9 HYDROGEOLOGY, GEOLOGY AND GROUND CONDITIONS

Introduction

9.1.1 The chapter describes: the assessment methodology; the baseline conditions at the Project site and surroundings and the likely significant effects, taking into account the mitigation measures required to reduce and minimise any adverse effects.

9.1.2 This chapter is supported by Appendix 9.1: Phase 1 Preliminary Geo-Environmental and Geotechnical Risk Assessment (Phase 1 PRA).

9.1.3 Further information regarding potential surface water receptors in the vicinity of the Project site is presented in Chapter 8: Hydrology and Flood Risk. In addition, Appendix 8.1 provides information regarding the proposed surface water management measures and drainage strategy.

Assessment Methodology

9.1.4 This section sets out the legislation, planning policy context and guidance that is relevant to this chapter and the assessment methodologies and baseline forecasting methods employed. A summary of the consultation that has been undertaken has also been provided.

Planning Policy Context

9.1.5 Relevant planning policy is identified below:

- The National Planning Framework 3 (NPF3) for Scotland (Scottish Government, 2014a);
- The Draft National Planning Framework 4 (NPF4) for Scotland (Scottish Government, 2021); and
- Scottish Planning Policy (SPP) (Scottish Governent, 2014b).

9.1.6 For North Ayrshire, the policy framework is:

- The North Ayrshire Local Development Plan 2 (North Ayrshire, 2019)

"Policy 22: Water Environment Quality states development will be required to ensure no unacceptable adverse impact on the water environment."

9.1.7 Key additional guidance for the Proposed Development is:

- The Hunterston Parc Development Framework (2021)

"Planning applications submitted to North Ayrshire Council would be expected to be accompanied by a desktop study covering a historical assessment of past site usage.

In certain circumstances, intrusive site investigation surveys and remediation strategies would be undertaken and the outcome submitted for assessment and approval either as part of a planning application or in compliance with a planning condition attached to a consent.

Peel Ports are currently producing a desktop remediation strategy which will form part of this framework."

Relevant Guidance

9.1.8 The following legislation and guidance is relevant to this assessment.

- Environment Act 1995;

- Environmental Protection Act (EPA) 1990 (as amended);
- Contaminated Land (Scotland) Regulations 2000, as amended;
- Water Act 2014;
- Water Resources (Scotland) Act 2013;
- Water Environment and Water Services (Scotland) Act 2003;
- Water Supply (Water Quality) Regulations 2016 (as amended 2018);
- Water Environment (Miscellaneous) (Scotland) Regulations 2017;
- Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended);
- Special Waste Amendment (Scotland) Regulations 2004;
- Landfill (Scotland) Amendment Regulations 2013;
- Environmental Authorisations (Scotland) Regulations 2018;
- Contaminated Land (Scotland) Regulations 2005.
- Land Contamination: Risk Management (Environment Agency, 2020);
- British Standard BS 10175 Investigation of Potentially Contaminated Sites (BSI, 2011 and amended 2017);
- Construction Industry Research and Information Association (CIRIA) Document C665: Assessing Risks Posed by Hazardous Ground Gases to Buildings (CIRIA, 2007);
- The Highland Council Guidance Note: Construction Environmental Management Process for Large Scale Projects (The Highland Council, 2010)
- British Standard requirements for the 'Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings' (BS8485:2015+A1:2019) (BSI, 2015); and
- Defra Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance (Defra, 2012).

Study Area

9.1.9 The study area includes the Project site and an additional buffer of up to 500 metres. This is considered to be sufficient to enable the identification of off-site potential sources of contaminants of concern, and other factors which may have influenced site conditions and/or sensitive off-site receptors that require consideration. Beyond this buffer impacts are considered unlikely.

Baseline Methodology

9.1.10 The description of baseline conditions is informed by a desk based study. The Preliminary Risk Assessment report is provided as Appendix 9.1.

9.1.11 The desk study utilises information from publicly available records and through data provided by an Envirocheck Report obtained for the Project site. This includes data provided from the following sources:

- Scottish Environment Protection Agency (SEPA) - regarding groundwater quality mapping, landfill sites and waste facilities, environmental permits, pollution incidents;
- British Geological Survey (BGS) - geology, radon risk and borehole records; and
- Ordnance Survey (OS) - historical mapping.

9.1.12 The methodology for the evaluation of baseline conditions at the Project site follows a phased approach as presented within Planning Advice Note (PAN) 33 (Scottish Government, 2017). The baseline characterisation of the Project site enables the development of a conceptual site model ('CSM'), which uses the source-pathway-receptor (pollutant linkage) approach as follows.

- Source: Referring to the potential source of contamination.
- Pathway: The mechanism by which a contaminant could move/migrate to a receptor.
- Receptor: Identified features that could be affected by a contaminant, based on the sensitivity of the site.

9.1.13 The CSM examines these elements for the Project site in its current form and use. Following this approach, the likelihood of contamination to exist has been considered based on all these elements being present and forming a pollutant hazard, pathway and receptor linkage.

Consultation

9.1.14 A summary of all consultation undertaken is provided in Table 9.1.

Table 9.1: Consultation Responses Relevant to this Chapter

Date	Consultee and Issues Raised	How/ Where Addressed
Date	Consultee and Issues Raised	How/ Where Addressed
16th December 2021	SEPA – Identify all aspects of site work that might impact upon the environment, potential pollutant risks associated with the proposals and identify the principles of preventative measures and mitigation.	A schedule of mitigation is provided in *Section 'Mitigation Measures Adopted as Part of the Project'*. All potential impacts are identified within *Sections 'Assessment of Construction Effects'* and '*Assessment of Operational Effects'*.
17th December 2021	North Ayrshire Council – An assessment of the soil and subsoil and contamination should be included in the EIA. Existing ground investigation reports are available for the site. Further investigations will be required. Any associated land use risks will be identified through this assessment and remedial measures implemented if required.	Exiting ground investigation reports have been reviewed as summarised within *Section 'Previous Reports'*. The requirement for further ground investigation is identified within *Section 'Mitigation Measures Adopted as Part of the Project'*.
30th November 2021	Fairlie Community Council - Unknown and unlisted contaminants from the former coalyard site which is reclaimed land with contaminated dump material. Negative impact is likely to be significant once preparation and construction work starts. There is no indication of whether pile driving will be necessary for the foundations of the tower or any other structures. Fairlie had a sandy beach from the Fairlieburne to the power stations at one time and that was consumed and replaced by dump material for land reclamation and Colombian coal with a high radioactive content was stored at the coalyard where the facility is to be located. A comprehensive study of the coalyard is necessary and an assessment made of the level of radioactivity.	A Desk Top Study and Preliminary Risk Assessment (DTS & PRA) has been undertaken, provided in Appendix 9.1. This provides a review of potential sources of contamination in relation to historical and current land use. The evidence indicates that quarried material was used for the coastal reclamation. Piling will be used for certain structures and a Piling Risk Assessment will be undertaken. Radiological monitoring undertaken by SEPA for Hunterston B Power Station and the surrounding area including around the Project site shows dose rates are well below human health assessment levels. Ground investigation will be undertaken as identified within *Section 'Mitigation Measures Adopted as Part of the Project'*. This will take into account information on radiological assessment of the Clydeport rail

Date	Consultee and Issues Raised	How/ Where Addressed
		loading facility by Clydeport Operations.
13th December 2021	NatureScot – An outline construction method statement should be included detailing mitigation and pollution prevention measures. The following is recommended for inclusion as part of the overall assessment of environmental impact: • Before any works starts, the boundary of the SSSI should be clearly marked and contractors advised not to enter it or use it for storage. • If crushed stone and recycled aggregates are to be used to construct hard-standing areas, they should be sourced from materials free from contaminants, so that there is no possibility of run-off onto the intertidal areas of the SSSI. • Any materials from the excavation of the tower foundation / other groundworks should be sensitively re-used onsite and or disposed of appropriately and not released onto the intertidal areas of the SSSI.	Construction will be managed through a Code of Construction Practice as identified and a CL:AIRE Materials Management Plan will be used to document the management soils on site, and this will include a risk assessment procedure to demonstrate that the soils do not present a risk to human health or the environment. These measures are identified within *Section 'Mitigation Measures Adopted as Part of the Project'*.
7th December 2021	Environmental Health (North Ayrshire Council) - Further investigations will be required for the development as part of the planning process. Any associated land use risks will be identified through this assessment and remedial measures implemented if required.	This chapter addresses impacts associated with potential contamination. Ground investigation will be undertaken and a Remediation Strategy prepared as appropriate, and as identified within *Section 'Mitigation Measures Adopted as Part of the Project'*.
9th December 2021	Scottish Water - A review of our records indicates that there are no Scottish Water drinking water catchments or water abstraction sources, which are designated as Drinking Water Protected Areas under the Water Framework Directive, in the area that may be affected by the proposed activity.	Noted.

Assessment Criteria and Assignment of Significance

9.1.15 The following section describes the approach taken to identifying the magnitude of an impact and the sensitivity/value of receptor. The definitions used for sensitivity and magnitude are presented in Table 9.2 and Table 9.3. These are based on descriptors presented within the DMRB methodology documents LA 109 and LA 113 (Highways England et al, 2019 and 2020). This guidance produced by Highways England, Transport Scotland, Welsh Government and the Department for Infrastructure Northern Ireland provides robust assessment principles for infrastructure developments.

Receptor Sensitivity/Value

Table 9.2: Definitions of Sensitivity or Value

Sensitivity	Definition
	Soils (superficial geology/topsoil and subsoils)
Very High	Soils supporting an EU designated site (e.g. Special Area of Conservation (SAC), Special Protection Area (SPA), Ramsar site).
High	Soils directly supporting a UK designated site (e.g. SSSI).
Medium	Soils supporting non-statutory designated sites (e.g. Local Nature Reserves, Site of nature Conservation Importance, mineral safeguarded area).
Low	Soils supporting non-designated notable or priority habitats.
Negligible	Previously developed land formerly in 'hard uses' with little potential to return to agriculture.
	Hydrogeology (aquifers)
Very High	Principal aquifer providing a regionally important resource and/or supporting a site protected under UK or EC legislation. Groundwater locally supports groundwater dependent terrestrial ecosystems (GWDTE). SPZ1.
High	Principal aquifer providing a locally important resource or supporting a river ecosystem. Groundwater locally supports a GWDTE. SPZ2.
Medium	Aquifer providing water for agricultural or industrial use with limited connection to surface water. SPZ3.
Low	Unproductive strata.
Negligible	N/A
	Surface Water
Very High	Watercourse having a WFD classification in a River Basin Management Plan (RBMP) and $Q_{95} \geq 1.0$ m^3/s. Site protected/designated under EC or UK legislation (SAC, SPA, SSSI, Ramsar site, salmonid water).
High	Watercourse having a WFD classification in a River Basin Management Plan (RBMP) and $Q_{95} < 1.0$ m^3/s. Site protected under EC or UK legislation.
Medium	Watercourses not having a WFD classification in a RBMP and $Q_{95} > 0.001$ m^3/s. Site protected under EC or UK legislation.
Low	Watercourses not having a WFD classification in a RBMP and $Q_{95} \leq 0.001$ m^3/s.
Negligible	N/A
	Human Health
Very High	Human health: very high sensitivity land use scenario (e.g. residential or allotments).
High	Human health: high sensitivity land use such as public open space or construction workers.
Medium	Human health: medium sensitivity land use such as commercial or industrial.
Low	Human health: low sensitivity land use such as highways and rail.
Negligible	Human health: undeveloped surplus land/no sensitive land use proposed.

Magnitude of Impact

Table 9.3: Definitions of Magnitude

Magnitude	Definition
	Soils (superficial geology/topsoil and subsoils)
High	Physical removal or permanent sealing of soil resource (Adverse).
	Highly beneficial impact on soils resource of the area (Beneficial).
Medium	Permanent loss/reduction of one or more soil function(s) and restriction to current or approved future use (e.g. through degradation, compaction, erosion of soil resources) (Adverse).
	Moderate benefit to soils resource of the area (Beneficial).
Low	Temporary loss/reduction of one or more soil function(s) and restriction to current or approved future use (e.g. through degradation, compaction, erosion of soil resource) (Adverse).
	Minor benefit to soils resource (Beneficial).
Negligible	No discernible loss/reduction of soil function(s) that restrict current or approved future use (Adverse).
	The Project would be of minor benefit or positive addition to local areas of soils resource, by potentially providing protection (Beneficial).
No change	No loss/reduction of soil function(s) that restrict current or approved future use.
	Hydrogeology (aquifers)
High	Loss of, or extensive change to, an aquifer. Loss of regionally important water supply. Loss of, or extensive damage to GWDTE or baseflow contribution to protected surface water bodies. Reduction in water body WFD classification (Adverse).
	Highly beneficial impact on hydrogeological environment (e.g. removal of existing polluting discharge to aquifer, or removing the likelihood of pollution discharges occurring to an aquifer, improvement in water body WFD classification) (Beneficial).
Medium	Partial loss or change to an aquifer. Partial loss of the integrity of GWDTE. Contribution to reduction in water body WFD classification (Adverse).
	Moderate benefit to the hydrogeological environment (e.g. contribution to improvement in water body WFD classification, support to significant improvements in damaged GWDTE) (Beneficial).
Low	Minor effects on the aquifer, GWTEs, abstractions and structures (Adverse).
	Minor benefit to the hydrogeological environment (Beneficial).
Negligible	Results in effect on groundwater but is of insufficient magnitude to affect the use or integrity (e.g. no measurable impact upon groundwater receptors) (Adverse).
	The Project would be of minor benefit or positive water quality (Beneficial).
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.
	Surface waters
High	Loss of regionally important public water supply. Loss or extensive change to a designated nature conservation site. Reduction in water body WFD classification (Adverse).
	Highly beneficial impact on water environment (e.g. removal of existing polluting discharge to watercourse, or removing the likelihood of pollution discharges occurring to a watercourse, improvement in water body WFD classification) (Beneficial).

Magnitude	Definition
Medium	Degradation of regionally important public water supply or loss of major commercial/industrial/agricultural supplies. Contribution to reduction in water body WFD classification (Adverse).
	Moderate benefit to the water environment e.g. contribution to improvement in water body WFD classification (Beneficial).
Low	Minor effect on water supplies (Adverse).
	Minor benefit to the water environment (Beneficial).
Negligible	Results in effect on surface water but is of insufficient magnitude to affect the use or integrity (e.g. no measurable impact upon surface water receptors) (Adverse).
	The Project would be of minor benefit or positive water quality (Beneficial).
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.
	Human Health
High	Human health: significant contamination identified. Contamination levels significantly exceed background levels and relevant screening criteria with potential for significant harm to human health. Contamination heavily restricts future use of land (Adverse).
	Highly beneficial impact on soil chemical quality (Beneficial).
Medium	Human health: contaminant concentrations exceed background levels and are in line with limits of relevant screening criteria. Significant contamination can be present. Control/remediation measures are required to reduce risks to human health/make land suitable for intended use (Adverse).
	Moderate benefit to the soil chemical quality of the area (e.g. the Project results in a brownfield contaminated site that is or is likely to be determined as Contaminated Land being remediated) (Beneficial).
Low	Human health: contaminant concentrations are below relevant screening criteria. Significant contamination is unlikely with a low risk to human health. Best practice measures can be required to minimise risks to human health (Adverse).
	Minor benefit to the soil chemical quality (Beneficial).
Negligible	Human health: contaminant concentrations substantially below levels outline in relevant screening criteria. No requirements for control measures to reduce the risks to human health/make land suitable for intended use (Adverse).
	The Project would be of negligible benefit to the soil chemical quality (Beneficial).
No change	No reduction in soil chemical quality that restricts current or approved future use.

Significance of Effects

9.1.16 The significance of predicted effects has been determined taking into account the sensitivity of the receptor and magnitude of impact. Table 9.4 below is used to inform the evaluation of the significance of effects. Where the matrix offers more than one significance option, evidence based professional judgement is used to decide which option is most appropriate.

Table 9.4: Assessment Matrix (Complex)

Sensitivity	Magnitude of Impact				
	No Change	Negligible	Low	Medium	High
Negligible	No change	Negligible	Negligible or Minor	Negligible or Minor	Minor
Low	No change	Negligible or Minor	Negligible or Minor	Minor	Minor or Moderate

Sensitivity	Magnitude of Impact				
	No Change	Negligible	Low	Medium	High
Medium	No change	Negligible or Minor	Minor	Moderate	Moderate or Major
High	No change	Minor	Minor or Moderate	Moderate or Major	Major or Substantial
Very high	No change	Minor	Moderate or Major	Major or Substantial	Substantial

9.1.17 The overall significance of an effect is expressed as negligible, minor, moderate, major or substantial based on the definitions below.

- Substantial: Only adverse effects are normally assigned this level of significance. They represent key factors in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category.
- Major: These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process.
- Moderate: These beneficial or adverse effects may be important, but are not likely to be key decision-making factors. The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall adverse effect on a particular resource or receptor.
- Minor: These beneficial or adverse effects may be raised as local factors. They are unlikely to be critical in the decision-making process, but are important in enhancing the subsequent design of the project.
- Negligible: No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

9.1.18 For the purpose of this assessment, any effect that is moderate, major or substantial is considered to be significant. Any effect that is minor or below is considered not significant.

Limitations of the Assessment

9.1.19 The baseline data set out in this assessment are based on information collated as part of the desk study and consultation process and assessed as part of a Phase 1 Preliminary Geo-Environmental and Geotechnical Risk Assessment (PRA) (see Appendix 9.1). Assumptions and limitations relevant to this assessment are as follows.

- This chapter is based on available factual and interpretative data for the Project site obtained from the sources described in the text and related to the Project site. There has been no direct consultation response from SEPA, however publicly available SEPA data have been reviewed in addition to standing advice and planning guidance. This is considered to be sufficient to inform the assessment.
- The accuracy of maps cannot be guaranteed and it should be recognised that different conditions on Project site may have existed between, and subsequent to, the various map surveys.
- Any borehole data from British Geological Survey sources is included on the basis that: "The British Geological Survey accept no responsibility for omissions or misinterpretation of the data from their Data Bank as this may be old or obtained from non-BGS sources and may not represent current interpretation".

- Where any data supplied by other sources, including that from previous Phase 2 intrusive investigations, have been used it has been assumed that the information is correct. No responsibility can be accepted by RPS for inaccuracies in the data supplied by any other party.
- Data relating to the ground investigation is applicable to the time of the investigation. Site conditions, and hence the validity of the information pertaining to this has the potential to change with time.

9.1.20 Notwithstanding the above, overall a moderate to high level of certainty has been applied to the baseline and assessment presented in this chapter. The information which was available is considered sufficient to establish baseline within the study areas for the purposes of EIA. Therefore, there are no data limitations that affect the robustness of the conclusions of this assessment.

Baseline Environment

9.1.21 The baseline conditions established by the Phase 1 PRA are summarised in the following sections. Further details are provided in Appendix 9.1.

Current Site Conditions

9.1.22 A description of current site conditions based on publicly available aerial photography and site visits undertaken as part of the wider EIA process is presented in Table 9.5.

Table 9.5: Site Conditions

Section	Description
Background:	The Project Site is located on part of the former Hunterston Coal Yard within the wider Hunterston Port and Resource Centre at approximate National Grid Reference NS 20238, 53343. It is roughly rectangular in shape with a pier extending from the northwestern corner and occupies an area of approximately 50.7.ha.
Site Topography	Generally, the Coal Stockyard was flat lying, having been levelled to an average height of 5.50m Above Ordnance Datum (AOD) with localised ground depressions / mounds.
Site Layout:	The Project Site could be split into the former Coal Stockyard area which comprised the bulk of the site, the pier (operational) and Clydeport Road, and a Yard area in the extreme south of the site used for storage and a maintenance facility.
Activity / Operations:	The Project Site was predominantly redundant at time of inspection. The site was used as a coal yard/storage facility to supply coal to local power stations. At the time of the site visit, the remaining heaps of coal were being cleared.
Building Structure(s):	Strips of concrete slabs (former conveyors) were present trending roughly north-south within the main area of the Project Site.
Surface Cover:	Mix of concrete and tarmacadam (poor and fair condition), hardcore, grass/vegetation.
Drainage:	2 water storage areas were located adjacent to northern boundary of the Project Site south of Clydeport Road.
Bulk Storage / Tanks:	Drums / IBC tanks were noted in various parts of the Project Site indicated to contain lubricants/fuel/antifreeze.
Waste:	Waste storage bins, chemical/paint containers (approx. 2.5L), IBCs and drums (indicated to contain lubricant) wooden pallets, timber, metal and concrete bars, sacks of fabric, cardboard and concrete debris were located on the pier. Heaps of construction debris (concrete, metal, bricks), oil drums indicated to contain antifreeze (approx. 205L), scrap metal filled IBCs (some indicated to previously contained AdBlue), gas cylinders, wooden pallets, redundant plant/equipment on main Project Site. Extensive stockpile of concrete blocks (rail track footings). Storage area in the northwest with shipping container including IBCs some filled with scrap metal, tyres, wooden pallets, jerry cans (contents unknown), work benches with electrical equipment, paint / jerry cans.

Section	Description
	Skip in southeastern part of the site. Plastic products, wooden pallets, WEEE, scrap metal, construction debris in the Yard area.
Electricity Substations /Transformers:	Substations adjacent to the eastern boundary of the site. Transformers in the Yard area and adjacent to the existing building immediately north of the main site (between Clydeport Road and the main site).
Visual Evidence of Contamination:	Localised spillage from fuel/oil tank in the Yard area (extreme south of the site).
Statutory Nuisance:	None identified.
Other Geo-Environmental Issues:	The former rail tracks in the central and southern parts of the main site were generally raised on low embankments with remaining tracks being removed. Heaps of coal were also present, especially in the southwestern and southern parts of the site. Ground depression in the northwestern corner indicated to be lined with a geotextile.

The Surrounding Area

9.1.23 The site is located in an area of predominantly rural land with adjoining industrial port land uses. At the time of the site inspection, neighbouring land consisted of the following:

Table 9.6: Site Conditions

Direction	Description
North:	Clydeport Road / Firth of Clyde water. Suspected pump house on the northern boundary.
East:	Wire fence / vegetation, with the A78 road beyond.
South:	Undeveloped land with Hunterston Power Station further south.
West:	Railway line and Southanan Sands SSSI.

Site History

Historical Map Review

9.1.24 The following review is based on past editions of readily available Ordnance Survey (OS) maps. These include scales of 1:1,250, 1:2,500, 1:10,560 and 1:10,000 dated 1856 to 2001.

Table 9.7: Historical Site Uses

On-site Land Use and Features	Dates
Northern half of the site is shown within Fence Bay (coastal water) below the high-water mark and the southern half of the site as fields with coastal beach. Glen Burn traverses the centre of the site trending approximately east-west.	1856
The current pier extends onto Southannan Sands, beyond the low-water mark and extending into the Firth of Clyde.	1869-1970
No further significant change is apparent to the Project Site.	1979
The northern half of the site has been reclaimed from the sea. The pier, including foot bridge and conveyor, has been constructed in the north-west and this links with the southern portion of the site, shown as occupied by three sets of travelling cranes and conveyors trending approximately north-south, with associated access roads forming part of Hunterston Ore Terminal.	2021

Table 9.8: Historical Neighbouring Site Uses

On-site Land Use and Features	Orientation	Distance	Dates	
			From	To
Electricity substation	North	0 m	1980	2021
Hunterston Ore Terminal Main Site with tanks, chimneys and electricity substation.	Southwest	0 m	1980	2021
Railway line (G&SWR Ardrossan and Largs Branch)	East	180 m	1897	1995
Embankment	East	0 m	1979	1995
Lagoon	North	0 m	1979	2021
Tanks	East	30 m	1980	1995
Railway lines	West	0 m	1979	1995*
Electricity substation	East	10 m	1979	1995

*Anecdotal information identifies the railway lines are operational.

Anecdotal Information

9.1.25 Anecdotal information from on-line sources indicates that the ore terminal was constructed by British Steel between 1974 and 1979, through coastal reclamation. This included the import of quarried materials from nearby sources such as Biglees Quarry (igneous/metamorphic rock) and Campbelton Farm. The site was screened by construction of mounds alongside the A78 and addition of tree plantings. The lagoon immediately north was added as part of a bird sanctuary forming part of the development.

Previous Reports

9.1.26 A ground investigation undertaken within the Coal Stockyard Area for a proposed multifuel power station development south of the Project Site (part of which overlaps the southern part of the Project Site) was reviewed. The findings of the intrusive investigation are discussed further in the following section and relate to the whole of the southern development site.

9.1.27 As part of the intrusive investigation within the former coal storage facility a total of 12 trial pits and 3 hand augers were excavated across the Coal Stockyard Area at an approximate 150 m grid spacing. Three hand auger samples were also collected from Southannan sands at low tide.

9.1.28 The following ground conditions were encountered:

Made Ground

- A layer of angular gravel and cobbles with occasional sand and clay deposits is generally spread along the site to depths of between 0.10m and 1.00m. The deeper extents of Made Ground are located in the northeastern corner where the bedrock is closer to the ground surface.
- One trial pit (TP5) contained rope and metal nails to 0.80 m below ground level. Trial pit TP9 included a layer of coal dust and coal fragments to a depth of 0.30m BGL as it was located adjacent to the coal yard. The remainder of the trial pits contained no obvious signs of man-made materials apart from angular gravel, cobbles and boulders.

Drift

- Natural soils were encountered in all of the trial pits excavated in the area and comprised two main deposits. The upper layer was generally brown gravelly cobbly medium sand with

increasing gravel content with depth and was encountered in TP3, TP6, TP8, TP11 and TP12. The lower layer was generally described as damp grey clayey medium sand occasionally silty or gravelly. A layer with organic (peaty) odour was noted in TP11 from 2.90m to 3.30 m depth.

- A layer of reddish gravelly and cobbly medium to coarse sand with large boulders and shells was noted in TP5 above the bedrock and TP12 between 1.50 m to 3.50 m depth.

Bedrock

- Red sandstone bedrock was encountered at depths between 0.80m and 1.60m in a number of trial pits (TP1, TP2, TP5, and TP8) located in the northeastern part of this area.

Groundwater

- A superficial layer of perched groundwater was noted in TP7, TP10 and TP13. The water was contained in a layer of fill comprising angular gravel and cobbles at depths between 0.20 m and 0.70 m depth. Seepage of water occurred also above the bedrock in TP1 and TP5. Seepage of water was noted in TP6 around 2.80 m depth.
- The remainder of the trial pits were generally dry but noted as being damp below 2.00 m depth.

9.1.29 The chemical characteristics of the soils and groundwater are identified below:

Soils

- No metal values exceeded the Generic Assessment Criteria (GAC) for a commercial industrial land use scenario for samples collected in either the Coal Stockyard Area or Southannan Sands.
- No TPH fraction concentrations exceeded the GAC for a commercial industrial land use scenario for samples collected in either the Coal Stockyard Area or Southannan Sands.
- No BTEX compound concentrations exceeded the GAC for a commercial industrial land use scenario for samples collected in the Coal Stockyard Area. All additional compounds within the Volatile Organic Compounds (VOCs) suite were recorded below the limit of detection.
- All SVOC compounds , including the key 16 Polycyclic Aromatic Hydrocarbons (PAHs) were recorded either below the limit of detection or well below the adopted GAC.
- All samples tested for PCBs were recorded below detectable limits.
- Cyanide was not recorded above the respective GAC in any of the samples analysed.
- No asbestos fibres were recorded in any of the samples submitted for analysis (4 No.).

Groundwater

9.1.30 Groundwater samples were collected from three trial pits TP7, TP10 & TP13 to give an initial assessment of the groundwater quality at the site. The water in these trial pits is considered to be perched above shallow bedrock deposits and potentially saline if continuous with the Largs channel to the west.

- The majority of the metal concentrations were recorded below their EQS respective screening values with the following exceptions:
  - Chromium – TP13 (18 µg/l);
  - Copper – TP10 & TP13 (6.4 µg/l & 21 µg/l respectively);
  - Lead – TP10 (28 µg/l); and
  - Zinc – TP10 (66 µg/l).

- All organic contaminants including TPH, PAHs, VOCs, SVOCs were below the limit of detection in all samples.
- Cyanide was below detectable limits in all three samples. There is no marine Environmental Quality Standards (EQS) for sulphate, however, sulphate levels were below both the Water Supply regulation drinking water quality guideline and freshwater EQS guideline values.
- pH ranged from 6.7 in TP13 to 8.1 in TP10.

Leachate

9.1.31 Soil samples were submitted also to assess the leachable metal content as a means of assessing the potential for the migration of metals from the soils to the water environment. The EQS for the marine environment were adopted for assessment purposes.

- There were no EQS exceedances recorded for any of the metals in a leachate form.

Other contaminants

9.1.32 In terms of radiological investigation, the following information is provided:

- Radiological monitoring has been undertaken by SEPA in the area surrounding Hunterston B power station located approx. 1 km to the southwest and included sampling stations from the area of the power station itself, to Millport and Fairlie and included locations on Gulls Walk (within the vicinity of the Project Site);
- Dose rates to the public were well below the 1 mSv human health assessment level for all pathways considered.

Published Geological Mapping

9.1.33 Based on British Geological Survey (BGS) mapping (1:50,000-scale) and the Scottish Environment Protection Agency (SEPA) Groundwater Vulnerability mapping (1:100,000-scale), the stratigraphic sequence and aquifer classifications beneath the site are indicated to be as follows:

Table 9.9: Descriptions of Geological Strata

Strata	Description & Approximate Thickness	Aquifer Classification
Marine Beach Deposits (northern part of site)	Sand and Gravel	Unclassified
Raised Marine Deposits (southern part of site)	Clay, Silt, Sand and Gravel	Unclassified
Kelly Burn Sandstone Formation	Sandstone	Moderately productive aquifer (Class 1B) although potential for salinity in the site locality

9.1.34 Numerous boreholes, assumed to have been drilled predevelopment of the site as an ore terminal, are located within the Project Site boundary. It is assumed that these boreholes were formed in the natural deposits as shown on the published mapping at times of low tide. The superficial deposits comprise an assemblage of predominantly sands, gravels and clay. The sands typically included shell fragments and clays commonly with silt and sand partings. The clays varied in consistency from soft to very stiff and the sands were typically described with a density of loose becoming medium dense.

9.1.35 Clayey and sandy peat was encountered towards the south of the site within two boreholes, described as being very soft (0.45 m and 1.00 m thickness).

9.1.36 The sandstone bedrock was encountered at variable depths across the site, typically deepest in the northwestern portion of the site at approximately 14.50 m depth (locally 22.85 m depth)

shallowing towards the east to approximately 8.00 m depth. Shallow bedrock of approximately 3.00 m to 5.0 0m depth was encountered in the southern portion of the site (locally 1.50 m depth).

9.1.37 Three boreholes were drilled along the alignment of the pier. These encountered Alluvium comprising loose becoming medium dense orangish brown silty sand with occasional shells to >10.45 m depth (depth unproven).

9.1.38 Made Ground is expected to be present across the Project Site as a result of the past construction and demolition activities.

Hydrogeology

9.1.39 Under the Water Framework Directive, the Scottish Environmental Protection Agency's (SEPA) website indicates groundwater beneath the site forms part of the West Kilbride and North Ayrshire Coastal waterbodies in the Clyde Basin district and classifies the overall groundwater quality as 'good'.

9.1.40 Information provided by the Scottish Government indicates that there are no records of active licensed groundwater abstractions within 2 km of the site.

Surface Water

9.1.41 There are numerous watercourses surrounding the site the closest being tributaries of Glen Burn immediately to the east and Burn Gill immediately to the south of the site. These are not classified within a River Basin Management Plan published by SEPA under the European Water Framework Directive (2000).

9.1.42 The Largs Channel which is the coastal water body immediately west of the site is classified as having 'good' overall water quality.

9.1.43 Information provided by the Scottish Government indicates that there are no records of active licensed surface water abstractions within 2 km of the site.

Ecologically Sensitive Sites

9.1.44 NatureScot data indicates that there is one ecologically sensitive site, that constitutes an environmental receptor as defined within Table 1 of the DEFRA Environmental Protection Act 1990: Part 2A - Contaminated Land Statutory Guidance (2012), located within a 1 km radius of the site. This is Southannan Sands which is designated a Site of Special Scientific Interest.

9.1.45 Also identified as a sensitive land use within 250 m are areas of designated Ancient Woodland to the east and northeast.

Environmental Information

9.1.46 Data provided by SEPA, Local Authority and BGS indicates that there are no recorded licensed or known historical landfill sites located within 250 m of the site.

Conceptual Site Model

9.1.47 A Conceptual Site Model (CSM) has been developed as part of the Phase 1 PRA. The CSM is used to identify potential hazard sources, exposure pathways and linkage to any credible receptors and is summarised in Table 9.10.

Table 9.10: Outline Conceptual Site Model

Potential Source	Contaminants of Concern	Via	Potential Pathways	Linkage Potentially Active?	Receptors	Qualitative Risk Rating	Notes
On site – current: Made Ground, embankments, storage tanks/drums, storage/maintenance yard. **On site – historical:** Ore/coal Terminal.	Metals, hydrocarbons, solvents, Polychlorinated biphenyls (PCBs) and asbestos.	Soil	Direct contact/ingestion	✓	Future site users	Moderate	Proposed end use is predominantly hard cover, however localised areas of soft landscaping are proposed.
			Inhalation of volatiles	✓		Moderate if accumulation in buildings Low for outdoor exposure	Current storage of potentially volatile contaminants is in relatively small quantities minimising risks from leaks/spillages. Potential for more extensive leaks/spillages associated with former use cannot be discounted.
			Airborne migration of soil or dust	✓	Off-site users	Moderate	Proposed end use is predominantly hard cover, however localised areas of soft landscaping are proposed.
			Leaching of mobile contaminants	✓	Groundwater	Low	Proposed end use is predominantly hard cover which will reduce infiltration and subsequent leaching of potential contaminants.
			Direct Contact	✓	Proposed building foundations/ water supply pipes	Moderate	Potentially deleterious Made Ground from past activities may be present and present a significant risk to buried structures or services.
		Groundwater	Direct contact/ingestion	✓✓	Future site users Off-site users	Low Low	Proposed end use is predominantly hard cover which will reduce infiltration and mobilisation of potential contaminants, however localised areas of soft landscaping are proposed.
			Inhalation of volatiles	✓ ✓	Future site users Off-site users	Moderate	As above for soils. Off-site migration through lateral flow.
			Vertical and lateral migration in permeable strata	✓ ✓ ✓	Groundwater Burns/coastal waters Southannan Sands (SSSI)	Low/ Moderate	Proposed end use is predominantly hard cover which will reduce infiltration and mobilisation of potential contaminants, however localised areas of soft landscaping are proposed.

Off-site – current: Electricity substations. Off-site – historical: Tanks, railway lines	Metals, hydrocarbons, solvent and PCBs	Groundwater	Direct contact/ingestion	✓	Future site users	Low	
			Inhalation of volatiles	✓	Future site users	Moderate	Likely to be localised point sources of contamination.
On and off-site – Made Ground / Marine Deposits containing peat and other organic material.	Carbon dioxide and methane	Ground Gas	Inhalation of ground gas	✓ ✓	Future site users Off-site users	Moderate in structures Low – outdoor exposure	BGS borehole records indicate localised peat deposits present beneath the site. Made Ground thickness and composition unproven.
			Explosive risks	✓ ✓	Future site users Off-site users Future and off-site Structures	Moderate in structures Low – outdoor exposure	As above.

Note The Qualitative Risk Rating does not consider the potential for the pathway to be active. In the event that a Moderate or High Qualitative Risk Rating is identified further assessment is recommended.

Future Baseline Conditions

9.1.48 The assessment considers how the future baseline may evolve in the absence of the Project. The primary sources of future change with respect to the baseline conditions, in the absence of any redevelopment, are changes arising due to climate change.

9.1.49 Generally, there is a potential for climate change to lead to increased leaching of contaminants from soil as a result of longer and more frequent periods and intensity of rainfall. In addition, there is a potential for increased land instability as a result of longer and more frequent periods and intensity of rainfall.

9.1.50 Increased ambient temperatures may result in the warming of soils and groundwater beneath the Project site, which could have the following impacts:

- accelerated breakdown of natural organic matter beneath the Project site leading to increased rates of carbon dioxide and methane generation; and
- accelerated breakdown of putrescible material in Made Ground, resulting in increased rates of carbon dioxide and methane production. Increased volumes of leachate would also be produced with the accelerated breakdown of this material.

9.1.51 Prolonged dry spells or increased rainfall, along with increased temperatures may impact soil with a high volume change potential, which could result in settlement / heave of foundations and earthworks, in particular when located within the influence of trees and vegetation.

9.1.52 These factors are taken into consideration in the assessment of effects, where practicable, and will be taken into account within the design of the Project.

Mitigation Measures Adopted as Part of the Project

9.1.53 The following mitigation measures would be implemented as part of the Project.

9.1.54 A Phase 2 intrusive investigation will be undertaken prior to the construction phase to verify the risk levels identified within the CSM. The scope of the investigation will be agreed with SEPA / North Ayrshire Council prior to its implementation.

9.1.55 Should the results of the Phase 2 intrusive investigation determine remediation is required to ensure the Site is suitable for its proposed use, a Remediation Strategy would be prepared. The strategy will comprise the following:

- implementation plan setting out the objectives and requirements of the remediation;
- validation sampling to confirm that remediation objectives are met; and
- verification report.

9.1.56 The scope of the Remediation Strategy will be agreed with the SEPA / North Ayrshire Council prior to its implementation. The verification report will also be sent to the SEPA / North Ayrshire Council for approval. Subject to the scope and results of the Remediation Strategy, the following would be undertaken where appropriate to inform construction activities and the detailed design of buildings:

- piling risk assessment (in accordance with the Environment Agency guidance) including control measures (where appropriate) to mitigate risk to the water environment during piling installation;
- dewatering risk assessment to mitigate risk to the water environment (specifically the Largs Channel and Southannan Sands) during deep excavation;
- detailed ground gas risk assessment and gas control measures to be incorporated into building design (where appropriate); and
- groundwater and/or surface water monitoring.

9.1.57 Should any previously unidentified contamination be detected at the Site during the construction phase, work in the area would cease. A suitably qualified environmental consultant would attend site to advise on an appropriate course of action. Details of the conditions encountered will be reported to the SEPA / North Ayrshire Council, and a suitable risk assessment and management strategy for dealing with the contamination would be submitted to these authorities for approval.

9.1.58 Construction will be managed through a Code of Construction Practice (COCP) which would be prepared post consent. An outline COPC will form the basis of the more detailed COCP, plans and method statements, to be prepared during the pre-construction period once a Principal Contractor is appointed. The COCP will be agreed with the North Ayrshire Council prior to the commencement of construction.

9.1.59 The outline CoCP sets out standard good practice construction mitigation measures that the construction workforce would be required to implement. This includes the following.

- Implementation of measures to prevent and control spillage of oil, chemicals and other potentially harmful liquids. This would ensure appropriate storage and handling of materials and products in accordance with the Guidance for Pollution Prevention (GPP) 2 2017, for example:
  - avoidance of oil storage within 50 metres of a spring, well or borehole;
  - within 10 metres of a watercourse;
  - where oil could run over hard ground into a watercourse;
  - secondary containment system that can hold at least 110% of the oil volume stored; and
  - avoidance of storage of oil in areas at risk of flooding.
- Refuelling of machinery would be undertaken within designated areas where spillages can be easily contained. Machinery would be routinely checked to ensure it is in good working condition. Any tanks and associated pipe work containing oils and fuels would be double skinned and be provided with intermediate leak detection equipment.
- Implementation of measures to protect groundwater during construction, including good environmental practices based on legal responsibilities and guidance on good environmental management in: CIRIA C532 Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors (CIRIA, 2001).
- Stockpiling of contaminated materials on site would be avoided where practicable. Soils would be placed within suitably constructed bunded areas and covered to prevent migration of contaminants via rainwater run-off.
- Industry standard dust suppression measures would be implemented during construction to minimise nuisance dust during the works.
- Implementation of control measures, including the use of appropriate personal protective equipment and welfare facilities. Health and Safety risk assessments will be completed prior to construction works in line with the Construction (Design and Management) Regulations 2015.

9.1.60 A CL:AIRE Materials Management Plan (or Scottish equivalent based on SEPA guidance) will be prepared to document the management of soils on site, and include a risk assessment procedure to demonstrate that the soils do not present a risk to human health or the environment. Excavation works will be carried out in such a way to enable effective segregation of clean materials for reuse on site wherever practicable.

Assessment of Construction Effects

9.1.61 This section sets out an assessment of the construction phase effects.

Impacts on Human Health – Construction Workers

9.1.62 The historical use of the Project site indicates the northern part is reclaimed land which c. 1979 was developed along with the remainder of the Project site as a coal stockyard as part of the Hunterston Ore Terminal. It is understood that the reclamation works are likely to have included the import of quarried aggregate from local sources however the extent and nature of imported material used for this purpose is unconfirmed.

9.1.63 Made Ground is present across the Project site as a result of its past construction and demolition activities (see paragraph 9.1.29).

9.1.64 During the construction process, activities would involve breaking the ground surface and disturbing soil and shallow groundwater (where present). Construction personnel may be at increased risk from any potential contamination, if present. Potential impacts to human health may arise as a result of contact with contaminants via dermal contact, ingestion of soil/soil-derived dusts and inhalation of contaminated dusts / fibres and ground gases. This will be mitigated through the preparation and implementation of the Remediation Strategy, as required.

9.1.65 Construction workers would be required to adopt appropriate levels of hygiene and personal protective equipment based on appropriate risk assessments in accordance with the requirements of CDM Regulations 2015. With such measures in place, they are not considered to be at significant risk from potential contaminants of concern.

9.1.66 During the construction phase, fuels, oils and chemicals would be stored on site. These represent potential sources of new contamination as a result of leaks and spills. There is also the potential for previously unidentified contamination to be encountered as a result of ground disturbance. These would be bunded and carefully sited to minimise the risk of hazardous substances entering the local watercourses.

9.1.67 Given the requirement to undertake specific Health and Safety risk assessments prior to construction works, in accordance with the CDM Regulations 2015, construction workers would be provided with appropriate protective equipment; appropriate welfare facilities and any specific control measures would be implemented. With this mitigation in place, the magnitude of the impact is considered to be **negligible**.

9.1.68 Construction workers are considered to have a **high** sensitivity to potential impacts. Taking into account the magnitude of impact with measures in place (negligible), the significance of effect is considered to be **minor adverse**, which is not significant in EIA terms.

Impacts on Human Health - Adjacent Sites Users

9.1.69 The contamination status of the Project site is as described above. There is potential for adjacent site users to come into contact with airborne soil derived dusts and fibres. The impact on adjacent site users during construction could have a direct and potential adverse effect. With the implementation of the construction mitigation measures described above, in particular dust control measures (Chapter 13: Air quality), the magnitude of impact would be **negligible**.

9.1.70 Adjacent site users are considered **very high** sensitivity. On this basis, the significance of effect is considered to be **minor adverse**, which is not significant in EIA terms.

Impacts on Groundwater

9.1.71 Construction activities which involve breaking the ground surface increase the potential for existing contaminants in the soil and shallow groundwater to be mobilised and migrate through the soil as a result of leaching (from exposure to rainfall), dewatering of excavations and from the creation of pathways to groundwater at depth (e.g. piling).

9.1.72 The results of the proposed Phase 2 intrusive investigation and assessment would allow a refined conceptual site model to be developed and any remediation requirements determined.

9.1.73 Measures to minimise the potential for spillages and leakages of fuels and chemicals would be implemented during the construction phase. These measures would be implemented through the CoCP.

9.1.74 With the implementation of appropriate pollution control measures described above, the magnitude of impact would be **negligible**.

9.1.75 Groundwaters are considered to have a **high** sensitivity given the good groundwater quality classification beneath the Project site.

9.1.76 On this basis, the significance of effect is considered to be **minor adverse**, which is not significant in EIA terms.

Impacts on Surface Watercourses

9.1.77 The nearest surface water feature is the Largs Channel coastal water body immediately west of the site and numerous watercourses surround the site the closest being tributaries of Glen Burn and Burn Gill.

9.1.78 Impacts on surface water quality may arise from surface runoff from construction areas and also as a result of leaching of contaminants in soils or shallow groundwater migrating to surface waters which may directly enter into the burns and the Largs Channel. It is expected the groundwater beneath the Project site will be tidal and in continuity with the coastal water body.

9.1.79 The construction process includes measures to intercept run-off and ensure that discharges from the Project site are controlled in quality, as well as water quality monitoring carried out throughout the construction phase to ensure no discharge of pollutants or increase in suspended sediment occurs. Measures to control surface water runoff will be implemented through the CoCP. On this basis, the magnitude of impact is predicted to be **negligible**

9.1.80 SEPA has designated that all watercourses should achieve a 'good' Water Framework Directive status in the future. Therefore, surface watercourses are considered to be of **high** sensitivity, despite the burns not having been individually classified.

9.1.81 The significance of the effect is therefore assessed as **minor adverse**, which is not significant in EIA terms.

Impacts on Ecological Sites

9.1.82 The Southannan Sands west of the Project site is designated a SSSI. Construction activities could lead to an increase in ground/groundwater disturbance, sediment scour and surface water runoff from the Project site. This in turn could lead to an increase in sediment/contaminant laden runoff discharging into the SSSI. The SSSI is considered to be of **very high** sensitivity.

9.1.83 The construction methodologies would ensure that no increase in uncontrolled off-site flows would occur during the construction phase. A minimum 50 metre buffer will be maintained, where possible, between working areas, machinery and watercourses and ditches with pollution prevention measures installed and maintained as appropriate. Designed-in mitigation measures would be implemented which would reduce any potential increase in uncontrolled surface water runoff during the construction phase. All stockpiled material will be fenced off in a designated place on site and covered or damped down (if likely to generate dust) and chemicals, oils and hazardous materials will be securely stored with appropriate containment in designated areas a minimum distance of 50 metres from any watercourses. A suitable temporary drainage network, including oil / sediment interceptors, would be constructed.

9.1.84 With the above construction engineering methods adopted as part of the project it is predicted that the impact would not affect surrounding local receptors directly. The magnitude is predicted to be **negligible**.

9.1.85 The significance of effects of any construction actives on the designated ecological sites to the west, with the implementation of the construction measures, would be **minor adverse**, which is not significant.

Impacts on Soils

9.1.86 The Project site is previously developed land formerly in 'hard use' with little potential to return to agriculture. The soils may be considered of **negligible** sensitivity and though the underlying soils will be permanently sealed with a magnitude of impact of **high**, the significance of effects would be **minor adverse**, which is not significant.

Further Mitigation

9.1.87 No further mitigation measures are considered necessary subject to the results of the Phase 2 intrusive investigation

Future Monitoring

9.1.88 No further monitoring is considered necessary subject to the results of the Phase 2 intrusive investigation

Accidents and/or Disasters

9.1.89 It is not considered that any operational accidents/disasters requiring assessment are relevant to this topic area.

Assessment of Operational Effects

Impacts on Human Health – Future Site Users

9.1.90 During operation, there is the potential for spillages or leakages of oil and fuels from plant and equipment. However, this would likely be of a limited volume, localised and contained within areas of hardstanding and bunds. Any spillages would be easily contained and recovered.

9.1.91 With the implementation of the mitigation measures described, the magnitude of impact is predicted to be **negligible**.

9.1.92 Future site users are considered to have a **medium** sensitivity given that more limited potential exposure pathways will be present.

9.1.93 On this basis, the significance of effect is considered to be **negligible**, which is not significant in EIA terms.

Impacts on Human Health – Adjacent Site Users

9.1.94 The operation of the facility would not be considered a dusty activity and the development is to comprise predominantly hard cover. The magnitude of impact would therefore be **negligible**.

9.1.95 Adjacent site users are considered to have a **very high** sensitivity. On this basis, the significance of effect is considered to be **minor**, which is not significant in EIA terms.

Impacts on Groundwater

9.1.96 Potential impacts from accidental leaks/spillages plant and equipment may occur whilst the Project is operational. However, these would be very small, localised and mitigated by surface water drainage mitigation measures (i.e. hydrocarbon interceptors).

9.1.97 The plant/structures and hardstanding would act to minimise infiltration rates in these areas and would reduce the potential for any residual contaminants (if present) in shallow soils leaching into the underlying groundwater.

9.1.98 Groundwaters are considered to have a **high** sensitivity given the good groundwater quality classification beneath the Project site. The magnitude of the impact of remediation of soil and/or groundwater beneath the Project site is **negligible**.

9.1.99 On this basis, the significance of effect is considered to be **minor adverse** at worst, which is not significant in EIA terms.

Impacts on Surface Watercourses

9.1.100 During the operation of the Project site there are a number of potential pollutants, which may give rise to water quality effects on the surrounding surface watercourses. These include:

- fine particulate materials (e.g. silts and clays); and
- oils and chemicals (from plant machinery and processes).

9.1.101 A new surface water drainage network would be constructed which would incorporate proprietary pollution interceptors. No process or 'dirty' water would be produced as part of the Project. The Project would incorporate a number of emergency procedures in the operational phase which would be used as a result of accidental spillage.

9.1.102 In summary, pollutants may be present as a result of normal operations, traffic and emergency or accidental spillage.

9.1.103 Pollution arising from accidental spillages on site such as road traffic would be controlled to **negligible** magnitude of impact given the provision of the above mitigation measures.

9.1.104 The sensitivity attributed to the surface waters is **high** despite not being classified within a River Basin Management Plan. On this basis, the significance of effect is considered to be **minor adverse**, which is not significant in EIA terms.

Impacts on Ecological Sites

9.1.105 The Southannan Sands west of the Project site is designated a marine SSSI. Operation and maintenance activities could lead to an increase in polluted surface water runoff from the Project site. This in turn could lead to an increase in sediment/contaminant laden runoff discharging into the SSSI.

9.1.106 The SSSI is considered to be of **very high** sensitivity.

9.1.107 Operational management systems and procedures, including accidental spill kits, would be on site to limit any potential accident or spillage. The surface water drainage strategy would be designed to limit any polluted runoff to the surrounding watercourses. The provision of operational measures, including on-site drainage networks, reduces the range of potential impacts to **negligible**.

9.1.108 The significance of effects of operation and maintenance activities on the ecologically designated site to the west, with the implementation of the operational measures, would be **minor adverse**, which is not significant.

Impacts on Soils

9.1.109 No additional impacts on soils as a resource are considered during operation.

Further Mitigation

9.1.110 No further mitigation measures are considered necessary.

Future Monitoring

9.1.111 No further monitoring is considered necessary.

Accidents/Disasters

9.1.112 It is not considered that any operational accidents/disasters requiring assessment are relevant to this topic area.

Potential Changes to the Assessment as a Result of Climate Change

9.1.113 Future changes in baseline conditions are not predicted to change any of the assessments for the operational phase and therefore no change of the significance levels is likely.

Assessment of Cumulative Effects

9.1.114 The zone if influence for cumulative developments may be considered to be similar to that of the study area and therefore the following development has been considered:

- Proposed synchronous compensator and ancillary infrastructure.

Impacts on Soils

9.1.115 It is considered that though the above development will also involve the permanent sealing of the underlying soils, the soils are of low sensitivity and therefore the cumulative effect would not be significant.

Impacts on Human Health

9.1.116 The planning process for the proposed compensator would involve investigation and risk assessment of the potential for contamination on their site and the implementation of mitigation/remediation (where appropriate) to reduce risks to on and offsite receptors. On this basis, cumulative effects of the proposed compensator with the Project would not be significant.

Impacts on Groundwater

9.1.117 Construction activities for the proposed compensator would also involve breaking the ground surface, and should they occur at the same time this may increase the potential for existing contaminants in the soil and shallow groundwater to be mobilised and migrate through the soil as a result of leaching (from exposure to rainfall) and from the creation of pathways to groundwater at depth (e.g. piling).

9.1.118 The development would require investigation and assessment as described above with implementation of appropriate mitigation and remediation measures as appropriate.

9.1.119 On this basis, cumulative effects of the proposed compensator with the Project would not be significant.

Impacts on Surface Water

9.1.120 The potential for additional uncontrolled surface water runoff should construction activities occur at the same time may be slightly increased however with effective measures to control surface water runoff in place for both developments no significant cumulative effects would be predicted to occur.

Impacts on Ecological Receptors

9.1.121 In line with the above there is potential for additional sediment loading on the SSSI during the construction phase however the requirement for mitigation measures to be implemented would reduce any potential increase and any cumulative effects would not be significant.

Inter-relationships

9.1.122 This chapter should be read in conjunction with other technical chapters relating to the hydrological environment, Chapter 8: Hydrology and Flood Risk, and impacts arising from construction dust (Chapter 13: Air Quality and Appendix 13.2).

Summary of Effects

9.1.123 A summary of effects for the construction and operational phases is presented in Table 9.11.

Table 9.11: Summary of Likely Environmental Effects on Hydrogeology, Geology and Ground Conditions

Receptor	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact	Significance of effect	Significant / Not significant	Notes
Construction phase							
Construction workers	High	Exposure through dermal contact, ingestion and inhalation of contaminated soil derived dusts/ground gases. Effects are direct and may be permanent or temporary.	Short term exposure (potential long term effects)	Negligible	Minor	Not significant	
Adjacent site users	Very high	Exposure through inhalation of contaminated soil derived dusts. Effects are direct and may be permanent or temporary.	Short term exposure (potential long term effects)	Negligible	Minor	Not significant	
Groundwater	High	Migration of contaminants in soils and perched/shallow groundwater through dewatering of excavations / creation of new pathways including piling. Likely effects are direct and temporary.	Short term	Negligible	Minor	Not significant	
Impacts on surface watercourses	High	Migration of contaminants in soils and perched / shallow groundwater and surface water runoff into surface waters. Likely effects are direct and temporary.	Short term	Negligible	Minor	Not significant	
Impact on ecological sites	Very high	Migration of contaminants in soils and perched / shallow groundwater and surface water runoff into surface waters and ecological site. Likely effects are indirect and temporary.	Short term	Negligible	Minor	Not significant	
Impacts on other soils	Negligible	Loss of soils resource. Effects are direct and permanent.	Long term	High	Negligible	Not significant	

Receptor	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact	Significance of effect	Significant / Not significant	Notes
Operational phase							
Future site users	Medium	Exposure through dermal contact, ingestion and inhalation of contaminated soil derived dusts/ground gases. Effects are direct and may be permanent or temporary.	Long term	Negligible	Negligible	Not significant	
Adjacent site users	Very high	No dust generation during operation. Effects are direct and may be permanent or temporary.	Long term	Negligible	Negligible	Not significant	
Groundwater	High	Migration of contaminants in soils and perched/shallow groundwater through creation of new pathways including piling. Likely effects are direct and temporary.	Short term	Negligible	Minor	Not significant	
Impacts on surface watercourses	High	Migration of contaminants in soils and perched / shallow groundwater and surface water runoff into surface waters. Likely effects are direct and temporary.	Short term	Negligible	Minor	Not significant	
Impact of ecological sites	Very high	Migration of contaminants in soils and perched / shallow groundwater and surface water runoff into surface waters and ecological site. Likely effects are indirect and temporary.	Short term	Negligible	Minor	Not significant	

References

British Standards (2017) BS10175:2011+A2:2017: Investigation of potentially contaminated sites – Code of Practice.

British Standards (2019). BS8485:2015+A1:2019: Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings.

British Standards (2020) British Standard for the Code of practice for ground investigations (BS8485:2015+A1:2020).

Construction Industry Research and Information Association (CIRIA) (1996) R132: A Guide for Safe Working on Contaminated Sites, December 1996.

Construction Industry Research and Information Association CIRIA (2001a) C552: Contaminated Land Risk Assessment: A Guide to Good Practice.

Construction Industry Research and Information Association (CIRIA) (2001b) C532: Control of Water Pollution from Construction Sites: Guidance for Consultants and Contractors.

Construction Industry Research and Information Association (CIRIA) (2007) C665: Assessing Risks Posed by Hazardous Ground Gases to Buildings.

Natural Scotland, Scottish Executive (2006) Environmental Protection Act 1990: Part IIA, Contaminated Land. Statutory Guidance.

Environmental Protection Scotland (2019). Land contamination and development. Version 2.12

The Highland Council Guidance Note (2010). Construction Environmental Management Process for Large Scale Projects, August 2010.

Highways England, Transport Scotland, Welsh Government and the Department for Infrastructure Northern Ireland (2020a) Design Manual for Roads and Bridges: Sustainability and Environmental Appraisal. LA 104: Environmental assessment and monitoring.

Highways England, Transport Scotland, Welsh Government and the Department for Infrastructure Northern Ireland (2019) Design Manual for Roads and Bridges: Sustainability and Environmental Appraisal. LA 109: Geology and Soils.

Highways England, Transport Scotland, Welsh Government and the Department for Infrastructure Northern Ireland (2020b) Design Manual for Roads and Bridges: Sustainability and Environmental Appraisal. LA 113: Road Drainage and the Water Environment.

Natural Scotland, Scottish Executive (2006) Environmental Protection Act 1990: Part IIA, Contaminated Land. Statutory Guidance.

Scottish Government (2014a) Ambition Opportunity Place: Scotland's Third National Planning Framework.

Scottish Government (2014b) Scottish Planning Policy.

Scottish Government (2017) Planning Advice Note 33: Development of contaminated land.

North Ayrshire Council (2019): Adopted Local Development Plan: Your Plan Your Future.

Scottish Government (2021) Scotland 2045 Our Fourth National Planning Framework Draft.