: Managing fire water and major spillages (SEPA, Environment Agency, & Environment and Heritage Service);
- GPP 21: Pollution incident response planning (NIEA, SEPA, & Natural Resources Wales, 2017d);
- PPG 22: Incident response – dealing with spills (NIEA, SEPA, & Environment Agency, 2011b); and
- Engineering in the Water Environment: Good Practice Guide Temporary Construction Methods (SEPA, 2009).

10.3 Assessment Methodology

This assessment has been undertaken primarily using a qualitative approach based on analysis of data and statutory or general guidance, combined with professional judgment. The assessment follows the methodology provided within Chapter 3: Methodology.

10.3.1 Baseline Data Collection

An Otter *(Lutra lutra),* Water Vole *(Arvicola amphibius)* and Eurasian Badger *(Meles meles)* survey was conducted for the Environmental Impact Assessment of the NorthConnect Interconnector Converter Station and High Voltage Alternating Current Cable Route on the 29th of September 2014 by Tracks Ecology (Bunyan, 2014). The walkover survey identified and assessed indirectly aquatic habitats quality as Water Vole and Otter have specific aquatic habitat requirements (Moss, 1998). In 2017 a further Otter, Water Vole and Eurasian Badger survey were conducted for this EIAR by Tracks Ecology, which indirectly assessed the quality of identified aquatic habitats of the HVDC cable route (Bunyan, 2017). In addition, a desk-based literature review was undertaken to further establish the baseline conditions, and this included use of the SEPA's interactive map to identify the status of water bodies.

10.3.2 Impact Assessment Methodology

10.3.2.1 Magnitude of Impact

The magnitude of impact takes into account change to the baseline conditions resultant from a given effect. It considers the level of change of the baseline conditions, value of the hydrological feature and duration of the effect upon the receptor prior to recovery. Definitions for a range of hydrological elements are set out in Table 10.1.

Table 10.1: Definitions of Magnitude of Impact

Magnitude of Impacted of Impact	Examples of Impact Magnitude
High	Material reduction in water quality. Characteristics may include: • Significant diffuse pollution. • Ecological impact e.g. fish deaths. • Medium to long-term impacts.
Medium	Reduction in water quality. Characteristics may include: • Minor diffuse pollution. • Measurable changes in water quality. • Minor harm to the ecosystem. • Reversible with no long-term impacts.
Low	Small changes to the water quality. Characteristics may include: • Localised pollution incident with reversible effects. • Potential visible signs of pollution. • No medium-term impacts. • No impacts on the ecosystem.

10.3.2.2 Likelihood of Impact Occurring

The likelihood of an impact occurring is also assessed. A qualitative approach is taken to predict the likelihood of an impact based on the probability of an impact occurring and professional judgment rather than data frequency. In this chapter, the likelihood categories are displayed in Table 10.2 with their definition. The likelihood of any effect occurring is described in the impact characterisation text.

Table 10.2: Likelihood Categories and their Definitions.

Likelihood	Definition
Certain/near-Certain	> 1 in 1 year
Probable	< 1 in 1 year but > 1 in 10 years
Unlikely	< 1 in 10 years but > 1 in 100 years
Extremely Unlikely	< 1 in 100 years

10.3.2.3 Significance of Effect

The significant of effect is derived by considering the magnitude of impact and probability of the impact occurring. Determination of whether the identified effect was categorised as significant or non-significant utilised the matrix set out in Table 10.3.

Table 10.3 Significance of Effects Matrix.

Magnitude of Impact	Probability			
	Certain	**Probable**	**Unlikely**	**Extremely Unlikely**
High	Major	Moderate	Moderate	Minor
Medium	Moderate	Moderate	Minor	Negligible
Low	Minor	Minor	Negligible	Negligible

Key

(orange)	**Significant Effect**
(light blue)	**Non-Significant Effect**

10.3.2.4 Identification and Assessment of Mitigation

Mitigation measures have been identified in line with best practice to prevent, minimise and mitigate impacts are discussed in Section 10.6.

10.3.2.5 Assessment of Residual Effects

Where mitigation has been identified, the magnitude of the impact will be reassessed as per Table 10.1 to 10.3, to understand the resultant residual effect.

10.4 Baseline Information

10.4.1.1 Surface Water Hydrology - Waterbodies

Figure 10.1 details identified waterbodies within the vicinity of the proposed HVDC project. There is a small pool (Waterbody 1), to the north of Fourfields. Waterbody 1 was manmade for fishing and is approximately 175m long and 75m wide with a small vegetated island. To the east of Waterbody 1 lie five smaller water bodies (Waterbody 2). Waterbody 2 consists of multiple settlement lagoons utilised for water treatment from the operational quarry. The lagoons are steep-sided and lined with coarse rock armour which has been colonised by vegetation (Bunyan, 2017).

Waterbody 3 to the east of Fourfields is a 20m long and 8m wide agricultural pond with agricultural drains entering the south eastern corner. Waterbody 4 lies approximately 90m north-north-west of the Landfall Horizontal Directional Drilling (HDD) area and approximately 60m east of the proposed onshore cable corridor. Waterbody 4 was likely to have been formed through natural infilling of a disused quarry. Surrounded by steep cliff edges, only limited vegetation surrounds the waterbody, dominated by tall herbs and some scrubs and the water depth is unknown (Bunyan, 2017). Approximately 300m south-south-west from the proposed landfall HDD area lies Waterbody 5. Waterbody 5 also appears to be an old quarry that has overtime filled with water and it also has steep rocky sides (Bunyan, 2014).

10.4.1.2 Surface Water Hydrology – Watercourses

Along the onshore HVDC cable route lie multiple watercourses (Figure 10.1). The watercourses were identified and assessed by the Otter, Water Vole and Badger surveys conducted in 2014 and 2017. Surveys concluded that the watercourses are agricultural drains dominated generally by low levels of water (Bunyan, 2017).

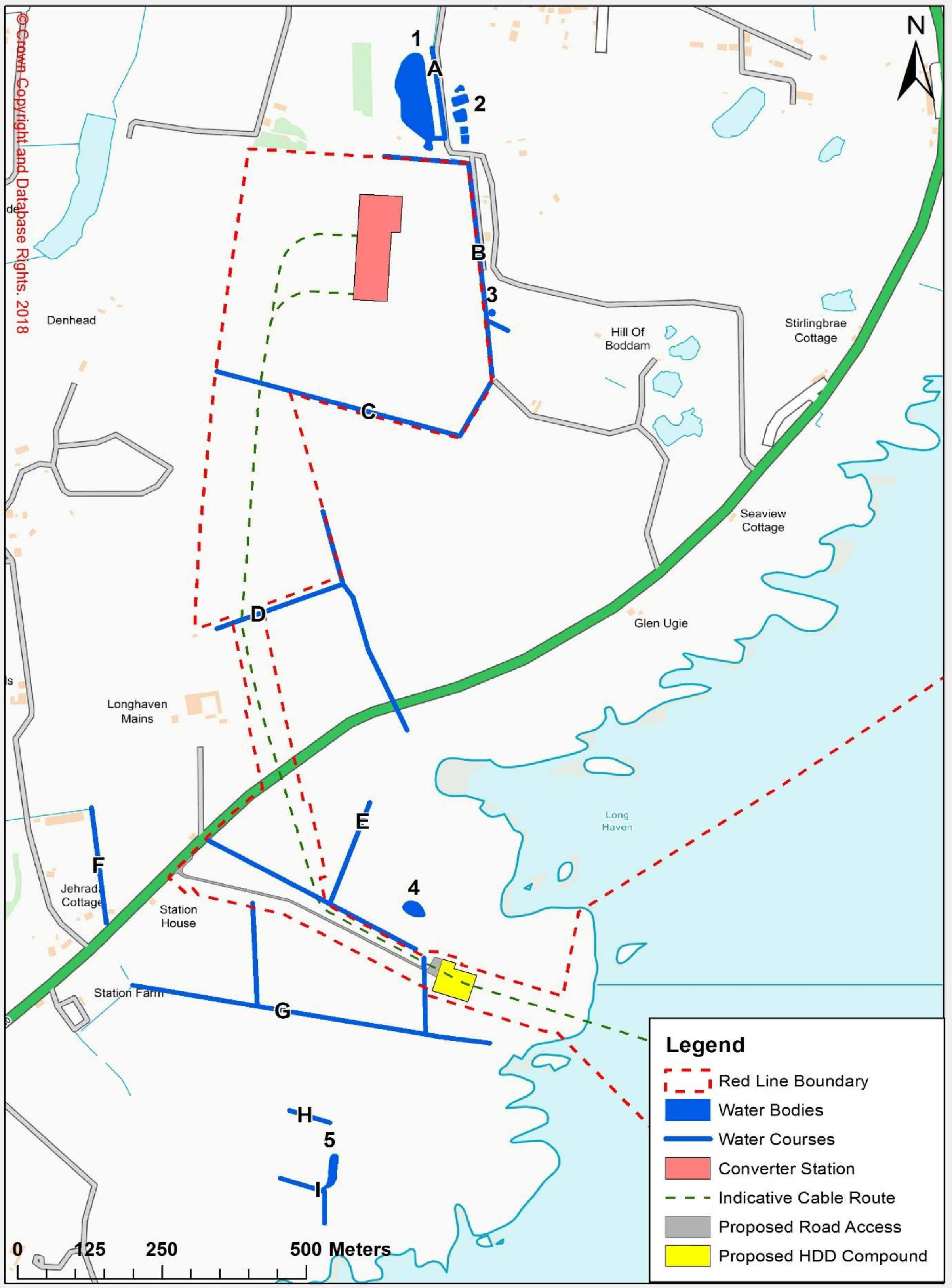

Figure 10.1: Locations of waterbodies, watercourses opposed HDD site, converter station and HVDC cable route.

Watercourse B and Waterbody 1 both flow into Watercourse A (see Figure 10.1), which flows north towards Lendrum Terrace where it passes under a public road via a culvert and appears to join the

Millbank Burn approximately 200m north of Lendrum Terrace. Watercourse B includes 2 branches, one running north along the eastern edge of the Fourfields site, and the other running east along the northern edge of Fourfields, both discharging into Watercourse A. Watercourse B was of low water depth, < 10cm when surveyed. The watercourse consists of steep sides with banks extending a maximum of 2.5m. Watercourse B has connectivity with Waterbody 3.

Watercourse C contained gravel substrate and, during the survey, no water was identified in this agricultural drain. Watercourse D is an agricultural drain with an approximate depth and width of 1m. Watercourses E and G are heavily covered by vegetation (Bunyan, 2017). The HVDC Cable will cross Watercourses C, D, E and G.

10.4.1.3 Surface Water Quality

The small nature of all identified waterbodies and watercourses mean that none are classified by SEPA. No obvious signs of pollution have been observed on site visits in any of the watercourses. There are no industrial discharges into any of the watercourses. Surface water runoff into the watercourses could wash in agricultural pollutants such as pesticides and herbicides, and, when fields are ploughed there could be silts and soils reaching watercourses.

Waterbody 2 is utilised for water treatment by the quarry and, as such, will have increased suspended solids loading. The other waterbodies showed no sign of pollution.

10.4.2 Flooding

As part of an initial Flood Risk Screening exercise, a visual inspection of the site has been undertaken. There has been no evidence of flooding of the drainage ditches along the onshore HVDC cable route and HDD site, however, the SEPA Floodmap (SEPA, 2017) shows Watercourse B as having a medium likelihood of flooding, which is defined as having a 0.5% probability of occurring in any given year (often expressed as a 1-in-200-year event), but not spreading into the Fourfields construction area. No other watercourses discussed in Section 10.4.1.2 were identified as having a likelihood of flooding (SEPA, 2017).

The entire cable route and Landfall HDD site fall within the Potentially Vulnerable Area PVA 06/08 Buchan Coastal, as shown on SEPA's Local Plan Districts and Potentially Vulnerable Areas - North East (SEPA, 2016). River flooding has been associated with the Millbank Burn and, in addition, there is a surface water flood risk in the Stirling village and Boddam area. Lendrum Terrace has flooded in recent years (SEPA, 2016).

10.4.3 Identification of Receptors

The potential hydrological receptors have been identified as watercourses and waterbodies which can be considered to receive any surface water, or which might be physically affected by the HDVC cable route (e.g. surface water runoff). All watercourses and waterbodies discussed above can be considered as potential receptors, except for the waterbodies and watercourse that were either a large distance away, or uphill, from the proposed cable route, namely Waterbodies 2 and 5 and Watercourses H and I.

10.5 Impact Assessment

Impacts on water quality will occur through either a direct physical disturbance of a watercourse, or through pollution events. These could take place during the construction phase, or during operation of the cable where maintenance works are required. Impacts on water quality arising during decommissioning were not assessed.

10.5.1 Construction

10.5.1.1 Release of Hazardous Substances

As identified in Chapter 24: Resources Usage and Waste, there will be fuel, oils and chemicals stored on site which, if released, could be harmful to the environment. It is assumed that they will be appropriately stored and utilised as detailed in Chapter 24, however, there is still a risk of loss of containment. The harm caused will be determined by the material involved and the volume reaching the aquatic environment.

The Landfall HDD site location as shown in Drawing NCGEN-NCT-Z-XD-0001-01 is 10m from Watercourse G. The indicative layout of the site (see Figure 2.10 in Chapter 2: Project Description) includes soil bunding to the south of the site, which will provide a physical barrier between the Landfall HDD works area and Watercourse G. The bund in effect breaks the pathway between the Landfall HDD works area and the stream. In addition, the fuel and storage areas are a distance away from Watercourse G.

Onshore trenching operations will require hydrocarbon-based fuels and hydraulic fluids to power required machinery. The mobile diesel storage tank(s) are the largest potential contaminating source, holding approximately 5m^3 of diesel.

As discussed in Chapter 24: Resource Usage and Waste, the fuel bowser will be under strict management controls to prevent pollution incidents. Where practicable, bio-degradable hydraulic fluids will be utilised in machinery and oils and chemicals will be subject to Control of Substances Hazardous to Health (COSHH) assessments, including environmental considerations and be appropriately stored. Spill kits and procedures will be in place.

The Landfall and Road Crossing HDD will utilise drilling fluid. It is assumed the drilling fluid bentonite will be used. Bentonite consists of a mixture of water and naturally occurring non-toxic clay. Additives like natural occurring xanthum gum and gypsum on occasions may be added to bentonite to improve the efficiency of the fluid (Sigma-Aldrich, 2012) and, in addition, Caustic Soda may be utilised as a pH modifier ((Riggall, 2017) provided as Appendix B.1).

Alternatives available to bentonite include Ecodrill and PureBore. Ecodrill is a silicate-based fluid that may also be utilised. Ecodrill does pose some environmental implications for aquatic environments where large volumes are released in an undiluted or unnaturalised state. The high pH of the fluid may affect the localised water quality by increasing the pH of the water (Silicates, 2012). Ecodrill, if utilised, would be diluted prior to use.

PureBore is similar to Ecodrill, in that it is a silicate-based fluid. It differs from bentonite and Ecodrill by having a lower pH, ranging from 6.5 to 8.5. Adaptation of PureBore pH sees Soda ash (sodium carbonate Na_2CO_3) being added to freshwater prior to mixing with concentrated PureBore, resulting in a neutral pH of the drilling fluid (Clear Solutions, 2018).

The drilling fluid will be appropriately stored, with the volume of drilling fluid minimised by recycling, as detailed in Chapter 2: Project Description. Spill kits and procedures will be in place with operatives' suitability trained. Spent drilling fluid will be tankered offsite for disposal. Even if drilling fluids are non-toxic they have a high solids loading which can increase suspended solid loadings and solids 'dropping out' of suspension can cover the stream beds, discolouring the water and reducing the ecological value of the watercourse or waterbody.

There may be a requirement for some in-situ concrete pouring for the Joint Pits. If required, it is likely that there will be cement washings arising. Cement washings can negatively affect water quality, if they reach the aquatic environment due to their high pH and solids content.

So, a discussed in Chapter 24: Resource Usage and Waste any equipment utilised for cement pouring will be washed out only at a designated area, designed to contain wet concrete/wash water, and the waste water arising will be appropriately treated prior to disposal.

The assessment utilises the source, pathway and receptor model, with the receptors being the watercourse and waterbodies discussed in Section 10.4.3. The assessment assumes compliance with the CAR GBR and the planned mitigation measures discussed above being in place (other than spill kits and procedures, which are an emergency mitigation measure only). Assuming that spills will not be contained and prevented from entering the watercourses by site personnel, is a pessimistic assumption for the purpose of assessment.

Table 10.4 provides an assessment of potential likely pollution risks upon the identified receptors.

Table 10.4: Loss of Hazardous Substances Impact Assessment

Source	Scenario	Pathway	Receptor	Probability	Impact Magnitude	Effect Significance
Fuel Storage bowser (5m^3 of diesel)	Catastrophic Failure - Loss of entire contents (upto 5m^3).	Spillage to ground with the potential to reach water.	Waterbody 3	Extremely Unlikely Due to the distance from cable installation operations (approximately 2km)	Medium	Negligible: Non-Significant
			Waterbody 4	Unlikely Due to the distance from cable installation (approximately 90m)		Minor: Non-Significant
			Watercourse B	Extremely Unlikely Due to distance to from cable installation (approximately 200m)		Negligible: Non-Significant
			Watercourse C	Unlikely Fuel bowser will be kept a minimum of 10m from the watercourse.		Minor: Non-Significant
			Watercourse D	Unlikely Fuel bowser will be kept a minimum of 10m from the watercourse.		Minor: Non-Significant
			Watercourse E	Unlikely Fuel bowser will be kept a minimum of 10m from the watercourse.		Minor: Non-Significant
			Watercourse G	Unlikely Fuel bowser will be kept a minimum of 10m from the watercourse.		Minor: Non-Significant
Refuelling Activities	Loss of fuel during refuelling (up to 360l of diesel).	Spillage to the ground with the potential to reach water.	Waterbody 4	Unlikely	Medium	Minor: Non-Significant
			Watercourse B	Extremely Unlikely Due to the distance from cable installation operations (approximately 200m)		Negligible: Non-Significant
			Watercourse C	Unlikely Fuel bowser will be kept a minimum of 10m from the watercourse.		Minor: Non-Significant
			Watercourse D	Unlikely Fuel bowser will be kept a minimum of 10m from the watercourse.		Minor: Non-Significant

Source	Scenario	Pathway	Receptor	Probability	Impact Magnitude	Effect Significance
Refuelling Activities	Loss of fuel during refuelling (up to 360l of diesel).	Spillage to the ground with the potential to reach water.	Watercourse E Watercourse G	Unlikely Fuel bowser will be kept a minimum of 10m from the watercourse.	Medium	Minor: Non-Significant
				Unlikely Fuel bowser will be kept a minimum of 10m from the watercourse.		Minor: Non-Significant
Machinery Hydraulic Fluids	Loss of hydraulic fluids due to pipe rapture (< 22l).	Spillage to the ground with the potential to reach water.	Watercourse B	Unlikely Due to the distance from cable installation operations (approximately 200m).	Low	Minor: Non-Significant
			Watercourse C	Probable Hydraulic pipes fail from time to time and work is in the immediate vicinity.		Minor: Non-Significant
			Watercourse D	Probable Hydraulic pipes fail from time to time and work is in the immediate vicinity.		Minor: Non-Significant
			Watercourse E	Probable Hydraulic pipes fail from time to time and work in the immediate vicinity.		Minor: Non-Significant
			Watercourse G	Probable Hydraulic pipes fail from time to time and work in the immediate vicinity.		Minor: Non-Significant
COSHH Store and general activities: hydraulic fluids, maintenance oils, chemicals.	Loss of containment during storage, handling, equipment maintenance and HDD operations.	Spillage to the ground with the potential to reach water.	Waterbody 4	Unlikely Due to the distance to storage on HDD site (approximately 90m). Contents will be appropriately stored and handled.	Medium	Minor: Non-Significant
			Watercourse E	Unlikely Due to the distance to storage on HDD site (>10m). Contents will be appropriately stored and handled.		Minor: Non-Significant
			Watercourse G	Unlikely Due to the distance to storage on HDD site (>10m). Contents will be appropriately stored and handled.		Minor: Non-Significant

Source	Scenario	Pathway	Receptor	Probability	Impact Magnitude	Effect Significance
HDD Drilling Fluids Landfall HDD and Road Crossing HDD entrances.	Loss of drilling fluid during HDD operations.	Spillage to the ground with the potential to reach water.	Waterbody 4	Unlikely Due to the distance to from HDD (>10m).	Medium	Minor: Non-Significant
			Watercourse E	Unlikely Due to the distance to from HDD (>10m).		Minor: Non-Significant
			Watercourse G	Unlikely Due to the distance to from HDD (>10m).		Minor: Non-Significant
Cement Wash	Cement washings	Spillage to the ground with the potential to reach water.	Watercourse C	Unlikely Due to the distance from Joint Pit 2 (approximately 30m) and no cement washing occurring within 10m of an aquatic environment.	Medium	Minor: Non-Significant
			Watercourse E	Extremely Unlikely Due to the distance to from Joint Pit 1 at A90 (approximately 70m) and no cement washing occurring within 10m of an aquatic environment.		Negligible: Non-Significant

10.5.1.2 Surface Water Runoff

Surface water run-off from construction sites greater than 4 ha require a complex CAR licence and, as part of the application process, there is a need to submit a Pollution Prevention Plan. It can therefore be assumed that a CAR licence and Pollution Prevention Plan will be in place.

The removal of top and subsoil giving rise to exposed soils, and also the storage soils, can both act as a source of silt-laden water in wet weather and dust in dry weather. Impacts associated with dust are discussed in Chapter 9: Air Quality. In wet weather, water running over exposed soil or soil stockpiles will collect silt and become silt-laden. If silt-laden water were to reach either a water course or a waterbody, it would reduce the water quality. Silt can increase suspended solid loadings and solids 'dropping out' of suspension can cover the stream beds, discolouring the water and reducing the ecological value of the watercourse or waterbody.

Each of the phases of work that could give rise to silt laden waters are discussed in turn below, as each element could pose a risk to different watercourses and waterbodies, due to the location of the works.

Enabling Works

During enabling works, the HDD access road will be formed and will require top soil to be stripped, and then sub-base and sections of tarmac to be placed. The sub-base will be compacted or rolled into place to allow it to take heavy loads and this will minimise its potential to act as a dust/silt source. The topsoil removed will be retained to allow the road to be reinstated once the construction works have been completed. It is proposed that where viable the topsoil is removed as 'turf' with the soil underneath requiring removal then be moved on to a prepared area. The prepared area will be adjacent to the access road, and preparation may include the laying of a geotextile layer. Once the excavated topsoil has been bunded any turf removed will be laid on top. This will allow the turf to be retained and used for reinstatement where practicable and assist in covering the soil to minimise the risk of silt laden waters.

The access road crosses Watercourse G (the crossing is discussed in Section 10.5.1.3) and, as such, during the stripping process, there is a **probable** likelihood that when it rains, surface water runoff could enter Watercourse G. This would give rise to a **medium** magnitude of impact giving rise to a **moderate, significant impact.**

Earthworks for the HDD site working platform are also required. This will require soil to be stripped and stored in the form of bunds that are approximately 3.5m wide, and the bunds will be turfed in a similar way as described for the access road. Where there is not enough turf to cover the stored soils, the bunds will be bladed off or other suitable means to reduce the potential for dust and silt run-off. The HDD site working platform will be surfaced with stone to provide an appropriate working base, this will be compacted or rolled, minimising the source of dust and silts. The long distance (approximately 90m) between the HDD site and Waterbody 4 reduces the likelihood of silt-laden surface water runoff entering the waterbody. Therefore, the impact from surface water runoff from the HDD setup on Waterbody 4 is assessed as **extremely unlikely, low** magnitude impact, resulting in a **negligible, non-significant effect.**

Watercourse E and G are closer to the HDD site and, although the likelihood of silt laden water reaching them is higher, however in most instances it is **unlikely** and would give rise to **medium** magnitude impacts, resulting in a **minor: Non-significant effects**. However, during the creation of the southern bund before the turf is placed, or other surface stabilising takes place, there is a **probable** likelihood of a **medium** magnitude of effect on Watercourse G due to the large source of sediments associated with the uncovered soils. This would give rise to a **moderate, significant effect.**

Cable Installation

The installation of the cable will require trenches and joint pits to be dug, with the excavated material stored for use as backfill once the cables have been installed. The material will be handled as described for enabling works, with the earth being placed onto a prepared areas (most likely in linear bunds along the length of the cable) and bladed off to minimise the potential source of silt associated with the stored material. The open trenches, including joint pits, will however remain a source of silt. Surface water, where practicable, will be routed away from the stored material and the trenches. This may require field drainage channels or pipes to be installed, the design of which would be captured in the Pollution Prevention Plan.

Depending on the soil types, the water table levels along the cable route and the weather conditions, rainwater may soak away into the ground and, as such, not give rise to silt laden water, or it may pool within or run along the trench. As shown in Drawing NCGEN-NCT-Z-XE-0003-01, there will be concrete waterstops at least every 100m along the trenches, with more in steep areas. This will prevent water flowing over long stretches of the trench picking up solids. There is a potential in some areas of the cable route that groundwater levels will be higher than the base of the trench and, as such, groundwater may also be present in the trenches. If water is collecting in the trenches and needs to be removed to facilitate cable installation, an area next to a waterstop trench will be dug slightly deeper to allow water to collect and settle, prior to the water being pumped out and discharged appropriately. Depending on the quantities of surface water, the presence of groundwater and the exact location in relation to the groundwater dependant ecosystems (Chapter 13: Terrestrial Ecology), dewatering of the trenching works may fall under the GBR15 of CAR and, hence, these will be complied with. Alternatively, it will be incorporated within the construction CAR licence and associated Pollution Prevention Plan.

The cable route crosses Watercourses C, D, E and G, the crossings of which are discussed in Section 10.5.1.3, however, due to their close proximity to the trench earthworks it is **probable** that they could be contaminated with silt laden water, and the resultant magnitude of impact could be **medium** giving rise to a **moderate, significant** effect.

10.5.1.3 Temporarily Modification of Aquatic Environments

Enabling Works

The temporary access road crosses Watercourse G twice, as shown in NCGEN-NCT-Z-YX-0002-01. Temporary culverted bridges will be installed to facilitate the crossings. These will be less than 5 metres wide and 10m long and, as such, CAR *GBR6: Construction and Maintenance (or removal) of a temporary bridge over a river, burn or ditch that has a channel width of less than 5 metres (SEPA, 2018)* is applicable. If there is flow in the drainage channel when works are planned, then dams will be installed up and downstream of the crossing point to allow it to dry out. The water will be pumped from upstream of the crossing point to downstream of the crossing point, such that flows up and downstream of the crossing point are maintained as far as practicable. Vegetation clearance will be minimised. The culvert will be installed and road laid. Prior to the removal of the dams, the culvert will be cleared of loose material. The probability of the works occurring is **certain,** the associated impacts are expected to be **low** giving rise to a **minor, non-significant** effect.

Cable installation

There will be 4 watercourse crossings along the route (Watercourses C, D, E and G). The watercourses are all relatively minor. The watercourse will be dammed to allow the crossing point to dry out. The water will be pumped from upstream of the crossing point to downstream of the crossing point, such that flows up and downstream of the crossing point are maintained as far as practicable. Vegetation clearance will be minimised. The cable trench shall be dug, ducts inserted, or cables laid directly in the ground, then the stream will be reinstated, and the dams removed to allow the stream to return to previous condition. Prior to removal of the dams, loose material will be removed as far as practicable and temporary silt fences installed at the end of the working area to prevent silt spreading downstream. Therefore, the impact is assessed **certain**, **low** giving rise to a **minor, non-significant** effect.

To provide access for cable installation, a temporary haul road adjacent to the cable trench will be installed. This will utilise culverted crossings (across Watercourses C,D,E and G) equivalent to those installed through the enabling works. The probability of the works occurring is **certain** the associated impacts are expected to be **low** giving rise to a **minor, non-significant** effect.

These engineering works to temporarily alter the watercourses during cable installation are likely to require a simple licence under the CAR regulations, and this is likely to be incorporated within the Construction CAR licence and associated Pollution Prevention Plan.

10.5.1.4 Flood Risk

As detailed in Section 10.3.2, Watercourse B was identified to have a medium risk on the SEPA Flood Map. The cable route and HDD site also fall within the Potentially Vulnerable Area PVA 06/08 Buchan Coastal (SEPA, 2016).

To the southeast of the A90, the new access roads and HDD works site will give rise to temporary additional areas of hardstanding. An area has been allowed for within the HDD works site to manage surface water and, if required, this would be detailed in the Pollution Prevention Plan supporting the Construction CAR licence.

The fields to the southeast are known to get saturated in winter and there is a potential for local pooling of water. To the northwest of the A90, the haul road will be the only additional hardstanding area. The main fields are generally on a slope, but water does collect where it drains off. No increase to flooding is expected from the cable installation on the fields to the northwest.

There are field drains both sides of the A90, however it would appear that these have not been maintained in recent years. During the works where, local field drains are encountered they will be maintained and where necessary replaced. This will be addressed through the Construction CAR licence and associated pollution prevention plan.

Within Fourfields, which the closest point to Watercourse B, there is a potential that groundwater will be incurred during the installation of the cable ducts (see Chapter 8: Geology and Hydrogeology). This will need to be appropriately managed as part of the wider converter station enabling works activities as discussed in Chapter 8. The cable duct installation will not give rise to an increase in flood risk in its own right.

10.5.2 Operation and Maintenance

Since the HVDC cable will be buried along its length from the landfall to the proposed converter station, no ongoing effects on water quality are expected during normal operation. Maintenance and repair work to the cable may be required during its lifetime. This will result in similar risks to water quality as those described for construction, however, these will only persist for the duration of the maintenance works and be of a much smaller scale. Operations will not give rise to any increase to flooding risk.

10.6 Mitigation Measures

Significant effects were identified for surface water run-off, hence, specific mitigation measures for this are discussed in Section 10.6.2. In addition to this, mitigation measures will be employed in line with best practice to minimise risks.

10.6.1 Release of Hazardous Substance

Although not taken account of within the assessment process, an appropriate spill response plan will be put in place, and this will align with the pollution prevention hierarchy, with prioritised as follows:

- Stop the source of the pollution;
- Interrupt any pathways to the environment;
- Report the incident in as much detail as possible to site management and the ECoW;
- Clean the contaminated area and recover pollutants; and
- Analyse the event to prevent further incidents.

The spill response plan will take account of the specific site inventory and risks. Appropriately specified and sized spill kits will be made available and operators will be trained in their use.

Spill kits will be available for use during refuelling activities and appropriate drip trays utilised for in-situ refuelling activities. Refuelling will only be carried out by trained operatives in accordance with site procedures.

It will be ensured that site personnel are trained in the spill response plans and activities through regular toolbox talks, drills and safety briefs.

10.6.2 Surface Water Runoff

In addition to the creation of a Pollution Prevention Plan to support the Construction site CAR licence application, the Risk Assessments and Method Statements for the construction of the temporary road, HDD works site, cable trenches and joint pits will detail how surface water is to be managed.

The RAMS will be developed to ensure appropriate steps are taken to prevent pollution and silt issues arising during the works. Particular regard will be made to Guidance for Pollution Prevention 5: Works and maintenance in or near water (GPP 5) (NIEA et al., 2017c) and applicable CAR GBR's. In accordance with Engineering in the Water Environment: Good Practice Guide Temporary Construction Methods (SEPA, 2009), the three following principles will be followed:

- Divert clean water away from exposed soils and working areas;
- Minimise erosion of exposed soils; and
- Prevent contaminated water from entering watercourses untreated.

Silt fences or equivalent (straw bales) will be utilised in the vicinity of watercourses to prevent silt laden water reaching the watercourses. There will be regular checks to ensure that silt fences are appropriately sited and working effectively.

10.7 Residual Effects

Effective implantation of the proposed mitigation measures will reduce the magnitude of all potential impacts to **Non-Significant**, as detailed in Table 10.5.

10.8 Cumulative Effects

There is the potential to have cumulative effects with the NorthConnect Converter Station and HVAC cabling, specifically for the cable installation works within the Fourfields site. The HVDC cable ducts will be installed as part of the converter station enabling works. The Environmental Statement (ES) from the NorthConnect Converter Station identified similar potential impacts arising from the development as were identified in this chapter, but with similar mitigation as that identified here, the resultant effects were negligible to minor, not significant. Hence no cumulative significant effects are expected.

10.9 Summary of Effects

The chapter assessed the potential impacts posed by construction and operation of the NorthConnect onshore HVDC cable infrastructure on onshore water quality. Table 10.5 details the summary of effects identified. The assessment identified no significant effects on onshore water quality during the construction or operation phase of the development with mitigation in place. Effects on water quality due to decommissioning of the project were not assessed.

Table 10.8 Summary of Onshore Water Quality Effects

Aspect	Phase	Predicted Impact	Probability	Receptor	Impact Magnitude	Significance (Absence of Secondary Mitigation)	Mitigation Summary	Residual Impact Magnitude	Significance of Residual Effect
Fuel Storage bowser (up to 5m^3 of diesel)	Construction	Loss of pollutant from fuel storage bowser (approx. 5m^3 of diesel) with the potential to reach water. Diesel in water increases total organic carbon and form an impregnable layer on top of the water column, reducing oxygen availability by preventing oxygen diffusion.	Extremely Unlikely	Waterbody 3	Medium	Negligible: Non-Significant	Compliance with GBR for oil storage. Spill responce procedures and kits in place, with personel trained in their use.	Low	**Negligible: Non-Significant**
			Unlikely	Waterbody 4		Minor: Non-Significant		Low	**Negligible: Non-Significant**
			Extremely Unlikely	Watercourse B		Negligible: Non-Significant		Low	**Negligible: Non-Significant**
			Unlikely	Watercourse D		Minor: Non-Significant		Low	**Negligible: Non-Significant**
			Unlikely	Watercourse E		Minor: Non-Significant		Low	**Negligible: Non-Significant**
			Unlikely	Watercourse G		Minor: Non-Significant		Low	**Negligible: Non-Significant**

Aspect	Phase	Predicted Impact	Probability	Receptor	Impact Magnitude	Significance (Absence of Secondary Mitigation)	Mitigation Summary	Residual Impact Magnitude	Significance of Residual Effect
Refuelling activity	Construction	Loss of pollutant during refuelling (upto 360l) with the potential to reach water. Diesel in water increases total organic carbon and form an impregnable layer on top of the water column, reducing oxygen availability by preventing oxygen diffusion.	Unlikely	Waterbody 4	Medium	Minor: Non-Significant	Compliance with GBR for oil storage. Spill responce procedures and kits in place, with personel trained in their use. Refuelling procedures in place and pperators trained in them. Refuelling actives to occur >10m from a watercourse or waterbody.	Low	**Negligible: Non-Significant**
			Extremely Unlikely	Watercourse B		Negligible: Non-Significant			**Negligible: Non-Significant**
			Unlikely	Watercourse D		Minor: Non-Significant			**Negligible: Non-Significant**
			Unlikely	Watercourse E		Minor: Non-Significant			**Negligible: Non-Significant**
			Unlikely	Watercourse G		Minor: Non-Significant			**Negligible: Non-Significant**

Aspect	Phase	Predicted Impact	Probability	Receptor	Impact Magnitude	Significance (Absence of Secondary Mitigation)	Mitigation Summary	Residual Impact Magnitude	Significance of Residual Effect
Machinery Hydraulic Fluids	Construction	Loss of hydraulic fluid (< 1L) with the potential to reach water. Potential to affect oxygen availability in water by preventing oxygen diffusion.	Unlikely	Watercourse B	Low	Negligible: Non-Significant	Machinery to be well maintained. Spill responce procedures and kits in place, with personel trained in their use.	Low	**Negligible: Non-Significant**
	Construction		Probable	Watercourse C		Minor: Non-Significant			**Minor: Non-Significant**
	Construction		Probable	Watercourse D		Minor: Non-Significant			**Minor: Non-Significant**
	Construction		Probable	Watercourse E		Minor: Non-Significant			**Minor: Non-Significant**
	Construction		Probable	Watercourse G		Minor: Non-Significant			**Minor: Non-Significant**
Loss of containment during storage, handling, equipment maintenance and HDD operations.	Construction	Loss of pollutant during handling, maintenance and HDD operations. Potential to cause: harmfull release to the aquatic environments, changing water pH and reducing oxygen availability.	Unlikely	Waterbody 4	Medium	Minor: Non-Significant	Compliance with GBR for oil storage. Appropriate chemical storage as discussed in Chapter 24. Spill responce procedures and kits in place, with personel trained in their use.	Low	**Negligible: Non-Significant**
			Unlikely	Watercourse E		Minor: Non-Significant			**Negligible: Non-Significant**
			Unlikely	Watercourse G		Minor: Non-Significant			**Negligible: Non-Significant**

Aspect	Phase	Predicted Impact	Probability	Receptor	Impact Magnitude	Significance (Absence of Secondary Mitigation)	Mitigation Summary	Residual Impact Magnitude	Significance of Residual Effect
Loss of drilling fluid during HDD operations	Construction	Potential to cause: harmfull release to the aquatic environments, increasing suspended solids, pH and reducing oxygen availability.	Unlikely	Waterbody 4	Medium	Minor: Non-Significant	Spill responce procedures and kits in place, with personel trained in their use.	Low	**Negligible: Non-Significant**
				Watercourse E		Minor: Non-Significant			**Negligible: Non-Significant**
				Watercourse G		Minor: Non-Significant			**Negligible: Non-Significant**
Cement Wash	Construction	Cement wash runoff with the potential to reach water. Leading to the potential altering of water pH.	Unlikely	Watercourse C	Medium	Minor: Non-Significant	Designated washing area, with capture and treatment of cement washings for appropriate disposal.	Low	**Negligible: Non-Significant**
			Extremely Unlikely	Watercourse E		Minor: Non-Significant			**Negligible: Non-Significant**

Aspect	Phase	Predicted Impact	Probability	Receptor	Impact Magnitude	Significance (Absence of Secondary Mitigation)	Mitigation Summary	Residual Impact Magnitude	Significance of Residual Effect
Surface Water Enabling Works	Construction	Silt ladden water from temporary road construction.	Probable	Watercourse G	Medium	Moderate: Significant	Utilisation of silt fences to screen and filter sediment.	Low	**Minor: Non-Significant**
		Silt ladden water from HDD site works.	Extremely unlikely	Waterbody 4	Low	Negligible: Non-Significant		Low	**Negligible: Non-Significant**
			Unlikely	Watercourse E	Low/ Medium	Minor: Non-Significant		Low	**Minor: Non-Significant**
			Unlikely	Watercourse G	Low/ Medium	Minor: Non-Significant		Low	**Minor: Non-Significant**
		Silt ladden water during HDD bund creation.	Probable	Watercourse G	Medium	Moderate: Significant		Low	**Minor: Non-Significant**
Surface Water Runoff from Cable Installation	Construction	Surface water runoff from cable installation activities	Probable	Watercourse C	Medium	Moderate: Significant	Utilisation of silt fences to screen and filter sediment.	Low	**Minor: Non-Significant**
				Watercourse D					
				Watercourse E					
				Watercourse G					

Aspect	Phase	Predicted Impact	Probability	Receptor	Impact Magnitude	Significance (Absence of Secondary Mitigation)	Mitigation Summary	Residual Impact Magnitude	Significance of Residual Effect
Temporary Modification of Watercourses **Enabling works**	Construction	Disturbance & modification of watercourses during culverts installation.	Certain	Watercourse G	Low	Minor: Non-Significant	GBR6 Rules and GPP5 followed. Silt curtains utilised.	Low	**Minor: Non-Significant**
Modification of Watercourses **Cable Installation**	Construction	Physical disturbance of watercourse through diversion during cable installation with the potential to increase water column sediment loading.	Certain	Watercourse C Watercourse D Watercourse E **Watercourse G**	Low	Minor: Non-Significant	GPP5 followed. Silt curtains utilised.	Low	**Minor: Non-Significant**

Key

	Significant Effect

10.10 References

Aberdeenshire Council. (2011). Supplementary Guidance No. 8: Flooding and Erosion 166.
Bunyan, J. (2014). North Connect Ecological Surveys: Otter, Water Vole & Badger Survey. 26.
Bunyan, J. (2017). North Connect Ecological Surveys: Otter, Water Vole & Badger Survey.
Clear Solutions. (2018). Pure-Bore. 1.
European Parliament, & Council, E. (2000). The Water Framework Directive.
European Parliament, & European Council. (2007). The European Union Floods Directive.
Moss, B. (1998). *Ecology of Fresh Waters* (Third ed.). Oxford: Blackwell Science.
NIEA, SEPA, & Environment Agency. PPG 6: Working at construction and demolition sites.
NIEA, SEPA, & Environment Agency. (2011a). PPG 7: The safe operation of refueling facilities.
NIEA, SEPA, & Environment Agency. (2011b). PPG 22: Dealing with spills.
NIEA, SEPA, & Environment Agency. (2013). Pollution Prevention Guidelines: PPG 1 - Understanding Your Environmental Responsibilities - Good Environmental Practice
NIEA, SEPA, & Natural Resources Wales. (2017a). GPP8: Safe storage and disposal of used oils.
NIEA, SEPA, & Natural Resources Wales. (2017b). GPP 2: Above ground oil storage tanks.
NIEA, SEPA, & Natural Resources Wales. (2017c). GPP 5: Works and maintenance in or near water.
NIEA, SEPA, & Natural Resources Wales. (2017d). GPP 21: Pollution incident response planning 25.
Riggall, T. (2017). Horizontal Directional Drilling (HDD) Feasibility Report. *NorthConnect Cable Landfalls, Longhaven, Peterhead, U.K.*(20160401RA-C-FR01_Rev00).
Scottish Government. (2009). Flood Risk Management (Scotland) Act 73.
Scottish Government. (2015). The river basin managment plan for the Scotland river basin district: 2015-2027.
Scottish Ministers. (2014). Scottish Planning Policy (SPP).
SEPA. (2009). Engineering in the Water Environment Good Practice Guide: Temporary Construction Methods. 61.
SEPA. (2016). Peterhead (Potentially Vulnerable Area 06/08). 12.
SEPA. (2017). SEPA Flood Map.
SEPA. (2018). The Water Environmetn (Controlled Activities) (Scotland) Regulations 2011 (as amended) - A Practical Guide. (8.2).
SEPA, Environment Agency, & Environment and Heritage Service. (2000). PPG 18: Managing fire water and major spillage's.
Sigma-Aldrich. (2012, 2018). Safety Data Sheet - Bentonite. Retrieved from https://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=GB&language=en&productNumber=B3378&brand=SIGMA&PageToGoToURL=https%3A%2F%2Fwww.sigmaaldrich.com%2Fcatalog%2Fproduct%2Fsigma%2Fb3378%3Flang%3Den
Silicates, N. (2012). Material Safetey Data Sheet - EcoDrill. Retrieved from https://www.pqcorp.com/docs/default-source/msds/pq-corporation/potassium-silicates/ecodrill/ecodrill_317_potassium_silicate_msds2012.pdf?sfvrsn=96034cc7_4
UK Government. (1974). Control of Pollution Act 1974.