9 Ground Conditions

EIA Addendum Update

The proposed reduction of 22 accommodation units at Woodbank and deletion of Area 10 does not change the outcome of the original assessment which raised no significant ground condition issues. No changes have been made to this chapter.

9.1 Introduction

9.1.1 This chapter of the EIAR provides an assessment of the likely significant effects from the proposed development on ground conditions. It also assesses the effects from the ground conditions such as potential contamination on the proposed development. The assessment is based on the characteristics of the site and surrounding area and the key parameters of the proposed development detailed in **Chapter 2** of the EIA Report.

9.1.2 This chapter has been prepared by Stantec, in line with best practice, a statement outlining the relevant expertise and qualifications of competent experts appointed to prepare this EIA Report is provided in **Appendix 1.1**.

9.1.3 This chapter is supported by the following figures and technical reports provided in **Appendix 9**:

- **Appendix 9.1 – Figures** includes:
  - **Figure 9-1 Composite Plan of Shallow Ground Conditions**. This has been reproduced from the 2017 Ground Investigation Report and does not reflect changes to the Site boundary;
  - **Figure 9-2 Site Investigation Locations where Contamination was Encountered and Ground Gas Characteristic Situations**. This has been reproduced from the 2017 Ground Investigation Report and does not reflect changes to the Site boundary; and,
  - **Appendix 9.2 – Preliminary Phase 2 Ground Condition Assessment**.

9.2 Policy Context, Legislation, Guidance and Standards

Legislation

9.2.1 The overarching legislative framework applicable to this EIA for the proposed development is outlined in **Chapter 4 – Legislation and Planning Policy Context**. Over and above this the following statutory provisions are of specific relevance to this assessment:

- Environmental Protection Act 1990 (Part IIA) (as amended);
- Environment Act 1995 (Section 57);
- The Contaminated Land (Scotland) Regulations 2000 (as amended);
- Water Environment and Water Services (Scotland) Act 2003 which implemented the Water
- Framework Directive 2000/60/EC (“the WFD”); and,
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended) which implements the Groundwater Directive 2006/118/EC (a daughter directive to the WFD).

Policy

9.2.2 The planning policy framework applicable to this EIA for the proposed development is outlined in **Chapter 4**. The statutory Development Plan applicable to the Site presently comprises:

9.2.3 Loch Lomond and the Trossachs Local Development Plan 2017-2021 (LLTNP, 2017), in particular:

- Natural Environment Policy 11: Protecting the Water Environment;
- Natural Environment Policy 16: Land Contamination;
- Scottish Planning Policy (2020), in particular the following relevant provisions:
  - Principal Policy on Sustainability (paragraphs 24-35);
  - Principal Policy on Placemaking (paragraphs 36-57); and,
  - National Planning Framework 3 (NPF3) (2014).

Guidance and Relevant Technical Standards

9.2.4 The following guidance and technical standards have informed this assessment:

- Land Contamination Risk Management (LCRM) (EA, 2021) which is based on the now withdrawn Contaminated Land Report (CLR) 11: Model Procedures for the Management of Contamination (EA, 2004). It is noted that CLR11 was used to guide the investigation of the Site reported in 2017, and that the essential principles of CLR11 and LCRM with respect to the assessment of contaminated land risk and remediation are closely aligned;
- BS 5930:2015 Code of practice for ground investigations (note that this guidance has been updated since the 2017 assessment took place);
- BS 10175:2011 Investigation of potentially contaminated sites – Code of practice (note that this guidance has been updated since the 2017 assessment took place);
- BS 8485:2015 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings (note that this guidance has been updated since the 2017 assessment took place);
- Scottish Government Planning Advice Note (PAN) 33 Development of Contaminated land (Scottish Government, 2017);
- Position Statement (WAT-PS-10-01) Assigning Groundwater Assessment Criteria for Pollutant Inputs v3.0 (note that this guidance has been updated since the 2017 assessment took place);
- Supporting Guidance (WAT-SG-53) Environmental Quality Standards and Standards for Discharges to Surface Waters v7;
- Department of the Environment (DOE) Industry Profiles;
- Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance, Second Edition; and,
- SEPA Guidance for Pollution Prevention (GPPs) including GPP 2 above ground oil storage tanks, GPP 5 works and maintenance in or near water, GPP 8 safe storage and disposal of used oils, GPP 21 pollution incident response planning, GPP 22 dealing with spills and PPG 26 safe storage – drums and intermediate bulk containers. All GGPs and the older PPGs are available at NetRegs (2022).

9.3 Methodology

Overview

Assessment Scope

9.3.1 The principal aspects considered within this assessment are:

- Human health – construction workers, future site users and maintenance workers and neighbours;
- Water environmental – River Leven, Loch Lomond and the superficial and bedrock groundwaters;
- Ecological systems – although no statutory designated sites are onsite or within 250m, Balloch Country Park (non-statutory) country park is within 250m of the Site;
- Property – pastural and arable land within 250m west;
- Property (structures and utilities) – utilities including the INEOS High Pressure Oil Pipeline and other gas apparatus are known to be present below the surface of the Site; and,
- Archaeological sites and ancient monuments – scheduled monument within 250m of the Site boundary (located in the Balloch Castle grounds).

9.3.2 The Ground Conditions chapter presents an assessment of likely significant effects on ground conditions from the proposed development. The assessment presented in this Ground Conditions chapter has been prepared in accordance with the EIA Regulations.

9.3.3 The assessment of likely effects makes comparison with the baseline year (2017) during which time the site surveys were carried out. The 2017 investigation entailed drilling of 57 windowless sampler boreholes at representative locations across the Site to enable the assessment of soil, groundwater and ground gas characteristics. Although the investigation was described as “preliminary”, the site wide coverage is considered to present an appropriate level of detail to characterise conditions. It was however noted that certain localised areas may require additional investigation once the proposed development layout had been finalised.

9.3.4 The Site has not undergone significant development or disturbance since the 2017 investigation and as such, the conditions reported at that time are considered to be representative of the current state of the environment.

9.3.5 The 2017 investigation took account of the findings of investigations undertaken by AECOM (AECOM, 2015).

9.3.6 Since the 2017 investigation, minor changes have been made to the Site boundary, in particular, the addition of an area identified as “Area D 4b and 10” **in Figure 2-1** (**Appendix 2**). The proposed development in Area D is limited in scope, comprising the upgrade of existing paths and woodland management in area 4b and delivery, storage and management facilities in area 10.

Assessment Process

9.3.7 In undertaking the assessment presented in this EIA Report chapter, the following activities have been carried out:

Consultation

EIA Screening and Scoping

9.3.8 WDC Environmental Health and SEPA were consulted by Loch Lomond and the Trossachs National Park for the EIA Scoping Opinion.

9.3.9 WDC noted that they would reserve comments on contaminated land for each area of development when planning applications are submitted. WDC noted that they have not been previously consulted on the ground investigation (GI) and may therefore comment the extent of

the investigations to date. It is understood that WDC have reserved comment partially due to the original GI being labelled as 'preliminary' in the absence of a masterplan.

Post Scoping Consultation

9.3.10 The following post-scoping consultation has taken place:

- WDC responded to the Stantec EIA Scoping Report within the Loch Lomond and The Trossachs National Park Scoping Opinion dated 27/06/21;
- The response stated that WDC Environmental Health would reserve comments on the development until planning permissions were submitted;
- WDC suggested that they should be consulted ahead of further ground investigation work proposed to support the development and stated that any SI will require to be reviewed and approved, **prior to the submission** of any Remedial Strategy for review and approval;
- Stantec discussed the comments above with the Contaminated Land Officer at WDC by telephone and email on 10/08/21 and 16/08/21; and,
- It was understood that the requirement for a revised site investigation report and assessment and (if required) a Remediation Strategy will be included as planning conditions.

9.3.11 Information requests have been sent to SEPA and the Local Authority Environmental Health Department for any additional information in relation to environmental issues at the Site / surroundings.

Study Area

9.3.12 The study area for the ground conditions assessment is based on the application red line boundary shown in **Figure 2-1** ("onsite") and the surrounding area ("offsite"). The study area includes a 500m buffer zone outside of the Site boundary to consider any contaminated land effects and interactions with the Site.

9.3.13 Although the Site boundary is broadly similar to the boundary used for the 2017 investigation, there have been some minor changes. Generally, the changes comprise reductions in the area under consideration. However, there is an additional area located to the east of the Woodbank House area, labelled Zone D on the parameters plan which was not included in the 2017 investigation. This area will mostly comprise upgraded woodland paths and a staff / service area.

Information Sources

9.3.14 The following sources of information have been reviewed and used to inform the geology and ground conditions assessment:

- Riverside & Woodbank Estate, Balloch, Preliminary Phase 2 Ground Conditions Assessment, Peter Brett Associates (now Stantec), 2017 or "the 2017 ground investigation'':
- Engineering Review, West Riverside, Balloch, AECOM, 2015;
- West Riverside, Loch Lomond Shores, Phase 1 Geoenvironmental Desk Study, AECOM 2015; and,
- Lomond Shores, Stage 2 Site Investigation Report, URS Report Fer 44762681/GLRP0533 Issue 2.

Approach to Assessment

9.3.15 In order to assess potential effects and identify the need for mitigation measures, Conceptual Models (CM) have been prepared for baseline, construction phase and operational phase of the development using the data identified above. Potential effects will be considered separately for

each potentially complete pollutant linkage such that any potential impacts are identified and mitigated as required. The CM considers:

- The principal pollutant hazards (the contamination sources);
- The principal pathways between the identified hazard(s) and receptor(s); and,
- The principal receptor(s) at risk from the identified hazards, for example, people, environmental assets, surface and/or groundwater.

9.3.16 The qualitative risk is determined by the interrelationship between the potential for a source of contamination to be present, the potential for migration of the contaminant along a given pathway, and the significance of potential receptors. A pollutant linkage is identified where all three elements (source-pathway-receptor) are present.

9.3.17 The level and significance of likely effects will be judged with reference to the likelihood and the consequence of the effect occurring. The receptor sensitivity will also be taken into consideration.

Table 9-1: Criteria Used in Ground Conditions for Classifying Receptor Value or Sensitivity

Classification	Definition / Example Scenario
High Receptor of national or international importance	Human health: Residential and uses where children are present Surface water: SEPA ecological status of High or Good Groundwater: Aquifer productivity class is High or Very High Ecology: Special Areas of Conservation (SAC and candidates), Special Protection Areas (SPA and potentials) or wetlands of international importance (RAMSAR) Buildings: World Heritage Site or Conservation Area
Moderate Receptor of county or regional importance	Human health: Employment Surface water: SEPA ecological status of Moderate Groundwater: Aquifer productivity class is Moderate Ecology: SSSI, National or Marine Nature Reserve (NNR or MNR) County Wildlife Sites (CWS) Buildings: Area of Historic Character
Low Receptor of local importance	Human health: Transient or Limited Access. Unoccupied/Industrial land use and construction workers* Surface water: SEPA ecological status of Poor or Bad Groundwater: Aquifer productivity class is Low and Very Low Ecology: Local habitat resources or no designation Buildings: Replaceable/local value

9.3.18 *assuming that construction workers will adopt appropriate health and safety and personal protective equipment (PPE) procedures

Impact Assessment Methodology

Table 9-2: Classification for Likelihood

Likelihood / Probability	Definition
High	There is a source-pathway-receptor relationship and an event either appears very likely in the short-term and almost inevitable over the long-term.
Likely	There is a source-pathway-receptor relationship, and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short-term and likely over the long-term.
Low	There is a source-pathway-receptor relationship and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place and is less likely in the shorter- term.
Unlikely	There is a source-pathway-receptor relationship, but circumstances are such that it is improbable that an event would occur even in the very long-term.
No Likelihood	There is no source-pathway-receptor relationship present.

Likelihood / Probability	Definition
	No further consideration of risk is therefore required (i.e. the risk is scoped out from resulting in likely environmental effects and is not taken forward to the assessment matrix detailed in **Table 9-4** below.

Table 9-3: Classification for Consequence

Severity of Impact	
Severe	Acute (short term) risks to human health. Catastrophic damage to buildings / property. Major pollution of the water environment (watercourse or groundwater) or atmosphere.
Medium	Chronic (long-term) risk to human health. Pollution of the sensitive water environment (surface waters or aquifers) or atmosphere. Measurable adverse effects on sensitive ecosystems or species. Major structural damage to buildings or structures.
Mild	Pollution of non-selective waters (e.g. groundwater in non-productive strata) or atmosphere. Limited structural damage to buildings or structures.
Minor	Damage to non-selective ecosystems or species e.g. existing poor quality surface water bodies. Minor damage to buildings or structures e.g. minor cracks which do not affect structural integrity.
Negligible	Potential damage to non-selective ecosystems or species or potential damage to buildings or structures that is beneath the level of perception. No further consideration of risk is therefore required (i.e. the risk is scoped out from resulting in likely environmental effects and is not taken forward to the assessment matrix.

Assessment of Effect Level and Significance

Table 9-4: Matrix for Establishing Risk Level and Significance

		Severity			
		Severe	**Medium**	**Mild**	**Minor**
Probability	**High**	Substantial	Major	Moderate/Minor	Minor
	Likely	Major	Moderate	Minor	Negligible
	Low	Major/Moderate	Moderate/Minor	Minor	Negligible
	Unlikely	Moderate/Minor	Minor	Minor	Negligible

Limitations and Uncertainty

9.3.19 The GI undertaken in 2017 is still considered to be relevant to this Proposed Development and the coverage is largely sufficient. Limited additional investigation is recommended post PPiP Planning stage and ahead of detailed proposals, in the eastern area to delineate and better understand the elevated concentrations of contaminants encountered during the 2017 GI. Furthermore, additional investigation is recommended within the footprints of the existing / ruined buildings onsite, in particular, the footprint of the hotel building destroyed by fire may represent a potential localised source of contamination. Where structures are proposed for which specialist foundations may be required (i.e. the swimming pool and monorail stanchions etc.), additional further geotechnical investigations may be required.

9.3.20 Since the previous application, the application red line boundary has varied slightly and therefore small additional areas noted in para 9.3.6 are yet to be investigated.

9.4 Baseline

9.4.1 Baseline conditions for the proposed development have been identified using the recent 2017 ground investigation, together with the historical studies by AECOM and URS.

The Site

9.4.2 The Site is located at the northern extent of the town of Balloch, at the southern end of Loch Lomond approximately centred at Ordnance Survey Grid Reference 238666, 682128. The Site boundary is presented as **Figure 2-1**.

9.4.3 The Site measures approximately 18.9 hectares over two distinct areas known as West Riverside in the east and Woodbank House in the west.

9.4.4 A detailed description of the Site and surrounding area is provided in **Chapter 2** of this EIA Report, with a Site Location Plan provided as **Figure 2-2**.

Current Land Use

9.4.5 The larger eastern area (West Riverside) is an irregular shape and is bounded to the north by the Lomond Shores centre and the bank of the Loch itself. To the east is the River Leven (the Maid of the Loch Slipway, including pontoons) and to the south is primarily housing. The majority of the Riverside area is occupied by woodland and walking paths. Two INEOS oil pipelines run through the Site from west to east and two fenced valve compounds are present.

9.4.6 The smaller western area (Woodbank House) is accessed via a track from Old Luss Road. The majority of the Site area comprises two relatively flat lying open fields, however, in the west is an area dominated by woodland and the ruins of an old hotel and outbuildings.

9.4.7 The Site in general is relatively flat lying however in the eastern area ground levels fall away towards the River Leven. The INEOS oil pipeline runs from west to east through the northern part of the Site and for the most part is situated within a cutting. Woodland areas are hummocky, with level variations in the region of 2 to 3m. Other mounds and hollows at the Site may be related to the superficial quarrying of sands and gravels. The western part of the Woodbank House area includes some steeply sloping ground which is thought to be a natural feature, possibly due to the effects of glacial movement

9.4.8 During the 2017 ground investigation, a belowground void was encountered in the east of the Site at borehole WS 40. It was later suggested that this void relates to a redundant 18” culvert at approximately 2m depth.

Historical Land Use

9.4.9 This summary is based on information from historical Ordnance Survey (OS) maps, which were included within the 2015 AECOM Phase 1 Desk Study.

9.4.10 The Lomond Banks site has a varied history. There is no record of heavy industrial land uses within the Riverside site, however, multiple small quarries were active, particularly in the northern and western areas. The eastern area (beside the slipway) was dominated by railway infrastructure from Balloch Station in the south to Balloch Pier in the north. A dye works was located immediately offsite to the south; however, this area is currently occupied by housing.

9.4.11 The majority of the Woodbank House area remained undeveloped from 1864 until present. The exception to this being the hotel and outbuildings present within the sloping woodland area in the west of the Woodbank House area. On later mapping the hotel was labelled as Hamilton House. The hotel building was destroyed in a fire in 1995. The majority of the building was ruined; however, the façade remains standing. The various outbuildings are in a state of severe disrepair.

Published Superficial Geology

9.4.12 The British Geological Survey (BGS) 1:50 000 scale geological map of the area, Sheet 30W and part of 29E (Scotland) - Drift “Greenock” (BGS, 1989) indicates the presence of some superficial deposits overlying the solid geology within the Site boundary. The superficial deposits comprise three main types:

- Raised Marine Deposits – Clay, silt, sand and gravel. Formed in shallow seas with mainly siliciclastic sediments. This is indicated to be present adjacent to and following the southern shoreline of the loch;

- Glaciofluvial Sand and Gravel – gravel, sand and silt formed in cold periods with Ice Age glaciers scouring the landscape and depositing moraines of till with outwash sand and

gravel deposits. These deposits are indicated to be present across the greater part of the Woodbank and Riverside sites; and,

- Till (Diamicton) – these deposits were formed in cold periods with Ice Age glaciers scouring the landscape and depositing moraines of till with outwash sand and gravel deposits. These deposits are indicated to be potentially present along the western part of the Woodbank House area.

9.4.13 In addition, the BGS mapping also shows areas of man-made deposits (Made Ground) being present and these are annotated by the BGS as being "deposited on original ground surface". These occur in two locations, being; in a narrow strip along the banks of the River Leven (Slipway) to the east of Pier Road (along the alignment of the former railway line); and in an area of ground to the North of Balloch Road and extending beneath Clairnish. Furthermore, infilled ground (annotated as being manmade deposits - filling former opencast excavation) is marked as a parcel of land to the east of Old Luss Road and northwest of Ben Lomond Way, however this is believed to be outside of the Site boundary.

9.4.14 The Geology of Britain viewer on the BGS website indicates that there are also deposits of Alluvium present at the Site, described as clay, silt, sand and gravel, and shown as a ribbon extending from the shore of Loch Lomond, adjacent to the River Leven and along the alignment of the former railway line, predominantly to the east of Piers Road. These deposits may be present beneath any Made Ground.

Published Solid Geology

9.4.15 The 1:50 000 scale geological map of the area, Sheet 30W and part of 29E (Scotland) - Solid "Greenock" (BGS, 1990) indicates that the Site is entirely underlain by the Teith Sandstone Formation of the Devonian Period.

BGS Boreholes and Historical Investigations

9.4.16 There are a number of BGS Borehole records available within the boundary of the Riverside site, and the deepest of these undertaken in 1998 for Balloch Footbridge (adjacent to the northern boundary of the Site) indicates that depth to bedrock is in excess of 35m at that location.

9.4.17 The 2015 Phase 1 Desk Study summarises the ground conditions indicated by previous ground investigations carried out at the Riverside site and identifies the presence of Made Ground and 'Organic Soils' overlying 'Fluvio/Upper Glacial Deposits', 'Glacial Till' with Bedrock (sandstone) encountered at depths of between 51m below ground level (m bgl) and 69m bgl. It is considered that the descriptor 'Organic Soils' could represent Alluvium.

9.4.18 There are no BGS borehole records from within the Woodbank House area. The closest BGS records relate to a string of shallow (generally <5m) boreholes drilled along the A82, to the west of the Woodbank House area boundary. The boreholes typically reached depths of around 4.0mbgl and described 'Soft, friable or dense clayey SAND with cobbles' to around 1.5mbgl followed by 'Hard or Stiff sandy clay with boulders'

9.4.19 Two of the boreholes to the north / west of Woodbank (close to Stoneymollan Road / Roundabout) encountered sandstone bedrock at 5m – 6.5mbgl.

9.4.20 The historical boreholes indicate that the depth to bedrock may be highly variable within the area of the Riverside / Woodbank House areas. Sandstone was encountered at a depth of 52.65m at Balloch Station (southern end of Riverside), whilst in close proximity to the roundabout at the southern tip of Woodbank House area sandstone was recorded at 5.0m.

2017 Ground Investigation

9.4.21 The 2017 ground investigation comprised 57 window sample boreholes to depths of up to 5m below ground level (mbgl). However, as a result of frequent obstructions which prevented drilling progress, several attempts were made at achieving depth at many of the boreholes and as a result, the total number of boreholes attempted was 73. Borehole locations and a summary of shallow ground conditions are shown on **Figure 9-1** of **Appendix 9.1** and within the 2017 Ground Investigation report, **Appendix 9.2**. The following section summarises the ground conditions encountered in the boreholes.

Made Ground

9.4.22 Made Ground was encountered in forty-six out of seventy-three window sample boreholes, either from the ground surface or below a relatively thin layer of topsoil, to depths of between 0.15m bgl and 3.5m bgl. With the exception of WS07 on the Woodbank House area, Made Ground thicknesses in excess of 1m were encountered predominantly to the east of Pier Road (as shown on **Figures 9-1** and **9-2** of **Appendix 9.1**), where a former railway line used to cross the Site on an embankment. The borehole descriptions of the Made Ground indicate that it varies in composition from being a predominantly cohesive deposit comprising very soft gravelly sandy clay, to more typically a granular deposit, being a very loose sand and gravel or organic silty gravelly sand. Each deposit contains varying quantities of cobbles, ash, glass fragments, pottery and brick fragments.

9.4.23 A programme of geochemical laboratory testing was carried out on selected soil and groundwater samples to determine the concentrations of a range of commonly occurring potential contaminants as part of the investigation. In addition, monitoring wells installed in selected boreholes were monitored on six occasions to enable a risk assessment of potentially hazardous ground gases.

Alluvium

9.4.24 Material considered to represent Alluvium was encountered in fourteen of the seventy-three window sample boreholes, at depths between 0.2m bgl and 5.0m bgl. The Alluvium was only encountered in the eastern part of the Site, between Pier Road and the River Leven. The Alluvium was typically described as very soft and soft peaty sandy Clay, but it is noted that beds (full thickness not proven but up to at least 2.85m) of very soft and soft sandy clayey Peat were encountered, as shown on **Figure 9-1** of **Appendix 9.1** within the middle part of the Site area east of Pier Road. The Alluvium is also occasionally encountered as a very loose and loose silty Sand. An additional window sample borehole containing 2.5m thickness of peaty Sand overlying sandy Peat was encountered at WS16 located offsite between Riverside and Woodbank.

Till (Diamicton)

9.4.25 Material considered to represent Till was encountered in five of the seventy-three window sample boreholes, all located in the western part of the Woodbank House area (**Figure 9-1** of **Appendix 9.1**). The Till was encountered at depths of between 0.1m bgl and 1.7m bgl and was typically described as a firm to stiff gravelly sandy Clay. The gravel was recorded as being flat to elongated subangular to rounded igneous rock and other lithologies. Some high value SPTs were recorded in the deposit which are considered to represent larger gravel /boulder elements present.

Glaciofluvial Deposits

9.4.26 Material considered to represent Glaciofluvial deposits was encountered in fifty-one out of seventy-three window sample boreholes, at depths from existing ground surface to 4.8m bgl. These deposits were typically encountered in the western part of the Riverside site and the eastern part of the Woodbank House area (**Figure 9-1** of **Appendix 9.1**). These deposits were typically described as medium dense Sand and Gravel, silty gravelly Sand and silty Sand, but also occasionally as gravelly sandy Clay. The gravel inclusions are described generally as elongated, sub angular to sub rounded, fine to coarse of quartz, sandstone, igneous rock and other lithologies.

Hydrogeological Setting

9.4.27 The 2015 Phase 1 Desk Study indicated that earlier ground investigations at the Site identified groundwater strikes in the ‘majority of exploratory locations’ and that ‘groundwater at the Site was in general hydraulic continuity with the River Leven at the level between 7.54m above Ordnance Datum (AOD) and 8.89m AOD.

9.4.28 During 2017 phase of investigation, groundwater was only encountered during drilling in fourteen of the seventy-three window sample boreholes, at variable depths of between 0.8mbgl and 3.7mbgl, predominantly located in the Made Ground, Alluvium and Glaciofluvial Deposits in the east of the Site. It is noted that the surface datum level of each of the boreholes was not recorded and as such the relative level of groundwater during this phase of investigation cannot

be determined. In subsequent monitoring visits, around 13 of the 36 installed boreholes remained dry.

9.4.29 The groundwater encountered is considered to be perched water, existing in pockets of more permeable strata (such as Sands and Gravels), restricted by lower permeability deposits (such as clays), rather than a continuous shallow groundwater body.

9.4.30 The SEPA Water Classification Hub indicates that both the superficial and bedrock groundwater bodies beneath the Site – the Loch Lomond and Leven Sand and Gravel groundwater (ID 150766) and Balloch groundwater (ID 150651), respectively – have both been given a status of Good by SEPA in 2020 (the latest available data).

9.4.31 The 2015 Phase 1 Desk Study stated that there were no known abstraction boreholes within 250m of the Site. Information requests have been sent to SEPA and WDC to confirm the absence of abstraction boreholes, however no response has been received at the time of writing.

Hydrological Setting

9.4.32 The nearest surface water features to the Site are Loch Lomond which is situated immediately to the north and the River Leven which is situated immediately to the east and enters the Loch adjacent to the north eastern point of the Site.

9.4.33 The SEPA Water Classification Hub indicates that Loch Lomond (ID 100257) and the River Leven (ID 10150) have both been given a status of Moderate ecological potential by SEPA in 2020 (the latest available data).

9.4.34 Information on nearby discharge consents was summarised in the Phase 1 Desk Study which includes a Landmark Envirocheck report. The only potentially extant discharge consent within the Site boundary relates to consent grated to Dumbarton District Council by SEPA to discharge 'public sewage: septic tank' into the River Leven. The consent was issued 19th January 1993. It is not known whether this is ongoing.

9.4.35 A flood risk assessment has been undertaken and is reported in this EIA Report under a separate chapter (see **Chapter 10 and Appendix 10.1**).

Other Potential Geological Hazards

9.4.36 Radon is a naturally occurring radioactive gas and emanates from geological formations to varying degrees, depending on the type, porosity and permeability. An assessment of potential for radon gas to be present is given in the 2015 Phase 1 Desk Study and indicates that the site is in the lowest category for potential radon risk. The online radon map of Scotland confirms this assessment (UK Government, 2011).

9.4.37 Based on the conclusions of the 2015 Phase 1 Desk Study and the Coal Authority website, the Site is not considered to be in an area where coal mining has occurred.

Geo-Environmental Conditions – Soil

9.4.38 The majority of the site has remained undeveloped. The main exceptions to this are the area of railway land in the east, the small superficial quarries (potentially backfilled with material of unknown origin) and the buildings associated with the hotel at the Woodbank House area. These areas are considered the main potential sources of onsite contamination.

9.4.39 **Table 9-5** below summarises the potential sources of contamination.

Table 9-5: Summary of Sources of Potential Contamination

Source	Comment
Onsite	
Railway land	Railway land is a potential source of contamination from the material used as ballast (including clinker and ashy material) as well as operational leaks and spills.
Made Ground	Made Ground or fill material of unknown origin can be a source of a range of contaminants including organic and inorganic compounds. Asbestos may be present within demolition rubble. If organic material is present, microbial decay can generate ground gases.
Peat / Organic Soils	Microbial decay can generate ground gases.

Source	Comment
Offsite	
Dye-works	Potential for waste material from the adjacent historical dye works being deposited onsite. The dye works may have affected groundwater, subsequently migrating below the Site.

9.4.40 The following sections summarise the contamination status of soils based on the results of soil sample analysis and assessment presented in the 2017 interpretive report which is included in its entirety as **Appendix 9.2**.

9.4.41 It is noted that, in the absence of a detailed master plan for the site in 2017, the preliminary investigation used the most conservative available soil assessment criteria which are designed to be protective of human health in residential settings with private gardens.

Woodbank House

9.4.42 Despite the presence of Made Ground near the existing / ruined buildings, no potentially significant contamination was encountered in soil samples recovered from the Woodbank House area.

9.4.43 It should be noted that no investigations have been undertaken from within the building footprints.

9.4.44 Given that the main hotel building was destroyed by fire, the potential exists for limited contamination to exist in soils within the building footprint. In particular, polycyclic aromatic hydrocarbons (PAHs) are often associated with combustion. If asbestos containing materials were present in any of the structures onsite, the potential exists for asbestos to be present in structures or rubble that currently remain onsite.

9.4.45 It is understood that the remnants of the hotel will be retained and developed into holiday apartments. Additional ground investigation locations are likely to be required within the existing / ruined building footprints to confirm the ground conditions in this area.

West Riverside

9.4.46 No potentially significant contamination was encountered within soil samples recovered from the natural soils to the west of Pier Road or South of Ben Lomond Way.

East of Pier Road / West of River Leven / North of Ben Lomond Way

9.4.47 Elevated concentrations of heavy metals (lead and less frequently, arsenic and hexavalent chromium) were encountered within Made Ground soils to the east of Pier Road and North of Ben Lomond Way. These are likely to be associated with the former railway land and activities and potentially linked to the offsite dye works.

9.4.48 Concentrations of lead ranged from a maximum of 5,100mg/kg (in WS47) to a minimum of 5.1mg/kg. The average concentration of lead was 268mg/kg. The most conservative assessment criteria for lead is 200mg/kg which is the Category 4 Screening Value (C4SL) for soils in a residential garden scenario (the most conservative criterion). Fourteen soil samples contained concentrations of lead above the C4SL of 200mg/kg. The 14 locations, together with the lead concentrations are included on **Figure 9-2** of **Appendix 9.1**.

9.4.49 With the exception of WS46 (which is in close proximity to Pier Road), all of the potentially elevated concentrations of lead were located in Made Ground to the East of Pier Road and north of Ben Lomond Way.

9.4.50 A single soil sample contained a concentration of arsenic that was above the threshold for residential garden soil (65mg/kg arsenic in WS38). This location is indicated on **Figure 9-2** of **Appendix 9.1**. A single soil sample contained a concentration of hexavalent chromium that was above the threshold for C4SL for soils in a residential garden scenario (8mg/kg hexavalent chromium in WS49). The elevated chromium concentrations correspond approximately with an area that driller noted some green colouration in soils during the site investigation.

9.4.51 No asbestos was encountered in any of the 63 samples analysed from West Riverside and Woodbank House.

9.4.52 The elevated concentrations of heavy metals in Made Ground summarised above will require further assessment in the context of the revised development plan.

9.4.53 The end use scenario in the area to the east of Pier Road / west of River Leven will be holiday accommodation based on woodland lodges linked by woodland paths. A monorail is proposed to travel across this area from south to north. There will be car parking in the northern part and commercial uses in the southern area including a brewery and a bike shop. As such, the potential for exposure of future site users to contamination in soils will be reduced compared to the residential gardens scenario used as a nominal (conservative) preliminary assessment scenario and should be reassessed accordingly.

9.4.54 The area to the north of Ben Lomond Way is proposed for a visitor hub, indoor water park and an apart hotel with car parking. As such, there will be very limited exposure of future human site users to any contamination present in soils.

Geoenvironmental Conditions – Groundwater

9.4.55 Samples from 15 boreholes across the site recorded concentrations of heavy metals that were, in some cases, elevated by comparison to the most conservative assessment criteria typically Annual Average (AA) EQS. However, with the exception of zinc and copper (which do not have a Maximum Allowable Concentration EQS), none of the samples were elevated by comparison to the less conservative Maximum Allowable Concentration (MAC) EQS.

9.4.56 The EQS for both copper and zinc are based on bioavailable concentrations, whereas the laboratory results are for the dissolved metals regardless of bioavailability. The actual bioavailable proportion would inevitably be lower than the total amount measured.

9.4.57 EQS thresholds are designed to be protective of the freshwater environment and are therefore intended to be applied at a compliance point within the surface water, after dilution has occurred, or to direct discharges. Therefore, it is highly conservative to compare these thresholds to samples of ground water recovered from boreholes within made ground or natural soils.

9.4.58 Both the River Leven and Loch Lomond have both been given a status of Moderate ecological potential by SEPA in 2020.

9.4.59 It is considered highly unlikely that groundwater from the Site is causing significant pollution of Loch Lomond or the River Leven as a result of the marginal concentrations of contamination encountered here. Contaminants have been recorded at relatively low concentrations and are likely to exhibit relatively low mobility through soil pores. The rate of flux of shallow perched groundwater from below the site into Loch Lomond is likely to be low. Furthermore, if contaminated groundwater from the site did reach the river or loch, the effect of dilution from such a large body of water would be highly effective.

Geoenvironmental Conditions – Ground Gas

9.4.60 Ground gasses were measured in 36 boreholes across the site on six occasions. The results and a ground gas risk assessment are included in **Appendix 9.2**.

9.4.61 Using the approach recommended in CL:AIRE (2012) and endorsed in BS 8485:2015, the Woodbank House area and the area of the Riverside site to the west of Pier Road and south of Ben Lomond Way may be classified as Characteristic Situation 1 (CS1) as defined in BS 8485:2015. This situation is representative of ground with a very low potential for gas generation. For CS1, BS 8485:2015 advises that no special gas protection measures are required.

9.4.62 Within the areas to the east of Pier Road and the north of Ben Lomond Way the site is classified as Category Situation 2 (CS2) for gas. This is due to the carbon dioxide (CO_2) and methane (CH_4) being recorded at concentrations above the trigger values of 5% and 1% respectively during the monitoring even though flow rates remained low.

9.4.63 The elevated concentrations of ground gases correspond with Made Ground and peaty soils.

9.4.64 Although flow rates remained low, depending on the nature of the structures proposed for this area, there may be a requirement to incorporate gas protection measures. The appropriate gas protection measures are dependent on the proposed building design and end use, however, typically gas protection measures comprise a combination of barrier (e.g. concrete slab, gas resistant membrane) and a ventilation layer (e.g. a void space).

Ground Stability Hazards and Geotechnical Considerations

9.4.65 If buried services that are sensitive to settlement (e.g. sewers) are required within the eastern area, it may be necessary to avoid areas of Peat, excavate and replace Peat or use ground improvement techniques.

9.4.66 Shallow spread foundations are unlikely to be suitable within the eastern area where deeper Made Ground, Alluvium and Peat are present.

9.4.67 The measured pH values and concentrations of water soluble sulphate measured on samples of soils recovered as part of the preliminary ground investigation are summarised in **Appendix 9.2** below. It is assumed that the groundwater conditions at the Site are mobile and therefore it is considered that the Aggressive Chemical Environment Concrete (ACEC) class for the site is AC2z.

9.4.68 Utilities including the INEOS High Pressure Oil Pipeline and other gas apparatus are known to be present below the surface of the site. Known utilities (and where available, standoff zones) are included the figures in **Appendix 9.2**.

9.4.69 A belowground void was encountered during hand digging at borehole WS 40. It was later suggested that this void relates to a redundant 18" culvert at approximately 2m depth. The direction and extent of this feature is not known and may require further investigation with an excavator. This feature is not included on service plans which have been reviewed (and are included the figures in **Appendix 9.2**) which suggests that it is not Scottish Water plant.

9.4.70 The eastern area of the site is known to have had extensive rail lines running north / south. The extent to which these rail lines have been removed or simply buried is not known.

Summary of Identified Sensitive Receptors

9.4.71 Sensitive receptors will include development and maintenance workers, future users, surface and groundwater and proposed buildings and structures, as shown in **Table 9-6** below.

Table 9-6: Summary of Sensitivity of Potential Receptors

Receptor	Sensitivity	Comment
Site Workers	High	Ground workers and construction workers are likely to come into direct contact with soils, albeit for a short period of time.
Future Site Users	High	Future users include employees, day visitors and residential tourists who will have variable exposure scenarios to the potential contaminants/ground gases.
Offsite Users	High	Off-site workers, visitors and residents including potential groundwater users.
Groundwater Resources	High	The superficial and bedrock aquifers beneath the Site have been classified by SEPA has being in Good condition, with a target of continuous improvement. The superficial groundwater encountered during the ground investigation is considered to be perched rather that a continuous groundwater body.
Surface Water Resources	Moderate	The site is immediately adjacent to the River Leven and Loch Lomond which are considered to be of Moderate ecological potential.
Built Environment	Moderate	Proposed buildings are potentially at risk from aggressive ground conditions caused by low pH or high sulphate and from the build-up of gases in confined spaces.

Baseline Evolution

9.4.72 In the absence of the proposed development, the future baseline conditions would likely remain consistent with the existing conditions onsite.

9.4.73 However, as described in **Chapter 10**, climate change may cause higher water flows and more frequent and intense rainfall events which would likely result in higher water levels in the adjacent Loch Lomond and River Leven. Higher groundwater levels could form a pathway (linkage) through the mobilisation of ground contamination present onsite which could have an adverse effect on the nearby waterbodies, and possibly, human health receptors.

9.5 Embedded Mitigation

9.5.1 As detailed in **Chapter 2**, a number of design features and embedded mitigation measures have been incorporated into the design and construction of the proposed development to avoid, prevent, or minimise significant adverse environmental effects and to enhance the beneficial effects.

9.5.2 The embedded mitigation measures of relevance to this assessment are set out below.

- Construction Environmental Management Plan (CEMP) will be prepared and implemented during the construction phase of the proposed development. The purpose of the CEMP is to mitigate any adverse environmental effects and will specifically include the following:
  - A watching brief for the visual and olfactory assessment of the soil and groundwater (if encountered) will be maintained with sampling and testing for verification and assessment purposes where necessary;
  - Contaminated hotspots plan (procedure for encountering unexpected contamination);
  - Surface water and groundwater protection measures (including an emergency spillage response procedure) and working to the SEPA GGP (guidance for pollution prevention) 5: Works and maintenance in or near water;
  - GPP 2: Above ground oil storage tanks, GPP 8: Safe storage and disposal of used oils and GPP 26 Safe storage – drums and intermediate bulk containers;
  - GPP 13: Vehicle washing and cleaning;
  - GPP 21: Pollution incident response planning;
  - GPP 22: Dealing with spills;
  - Details around dust suppression measures, which will be required during periods of prolonged dry weather;
  - An exclusion zone will be present around either side of the INEOS gas pipeline;
  - If required, remediation is likely to comprise localised excavation of contaminated soils and / or capping with clean material to present a barrier between contamination and receptors. In the case of proposed buildings or areas of hardstanding, the barrier will be integral to the design of the new development;
  - If required, gas protection measures will be incorporated into the design of the proposed buildings to protect the building structures and human health (future end users). Depending on the design of certain structures such as woodland lodges, the requirement for gas protection measures may be mitigated by the presence of an air gap beneath the buildings;
  - Site-specific risk assessment specifically designed to assess the risks posed by piling. Ultimately, if piled foundations are required, the technique used will be selected on the basis of protecting deep groundwater from contamination; and,
  - Risk Assessments and Method Statements (RAMS) will be prepared. Construction/ground workers should take cognisance of the contamination reported and will be required to work in accordance with the RAMS which will include the use of appropriate safety equipment and personal protective equipment (PPE).

9.5.3 In relation to geology and ground conditions, it is not anticipated that specific embedded mitigation will be required at the operational phase of the proposed development.

9.6 Assessment of Likely Effects

9.6.1 This section is an assessment of the potentially significant effects from the proposed development on the sensitive receptors identified in **Section 9.4** (summarised in **Table 9-6** above). It also considers the effects of potentially contaminated ground or groundwater conditions on the proposed development.

9.6.2 The assessment of effects takes the embedded mitigation (identified in **Section 9.5** above) into account.

Construction Phase

Human Health (Construction Workers)

9.6.3 The risk to site workers during the construction works relates to the risk of skin contact, inhalation and ingestion of contaminated material on the site. In accordance with current health and safety legislation, the contractor will be required to adopt measures to mitigate the risk to site workers.

9.6.4 Based on site investigations to date, it has been established that there are some potentially elevated contaminants in soils at the Site associated with the former neighbouring works, infilled Made Ground and naturally occurring Peat which can produce ground gasses. However, the likelihood of severe / mobile contaminations is considered low.

9.6.5 Localised, potentially elevated contaminants were identified during the previous preliminary ground investigation, including hotspots of heavy metals (lead and less frequently, arsenic and hexavalent chromium) in the Made Ground in the eastern part of the Site.

9.6.6 The Woodbank House area while free of identified contaminant may have issues associated within the footprint of the former hotel which was destroyed by fire and in some areas has therefore not been fully investigated at this stage.

9.6.7 Humans are considered highly sensitive receptors. Without prior knowledge of the Site or appropriate planning and mitigation measures, construction workers' health could potentially be adversely affected by contamination. It is noted that the assessment presented in the 2017 report used the assessment criteria for residential soils in private gardens. These are based on the potential long-term exposure of residents to soils. It would be highly conservative to apply these assumptions (and therefore these assessment criteria) to construction / groundworkers who are only likely to come into contact with soils for a brief period of time during belowground work.

9.6.8 Following the completion of the proposed development, the presence of hardstanding / buildings and managed landscaping will reduce infiltration (and therefore potential migration) of contamination in the subsurface. Pathways to sensitive receptors will be broken and no direct contact with workers or users will result.

9.6.9 Once the embedded mitigation has been implemented, the construction phase of the proposed development is likely to have a direct **Minor Adverse** effect on construction workers.

Human Health (Neighbours)

9.6.10 Measures will be adopted to mitigate the risk to offsite users associated with air borne or settled dust arising from areas of potentially contaminated land. Such measures will include the selection of appropriate methods to reduce disturbance to the existing near-surface soils present on the Site, such as the spraying of stockpiles and other large, unsealed surfaces to limit the risk of generating air borne dust and covering of excavated materials.

9.6.11 Dust mitigation measures may be required in the event of prolong warm dry weather.

9.6.12 Once the embedded mitigation has been implemented, the construction phase of the proposed development is likely to have an indirect **Minor Adverse** effect on neighbours.

Water Environment (Groundwater and Surface Resources)

9.6.13 It is considered highly unlikely that groundwater from the Site is causing significant pollution of Loch Lomond or the River Leven as a result of the marginal concentrations of contamination encountered. Contaminants have been recorded at relatively low concentrations and are likely to exhibit relatively low mobility through soil pores. The rate of flux of shallow perched

groundwater from below the site into Loch Lomond is likely to be low. Furthermore, if contaminated groundwater from the site did reach the river or loch, the effect of dilution from such a large body of water would be highly effective.

9.6.14 Without prior knowledge of the Site or appropriate planning and mitigation measures, it is possible that construction techniques (notably piling, deep excavations and ground improvement) could mobilise contaminants and / or introduce pathways via which contaminants could migrate to the groundwater. However, mitigation (considered as embedded mitigation in this assessment) will be required as good construction practice in accordance with the CEMP and CAR regulations.

9.6.15 There is potential however, for the accidental release of stored fuels and chemicals directly affecting localised areas of the surface water and groundwater quality during the construction of the proposed development. These pollution incidents may occur due to incorrect storage / transport / use of materials such as fuels, oils and chemicals. With containment in place, any accidents may result in the containment system being affected and a greater risk of measures being defeated. The presence of hardstanding / buildings and surface planting should reduce infiltration (and therefore migration).

9.6.16 Overall, once the embedded mitigation has been implemented, the construction phase of the proposed development is likely to have a **Minor Adverse** effect on the water environment (both groundwater and surface water resources).

Operational Phase

Human Health (Future Users)

9.6.17 There is the potential for future site users and maintenance workers to be affected by exposure to potential contaminants including metals and asbestos where Made Ground material is to remain in place in any proposed soft landscaped areas.

9.6.18 Based on the ground gas risk assessment, future users could be exposed to hazardous ground gases within any buildings or confined spaces, and the risk level is variable across the different areas of the Site. The ground gas risk assessment has characterised the Site and provides preliminary recommendations for mitigation measures to be incorporated into design of buildings at the Site which would result in a **Negligible** effect which is Not Significant.

Built Environment

9.6.19 The built environment, including foundations and services, can be affected by aggressive ground conditions, particularly sulphates and acids. Once the embedded mitigation has been implemented, the operational phase of the proposed development is likely to have a **Negligible** effect on the build environment.

9.6.20 In relation to ground instability, subject to appropriate ground investigation, geotechnical assessment and design, it is not anticipated that there will be any effects during operation of the Proposed Development.

9.7 Further Mitigation and Enhancement

9.7.1 The following additional mitigation measures are proposed to ensure that detailed design stages are informed by

- Additional intrusive investigation will require to be undertaken in specific localised areas to inform detailed design and delineate contamination. The results will be assessed in the context of the detailed master plan and, if required, a remediation strategy will be developed; and,

- Further intrusive investigation may be required in within and around the derelict buildings in the Woodbank House area to determine the potential for contaminants of concern including asbestos and PAHs. It is understood that the existing relic buildings will be renovated to form apartment accommodation.

9.8 Residual Effects

9.8.1 Taking account of all proposed mitigation and enhancement measures, the likely residual effects from the construction and operation of the proposed development on ground conditions are identified in **Table 9-7** below.

Table 9-7: Summary of Likely Residual Effects Related to Ground Conditions (Construction Phase)

Receptor	Residual Effect Significance	Justification
Human Health (site workers)	Minor Adverse	The Contractor will take cognisance of the investigation works undertaken and prepare Risk Assessment Method Statements (RAMS) as appropriate. The CEMP will document the procedures to minimise and manage spillages from chemical storage, dust generation, dewatering discharges and run-off. The possibility exists for unexpected conditions to be encountered during groundworks, therefore a watching brief should be maintained. Work should be halted in the event of unexpected, potentially detrimental conditions pending further assessment.
Human Health (future site users, workers, guests, customers and maintenance workers)	Not Applicable	Not a construction phase receptor.
Water Environment	Minor Adverse	Construction phase will occur following some further site investigation and, if necessary, site remediation. As such, contaminants in the subsurface will have been quantified and deemed to pose an acceptably low risk or remediated. Piling and / or other ground improvements / deep excavations will only take place following a specific risk assessment and method statement. Techniques to minimise the creation of pathways / mobilisation of contaminants will be employed. The CEMP will document the procedures to minimise and manage spillages from chemical storage, dust generation, dewatering discharges and run-off.
Built Environment	Not Applicable	Not a construction phase receptor.
Ecological Systems	Not Applicable	No designated ecological sites have been identified in the vicinity, mitigation measures for the site Ecology are addressed in other Chapters of this EIA.

9.9 Monitoring

9.9.1 In the absence of any likely significant adverse effects, no monitoring is considered to be proportionate or required.

9.10 Cumulative Effects

9.10.1 There are no cumulative developments of relevance to the assessment of ground conditions.

9.11 Summary

9.11.1 This chapter of the EIAR provides an assessment of the likely significant effects from the proposed development on ground conditions. It also assesses the effects from the ground conditions such as potential contamination on the proposed development.

9.11.2 The Woodbank House area is currently occupied by fields used for grazing, vegetated with woodland and various ruined buildings formerly associated with a hotel. The West Riverside area is occupied by woodland and walking paths and two INEOS oil pipelines run through the site from west to east.

9.11.3 A ground investigation undertaken in 2017 has characterised ground conditions across the Site, which comprise natural drift deposits with Alluvium (soft, sandy, clayey peat) primarily to the east of Pier Road, Glaciofluvial Deposits (sands and gravels with silt and clay), Till (gravelly sandy clay) and Made ground of more than 1m thick (almost entirely restricted to the eastern part of the site where former railway lines ran).

9.11.4 Soils containing potentially elevated contaminants were primarily restricted to the area to the east of Pier Road and to the North of Ben Lomond Way. The primary contaminant of concern was lead which was potentially elevated in 14 soil samples. There are single isolated occurrences of potentially elevated concentrations of arsenic and chromium (VI), respectively. More detailed assessment of the potential risks posed by contaminants will be undertaken in the context of detailed design following this PPiP stage. It is likely that some remediation measures will be required in the eastern area where woodland cabins are proposed, however, if required, remediation is likely to be localised excavation and / or capping of contaminated soils.

9.11.5 The results of the analysis of groundwater samples have confirmed the presence of slightly elevated concentrations of heavy metals in some of the boreholes. The concentrations encountered are considered not likely to pose a significant risk to the sensitive water environment receptors (Loch Lomond and River Leven).

9.11.6 Ground gas monitoring indicates that the area east of Pier Road and north of Ben Lomond Way will be classified in accordance with British Standard BS 8485 as Characteristic Situation 2 (CS2) as a result of concentrations of carbon dioxide and methane in exceedance of trigger values. The design of buildings in these areas may require the inclusion of gas protection measures, however, the nature and need for protection measures will be to some extent dependent on the design and characteristics of the buildings. The results for the remainder of the site indicate that it would be classified as Characteristic Situation 1 (CS1) and no gas protection measures will be required.

9.11.7 Additional area-specific site investigation will be designed to quantify the potential sources of contamination and to inform the design of the remediation / mitigation measures to be adopted. Investigations will also be required to target areas of potential instability associated with former Made Ground deposits and in areas of Peat and at heavily loaded or unusual structures such as the swimming pool and monorail stanchions.

9.11.8 Once embedded mitigation is taken into account, the likely construction and operational phases of the proposed development effects result in Minor Adverse effects which are considered to be Not Significant.

9.12 References

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