Phase 1 Geoenvironmental Desk Study

Northfleet,

Kent, DA11 9AD

for

Hyro Energy Ltd

G-22-049

May 2023

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Executive Summary

Site Description	The site is 560m long (N-S) and 215m wide (E-W) maximum dimensions of c. 10.1ha area, within the existing Kimberley Clark paper mill facility, located in Northfleet on the south bank of the River Thames, Kent. It is understood that the proposed development will comprise a hydrogen gas production plant, Green Hydrogen 3.
Site History	• The site formerly comprised a chalk quarry which by the mid 19th Century was occupied by residential houses and gardens, tramway and earthworks embankments, wharf, iron foundry, brickworks and limekilns until the 1950s. Since the 1960s the site has been occupied by a paper mill with associated storage tanks, effluent treatment plant and boiler house (currently gas oil fired). • The adjacent land has been occupied by a dockyard and wharf, chalk quarry, limekilns, paper mill, power station and cement works.
Geology	• Superficial drift: BGS records including historic borehole records indicate superficial deposits to underlie the site, primarily comprising made ground, with potential alluvial deposits below the northern boundary adjacent to the River Thames. • Solid geology: Chalk strata at shallow depth. • No geologic faults recorded on site. • The majority of the site lies within an area with very low risk of ground dissolution of soluble rock apart from the southern boundary which is at low risk.
Environmental	• The site lies 40m south of the River Thames adjacent to a jetty. • Superficial deposits below the northern boundary comprise a Secondary Undifferentiated aquifer of high groundwater vulnerability. • Bedrock comprises a Principal Aquifer of high groundwater vulnerability. • No Nitrate Vulnerable Zones within 2000m. • 1 No. licensed surface water abstraction within 2000m, 865m NW. • 15 No. licensed groundwater abstractions within 500m. 2 No. on site relating to boiler feed supply. • Within Source Protection Zones from 1 to 3. • No discharge consents relate to the site and 10 No. within 250m. • 1 No. pollution incidents on site dated 2003 relating to firefighting run-off. 2 No. 31m NE dated 2006 relating to inert wastes.
Flooding	• Site is designated to be at very low risk of tidal flooding. • The main site area lies within a Flood Zone 2 and northern perimeter Flood Zone 3.

	• High risk of surface water flooding. • Moderate to high risk of groundwater flooding
Contamination	• Various previous contaminative land uses have been identified on site and adjacent to the site which present potentially contaminative processes and are considered to present a moderate to high risk of potential mobile contaminants to the site.
Ground Gas	• Low risk of ground gas generation. • No radon protective measures are required for buildings in this area
Drainage	• The site is underlain by variable made ground directly overlying the Chalk bedrock which is classified as a Principal Aquifer with an anticipated shallow water table, therefore, it is unlikely that soakaway drainage systems will be suitable.
Recommendations for Ground Investigation	Targeted ground investigation to include: • Window sample boreholes to allow for in-situ testing, sampling and installation of gas/groundwater monitoring wells. • Trial pits to assess shallow ground conditions, prove the presence or not of buried obstructions and allow sampling of made ground. • Geotechnical and chemical laboratory testing of soils and bedrock for contamination/pollution risk assessment and foundation design. • Gas and groundwater monitoring – 6 visits over a 3 month period. • Factual and interpretive report.

The executive summary should not be read or used in isolation and reference should be made to the full report which provides a detailed assessment of the risks potentially affecting the development.

1.0 Introduction

1.1 Commission

GVR Geoservices Ltd (GVR Geo) was appointed by Renewable Energy Systems (RES) Ltd on behalf of Hyro Energy Ltd to undertake a Phase 1 Geoenvironmental Desk Study for the proposed development of a hydrogen gas manufacturing plant at the Kimberley Clark paper mill site in Northfleet, Kent, DN11 9AD. The site is on the south bank of the River Thames with a river frontage and an in-river berthing docks. A site location plan is presented as Drawing No. G-22-049-001 in Appendix A**.**

1.2 Proposals

It is understood that the Hyro Energy Ltd propose to construction a new hydrogen gas production facility at the site, including hydrogen electrolysers, substations, hydrogen storage tanks and supply connection pipelines, together with office and equipment containers. In addition, at some point in the future (not under consideration here) a new dual fuel hydrogen and natural gas fired boiler is to be installed to replace the existing natural gas fired boiler, initially running in tandem during commissioning. The proposed layout of the hydrogen facility is shown on RES Drawing No. 05135-RES-PRO-DR-PE-001 Rev. 3 in Appendix A. Much of the new proposed construction is to be containerised plant brought onto site and set up on prepared hardstanding but includes new underground infrastructure (e.g. cabling routes and surface water drainage measures) for the proposed development.

This report is required to support the planning application for the proposed development and to inform the works of potential land contamination and remedial actions to facilitate the construction works.

1.3 Objectives

The objectives of this report are as follows:

- Conduct a site walkover survey of the land to look for evidence of potential land contamination.
- Assess the land use history and whether the former site use may have given rise to significant ground contamination that could affect the development.
- Provide information on the ground and groundwater conditions, including the potential for surface or underground natural cavities or dissolution features.
- Describe the environmental setting of the site and status of environmental receptors.
- Assess the potential for hazardous ground gas to affect the proposed end use.
- Present the results of a detailed Unexploded Ordnance (UXO) risk assessment.
- Provide a conceptual site model on which to base a preliminary environmental risk assessment.
- Inform the need for and scope of further assessment works.

This report presents factual information obtained during this appraisal, an interpretation of the data and recommendations with respect to the proposed development.

1.4 Sources of Information

The study includes a review of the following information sources:

1. Groundsure Insight report which includes but is not restricted to; historical OS maps and land use, geology, hydrogeology, hydrology, environmental receptor search data, past and present landfill and waste management, hazardous substances, industrial land use and sensitive land uses.
2. British Geological Survey (BGS) GeoIndex online search tool.
3. Detailed UXO Risk Assessment Report prepared by 1st Line Defence Ltd, Report Ref: DA11104a-00, dated 19/5/23.

1.5 Limitations

This report has been prepared for Hyro Energy Ltd and their appointed agents only and should not be relied upon by any third party without the written permission of GVR Geo. If any unauthorised third party comes into possession of this report, they rely on it at their own risk and the authors do not owe them any Duty of Care or Skill. This report is based on and limited to an assessment of the information and ground conditions identified here. GVR Geo is not responsible for ground conditions not revealed during these investigations.

2.0 Site Setting

Grid Reference	Approx. OSGR 562689, 174568, NGR TQ 627 746
Area	The site comprises a roughly rectangular area of land, up to 560m N-S x up to 215m E-W maximum dimensions with an approximate area of 10.1ha.
Description	The site currently comprises the Kimberley Clark papermill on the south bank of the River Thames, which lies within a former Chalk quarry. The papermill facility comprises a mixture of industrial buildings/warehouses, office buildings, a boiler house and effluent treatment plant, together with various storage tanks, open storage hardstanding areas and access roads. Access is currently gained via Crete Hall Road on the eastern boundary of the site. A site walkover was carried out on 2nd May 2023, selected photographs from which are presented in Appendix E. In addition to the above, the walkover survey has indicated the following: • The proposed hydrogen electrolysis plant is located in the northern area between the boiler house and effluent treatment plant. This part of the site currently comprises a level concrete hardstanding area primarily used for storage of materials (paper). • Adjacent to the west of the boiler house are 3 No. sunken former storage tank bases with adjacent signage indicating the tanks were used for the gas oil. A summary of the chemicals currently stored on site is provided in the table below.
Adjacent Land Use	The adjacent land comprises a wharf and jetty to the north with the River Thames beyond. To the south is a near vertical Chalk quarry highwall with a narrow strip of land between the site and the base of the highwall used as an HGV parking area. The land at the top of the Chalk highwall extending south away from the site comprises the B2175 London Road with predominantly residential development beyond. The land to the east is occupied by light industrial buildings and logistics warehousing and area of hardstanding for container storage and vehicle parking. To the west is a cement manufacturing works.

Summary of Chemicals Currently Stored On Site (Within the Site Red Line Boundary)

CHEMICAL NAME	MANUFACTURER	DESCRIPTION	STORAGE SIZE	LOCATION
Aluminium Sulphate Solution	Monarch	Aluminium Sulphate	20,000 L	Effluent Treatment Plant
Amercor 8785	Solenis	Corrosion Inhibitor	220 L Drum	Boiler House
Bubond 2681	Buckman	Yankee Coating	IBC	Tissue Machine
Bulab 8862	Buckman	Isothiazaline based RO preservative	IBC	Effluent Treatment Plant
Bulab 8882	Buckman	RO Cleaning Product	IBC	Effluent Treatment Plant
Bulab 8885A	Buckman	RO Cleaning Product	IBC	Effluent Treatment Plant
Ferric Chloride Solution 40%	Monarch	Flocculant	IBC	Effluent Treatment Plant
Phosphoric Acid more than 25%	Monarch	Nutrient for Bioreactor	IBC	Effluent Treatment Plant
SigmaFast 20	Sigma Coatings	Anticorrosive primer	5 L	Workshop
Sigmarine 35	Sigma Coatings	Corrosion resistant paint	5 L	Workshop
Sodium Hypochlorite	Monarch	RO & Sand filter Biocide	15000 L	Effluent Treatment Plant
Spectrum XD1415	Solenis	pH stabilised sodium hypochlorite	IBC	Tissue Machine
Sulphuric Acid 98%	Monarch	Sulphuric Acid	20,000 L	Boiler House

3.0 Geoenvironmental Information

Historical maps are included in Appendix B and environmental data is included in Appendix C.

3.1 Historical Land Use

A brief summary of the land use history of the site is presented below which is intended to only describe the changes that have occurred on or adjacent to the site that are relevant to the objectives of this investigation.

It should be noted that the available mapping and Ordnance Survey records are carried out on a cycle of approximately 20 years, so surface mineral extractions and other short-term disturbance of the site may not have been mapped.

A summary of the land use historical features of the site is shown on Drawing No. G-22-049-002 presented in Appendix A**.**

Map Dates	On-Site	Off-Site
1865	Northern half of the site comprises terraced residential development with back yards and gardens and public houses. The northern edge overlies tidal flats of the River Thames with a wharf in the NW corner. Allotment gardens. A tramway extends across the central and southern area with evidence of earthworks/embankments associated with former chalk quarrying Mound named Collybank located centrally adjacent to western boundary.	Dock adjacent NE corner. Dockyard (incl. engineering shop/smithery and foundry) adjacent E. Chalk quarry adjacent E. Limekilns 20m and 250m E. Wharf 260m NW. Rifle Range 20m S.
1895-1909	Small iron foundry in NE corner. Brickworks across the southern half with possible reservoir structures in SW. Kilns in central area.	Dock to NE corner disused by 1897. Terrace housing in place of limekilns adjacent E. Cement works 80m W (incl. tanks, kilns, tramway, wharf).
1932-1955	Brickworks no longer present.	Dock infilled adjacent E. Dockyard now paper mill adjacent E. Tank 100m W.

Map Dates	On-Site	Off-Site
1966-1992	Significant redevelopment as paper mill with various buildings and ground levelling with hardstandings and travelling cranes, extension of land into the former tidal flats area. Tanks on northern and southern boundaries. Boiler house building N boundary. Collybank mound removed.	Construction of new jetty 10m N into the river. Expansion of paper mill – adjacent E. Works including tanks 130m W. Power station 300m E with possible tanks/cooling towers.
2001-2023	Further changes to paper mill buildings. Tanks SW corner.	Power station 300m E.

3.2 Geology

Presented below is a summary of the geological conditions at the site based on the historic Ordnance Survey map information and online data available on the BGS website. The BGS information includes the records of 4 historic boreholes undertaken within the NE corner of the site in 1972.

Made Ground	In view of the historical land uses on site including earthworks embankments, tramways and more recently construction of the paper mill buildings and hardstandings it is anticipated that surface made ground will be present below the site from ground level. This is expected to be of variable composition and thickness, with more significant thicknesses present in the northern boundary area where the mill hardstandings extend over the former river tidal flats and where potentially deep storage tanks are expected to be present. The presence of "worked ground" is confirmed by one historic borehole record (1972) which indicates made ground with a thickness of up to 2.13m.
Superficial Geology	The BGS GeoIndex online viewer indicates that there are no recorded natural superficial deposits underlying the site. This is likely to be due to the site lying within a former chalk quarry where any superficial deposits would have been removed during extraction of the chalk bedrock. However, Alluvium and River Terrace Deposits could underlie the northern edge of the site adjacent to the River Thames. The presence of alluvium "River Mud" is recorded on one historic borehole record (1972), with a thickness of 3.96m.
Solid Geology	The solid geology is recorded by the BGS to comprise Undifferentiated Chalk. All historic borehole records confirm Chalk underlies the site.
Faults	No geologic faults are recorded on or immediately adjacent to the site.
Quarrying And Mineral Extraction	The site and the adjacent land to the E and W lie within a former chalk quarry where chalk extraction took place primarily up until the mid 19th Century associated with the manufacture of cement and extraction of flint. The edge of the quarry forms a chalk highwall approximately 30m to the S and

	immediately adjacent the SW boundary with a height extending up to 25m above site ground levels. The outlying area to the S, SE and SW has generally been subject to extensive historic chalk quarrying.
Coal Mining	The site does not lie within a Coal Authority defined coal mining reporting area indicating the site is not at risk from historic underground coal extraction activities.

3.3 Hydrology and Hydrogeology

Water Courses	The River Thames is located 40m N of the site with the northern boundary area providing a river wharf.
WFD Surface Water Body Catchment	The site is classified as a coastal catchment (not part of a river water body catchment). Water Body ID 130 – Lower Medway Operational Catchment and Medway Management Catchment.
WFD Surface Water Bodies	River Thames (Thames Middle) Water body ID GB530603911402 recorded 2m N of the site. • Overall rating - Moderate • Chemical rating – Fail • Ecological rating – Moderate • Year - 2019
WFD Groundwater Bodies	The site lies within the North Kent Medway Chalk Aquifer. Water body ID GB40601G500300. • Overall rating - Poor • Chemical rating – Poor • Quantitative – Poor • Year – 2019
Flood Risk	• The site lies within a river and coastal flood plain recorded to be at very low risk of flooding. • The are no recorded historical flood events relating to the site. • There are records of 2 flood defences on site located on the northern boundary associated with the wharf. • The main area of the site lies within a Flood Zone 2 (a 1 in 1000 chance of flooding each year) and the northern perimeter lies within a Flood Zone 3 with a 1 in 200 or greater chance of flooding each year when the presence of flood defences are ignored. • The site is classified as having a high, up to 1 in 30 year, 0.1 – 0.3m risk of surface water flooding. • The site has a variable moderate to high risk of groundwater flooding.

Groundwater Classification	<u>Superficial Geology</u> The nearest superficial aquifer is recorded to be adjacent to the northern site boundary associated with river deposits which are designated as a Secondary Undifferentiated Aquifer. This designation is assigned where it is not possible to attribute category A or B, previously designated as both minor and non-aquifers. <u>Solid Geology</u> The Chalk bedrock strata is classed as a Principal Aquifer.
Groundwater Vulnerability	• Soil/Surface leaching: intermediate vulnerability • Superficial Geology: high vulnerability • Solid Geology: high vulnerability • Soluble Rock Risk: very significant soluble rocks are likely to be present with a moderate possibility of localised subsidence or dissolution-related degradation of bedrock (3% of site at maximum risk).
Groundwater	2 No. licensed groundwater abstractions on site relating to 2 borehole abstractions used for boiler feed supply for Kimberley Clark (borehole names Springhead and Greensands). Current licence expires 31/3/2018 and 31/03/2030. 5 No. groundwater abstractions within 250m; including 68m NE, 118m SE, 121m SE, 177m SE and 224m E all relating to borehole boiler feed supplies to Kimberley Clark, Northfleet. A further 8 No. groundwater abstractions between 456m to 500m from the site. 10 No. Source Protection Zones within 500m. The southern area of the site is within a Source Protection Zone 1, the remaining site lies within both a Zone 2 and 3.
Licensed Surface Water Abstractions	1 No licensed surface water abstraction recorded within 2000m, 865m NW relating to abstraction from River Thames for mineral washing.
Discharge Consents	10 No. licensed discharges to the River Thames within 250m of the site: • 2 No. 37m SW relating to sewage discharges relating to the paper mill, both revoked. • 1 No. 51m N unspecified type - now revoked. • 1 No. 81m N cooling water discharge related to the adjacent cement works – now revoked. • 3 No. 166m NW trade discharges relating to the adjacent cement works. • 2 No. 201m NW cooling water discharges relating to the nearby cement works, both revoked.

Pollution Incidents	16 No. within 500m of the site: • 1 No. on site dated 2003 relating to firefighting run-off and classified a minor impact to water, land or air. • 2 No. 31m NE both dated 2006 relating biodegradable materials and inert wastes classified as no impact to water and significant impact to land and air. All other incidents do not relate to the site.

3.4 Landfill and Waste Management

Landfill Records	1 No. historic landfill on site (BGS source, No. 1947) relating to Northfleet Power Station. 1 No. 426m SE, relating to Northfleet Power Station including inert, industrial and liquid wastes, last recorded 1992. 1 No. 440m S, Kent County Council, Springhead Road landfill allowing inert, industrial, commercial and household waste, dated 1984. 1 No. 448m SE, relating to Northfleet Power Station allowing inert, industrial and liquid sludge waste, dated 1992. 1 No. 465m S, a refuse tip dated 1971. 1 No. 473m S, a refuse tip dated 1971.
Other Waste Transfer, Treatment or Disposal	5 No. within 500m of the site. 4 No. 302m NW, all relating to Northfleet temporary inert waste transfer facility relating to non-biodegradable wastes. 1 No. 365m E, Red Lion Wharf.

3.5 Industrial Land-use, Environmental Licences, Permits and Registers

Recent/current Industrial Land Use	There are 37 No. recorded recent industrial land uses with 250m of the site. 10 No. are recorded on site and relate to 8 No. storage tanks, an electricity sub station and an industrial engineering business. 11 No. of the recorded recent land uses between the site and 100m include: • Tank 5m SW. • Pylon 38m NE. • Travelling cranes 42m N and 96m NE. • Electrical and electronic engineering business 43m SW. • 3 No. electricity substations 63m E, 69m E and &3m S. • Vehicle repair services 77m SW. • Wharf 83m NE. • Cutting, drilling and welding services 88m S. Beyond 100m of the site a further 16 No. recent/current land uses include; substations, pylons, masts, chalk pits and light industrial businesses.
Recent/current Petrol Stations	None recorded within 500m
Part 2A Designated Contaminated Land	None recorded within 500m
COMAH/Regulated Explosive Sites	None recorded within 500m
Historical IPC Authorisations	2 No. recorded within 500m, both 207m E relating to paper and pulp manufacturing processes by Kimberly Clark.
Part A (1) and IPPC Authorised Activities	13 No. recorded within 500m, including 3 No. permits for site with 2 No. relating to the disposal of non-hazardous waste involving biological treatment and 1 No. relating to the combustion of fuel. 9 No. 199m E and 207m E relating to paper/board producing processes, combustion of fuel and biological treatments operated by Kimberly Clark. 274m NW production of cement clinker.
Part A(2)/B Licensed polluted release	2 No. within 500m: • 74m W cement permit. • 291m E quarry processes.
Red List Discharge Consents (potentially harmful discharges to controlled waters)	None recorded within 500m

List 1 and List 2 Dangerous Substances Inventory Sites	5 No. List 1 with 500m. • 51m N mercury, cadmium and pentachlorophenol – Kimberley Clark. • 3 No. 142m NW cement, mercury and cadmium. • 314m W cadmium – Blue Circle Cement. 1 No. List 2 within 500m. • 51m N atrazine and simazine, organotin – Kimberley Clark.

3.6 Radon

The Groundsure report assesses radon risk using data supplied by Public Health England along with BRE Document 'BR 211 - Radon: Guidance on the Protective Measures for New Dwellings' which indicates that the site partly lies within an area where less than 1% of properties are above the action level. On this basis, no radon protective measures are currently required.

3.7 Environmental Receptors

Designated Sites: SSSI, RAMSAR, SAC, SPA, NNR, LNR etc.	7 No. SSSIs within 2000m all relating to the Swanscombe Peninsula 1103 – 1966m W.
Other Relevant Environmental Receptors	2 No. designated Green Belts within 2000m, including areas in Dartford 1766m SW and Gravesham 1974m S.

3.8 Unexploded Ordnance (UXO)

A detailed UXO risk assessment report was commissioned by GVR Geo and undertaken by specialist subconsultants 1st Line Defence to assess the probability of encountering explosive ordnance during the proposed redevelopment of the site using various available national archives and records. In summary, the report indicates the site to be of Low to Medium risk. The paper mill immediately east suffered several bomb strikes in WWII. On this basis, the report recommends that a UXO Risk Management Plan is undertaken prior to any future intrusive ground works taking place and that any staff involved in such works should receive UXO awareness briefings. The 1st Line Deference Report is presented in Appendix D.

4.0 Conceptual Site Model

4.1 Background

This assessment is designed to meet the requirements for preliminary environmental risk assessment as detailed within the 'Land contamination: risk management' (Environment Agency, 2020) and 'Guidance for the Safe Development of Housing on Land Affected by Contamination' (R&D Publication 66: 2008). The latter guidance is particularly focussed on the development of housing on land affected by contamination. However, the advice is generally applicable to other forms of development and to sites where no development is proposed.

Risk to human health or environmental receptors is based on an assessment of one or more source-pathway-receptor linkages. The contaminant 'source' is any substance which has the potential to cause significant harm to a relevant receptor and the 'pathway' is any route by which the contaminant may travel to impact on a 'receptor'.

The Conceptual Site Model (CSM) summarises the principal contaminant sources, pathways and receptors for this site and the likelihood of the existence of a plausible contaminant linkage. The assessment is based on the proposed end use of 'commercial'.

4.2 Contaminants of Concern

The site history, as a chalk quarry, wharf, iron foundry, embankments, tramways, brickworks and paper mill present potentially significant contaminative land uses. The adjacent land to the east presents a similar contaminative land use and to the west a cement works. Based on these historic land uses the following contaminants of concern may be anticipated:

- Polyaromatic hydrocarbons (PAH), heavy metals, water soluble sulphates.
- Mineral oils and total petroleum hydrocarbons (TPH).
- Phenols and polychlorinated Biphenyls (PCB).
- Asbestos containing materials (ACM).

4.3 Ground Gas Risk

There is a low to moderate risk of significant ground gas generation from made ground soils and organic alluvium on site and the adjacent land to present a risk to the proposed development and end users, especially where development includes confined spaces.

4.4 Phase 1 CSM and Preliminary Environmental Risk Assessment

The significance of the potential source-pathway-receptor linkages identified in the CSM is assessed using the following criteria:

Low Risk
Not likely to cause significant harm to human health or controlled waters. Remedial measures are unlikely to be required.

Moderate Risk
Possible significant harm to human health or controlled waters could occur depending on site specific circumstances. Remedial measures may be required.

High Risk
It is likely that significant harm to human health or controlled waters will occur unless appropriate remedial measures are incorporated into the development.

Conceptual Site Model and Preliminary Environmental Risk Assessment

Source	Pathway	Receptor	Contaminant Linkage: Assessed Risk
Human Health			
Potential contaminants within the made ground/alluvium on site: PAHs, mineral oil and TPH, heavy metals, phenols, PCBs, water soluble sulphates and asbestos.	Direct contact and ingestion/inhalation of contaminated soil and dust	Construction workers	**Moderate to High** Mitigated by controlled removal of any proven contaminants prior to construction and use of appropriate PPE and good site hygiene practice during construction.
	Direct contact and ingestion/inhalation of contaminated soil and dust	End users	**Moderate** Mitigated by the provision of an effective barrier in the form of a concrete floor slab and hardstanding. No mitigation anticipated.
Off-site sources of soil or groundwater contaminants	Migration of contaminants in the adjacent land via leaching and surface water run-off or groundwater migration on to site and ingestion/inhalation of contaminated soils.	End users	**Low to Moderate** Mitigated by the provision of an effective barrier in the form of a concrete floor slab and hardstanding on site. No mitigation anticipated.
Ground gas migration from infilled ground on site or adjacent land.	Migration through permeable natural strata and made ground and accumulation in confined spaces and inhalation	End users	**Low to Moderate** If present, mitigation could be in the form of gas protection measures if fixed buildings with confined spaces are proposed.

Source	Pathway	Receptor	Contaminant Linkage: Assessed Risk
Controlled Waters			
Contaminants within the made ground or alluvial deposits on site.	Vertical and lateral migration to groundwater.	Secondary Undifferentiated Aquifer (Alluvial Deposits)	**Low to Moderate** There is the potential for leachable contaminants in the made ground overlying the natural superficial deposits below the northern edge of the site to be currently impacting on this minor groundwater body, albeit the water quality will be brackish and therefore not fit for portable supply. If required, mitigation may be required in the form of removal of proven mobile or leachable contamination during construction.
		Principal Aquifer (Chalk strata)	**High** There is the potential for leachable contaminants in the made ground directly overlying the Chalk below the site to be currently impacting on this Principal Aquifer. Mitigation may be required in the form of removal of proven mobile or leachable contamination during construction.
		Surface Waters (River Thames)	**Moderate** There is potential for mobile or leachable contaminants in the made ground to be currently impacting on this sensitive surface water receptor. Mitigation may be required in the form of removal of proven contamination during construction.

5.0 Conclusions and Recommendations

The following assessment should be considered as preliminary until it can be verified by a targeted ground investigation for the proposed development. The investigation will acquire environmental data on the potential contaminants on site and geotechnical data necessary for engineering design.

5.1 Foundation Design and Construction

The depth, strength, density and plasticity of the underlying made ground, any natural superficial deposits and the Chalk bedrock should be determined by sampling and in-situ testing to identify the type and required depth of foundations for the proposed development.

5.2 Contaminants of Concern and Remediation

The presence or not of potential contaminants of concern in the made ground and alluvial deposits should be assessed by targeted investigation, sample analysis and risk assessment to determine if there are identified contaminants that pose a risk of harm to human health/controlled waters/ecosystems. Following this, remediation mitigation measures can be considered, if required.

5.3 Ground Gas

There is a low to moderae risk potential of ground gases on site affecting the proposed development if fixed buildings with confined spaces that are to be occupied are proposed. Therefore, ground gas monitoring should be undertaken to assess this risk, if required. If only portable, containerised, ground-mounted buildings are proposed, then the risk of gas entering such structures with is considerered to be low and no ground gs risk assessment is deemed necessary.

No radon protective measures are required for occupied buildings in this area.

5.4 Drainage

The site comprises an operational paper mill which currently includes surface water drainage. Localised changes to the existing surface water drainage are likely to be required, but as there is likely to be a very shallow water table, soakaway drainage is unlikely to be suitable. Therefore, no assessment of soakaway drainage is proposed.

5.5 Recommendations for Ground Investigation

To establish the environmental risk based on the findings of the CSM, the following ground investigation works are recommended:

- Window sample boreholes extending through the made ground, any natural superficial deposits and into the Chalk bedrock to a depth of 5m to determine; the presence of potential contaminants of concern, allow the installation of gas/groundwater monitoring wells and to prove the conditions for infrastructure installation.
- Trial pits extending into the made ground to assess shallow ground conditions, prove the presence or not of buried obstructions and allow samples to be retrieved for chemical testing to determine the presence of potential contaminants of concern.
- Geotechnical laboratory testing of soils and bedrock to provide parameters for foundation design.

- Undertake 6 ground gas monitoring visits over a 3 month period.
- Factual and interpretive report, providing recommendations for remedial actions as required to allow the safe development of the site and recommendations for foundations and engineering design.