

Contents

Contents	i
List of Tables	ii
Glossary	1
Abbreviations and Acronyms	2
7A Flood Risk Assessment.....	3
7A.1 Introduction	3
7A.2 Policy and Guidance.....	3
7A.3 Application Site	4
7A.3.1 Topography	4
7A.3.2 Geology and Hydrogeology	5
7A.3.3 Groundwater Levels and Flow.....	5
7A.3.4 Hydrology	5
7A.3.5 Sewer and Water Supply Infrastructure.....	6
7A.3.6 Coastal Setting.....	7
7A.4 Onshore Transmission Works.....	8
7A.5 Flood Risk Assessment.....	8
7A.5.1 Sources of Information.....	8
7A.5.2 Technical Assessment of Flood Risk	9
7A.6 Flood Risk Management.....	14
7A.6.1 Mitigation by Design	15
7A.6.2 Proposed Flood Risk Management	15
7A. 7 Off Site Impacts	16
7A.7.1 Surface Water Runoff.....	16
7A.7.2 Water Services.....	17
7A.8 Residual Flood Risk.....	17
7A.8.1 Groundwater Flooding	17
7A.8.2 Coastal Flooding	17
7A.8.3 Failure of Surface System	17
7A.9 Conclusions	18
References	19
Annex 7.1	1

List of Tables

Table 7A.1 SPP Flood Risk Framework 11

Table 7A.2 Summary of Flood Risk..... 14

Glossary

Annual Exceedance Probability (AEP)	The probability of an event occurring within any year
Berm	An artificial ridge or embankment
Inter-granular fracture flow	Groundwater flow occurs through a combination of intergranular and fracture flow
Made Ground	Infilled ground comprising of unspecified materials (often a combination of backfilled natural material and man-made deposits i.e. rubble)
Micrograbbo	A medium grained basic hypabyssal igneous rock
Moderately Productive Aquifer	An aquifer system with moderate potential for groundwater abstractions, providing yield of up to 10l/s
Passage Formation	Cyclic sequence of sandstone, mudstone, seatearths and siltstone with ironstone and limestone bands
Port Setton Spittal Dyke	A Quartz Microgabbro rock
Quartz	A silica based mineral (SiO ₂)
Runoff	Movement of surface water across ground
Site Investigation	Intrusive investigation to confirm geological, geotechnical and hydrogeological conditions
Site Walkover	Walkover of the Application Site and surrounds to identify current ground conditions, identify watercourses etc.
Sump	A low lying area which receives drainage
Upper Limestone Formation	Sandstones, siltstones and mudstones with seatearths or seatclays and multiple coal seams. Sandstones are normally fine-grained and grey or pale yellow in colour but coarse-grained pebbly sandstones occur in parts

Abbreviations and Acronyms

AEP	Annual Exceedance Probability
BGS	British Geological Survey
CAR	Controlled Activities Regulations
CEMP	Construction Environmental Management Plan
DWS	Drinking Water Standards
EIA	Environmental Impact Assessment
ELC	East Lothian Council
ES	Environmental Statement
FRA	Flood Risk Assessment
GPP	Guidance for Pollution Prevention
GWDTE	Groundwater Dependant Terrestrial Ecosystems
ICOL	Inchcape Offshore Limited
LDP	Local Development Plan
mAOD	metres Above Ordnance Datum
NPF3	National Planning Framework 3
OnTW	Onshore Transmission Works
PPC	Pollution Prevention and Control
PPG	Prevention of Pollution Guidance
RBMP	River Basin Management Plan
SEPA	Scottish Environmental Protection Agency
SNH	Scottish National Heritage
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
TMP	Traffic Management Plan
WFD	Water Framework Directive

7A Flood Risk Assessment

7A.1 Introduction

- 1 This report provides a technical appendix to *Chapter 7: Hydrology, Geology and Hydrogeology* of the Environmental Impact Assessment (EIA) to assess the Flood Risk to the Inch Cape Onshore Transmission Works (OnTW). This report should be read in conjunction with *Chapter 7: Hydrology, Geology and Hydrogeology* of the EIA.
- 2 This report has been prepared under the guidance and direction of an SLR Technical Director who specialises in flood risk assessment and drainage design.
- 3 A site walkover has been conducted by a Technical Director who specialises in the assessment of flood risk in July 2017 and key findings have been incorporated into this assessment.

7A.2 Policy and Guidance

- 4 This assessment has been completed in accordance with guidance presented within Scottish Planning Policy (SSP)¹, the National Planning Framework for Scotland 3 (NPF3)² and taking cognisance of the Flood Risk Management (Scotland) Act 2009 and the Scottish Environment Protection Agency's (SEPA) Surface Water Management Planning Guidance³.
- 5 The assessment also references and takes due consideration (where appropriate) of the following principal guidance and policy documents:
 - British Standards Institution (2013) Code of Practice for Surface Water Management from Development Sites, Report BS-8582:2013, November 2013;
 - British Standards Institution (2011) Assessing and Managing Flood Risk in Development – Code of Practice, Report BS-8533:2011, October 2011;
 - CIRIA (2004) Development and Flood Risk – Guidance for the Construction Industry, Report C624;
 - CIRIA and National SuDS Working Group (2004) Interim Code of Practice for Sustainable Drainage Systems, Report C704;
 - CIRIA (2015) The SuDS Manual (v1), Report C753, November 2015;
 - East Lothian Council (2008) Local Plan;
 - East Lothian Council (2016) Local Development Plan (Proposed)
 - Scottish Government planning advice notes (PAN):

¹The Scottish Government (2014) Scottish Planning Policy, June 2014

² The Scottish Government (2014) National Planning Framework 3, June 2014

³ Scottish Environmental Protection Agency (2013) Surface Water Management Planning Guidance, February 2013

- a) PAN 61 (2001): Planning and Sustainable Urban Drainage Systems
- b) PAN 79 (2006): Water and Drainage
 - Scottish Water (2015) Sewers for Scotland 3rd Edition, April 2015; Level 1 Heading
 - SEPA (2012) General Binding Rules for Surface Water Drainage Systems (WAT-SG-12, v4) July 2012;
 - SEPA (2014) SuDS Regulatory Method (WAT-RM-08, v5.2) August 2015; and
 - SEPA (2015) Technical Flood Risk Guidance for Stakeholders (Reference: SS-NFR-P-002) June 2015.

7A.3 Application Site

- 6 The Application Site is located on the site of the former Cockenzie Power Station on the southern banks of the Firth of Forth in the town of Cockenzie and Port Seton, East Lothian. The Application Site is centred at National Grid Reference (NGR) 339400, 675400.
- 7 At the time of writing the former Cockenzie Power Station has been demolished and restoration and remediation works are ongoing. It is understood that as part of these works excavation works are currently taking place between ground level (c.5 mAOD) and the top of the basal pad for the former Cockenzie Power Station (c.1.2 mAOD).
- 8 From the site walkover it appears that the excavated materials are being crushed and sorted to separate materials such as metals and non-mineral substances from the soils, rocks and crushed concrete for off-site removal. The remaining materials are being re-placed and compacted across the site.
- 9 The Application Site is bounded to the north-west by the Firth of Forth, with a 10 metre width of land (the John Muir Way) running along the bund which separates the site from the coast. To the north-east is the remainder of the former Cockenzie Power Station, while to the south-east is Edinburgh Road (B1348) with a gas-fired electricity generation plant beyond. To the south-west is Preston Links; an area of scrub grassland.

7A.3.1 Topography

- 10 The Application Site is in the process of being restored and remediated and no information has, to date, been provided on the final ground elevation once the remediation and restoration works are complete.
- 11 It is understood that the former Cockenzie Power Station site was built on a reinforced concrete foundation slab which lies at 1.2 mAOD. The power station building has now been removed down to the foundation slab level.
- 12 The site walkover suggests that following remediation and restoration works the majority of the site will consist of the exposed foundation slab (1.2 mAOD) surrounded on all sides by ground at the typical level of 5.0mAOD.

- 13 Beyond the Application Site boundary the ground elevations rise gradually to the south and south-west.

7A.3.2 Geology and Hydrogeology

- 14 The geological setting is outlined in detail within *Chapter 7: Hydrology, Geology and Hydrogeology* of the EIA Report and summarised below.
- 15 The Application Site is located above the Upper Limestone Formation, which comprises a cyclical sequence of sandstones, siltstones, mudstones, marine limestones and seatearths. This formation has been intruded by the south-westerly striking Port Seton-Spittal Dyke, composed of quartz micrograbbo.
- 16 The Upper Limestone overlies the index Limestone (a bioclastic marine limestone) and the Limestone Coal Formation (cyclical sandstones, siltstones, mudstones, seatearths and multiple coal seams). Collectively these units are referred to as the 'Clackmannan Group'.
- 17 There are no overlying superficial deposits, as any which were resented were removed prior to the construction of the power station. The site is, instead, underlain by Made Ground, which includes a concrete slab, located at an elevation of c.1.2 mAOD.
- 18 The Clackmannan Group is classified as a moderately productive aquifer by the BGS⁴ which is typified as having discontinuous hydrogeological properties owing to the cyclical nature of the geology. Groundwater flow will be concentrated in the more permeable sandstone strata.

7A.3.3 Groundwater Levels and Flow

- 19 It is understood that the former Cockenzie Power Station operated a pumped drainage system which pumped surface water run-off, as well as groundwater ingress, from beneath the site. It is anticipated that this will have reduced groundwater levels locally to the elevation of the concrete slab (c. 1.2 mAOD). Given that this drainage system is now disused it is likely that groundwater levels will have rebounded to natural elevations.
- 20 Given the proximity of the Application Site to tidal waters of the Firth of Forth it is likely that since cessation of the pumped drainage system groundwater levels across the Application Site will be controlled and be in continuity with tidal levels in the adjacent Firth of Forth. The tidal range at Cockenzie⁵ is between 0.3 m and 5.9 m above Chart Datum (c.-1.8 mAOD to 3.5 mAOD)⁶ with a mid-tide elevation of 2.7 m above Chart Datum (0.6m AOD).

7A.3.4 Hydrology

- 21 The Application Site hydrology is outlined within *Chapter 7: Hydrology, Geology and Hydrogeology* of the EIA Report and is summarised below.

⁴ British Geological Survey Geoindex (Accessed 17/11/2017) <http://mapapps2.bgs.ac.uk/geoindex/home.html>

⁵ <https://www.tide-forecast.com/locations/Cockenzie/tides/latest>

⁶ Converted using data as provide within <http://www.ntsif.org/tides/datum>

- 22 The Application Site is located on the southern shore of the Firth of Forth, the foreshore is located approximately 10 m to the north-west of the Application Site.
- 23 There are no surface water features within the Application Site boundary and no watercourses are recorded on OS mapping within a 400 m radius of the Application Site. The closest watercourse is a minor drainage ditch associated with the former Power Station coal store area, c.500 m to the south-east.
- 24 This drainage ditch runs around the southern and western edge of the former coal store. It is not clear from the mapping if the drain extends beyond the edge of the former coal store site. There is no indication of a watercourse on historic OS mapping in the area of the coal store or of an outfall along the coast on current OS mapping which would indicate a culverted watercourse from the coal store. This was confirmed by the site visit.
- 25 It is considered, therefore, that the drainage ditch was installed to control and manage runoff locally from the coal store, rather than route or manage a naturally occurring watercourse.
- 26 Mapping provided by Scottish Water, presented in Appendix 01 and discussed in Section 1.1.4 below, indicates that there are no sewers or watercourses extending beneath the Application Site.

Existing Surface Water Management

- 27 As detailed above the Application Site is currently undergoing restoration following the demolition of the former Cockenzie Power Station. Excavation is taking place between ground level (c.5 mAOD) and the top of the concrete base pad (c.1.2 mAOD). From the site walkover it appears that the excavated materials are being crushed and sorted to separate materials such as metals and non-mineral substances from the soils, rocks and crushed concrete for off-site removal. The remaining materials are being re-placed and compacted across the site.
- 28 It is at this stage unclear what the final ground level the restored site will be returned to, however it is likely that it will be below the surrounding ground level. Given that there will be no formal drainage in place it is likely that incidental rainfall will either discharge to ground, if local ground conditions are suitable, or pond within the Application Site. There may therefore presently be a requirement for pumping of surface water run-off.
- 29 It is understood that the former Cockenzie Power Station site utilised a pumped surface water management system. Runoff from the former Cockenzie Power Station site drained to a sump within the concrete platform (which also received groundwater ingress) and was pumped and discharged to the Firth of Forth.

7A.3.5 Sewer and Water Supply Infrastructure

- 30 Sewer and water supply asset plans have been obtained from Scottish Water for the Application Site and are included as Appendix 01.

- 31 The plans indicate that there are no sewers (surface water or foul) or water supply infrastructure within the Application Site; however the following are recorded within a c.200 m radius:
- A combined Sewer Outfall (CSO) run in a north-westerly direction along the south-western boundary of the Application Site. The CSO discharges combined surface water and foul overflow water to the Firth of Forth, immediately to the north-west of the site;
 - A combined sewer (350mm diameter) is present beneath Edinburgh Road (B1348) to the immediate south-east of the Application Site. The sewer flows in a south-westerly direction; and
 - A water distribution main is also located beneath Edinburgh Road.

7A.3.6 Coastal Setting

Current Coastal Defenses

- 32 As detailed above the Application Site is located on the southern shore of the Firth of Forth. Between the Application Site and the coastline, a strip of some 10 m width remains undisturbed. This area has a partially sealed surfacing. The John Muir Way footpath runs along this strip. No formal development is proposed across this area, although it is noted that the Offshore Export Cables will need to cross beneath this area.
- 33 Along the northern edge of this strip are sea defences that it is believed were constructed as part of the initial construction of the former Cockenzie Power Station. These defences both retain the fill materials that were initially placed in this area, and provide erosion protection against wave and current action from the sea.
- 34 The defences consist of a thick reinforced concrete seawall with a wave deflector at its upper edge, and with rock revetment outboard of the seawall (Rock Armour). There is no information available to confirm the foundation details of the seawall, and the drainage mechanisms through the seawall.
- 35 The ground levels of the land between the Application Site and the coastline are at around 5.0mAOD while the reinforced concrete seawall has a crest level of some 6.2mAOD immediately adjacent to the Application Site. This would provide some defence against wave overtopping in extreme storm events immediately adjacent to the Application Site, however it is noted that the sea wall is not continuous to the east and west of the Application Site, and would therefore not provide an effective defence against sea levels of more than 5.0mAOD (the approximate ground elevation to the east and west).

Tidal Levels

- 36 Extreme tide level estimates for Cockenzie have been produced in a study by the Environment Agency (EA)⁷. The 0.5% Annual Exceedance Probability (AEP) (1:200 year) tidal level from that analysis is approximately 4.65 mAOD.
- 37 The EA study also indicates that sea levels at Edinburgh are predicted to rise due to climate change by between 0.23 m (low emissions scenario) and 0.39 m (high emissions scenario) by 2095. This is similar to the figure outlined within the East Lothian Shoreline Management Plan⁸ which states that future net sea level rise is predicted to be five to six millimeters per annum (250 – 300 mm over a 50 year timescale).
- 38 Given the above the predicted 0.5% AEP (1:200 year) tidal level including climate change is c. 5.04 mAOD.

7A.4 Onshore Transmission Works

- 39 The Onshore Transmission Works (OnTW) is being developed for the transmission of electricity from ICOL's Offshore Wind farm.
- 40 The OnTW includes both the electricity cables, which will run through the intertidal zone connecting the Offshore Export Cables to the Onshore Substation.
- 41 The Onshore Substation will be constructed on the site of the former Cockenzie Power Station. The final layout of the Onshore Substation will be confirmed at detailed design, however all elements of the Onshore Substation will be located on the site of the former Cockenzie Power Station site. The final development level will also be confirmed following the completion of restoration works, however it is noted that the Application Site will have an elevation of approximately 3.5mAOD.
- 42 A berm is also proposed around the perimeter of the Application Site, this will be elevated to c.1m above the surrounding ground level of the site and to a minimum elevation of 6.2mAOD along the northern boundary to tie in with the existing tidal flood defences and provide screening to the proposed Onshore Substation.

7A.5 Flood Risk Assessment

7A.5.1 Sources of Information

- 43 The following sources of information have been utilised to assess the potential flood risk to the Application Site:
- National Floodplain Mapping and Risk Assessment: Strategic level information regarding the current flood risk at the site has been obtained from Scottish Environment Protection

⁷Coastal Flood Boundary Conditions for UK Mainland and Islands, Project SC060064/TR4: Practical Guidance Design Sea Levels. Environment Agency, 2011.

⁸ East Lothian Council Shoreline Management Plan (East Lothian Council, 2002)

Agency (SEPA) via the online Indicative Flood Map⁹ and National Flood Risk Assessment (NFRA) Portal¹⁰;

- Observations obtained during a site walkover by an experienced SLR Hydrologist in July 2017;
- Details of the existing and proposed site layout, as outlined in Section 1; and
- Historical Flooding: A focussed internet search was undertaken to identify any significant flooding events within the vicinity of the site.

7A.5.2 Technical Assessment of Flood Risk

Planning Context

- 44 The relevant sections of Scottish Planning Policy (SPP), East Lothian Local Plan (2008) and proposed ELC Local Development Plan (2016) have been reviewed to inform this assessment. The relevant policies are outlined below

East Lothian Local Plan

- 45 Policy DP16: Flooding
- 46 Development that is likely to cause unmanageable flood risk, either on or off site, or would require additional unplanned public investment for flood protection works, will not be permitted. In particular:
- 47 Development in areas of importance for natural drainage and flood control:
- *The flood storage capacity of functional flood plains with a 0.5% or higher probability of flooding in any one year must be safeguarded from development. Development on greenfield land within a functional flood plain will only be permitted for essential infrastructure where the specific location is essential for operational reasons and there are no alternative locations available. Appropriate water resistant materials and construction technique will be required to ensure that the facility remains operational during times of flood.*
 - *Development that will reduce flood water storage capacity, including land raising and flood prevention measures, will not be permitted, unless it can be demonstrated to the satisfaction of East Lothian Council and SEPA at the time of making a planning application that -*
- c) *All such development proposals are accompanied by a Flood Risk Assessment;*
- d) *Sufficient compensatory water storage capacity can be provided in an appropriate location to replace that lost;*

⁹ Scottish Environment Protection Agency (2016) Online Interactive Flood Map Tool, available at: <http://map.sepa.org.uk/floodmap/map.htm> (accessed 27th November 2017).

¹⁰ Scottish Environment Protection Agency (2016) Online National Flood Risk Assessment Interactive Map <http://map.sepa.org.uk/nfra/map.htm> (accessed 17th November 2017)

- e) *A sufficient allowance for freeboard is included;*
- f) *A drainage assessment submitted in support of development proposals indicates there will be a neutral effect on the probability of flooding elsewhere.*
- g) *Appropriate water resistant materials and forms of construction will be used where appropriate.*

48 *Where acceptable in principle, the implementation of compensatory water storage will be secured through planning condition or legal agreement. Suspensive planning conditions may be required. Management arrangements must be secured for any such storage area in perpetuity.*

Development in all areas at flood risk:

49 *In areas subject to flood risk there is a presumption against forms of development particularly vulnerable to flooding, including, but not limited to, those identified in SPP7. Development flood risk will be assessed in conjunction with SEPA taking account of local circumstances. Acceptable development must be designed to manage a 0.5% probability of flood risk and remain operational during such flood times. Appropriate water resistant materials and forms of construction will be required.*

50 *To minimise flood risk, new development must protect existing watercourses and avoid the introduction of new culverts or works detrimental to the effectiveness of existing flood defences. Removal of existing culverts and restoration of watercourses to their natural form is encouraged.*

51 *Proposals for flood protection and alleviation must be consistent with all other relevant Local Plan policies.*

Scottish Planning Policy

52 The policy principles of Scottish Planning Policy (SPP) relating to Managing Flood Risk and Drainage state that the planning system should promote:

- *“a precautionary approach to flood risk from all sources, including coastal, water course (fluvial), surface water (pluvial), groundwater, reservoirs and drainage systems (sewers and culverts), taking account of the predicted effects of climate change;*
- *flood avoidance: by safeguarding flood storage and conveying capacity, and locating development away from functional flood plains and medium to high risk areas;*
- *flood reduction: assessing flood risk and, where appropriate, undertaking natural and structural flood management measures, including flood protection, restoring natural features and*
- *characteristics, enhancing flood storage capacity, avoiding the construction of new culverts and opening existing culverts where possible; and*
- *avoidance of increased surface water flooding through requirements for Sustainable Drainage Systems (SuDS) and minimising the area of impermeable surface”*

- and;
- *"To achieve this 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."*

53 SPP presents a risk framework for planning decision making relating to flood risk. A summary of this risk framework is replicated in Table 7A.1.

Table 7A.1 SPP Flood Risk Framework

SPP Flood Risk Framework
<p>Little or No Risk – annual probability of coastal or watercourse flooding is less than 0.1% (1:1000 years):</p> <p>No constraints due to watercourse, tidal or coastal flooding.</p>
<p>Low to Medium Risk – annual probability of coastal or watercourse flooding is between 0.1% - 0.5% (1:1000 – 1:200 years):</p> <p>Suitable for most development. A flood risk assessment may be required at the upper end of the probability range (i.e. close to 0.5%), and for essential infrastructure and the most vulnerable uses. Water resistant materials and construction may be required.</p> <p>Generally not suitable for civil infrastructure. Where civil infrastructure must be located in these areas or is being substantially extended, it should be designed to be capable of remaining operational and accessible during extreme flood events.</p>
<p>Medium to High Risk – annual probability of coastal or watercourse flooding is greater than 0.5% (1:200 years):</p> <p>May be suitable for:</p> <p>residential, institutional, commercial and industrial development within built-up areas provided flood protection measures to the appropriate standard already exist and are maintained, are under construction, or are a planned measure in a current flood risk management plan;</p> <p>essential infrastructure within built-up areas, designed and constructed to remain operational during floods and not impede water flow;</p> <p>some recreational, sport, amenity and nature conservation uses, provided appropriate evacuation procedures are in place; and</p> <p>job-related accommodation, e.g. for caretakers or operational staff.</p> <p>Generally not suitable for:</p> <p>civil infrastructure and the most vulnerable uses;</p> <p>additional development in undeveloped and sparsely developed areas, unless a location is essential for operational reasons, e.g. for navigation and water-based recreation, agriculture, transport or utilities infrastructure (which should be designed and constructed to be operational during floods and not impede water flow), and an alternative, lower risk location is not available; and</p> <p>new caravan and camping sites.</p> <p>Where built development is permitted, measures to protect against or manage flood risk will be required and any loss of flood storage capacity mitigated to achieve a neutral or better outcome.</p> <p>Water-resistant materials and construction should be used where appropriate. Elevated buildings on structures such as stilts are unlikely to be acceptable.</p>

SPP Flood Risk Framework

Surface Water Flooding

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).

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.

Historical Flooding

- 54 SEPA has confirmed that they hold no records of any historic flood events within a 2 km radius of the Application Site and an internet search and review of the NFRA also failed to record any previous flood events at the Application Site.

Fluvial Flood Risk

- 55 The fluvial flood risk is shown on SEPA mapping⁹, and indicates that the site is located partially within an area of '*high likelihood*' (10% or 1:10 Annual Exceedance Probability - AEP) and '*Medium Likelihood*' (0.5% or 1:200 AEP). SEPA licensing restrictions mean it is not possible to reproduce their mapping as part of this report. The flood extent shown is discrete and not connected to any watercourses.
- 56 As there are no watercourses near to the Application Site that could generate this flood extent, and there are no records of fluvial flooding at the Application Site, it is considered that the automated mapping that has generated the flood extents has picked up the low lying areas that previously surrounded the former Cockenzie Power Station building on this site, and does not provide a realistic representation of fluvial flood risk.
- 57 The current design of the Onshore Substation includes backfilling the Application Site to a level of at around 3.5 mAOD. This will be lower than the surrounding area (generally at around 5 mAOD), but as the Application Site is not hydraulically connected to any watercourses, the risk of fluvial flooding at the Application Site is considered to be Little or No Risk.

Surface Water Flood Risk

- 58 The SEPA flood mapping⁹ indicates that the site is located partially within a discrete area of '*high likelihood*' (10% or 1:10 AEP) and '*Medium Likelihood*' (0.5% or 1:200 AEP) surface water flooding, although it is noted that the center of the Application Site is shown not to at risk of surface water flooding.
- 59 Again, it is considered that the flood mapping reflects the low lying nature of the previous conditions of the site of the former Cockenzie Power Station.

60 As noted above, the future site ground levels at the Application Site are likely to remain below the surrounding ground levels, and there will therefore be a risk of localised surface water flooding.

61 The risk of surface water flooding is therefore assessed as Medium to High as per the surface water mapping. Measures to manage and mitigate this risk area outlined within Section 7A.6.

Coastal Flood Risk

62 The SEPA flood mapping⁹ indicates that the Application site is located entirely outside of the predicted Tidal flood risk extent (i.e. outside of the 0.1% or 1:1000 AEP risk area), although it is noted that the Application Site is classified as being within a *Potentially Vulnerable Area*.

63 As detailed within Section 1 the predicted 0.5%AEP tidal flood level for the application site is 4.65 mAOD, rising to approximately 5.04 mAOD including an allowance for climate change. The current standard of defences along the coastline to the north-west is between 5 mAOD and 6.2mAOD.

64 The application site is therefore considered to be currently fully defended for the 0.5%AEP event; however there is a risk of shallow tidal flooding with an allowance for Climate Change.

65 The overall tidal flood risk is assessed as Medium. Management and mitigation measures are outlined within Section 7A.6.

Groundwater Flood Risk

66 Following restoration of the former Cockenzie Power Station groundwater elevations beneath the site are expected to lie at about 0.6mAOD and vary slightly in response to varying tidal levels (e.g. be lower at low tide and higher at high tide).

67 It is proposed that the Application Site will be backfilled to a level of approximately 3.5 mAOD and thus well above average groundwater elevations.

68 It is however noted that there is the potential for groundwater levels to rise above 3.5 mAOD in the event that extended duration high tide and surge conditions were to occur.

69 Based on the above, and adopting a precautionary approach, the overall groundwater flood risk is assessed as Medium. Mitigation and management measures are therefore proposed.

Artificial Drainage Systems

70 Scottish Water drainage plans indicate that there are no sewers or water supply infrastructure within the Application Site (see Appendix 01). It is however noted that a CSO is located along the south-western boundary and combined sewer and distribution main are present beneath Edinburgh Road to the south.

- 71 In the event of flooding from any of these sources the floodwater will follow the local topography, either along Edinburgh Road (to the south) or in a northerly direction towards the coast. The resulting flood depth therefore is likely to be dispersed and shallow.
- 72 The flood risk associated with drainage or water supply infrastructure is therefore assessed as Low.

Summary of Flood Risk

- 73 The overall flood risk to the application site is summarised in Table 7A.2.

Table 7A.2 Summary of Flood Risk

Source of Flood Risk	Flood Risk Assessment	Description
Fluvial	Little or No Risk	There are no watercourses in the vicinity of the Application Site.
Surface Water	Medium to High	The proposed development will be below surrounding ground level, runoff will therefore need to be managed to prevent surface water flooding
Coastal	Medium	The Application Site is defended by existing sea defences for events up to and including the 0.5%AEP, however residual risk remains when including an allowance for climate change / or for wave overtopping
Groundwater	Medium	Groundwater levels are anticipated to be in continuity with tidal levels and below the minimum development elevation. Should groundwater not freely flow to the coast or should elevated groundwater levels be sustained by a tidal surge groundwater egress onto the Application Site could occur.
Artificial Drainage Systems	Low	There are no artificial drainage systems beneath the Application Site and no drainage routes for offsite flooding to impact on the development site

7A.6 Flood Risk Management

- 74 The above assessment indicates that there is a potential flood risk to the Application Site associated with surface water, coastal and groundwater flooding. Measures have however been built into the proposed design of the Application Site to minimise and manage these flood risks. Details are given below.

7A.6.1 Mitigation by Design

Site Investigation

- 75 It is noted that there are uncertainties regarding the ground conditions and ground elevations of the Application Site following completion of restoration works at the former Cockenzie Power Station site.
- 76 Prior to completion of a detailed site design a site investigation will be undertaken to include the completion of a topographical survey and installation of shallow groundwater monitoring boreholes at the Application Site. The results of these investigations will be used to inform the final design of the substation and associated infrastructure.

Development Levels

- 77 The proposed development platform will be set at an estimated elevation of 3.5 mAOD to ensure that the substation is located above the maximum predicted groundwater level. The final development level will be reviewed once access is gained to the Application Site and the site investigation has been completed.
- 78 In addition, it is proposed that any sensitive infrastructure will be raised at least 300 mm above ground level to allow for shallow flooding to occur without adversely impacting the substation.
- 79 The proposed berm will ensure that there is a freeboard of more than 1m above the predicted 0.5%AEP plus climate change tidal level to allow for any additional impact from wave overtopping or more extreme tidal events.

Onshore Cables

- 80 The onshore cables will connect the substation to the offshore cable through the intertidal zone. The cables will be constructed using a cut and fill approach and will be located at shallow depth below ground level, they will therefore not be impacted by or impact upon flood risk.
- 81 The cables will have to cross the John Muir Way and pass through the coastal defences, however these will be re-instated following installation of the cables and will not impact on the standard of the flood defences.

7A.6.2 Proposed Flood Risk Management

Surface Water Flooding

- 82 A surface water drainage scheme for the substation will be developed as part of the detailed site design. This will be designed to collect and manage incident rainfall runoff onto the site but also have redundancy to manage elevated groundwater elevations should the ground investigation suggest this might be necessary.
- 83 Redundancy would also be provided to manage sea spray that from the Forth.

- 84 The surface water system would be developed using Sustainable Drainage Systems (SuDS) in accordance with best practice.
- 85 Subject to final ground levels the surface water system will have a gravity outfall to the Firth of Forth.

Coastal Water Flooding

- 86 It has been shown that locally existing ground levels and coastal defences provide protection for events up to and included the 0.5% AEP event.
- 87 Climate change predictions confirm that sea levels could rise over the lifetime of the development and result in shallow flooding of the site. The existing defences would not be over-topped; rather flooding could result locally where there are gaps in the flood defences.

Groundwater Flooding

- 88 Groundwater flooding is unlikely to occur as shallow groundwater will locally be in hydraulic continuity with the Forth Estuary and be controlled by the water level in the Forth. Notwithstanding this, redundancy is proposed in the surface water drainage system to locally lower high groundwater levels and discharge this in a controlled manner to the Firth of Forth.
- 89 The required groundwater control would be confirmed as part of the detailed drainage design and the benefit of groundwater elevation monitoring and ground conditions data that would be collected by a targeted site investigation at the Application Site.

7A. 7 Off Site Impacts

- 90 Given the Application Site setting, on the southern shore of the Firth of Forth it is considered that there will be no detrimental impact of the proposed development on flood risk downstream.

7A.7.1 Surface Water Runoff

- 91 The proposed site drainage will discharge directly to the Firth of Forth. Given that the discharge is to a tidal waterbody there is no potential for the discharge to increase flood risk off-site.
- 92 The proposed perimeter berm has the potential to act as a barrier to natural drainage flow routes, however it is considered that any overland flow from the south would drain along the route of Edinburgh Road, in the same manner as present, while any overtopping of this drainage route or flooding along the western edge of the site (associated with the combined sewer overflow) would be routed in a northerly direction to the coast across open grassland. There would be no impact on off-site receptors.

7A.7.2 Water Services

- 93 The proposed development will discharge all surface water runoff to the Firth of Forth and will therefore not impact on the capacity of the existing combined sewer to the south of the Application Site.
- 94 Any discharge from the site welfare facilities would only be made to Scottish Water infrastructure with consent from Scottish Water. Should there be capacity constraints, foul water would be collected on site and disposed of an appropriately licensed facility.

7A.8 Residual Flood Risk

- 95 The flood risk assessment and Application Site layout and drainage design has confirmed that while there is a potential risk from surface water, groundwater and tidal flooding with incorporation of the outlined mitigation measures the flood risk can be managed and the risk from surface water, groundwater and tidal flooding reduced to **'low'**.
- 96 A residual flood risk will remain from either overtopping or breach of the tidal flood defences (either from wave action or extreme tidal flooding), higher than predicted groundwater levels or from a failure of the surface water system. This is discussed below.

7A.8.1 Groundwater Flooding

- 97 In the event of groundwater levels rising higher than the predicted level and above the base of the Application Site the groundwater flood risk would continue to be managed by the surface water management system and any excess groundwater discharged Firth of Forth. This residual risk can therefore be readily managed.

7A.8.2 Coastal Flooding

- 98 The residual flood risk from coastal flooding is considered to be low due to the proposed improved flood defences along the north-western edge of the Application Site which will raise the levels of defence from tidal flooding to c.6.2mAOD, in excess of 1m above the 0.5%AEP plus climate change tidal level.
- 99 The flood defences are located on the coastal side of the John Muir Way, any localised overtopping or spray from wave action will therefore primarily fall within this area as opposed to directly impacting the proposed development.
- 100 Any residual spray which does enter the Application Site will drain to the surface water system and be discharged to the Firth of Forth. This residual risk can therefore be readily managed.

7A.8.3 Failure of Surface System

- 101 Regular maintenance and inspection of the surface water drainage would be undertaken.
- 102 In the event of a failure of the surface water system it is considered that the residual flood risk from surface water would remain low. The permeable nature of the underlying backfill material would continue to allow infiltration to ground while key infrastructure will be located

a minimum of 300 mm above ground level to ensure that shallow flooding could occur without impacting on the substation.

7A.9 Conclusions

- 103 This Flood Risk Assessment (FRA) has been undertaken to assess the potential flood risk to the proposed Onshore Transmission Works (OnTW) for the transmission of electricity from proposed offshore wind farm. The OnTW is to be located on the site of the former Cockenzie Power Station, Cockenzie and Port Seton.
- 104 A review of the potential flood risk from fluvial, tidal, surface water, groundwater and infrastructure has been undertaken and confirms that the Application Site is potentially at risk from tidal, surface water and groundwater flooding, although it is noted that the risk from all sources is low and readily mitigated.
- 105 The proposed site layout will include raising the development level above the maximum shallow groundwater level beneath the Application Site, local improvement to the tidal defences to ensure they are contiguous around the seaward edge of the Application Site and the specification of a suitable surface water drainage system which will allow discharge surface water run-off to tidal waters.
- 106 Inclusion of the measures outlined above will ensure that the flood risk to the application site is manageable and will not impact upon the development or operation of the Application Site.
- 107 The proposed mitigation would have no impact on off-site flood risk nor increase flood risk to off-site property.
- 108 It is therefore concluded that the Application Site and proposed development at this location is suitable and in accordance with national and local planning policies as well as best practice guidance.

References

British Geological Survey Website (Accessed 17/11/17). Available at:

<http://mapapps2.bgs.ac.uk/geoindex/home.html>

Scotland's Environment, Environmental Mapping, available at:

<https://map.environment.gov.scot/sewebmap/>

Ordnance Survey, 1:25,000 Scale Explorer Map, available at: www.ordnancesurvey.co.uk

Scottish Environmental Protection Agency, Flood Maps, available at:

<http://map.sepa.org.uk/floodmap/map.htm>

East Lothian Council (6th November 2002) Shoreline Management Plan: Summary Report, ABP Research & Consultancy Ltd, BWA 202231

East Lothian Council (28th October 2008) The East Lothian Local Plan 2008

British Geological Survey, Scotland's aquifers and groundwater bodies, available at:

<http://nora.nerc.ac.uk/511413/>

Environment Agency (2011) Coastal Flood Boundary Conditions for UK Mainland and Islands, Ref: SC060064/TR4

Tide Forecast, 2017 Tide Forecast, available at: <https://www.tide-forecast.com/>

National Oceanography Centre; The national Tidal and Sea Level Facility, available at:

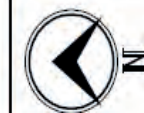
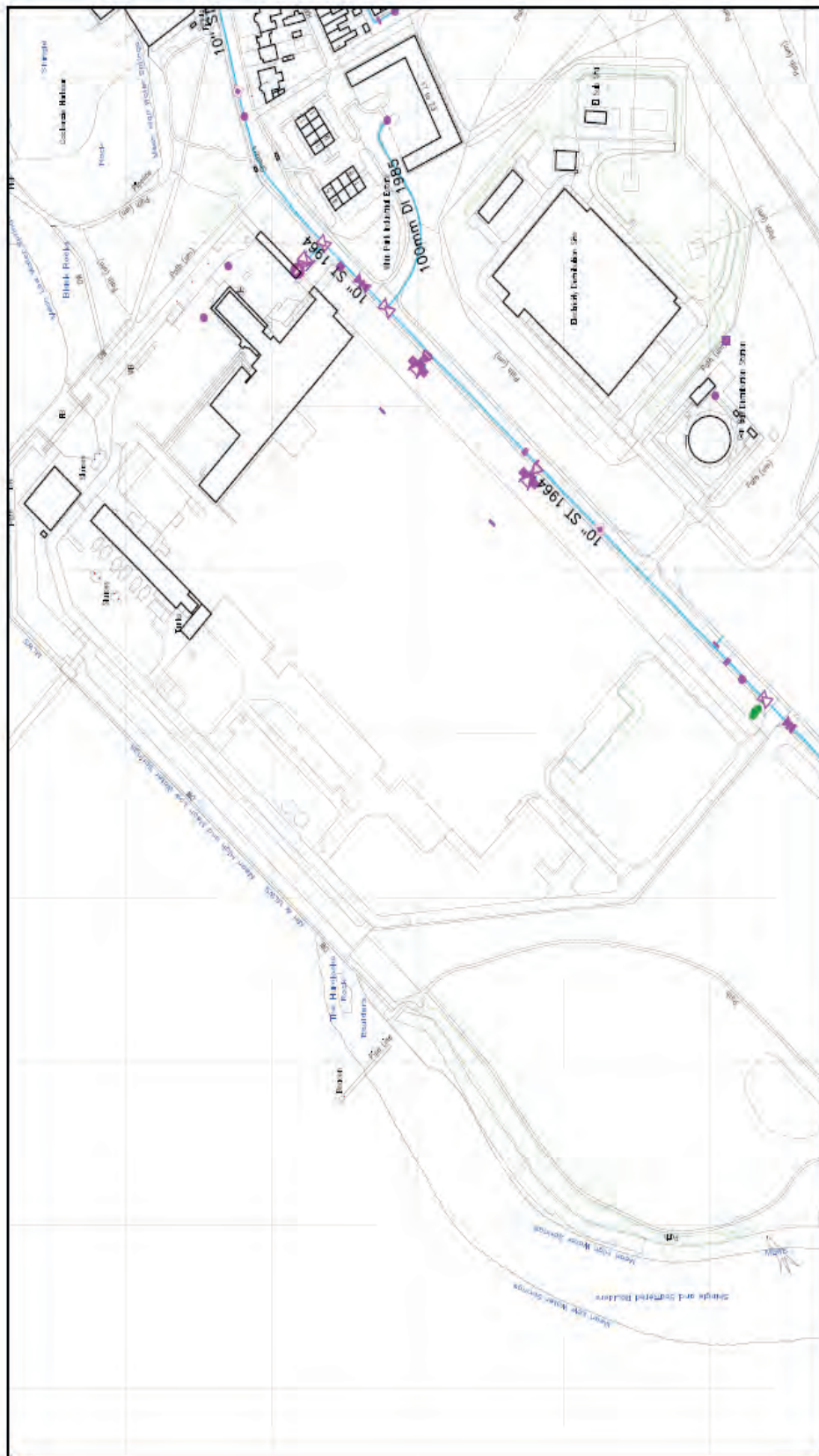
<http://www.ntslf.org/>

The Scottish Government (June 2014) Scottish Planning Policy

The Scottish Government (June 2014) National Planning Framework 3

Scottish Environmental Protection Agency (Feb 2013) Surface Water Management Planning Guidance

Annex 7.1



The representation of physical assets and the boundaries of areas in which Scottish Water and others have an interest does not necessarily imply their true positions. For further details contact the appropriate District Office.
Date Plotted: 14/11/2017

OP/KKQRX143

Water Plan








































































250 metres

Scale: 1:2500

(c) Crown copyright and database rights 2017 Ordnance Survey 100023460. You are permitted to use this data solely to enable you to respond to, or interact with, the organisation that provided you with the data. You are not permitted to copy, publish, distribute or sell any of the data or any part thereof in any form.



SMALL WORLD GIS WATER LEGEND

 Trunk Main (in use)  Distribution Main  Raw Water Main  Mains (abandoned)  Mains (proposed)  Mains (isolated)  Communication Pipe  Supply Pipe  Tunnel  Open Course  Aqueduct  Logical Service Link  Duct  Air Valve Double  Air Valve Single  Anode  Hydrant : Terminal  Hydrant : Fire  Dialysis Patient	 Tapping  Field trough  Other fitting  Orifice Plate  Meter Point  Cleansing Cock  Coupling  Flow Restrictor  Taper  Change Collar  End Cap  Stopcock  Sample Point  Service Point  Hatchbox  Chemical Dosing Point  Break Pressure Tank	 Bulk Meter  Revenue Meter  Meter Cable  Meter Display Unit  Pumping Station  Booster Station  Pump Symbol  River Intake  Spring Intake  Borehole Intake  Other Company Intake  Clear Water Tank  Service Reservoir  Impounding Reservoir  Pumped Storage Reservoir  Storage Tank  Storage - Other  Balancing Tank - Current	 Water Treatment Works  Pressure Reducing Valve  Pressure Sustaining Valve  Reflux (Non-Return) Valve  Washout (Scum) Valve  Control Valve  Pressure Relief Valve  Airlock Valve  Level Control Valve  Valve - Other  BC WSZ Valve  BC DMA Valve  BC WOA Valve  BC PRA Valve  BC FCC Valve  BC PSA Valve  Pipebridge
--	---	---	---

SMALLWORLD GIS – WASTEWATER LEGEND

Pipework				
	Combined (red)			Collapse/Choke (not visible by default)
	Foul (brown)			Combined Storm Overflow
	Surface Water (blue)			Connection (not visible)
	Natural Water (light blue)			Duct
	GSO (dark blue)			Ghost Node (not visible by default)
	Trade Effluent (brown)			Hatchbox
	Treated Effluent (black)			Hydraulic Control Chamber
	Abandoned (grey)			Lamphole
	Water Course (dark green)			Change of Attributes
	PFI sewer (bright green)			Outfall
	Rising Main (red)			Inlet
	Proposed sewers (foul, combined and surface water)			Pumping Station
	Syphon			Wash Out
	Chamber (same colour as pipework)			Bifurcation Chamber
	Dual Chamber (same colour as pipework)			
	Surface Water Chamber			
				Balancing Pond
				Rodding Eye
				Septic Tank
				Sewer Junction
				Sewer Structure
				Sewerage Air Valve
				Sewerage Pipe Bridge
				Sluice Valve
				Storm Tank
				Unknown End
				Treatment Plant
				Vent Column
				Buchan Trap
				Capped End (same colour as pipework)