

Water Eaton

PR6a : Land East of Oxford Road

Environmental Statement Appendix 2.2:
Phase 1 Geo-Environmental Appraisal
(main report only)

Bellway


**STRATEGIC
LAND**



*Christ Church
Oxford*



PHASE 1 GEO-ENVIRONMENTAL APPRAISAL
Water Eaton, Oxford
PR6a: Land East of Oxford Road

Document History

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1.0 Introduction

- 1.1 This Phase 1 Geo-Environmental Appraisal has been prepared by Glanville Consultants on behalf of Bellway Homes Limited and Christ Church, Oxford with respect to an outline planning application (with all matters except access reserved for future consideration) for development of land at Water Eaton, Oxford, OX2 8HF.
- 1.2 The Site is included in the Cherwell Local Plan 2011-2031 (Part 1) Partial Review as Site PR6a, Land East of Oxford Road. Site PR6a allocates the Site for mixed-use development including around 690 dwellings, a two form entry primary school, a local centre and recreation space. The strategic allocation extends to approximately 45.8 hectares of land to the east of the A4165, Oxford Road, as shown on the extract from the Cherwell Local Plan Partial Review included in Appendix A.
- 1.3 This report has been prepared in accordance with the National Planning Policy Framework Section 11 and the Land Contamination Risk Management (LCRM) guidance to assess if there is any potential risk to the site from a geo-environmental perspective.
- 1.4 The report identifies previous land uses and findings from non-intrusive environmental and geological searches for the purpose of identifying issues that may adversely affect the development of the site for its intended end use.
- 1.5 The information within this appraisal has been derived solely from information and records registered in the available public records quoted. The specific categories of desk study information and public records referenced within this appraisal are described in Appendix B. A walkover survey of the site has also been performed, with a record of the visit included in Appendix C.
- 1.6 This report fulfils the requirements of the Preliminary Risk Assessment tier of Stage 1 of the LCRM. It should be noted that an intrusive site investigation has not been carried out as part of this assessment.
- 1.7 Intrusive site investigation works have separately been undertaken within a Phase 2 site investigation report by ST Consult which furthers investigate ground conditions, including contamination and geotechnical properties. The Phase 2 site investigation report is submitted separately with this application and is not considered as part of this Phase 1 Geo-Environmental Appraisal.

2.0 Development Proposals

2.1 A copy of the illustrative masterplan is included in Appendix D. The proposed development consists of:

- The demolition of existing buildings;
- Erection of up to 800 dwellings (Class C3);
- A two form entry primary school;
- A local centre comprising: convenience retailing (not less than 350sqm and up to 500sqm (Class E(a))), business uses (Class E(g)(i)) and/or financial and professional uses (Class E(c)) up to 500sqm, a café or restaurant (Class E(b)) up to 200sqm;
- Community building (Class E and F2);
- Car and cycle parking;
- Associated play areas, allotments, public open green space and landscaping.
- New vehicular, pedestrian and cycle access points, internal roads and paths and communal parking infrastructure.
- Associated works, infrastructure (including Sustainable Urban Drainage, services and utilities) and ancillary development.
- Works to the Oxford Road in the vicinity of the site to include, pedestrian and cycle infrastructure, drainage, bus stops, landscaping and ancillary development.

3.0 Existing Site Characteristics

3.1 This Section outlines the existing site characteristics. The site extends to approximately 45.8ha and is located to the east of the A4165, Oxford Road to the north of Oxford. The site largely consists of agricultural land, with Pipal Barns located in the north-west of the site alongside Oxford Road. St Frideswide's Farm is located adjacent to the eastern site boundary and Pipal Cottage is located adjacent to Pipal Barns outside of the site boundary. A site location plan is included in Appendix E.

3.2 The site is irregular in shape and mainly consists of agricultural land, used as arable fields.

Topography

3.3 The site generally falls away from two main high points. The first is located in the centre of the site along the western boundary with the A4165, with land falling to the north, and to the east towards St Frideswide's Farm. The second high point is located along the southern boundary, with land falling from this point to the east towards the River Cherwell, and to the north towards St Frideswide's Farm. The topographical survey is included in Appendix F.

Walkover Survey

3.4 Glanville Consultants initially visited the site on 22 February 2018 to carry out a walkover survey and have also visited the site on multiple occasions between July 2021 and March 2022. The site consists of agricultural fields with hedged boundaries and ditch networks. A septic tank / on-site treatment plant was identified at Pipal Cottage, which could discharge treated effluent into a piped network and eventually to a watercourse to the east of the site. No significant potentially contaminative features were identified.

3.5 A photographic record of the site is included in Appendix C of this report.

4.0 Site Land Use

Summary of Historical Information

- 4.1 The history of development and land use at the site from 1876 onwards has been derived from public records and historical Ordnance Survey maps. A summary of the findings from the historical maps is shown in Table 1 overleaf, with full maps included in Appendix G. It should be noted that information from maps of a similar age have been grouped for ease of reading. Where no description is entered in the table, no significant changes have been identified from the maps.
- 4.2 The mapping and datasheets included in all appendices within this report covers a greater area of land than the application site. The highlighted area within the mapping includes both the PR6a and PR6b sites from the CDC Local Plan 2011-2031 (Part 1) Partial Review – Oxford's Unmet Housing Need. However, the following sections of this report only apply to the application site, PR6a, and as such distances quoted within this report have been adjusted from the Envirocheck report to apply to the PR6a application boundary.
- 4.3 Since the initial purchase of the mapping and datasheets referenced in this report, the boundary of PR6a has also be altered in the south-eastern corner of the site, and as such distances quoted in this report have been adjusted from the Envirocheck report to apply to the new application boundary.

Table 1: Summary of Historical Information

Map Date	Map Scale	Site Land Use	Land Use in Surrounding Area		
			Compass Direction	Approx. Distance (m)	Land Use
1876	1:2,500	<ul style="list-style-type: none"> All of site shown as agricultural fields. Pipal Cottage and Water Eaton Lodge adjacent to present-day A4165. Water Eaton Copse along eastern boundary of northern fields. 	ALL	-	Agricultural land
			E	0	Frideswide Farm
			NW	240	Oxford-Bicester Railway Line
			N	250	Oxford Road Crossing and Weighbridge
1876-1878	1:2,500		W	700	Yarnton Loop Railway
			W	600	Pear tree Hill Farm
			SE	100	Cuttleslowe Farm (Gravel Pit noted)
			SW	640	Brickworks Adjacent to Bicknell Cottage
1887	1:10,560	-	W	390	Gravel Pit Noted
		-	W	925	Pear tree Brickworks.
1899	1:2,500	-	W	390	Gravel Pit not present
1900	1:10,560	-	SW	150	Wolvercote Cemetery
1913	1:2,500	-	-	-	-
		-	W	25	Part of land to the west shown as Golf Course
1913-1921	1:2,500	-	NW	250	North Oxford Halt on railway line.
			-	-	-
1914	1:10,560	-	-	-	-
1921	1:2,500	-	-	-	-
1922	1:10,560	-	-	-	-
1936	1:2,500	<ul style="list-style-type: none"> Tumulis identified. 	S	120	Warehouse.
1936-1937	1:2,500		NW	250	Oxford Road crossing replaced by bridge.
			1937	1:2,500	SW
1938	1:10,560				S
			1938-1947	1:10,560	W
1947	1:10,560				-
1955	1:10,000	-	S	50	Sports Ground.
			W	925	Pear tree Hill Brickworks ceased.
			S	-	Residential development
			S	120	Warehouse replaced by Engineering Works.
			N	90	Buildings
1956-1957	1:2,500	-	S	-	Residential development
1957	1:1,250				
1957-1958	1:2,500				
1958	1:2,500				
1960-1961	1:10,000	-	W	525	New A34 route (Oxford Ring Road) under construction.

Map Date	Map Scale	Site Land Use	Land Use in Surrounding Area		
			Compass Direction	Approx. Distance (m)	Land Use
1965-1968/71	1:2,500	-	S	-	Residential development
1966-1972/73	1:1,250		SE	100	Cuttleslowe Farm developed into sports ground.
1967-1968	1:10,000		W	525	New A34 route (Oxford Ring Road) constructed (1962)
1969	1:10,000				
1969-1970	1:2,500		N	-	Residential development
1970	1:2,500				
1970-1977	1:10,000	-	-	-	
1973	1:10,000				
1973-1974	1:1,250				
1974	1:1,250				
1977-1978	1:2,500				
1979-1990/92	1:1,250	-	-	-	
1981	1:10,000	• Water Eaton Lodge demolished.	W	700	Yarnton Loop dismantled.
			S	-	Residential development
1981-1982	1:10,000		N	-	Residential development
			W	25	Pond identified adjacent to Oxford Road in north of Golf Course.
1988	1:1,250	-	S	120	Warehouse replaced by Business Park.
1988-1991	1:1,250	-	-	-	
1990	1:2,500				
1991	1:1,250				
1992-1994	1:10,000	-	W	250	New (current) A34 route constructed
1994	1:1,250	-	W	675	Peartree Park & Ride.
1999	1:10,000	-	-	-	
1999	Aerial				
2006	1:10,000	-	N	0	Buildings demolished and replaced with Water Eaton Park & Ride.
2018	1:10,000	-	N	90	Oxford Parkway station constructed (2015).

Summary of Industrial Land Uses

4.4 Industrial land uses within 1000m of the site have been derived from available public records. In Table 2 overleaf, records from the Contemporary Trade Directory Entries, Fuel Station Entries and Points of Interest identified in the datasheets included in Appendix B, have been combined with Potentially Contaminated Industrial Uses and Potentially Infilled Land identified in the datasheets included in Appendix H. These locations of these land uses are shown on the maps included in Appendices I and J, respectively. Land uses within 500m of the application site only are detailed in Table 2.

Table 2: Summary of Industrial and Potentially Contaminative Uses within 500m of the site

Map ID	Appendices (Datasheet / Map)	Name	Classification	Map Date / Status	Compass Direction	Estimated Distance (m)
C-1	H / J	Oxford-Bicester Line	Railways	1887-1992	N	240
A-3	H / J	Yarnton Loop	Railways	1887-1955	W	450
A-5	H / J	Future Station / Park and Ride Site	Electricity Production & Distribution	1993	N	91
A-6	H / J	Warehouse / Engineering Works	Machinery: engines, building & general industrial	1955	S	151
A-124	B / I	Oxford Business Park	Business Parks and Industrial Estates	-	SE	163
A-127	B / I	Oxford Parkway Rail Station	Railway Stations, Junctions and Halts	-	N	170
B-90	B / I	Cuttleslowe Farm	Tanks (Generic)	-	S	180
A-129 A-130 A-131 B-84 A-7	B / I B / I B / I B / I H / J	Wolvercote Cemetery	Cemeteries & Crematoria	Active	S/SW	183-359
A-110	B / I	Universal Mounting Solutions	Projection Screens – Manufacturers and Suppliers	Inactive	S	311
A-125	B / I	Tank	Tanks (Generic)	-	SE	421-426
A-111	B / I	Holmes Refrigeration	Refrigeration Equipment – Commercial	Inactive	SE	457
A-112	B / I	Crown	Commercial Cleaning Services	Active	SE	459
A-112	B / I	M D Carpet Cleaning	Carpet, Curtain & Upholstery Cleaners	Active	SE	461

5.0 Site Geology

- 5.1 Geological maps published by the British Geological Survey (BGS) indicate that the site is underlain by a bedrock geology of Oxford Clay Formation and West Walton Formation, consisting of mudstone. The mapping indicates that there is no known superficial geology underlying the majority of the site, namely the land to the north and west of St Frideswide's Farm, with a band of Wolvercote Sand and Gravel Member present between St Frideswide's Farm and the southern boundary. This is confirmed by BGS borehole records which show Oxford Clay Formation underlying the entire site, with some sand and gravel superficial deposits in the south-east between Frideswide's Farm and the southern boundary. A band of Alluvium deposits is also shown along the site boundary in the south-eastern corner of the site, consisting of clay, sand, silt and gravel. Geological maps and the locations and details of borehole records are included in Appendix K.
- 5.2 No areas of artificial or made ground were identified within the site boundary. An area of made ground was indicated to the south of the site, which is understood to relate to infilling of land at Cutteslowe Farm to the south-east, while made ground is also highlighted at the former Wolvercote brickworks and the A34 to the south-west. Geological maps showing areas of artificial or made ground are included in Appendix K.
- 5.3 The national soil chemistry mapping indicates the concentrations of arsenic, cadmium, chromium, lead and nickel in the site and surrounding areas. The Environment Agency (EA) publishes Soil Guideline Values (SGVs) for chemicals to assist in the assessment of risk from land contamination. The EA has withdrawn the SGV for nickel and updated SGVs for lead and chromium are currently under development. The estimated concentrations of the contaminants were assessed against new and former SGVs where appropriate and were found to be within acceptable concentrations; the estimated concentrations and corresponding SGVs are shown in Table 3, with results highlighted green where the estimated concentration is lower than the SGV, and yellow where they exceed the SGV. The national soil chemistry maps are included in Appendix L.

Table 3: Chemical Concentrations and SGVs

Chemical	Estimated Concentration (mg/kg)	Soil Guideline Value (SGV) (mg/kg)			SGV Notes
		Residential	Allotment	Commercial	
Arsenic	15-25	32	43	640	2009
Cadmium	<1.8	10	1.8	230	2009
Chromium	90-120	130	130	5000	2002 (out-of-date)
	60-90				
Lead	<100	450	450	750	2002 (out-of-date)
Nickel	30-45	130	230	1800	2009 (withdrawn)

- 5.4 Brine subsidence and compensation areas define zones where damage to land and buildings caused by subsidence due to brine pumping has or could occur. The site and surrounding area are not located within a brine subsidence or compensation area.

- 5.5 There is one recorded BGS mineral site within a 500m radius of the application site: Banbury Road Rail Depot. Table 4 gives further details of this entry, as well as details of extractive industries and areas of potentially infilled land in also within 500m of the site. Full details can be found in the datasheet and maps included at Appendix M, as well as the datasheet and maps included in Appendices B and I.

Table 4: Mineral Sites, Extractive Industries & Potentially Infilled Land within 500m of the site

Map ID	Appendices (Datasheet / Map)	Name	Type	Map Date	Compass Direction	Estimated Distance (m)
A-8	M / M	Golf Course Pond	Pond	1978-	W	35
A-9	M / M	Oxford-Bicester Railway	Railway Cutting	1974-	W	275
A-10	M / M	Frideswide Farm Pond	Pond	1978-	E	18
A-11	M / M	Yarnton Loop	Railway Cutting	1974-	W	300
A-16 A-97	M / M B / I	Unknown filled ground	Water	1955	NE	45
A-1 A-102	M / M B / I	Banbury Road Rail Depot	Rail Depot – Crushed Rock	Active	N	151
B-1 B-76	M / M B / I	Cuttesslowe Farm	Water	1955	SE	181
A-14 A-95	M / M B / I	A34 construction	Pit, quarry etc	1992	NW	290
B-2 B-77	M / M B / I	Unknown filled ground	Water	1955	SE	422

- 5.6 Maps illustrating the hazards discussed in the following paragraphs are included in Appendix M.
- 5.7 Information obtained from the public register indicates that the site and surrounding area is highly unlikely to be at risk from coal mining hazards.
- 5.8 The superficial alluvium deposits located along the south-eastern boundary are associated with a moderate hazard potential relating to compressible ground stability, with a negligible potential for collapsible ground stability hazards. The remainder of the site is shown to have no potential for compressible ground stability hazards and a very low potential for collapsible ground stability hazards.
- 5.9 Ground dissolution occurs when water passes through soluble rock and forms underground cavities. These cavities reduce support to the ground above. Rocks that commonly suffer with dissolution stability hazards are salt, gypsum, limestone and chalk. It is indicated that there is no hazard potential relating to this form of hazard within the site or surrounding area.
- 5.10 Landslides are dependent on such factors as geology, topography, weathering, drainage and manmade construction. The risk of damage to properties on the site from landslides is indicated to be very low.

- 5.11 Soils which contain loosely packed sandy layers can become fluidised by water flowing through them, thus removing support from overlying buildings and potentially causing damage. It is indicated that there is a no hazard potential relating to this form of hazard across the majority of the site, with a low hazard potential associated with the superficial alluvium deposits in the south-east of the site and a very low hazard potential associated with the sand and gravel superficial deposits in the south of the site.
- 5.12 Soils containing clay materials absorb water at different rates depending on seasonal factors resulting in shrinking or swelling. The potential for shrinking or swelling clay ground stability hazards on the site and surrounding is indicated to be moderate.

6.0 Site Hydrology and Site Sensitive Land Use

- 6.1 A network of drainage ditches are located along field boundaries within the agricultural land on-site. These ditches generally flow in easterly and southerly directions, discharging into a watercourse which flows in a southerly direction approximately 150m to the east of the site at its closest point, which eventually discharges to the River Cherwell. The River Cherwell is the closest watercourse designated as a main river by the Environment Agency (EA), located approximately 0.5km to the east of the site at its closest point. The existing drainage situation is illustrated on the plan included in Appendix N.
- 6.2 The groundwater vulnerability map published by the Environment Agency (EA) indicates that the bedrock geology underlying the site is associated with a negligibly permeable non-aquifer. The superficial deposits of sand and gravel in the south-east of the site are associated with a variably permeable minor aquifer of low leaching potential, with an area of high leaching potential associated with the Alluvium deposits in the south-eastern corner of the site, as well as an area just outside the southern boundary. The groundwater vulnerability map is included in Appendix O.
- 6.3 The bedrock aquifer designation map published by the EA shows the mudstone bedrock underlying the majority of the site is classified as unproductive strata. The superficial sand and gravel deposits, as well as the alluvium, in the south-east of the site are associated with a Secondary A aquifer. Unproductive Strata indicate regions where layers of rock or drift deposits have low permeability and have negligible influence on water supply or river base flow. Secondary A aquifers indicate regions where layers of rock or drift deposits are permeable and therefore capable of supporting water supply on a local scale and may provide a source of base flow to rivers. The aquifer designation map is included in Appendix O.
- 6.4 The EA defines Source Protection Zones (SPZs) for groundwater sources such as wells, boreholes and springs used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area. The SPZs mapping indicated that the site is not located within an SPZ. The groundwater source protection map is included in Appendix O.
- 6.5 A Nitrate Vulnerable Zone (NVZ) is a conservative designation for areas of land that drain to nitrate polluted waters or waters which could become polluted by nitrates. The site and surrounding area are indicated to be situated within a surface water NVZ (Cherwell (Ray to Thames) And Woodeaton Brook, Thames (Leach to Evenlode)). The NVZ map is included in Appendix O.
- 6.6 The EA defines Drinking Water Safeguard Zones (SgZs) and Drinking Water Protected Areas (DWPAs) for water sources used for public drinking water supply. SgZs define areas where additional pollution control measures are needed to avoid deterioration in water quality. DWPAs are areas where water sources need to be protected to prevent pollution. The site is located within a surface water SgZ, but not within a DWPA.
- 6.7 There are four recorded Local Authority Pollution Prevention and Controls within a 1000m radius of the site, none of which are within 500m of the site. These records relate to authorised air pollution controls from nearby service stations and a motor dealership. Full details can be found in Appendix B and their locations illustrated on the maps included in Appendix I.

6.8 The public records obtained indicate there to be nine recorded discharge consents within 1000m of the site, five of which are within 500m of the site. The discharge consents within 500m of the site are detailed in Table 5, and full details are available in the datasheet included in Appendix B and their locations illustrated on the maps included in Appendix I.

Table 5: Discharge Consents within 500m of the site

Map ID	Property Type	Location	Discharge Type	Discharge To	Date	Status	Compass Direction	Estimated Distance (m)
A-1	Domestic (Single)	Pipal Cottage, OX2 8HE	Final/Treated Effluent	Stream (Tributary of River Cherwell)	2003	New Consent	W	0
A-2	Golf Club	North Oxford Golf Club	Final/Treated Effluent	Irrigation Area (Alluvium)	1992	New Consent	W	190
A-3	Motor vehicle sale/repair	North Oxford Park and Ride	Final/Treated Effluent	Stream (Tributary of River Cherwell)	2002	New Consent	N	96
A-5	Thames Water Pumping Station	Harefields	Sewage discharges	Stream (River Cherwell)	1989	Revoked 1997	SE	220
B-1	Thames Water Pumping Station	Sparsey Place	Sewage discharges	Stream (River Cherwell)	1989 and 2010	Surrendered under UPR 2010	SW	369

6.9 The public records obtained indicate there to be nine recorded pollution incidents to controlled waters within 1000m of the site, which are detailed in Table 6, with full details included in Appendix B and their locations illustrated on the maps included in Appendix I.

Table 6: Pollution Incidents to Controlled Waters within 1000m of the site

Map ID	Pollutant	Date	Category	Compass Direction	Estimated Distance (m)
A-13	Oils - Unknown	1994	3 - Minor	S	21
A-14	Miscellaneous - Other	1999	3 - Minor	W	630
A-15	Oils - Unknown	1995	3 - Minor	W	950
A-16	Oils - Unknown	1994	3 - Minor	SW	990
B-3	Miscellaneous - Unknown	1989	3 - Minor	S	824
A-18	Oils - Unknown	1994	3 - Minor	SE	887
B-4	Miscellaneous - Unknown	-	3 - Minor	S	895
B-5	Miscellaneous - Unknown	-	3 - Minor	S	908
	Unknown sewage	1996	3 - Minor	S	912
B-6	Storm sewage	1998	3 - Minor	S	976

- 6.10 The public records obtained indicate there is one recorded water abstraction site within a 1000m radius of the site, with three further abstractions indicated between 1000m and 2000m of the site. Details of the water abstractions within 1000m of the site are shown in Table 7, with full details included in Appendix B and their locations illustrated on the maps included in Appendix I.

Table 7: Water Abstraction within 1000m of the site

Map ID	Location	Abstraction Type	Date	Source	Compass Direction	Estimated Distance (m)
B-7	Cuttesslowe Allotments	General Farming and Domestic (Single Point)	1966	Groundwater	S	601

- 6.11 Pipal Cottage in the north-west of the site and St Frideswide's Farm to the east of the site are not known to connect into the public sewer network and instead are served by a septic tank / on-site treatment.

7.0 Hazardous Substances, Waste and Ground Gases

- 7.1 The public records obtained indicate that the site is located within an area where basic radon protective measures are not considered necessary for the construction of new dwellings. This is confirmed by a review of the Public Health England document HPA-RPD-033 'Indicative atlas of radon in England and Wales', which provides an overview of more detailed radon mapping and indicates that the site is located in a region where between less than 1% of homes are above the action level.
- 7.2 Information obtained from the public register indicates there are two historic landfill sites situated within 1000m of the site, which are detailed in Table 8 below. Full details are provided in Appendix B and are illustrated on the map included in Appendix I.

Table 8: Historic, Former and Current Landfill Sites

Map ID	Site Name	First Input Date	Last Input Date	Specified Waste	Boundary Quality	Compass Direction	Estimated Distance (m)
A-88	Gosford Tip, Yarranton	-	-	-	-	W	350
A-89 A-91 A-92 A-93	Peartree Railway Cutting	-	1973	Inert Industrial Commercial Household	Good / Moderate	NW/W	350-725

8.0 Initial Conceptual Model

8.1 This section reviews past activities both on and near to the site identified from the available records and assesses the likelihood of contaminants being present. It should be noted that it would not be expected to find all the identified contaminants on the site as contamination often depends on the policies regarding waste management for individual operations which can vary significantly in quantity and type from site-to-site.

Potential Sources

8.2 This section of the report is not informed by intrusive site investigations and the following does not represent an exhaustive list of potentially contaminative operations, active or inactive, located on or near the site. As such, other potential sources of ground contamination may exist that have not been identified by this appraisal.

8.3 The information obtained indicates that potentially contaminative activities have occurred on and near to the site. All potential sources of contamination identified in this appraisal have been summarised in Table 9. Due to their distance from the site, potentially contaminative activities or incidents greater than 500m from the site have not been considered as sources which could affect receptors on the site.

Potential Pathways

8.4 Potential pathways for on-site sources are ingestion, dermal contact, inhalation, overland flows and surface water. The bedrock geology within the site is considered to be negligibly permeable, and the area of superficial deposits to have low leaching potential, and therefore the underlying soils have low potential for contaminant migration. Therefore, potential migration of contaminants from on-site sources through the underlying geology is considered to be limited.

8.5 Potential pathways for off-site sources are inhalation, overland flows and surface water. There are some areas of higher leaching potential adjoining the southern boundary and to the east of the site, associated with variably permeable superficial deposits. However, potential migration of contaminants into the site is considered to be limited, due to the aforementioned low permeability and low leaching potential of the bedrock geology and superficial deposits respectively which underlie the site.

Potential Receptors

8.6 Potential receptors for the site are construction operatives, end users and surface water. As discussed, ground conditions are relatively impermeable and therefore no pathways exist to groundwater. Water abstractions noted in Table 7 are all located at significant distance from the site and are used for non-potable purposes. As such, groundwater and water abstractions are not considered as potential receptors.

Source-Pathway-Receptor Linkages

8.7 In order to assess whether it is possible for the sources outlined in Table 9 to reach the receptors, the potential pathways have been considered, as well as the age, location, topography and distance from the site of each potential source of contamination. This assessment is illustrated by in Table 9, with orange representing site contamination potential, and green representing no site contamination potential.

Table 9: Potential Sources of Contamination within 500m of the site

Source	Evidence	Table Ref.	Years Operational / Occurred	Compass Direction	Closest Estimated Distance (m)
Agricultural land	Historical Map	1	Current	ALL	0+
Pipal Cottage Effluent	Discharge Consent	5	2003-present	W	0
Frideswide Farm Effluent	Lack of public sewer.	-	Current	E	20
Frideswide Farm Pond	Infilled Land	4	Current	E	18
Pollution - oils	Pollution Incident	6	1994	S	21
Golf Course Pond	Infilled Land	4	1978 - present	W	35
Unknown	Infilled Land	4	1955	NE	45
Electricity Production	Industrial Uses	2	1993	N	91
Water Eaton Park & Ride	Historical Map Industrial Uses	1 2	2006 - present	N	90
Oxford Parkway Station	Historical Map Industrial Uses	1 2	2013 - present	N	90
Warehouse	Historical Map Industrial Use	1 2	1936-1955	S	151
Engineering Works	Historical Map Industrial Use	1 2	1955-1988	S	151
Oxford Business Park	Historical Map Industrial Use	1 2	1988 - present	SE	151
Banbury Rail Depot	Extractive Industry	4	Active	N	151
North Oxford Halt	Historical Map Industrial Uses	1 2	1905 – 1926	N	170
Cuttleslowe Farm	Historical Map Industrial Uses Infilled Land	1 2 4	1876 - present	SE	181
Wolvercote Cemetery	Historical Map Industrial Use	1 2	1889 - present	SW	183
Golf Club – Effluent and Tanks	Discharge Consent	5	1992	W	190
Pumping Station	Discharge Consent	5	1989	SE	220
Oxford-Bicester Railway Line	Historical Map Industrial Use Infilled Land	1 2 4	1850 - present	N	240
A34	Infilled Land	4	1992	W	290
Projection Screens	Industrial Use	2	Inactive	S	311
Yarnton Loop Railway Line / Gosford Tip	Historical Map Industrial Use Infilled Land Landfill Sites	1 2 4 8	1854-1981	W	350
Pumping Station	Discharge Consent	5	1989 - 2010	SW	369
Tank	Industrial Use	2	-	SE	421
Unknown	Infilled Land	4	1955	SE	422
Holmes Refrigeration	Industrial Use	2	Inactive	SE	457
Crown Cleaning	Industrial Use	2	Active	SE	459
MD Carpet Cleaning	Industrial Use	2	Active	SE	461

- 8.8 The conceptual model is based on the information detailed in previous sections of this report. This model is not based on any intrusive ground investigation and has been constructed to provide an initial assessment of whether potentially unacceptable risks may exist on site. This model has been prepared with reference to LCRM guidance and is aimed at identifying areas where further information may be required to clarify or refine this model.
- 8.9 With reference to the previous sections, potential contaminants, pathways and receptors have been linked in the proposed conceptual model set out in Table 10.

Table 10: Potential Conceptual Model

Potential Source of Contamination	Contaminants										Pathways					Risk to Receptors		
	Oils / Fuels	PCBs	PAHs	Solvents	Herb- / Pest-/Fung-icides	Acids / Alkalis	Organic Compounds	Pathogens	Heavy Metals	Asbestos	Surface Water	Overland Flow	Inhalation	Dermal Contact	Ingestion	Construction Operatives	End Users	Surface Water
Agricultural land	Y			Y	Y						Y	Y	Y	Y	Y	Low	Low	Med
Pipal Cottage Effluent							Y	Y	Y		Y	Y	Y	Y	Y	Low	Low	Med
Electricity Production		Y									Y	Y				Very Low	Very Low	Very Low
Water Eaton Park & Ride	Y								Y		Y	Y	Y			Very Low	Very Low	Very Low
Oxford Parkway Station	Y		Y								Y	Y	Y			Very Low	Very Low	Very Low
Warehouse	Y	Y		Y		Y			Y	Y	Y	Y				Very Low	Very Low	Very Low
Engineering Works	Y	Y		Y		Y			Y	Y	Y	Y				Very Low	Very Low	Very Low

- 8.10 Based on this model, the overall risk to the on-site receptors can be described as 'Very Low to Medium'. Medium risks to surface water receptors are attributed to possible discharge of treated foul effluent at Pipal Cottage and from historical agricultural uses on-site. Low risks are identified to exist to construction operatives and end users from these sources, as well as from the adjacent railway line, from which there is also low risk to surface water receptors.
- 8.11 The site is located within a surface water Nitrate Vulnerable Zone (NVZ) and Drinking Water Safeguard Zone (SgZ). As such, detailed consideration has been given to the risks posed to receiving surface waters. It should be noted that agricultural use can be a source of nitrate pollution, and as such developing the site will reduce the pollution risk posed to the receiving surface waters.

9.0 Mitigation Measures and Further Investigations

- 9.1 This section evaluates the mitigation measures and further investigations that are recommended based on the outcome of the conceptual model outlined in Section 7.
- 9.2 The use of appropriate Personal Protective Equipment (PPE) and welfare facilities will reduce the risk to construction and investigative operatives.
- 9.3 Any future end users of the site will be further protected as any soft landscaping areas will receive a depth of clean topsoil from a certified source which will act as a buffer between any contamination that may be present and future users. The topsoil should be in accordance with BS 3882:2007.

Agricultural Land

- 9.4 Any farm materials and waste present on the site should be removed from the site in accordance with best farming practice prior to any development commencing. This will reduce the risk posed by agricultural sources. Any residual contamination present in the ground through the use of herbicides, pesticides or fungicides is considered to be negligible. The spillage or leakage of oils and fuels from farm machinery could have occurred, leading to potentially contaminated hotspots. Should any hotspots be identified during demolition or construction work, detailed intrusive investigation works should be carried out to investigate their impact.

Pipal Cottage

- 9.5 The risk of prior or future contamination from foul effluent from Pipal Cottage can be considered to be low, provided the septic tank / treatment plant has been and will be maintained and operated in accordance with the manufacturer's guidelines. Therefore, no further measures are considered necessary to mitigate this risk. It is also possible that Pipal Cottage could be connected to the new foul drainage network which would serve the development, thereby removing any future risk of contamination.

Summary

- 9.6 The implementation of the mitigation measures described in this section are considered to sufficiently reduce the risk from identified sources, such that the risk to receptors is very low. Therefore, there should be no significant geo-environmental issues that would prevent the site from being developed for its intended use.
- 9.7 Should any potentially contaminated areas be identified during demolition or construction work, detailed intrusive investigation works should be carried out to investigate their impact.
- 9.8 Pollution risk and control measures relating to the proposed site uses are assessed and considered in the outline surface water drainage strategy, as detailed in the Flood Risk Assessment report.

10.0 Geotechnical Considerations

- 10.1 No major geotechnical issues which could affect the development of the site were encountered during the examination of the available public records.
- 10.2 The mudstone bedrock underlying the site is indicated to be associated with moderate hazard potential relating to shrinking or swelling clay. As such, this hazard potential should be further investigated during intrusive site investigation works at the appropriate stage of the design process in order to establish what, if any, impact this could have on the construction of proposed buildings.

11.0 Conclusions and Recommendations

- 11.1 This Phase 1 Geo-Environmental Appraisal has been prepared to assess the suitability of a site for development.
- 11.2 This report has been prepared in accordance with the NPPF Section 11 and the Land Contamination Risk Management (LRCM) guidance.
- 11.3 A conceptual model of the potential sources, pathways and receptors of contamination has been developed as part of this appraisal. Based on this model, the overall risk to the on-site receptors can be described as 'Very Low to Medium'.
- 11.4 The use of appropriate Personal Protective Equipment (PPE) and welfare facilities will reduce the risk to construction and investigative operatives. Any future end users of the site will be further protected as any soft landscaping areas will receive a depth of clean topsoil from a certified source which will act as a buffer between any contamination that may be present and future users.
- 11.5 The site has historically been used for agricultural purposes. Any farm materials and waste present on the site should be removed from the site in accordance with best farming practice prior to any development commencing.
- 11.6 It is possible that leakage or spillage of oils, fuels, or other contaminants could have occurred from farm machinery or storage tanks on the site, leading to potentially contaminated hotspots. Should any contaminated hotspots be identified during demolition or construction work, detailed intrusive investigation works should be carried out to investigate their impact.
- 11.7 The implementation of the mitigation measures described in this section are considered to sufficiently reduce the risk from identified sources, such that the risk to receptors is very low. Therefore, there should be no significant geo-environmental issues that would prevent the site from being developed for its intended use.
- 11.8 Should any potentially contaminated areas be identified during demolition or construction work, detailed intrusive investigation works should be carried out to investigate their impact.
- 11.9 Intrusive site investigation works have also been undertaken within a Phase 2 site investigation report by ST Consult which further investigate ground conditions, including contamination and geotechnical properties. The Phase 2 site investigation report is submitted separately with this application and is not considered as part of this Phase 1 Geo-Environmental Appraisal.