

Smithfield, Scoldhall Lane, Surfleet, Spalding

Phase 1 Desk Study

Kirk Homes Ltd.

October 2021

Final Report

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EXECUTIVE SUMMARY

Purpose of this report	Phase 1 Desk Study
Client	Kirk Homes Ltd.
Site name	Smithfield, Scoldhall Lane, Surfleet, Spalding. PE11 4BJ
Site Location	The site is located off Scoldhall Lane, Surfleet, Lincolnshire, approximately 4.4km north-east of the town of Pinchbeck, and 6km north of Spalding. The site comprises a rectangular shaped parcel of land aligned north-east to south-west, and occupying an approximate area of 0.41 hectares (4,100m²). The postcode for the site is PE11 4BJ, and the approximate National Grid Reference is 526500, 329400.
Current Land Use	At the time of the walkover the western and southern sections of the site were occupied by open ground. The majority of this area comprised rough unmanaged scrubland, and was not under cultivation. Toward the north-east of the site was a single storey agricultural building of breeze block construction, with a high (3-4m) sloping roof of cement sheet construction. The roof was damaged in a number of locations, and had collapsed entirely toward the centre of the building. An external concrete slab occupied the east of the site adjacent to Scoldhall Lane. This slab was extensively cracked, and appeared in relatively poor condition. Immediately east of the agricultural building at the time of the investigation was a HGV trailer, which appeared to be in poor mechanical condition. Within the trailer were a number of empty plastic baskets/containers. South of the building, situated on and adjacent to the concrete yard were stockpiles of waste metal, rubber, ceramic, concrete and timber artefacts. A stockpile of soil, gravel and cobbles was also noted in this area. A larger heavily vegetated stockpile was recorded further to the west, close to the building. Due to the nature of the vegetation, the material within this stockpile could not be further examined.
Proposed Development	Development proposals include the demolition of all existing structures, the removal of existing concrete hardstanding and the construction of two new structures across the northern and southern sections of the site which will form a contractor's yard/office, and a storage unit for the nearby Farm Shop respectively. Vehicle parking areas and access roads will be constructed across the east and centre of the site using permeable paving material, and exterior gravel yard areas will be constructed across the western and south-western sections.
Site History	By 1887 the site comprised undeveloped agricultural land. The site remained undeveloped until the early 1970s, by which time the existing on-site buildings had been constructed, and two large glasshouses had been built across the central and western sections of the site. No significant changes were noted until 2021, by which time the glasshouses which previously occupied the centre and west of the site had been demolished.
Unexploded Ordnance	The Zetica UXB map for the site indicates that the site is in an area which exhibits a low bomb risk.
Geology and Radon	Due to the development history of the site, it is considered possible that nominal thicknesses of Made Ground may be present. The site is recorded to be underlain by superficial Tidal Flat deposits of Quaternary age. These materials are typically described as soft silty clay with subordinate layers of sand, gravel, and peat. The bedrock underlying the site is recorded to comprise mudstone from the Oxford Clay Formation, of Jurassic age. Locally these deposits are typically described as grey silica rich mudstones with sporadic beds of limestone nodules.

	The site is within a Lower Probability Radon Area (with less than 1% of homes estimated to be at or above the Action Level). Basic radon protection measures are therefore required in the construction of new homes or buildings in this area.
Mining and Mineral Extraction	The site is listed within the Envirocheck Report as being within an area that 'might not be affected by coal mining'. No further investigation has therefore been undertaken with respect to coal mining as part of the current investigation. No hazards have been recorded with respect to 'non-coal' mining within the vicinity of the site. No BGS Recorded Mineral Sites have been identified by Envirocheck within 500m of the site.
Hydrogeology	Both the superficial Tidal Flat deposits and the bedrock from the Oxford Clay Formation have been classified as Unproductive aquifer units. No groundwater abstraction consents have been recorded within 500m of the site. The site is not located within a Source Protection Zone (SPZ) and there are no SPZs recorded within a 1km radius. One groundwater discharge consent has been issued within 500m. This consent relates to the discharge of agricultural and surface drainage/runoff from a property located approximately 313m north of the site (Red House Farm). No Water Industry Act referrals have been recorded with respect to groundwater discharges within 1km.
Hydrology	The nearest surface water feature recorded by Envirocheck is a drainage channel situated approximately 4m east of the site. No surface water abstraction consents have been recorded within 500m of the site. Four surface water discharge consents have been issued within 500m. The closest consent relates to the discharge of final treated effluent from a residential property located 294m south-west of the site. The receiving water is referred to as Fen Drain. No Integrated Pollution Control (IPC), Integrated Pollution Prevention and Control (IPCC), or Local Authority Pollution Prevention Control (LAPPC) authorisations have been recorded within 500m of the site. One pollution incident has been recorded by Envirocheck within 500m. This incident occurred on 22nd October 1997, and involved the release of crude sewage from a residential property located 416m south-west of the site to a freshwater stream. The cause of this incident, which was recorded by the Environment Agency as a Category 3 (minor) event, was understood to be leaking pipework. No Water Industry Act referrals have been recorded with respect to discharges to surface water receptors within 500m of the site.
Flood Risk	No data regarding groundwater flood susceptibility has been provided by the BGS. This may be due to the presence of 'unproductive' superficial and solid geological units underlying the site. The site is located both within a Zone 2 and Zone 3 floodplain, indicating that the annual probability of river or tidal flooding is greater than 1:100 yrs. The site is recorded by Envirocheck to be at risk of flooding and extreme flooding from rivers of seas without defences based on fluvial models. No flood defences, areas benefitting from flood defences, or areas used for flood storage were recorded within 250m of the site.
Waste Management	No BGS recorded, Local Authority recorded, or historical landfill sites have been identified by Envirocheck within 1km of the site. There are no records of licensed waste management facilities, registered waste transfer sites or treatment or disposal sites within 1km of the site. No records of potentially infilled land have been identified within 1km. No records of explosive sites, planning hazardous substance consents or enforcements, Control of Major Accident Hazards (COMAH) or Notification of Installations Handling Hazardous Substances (NIHHS) sites have been identified within 1km of the site.

Geotechnical Hazards	Envirocheck has identified moderate risks associated with compressible ground and running sand hazards at the site resulting from the anticipated presence of superficial Tidal Flat deposits. Tidal Flat deposits, considered likely to exhibit poor geotechnical competence are likely to be present below the site to a significant depth. It is therefore anticipated that competent founding strata will also be present at relatively increased depth.
Conclusions	Based on historical and current activities and site use, the risk from land contamination at the site is considered **Low** with respect to the majority of potential sources identified. **Moderate** risk has, however been identified with respect to the presence of stockpiles which were recorded on-site during the site walkover. It is recommended that a nominal ground investigation is undertaken. This would involve the further investigation, logging, and sampling of on-site stockpiles to identify the presence of associated contamination. Due to the potentially poor geotechnical competence of the Tidal Flat deposits, an intrusive geotechnical site investigation will likely be required to support the proposed development. It is recommended that during any such investigation, samples are collected for laboratory chemical analysis in order to confirm the contaminative status of soils and groundwater at the site. In addition, further examination of the ground gas generation potential, and the likely permeability of the Tidal Flat deposits underlying the site is recommended in order to corroborate the preliminary CSM. An asbestos survey of the existing buildings should be undertaken by a licensed and experienced contractor, and appropriate mitigation/removal of ACMs should be carried out prior to, or as part of the demolition programme.

This Executive Summary forms part of Grange GeoConsulting Limited report number R21071 (Issue 1) and should not be used as a separate document.

1.0 INTRODUCTION

1.1 Terms of Reference

It is currently proposed by the Client, Kirk Homes Ltd. to undertake redevelopment of a site located off Scoldhall Lane, Surfleet, Lincolnshire, approximately 4.4km north-east of the town of Pinchbeck, and 6km north of Spalding. The postcode for the site is PE11 4BJ, and the approximate National Grid Reference is 526500, 329400. A Site Location Plan (Drawing R21071-DWG1) is presented in Appendix A.

The site comprises a rectangular shaped parcel of land aligned north-east to south-west, and occupying an approximate area of 0.41 hectares (4,100m²).

At the time of the investigation, the western and southern sections of the site comprised open ground which formed part of a field unit which extended off site to the west. A series of structures used for the storage of farming equipment and supplies were present toward the north and west of the site. Toward the east of the site was a concrete yard area with vehicular access from Scoldhall Lane. A small area of open scrub was present toward the south-eastern corner of the site adjacent Scoldhall Lane.

The area surrounding the site is predominantly rural and agricultural in character. The areas to the north, west and east (beyond Scoldhall Lane) of the site are occupied by agricultural fields. South of the site is a residential property with an associated garden area, beyond which is Spalding Farm Shop and Seasonal Plant Centre. A small car-park associated with this facility is present to the rear (west), approximately 60m south-west of the site.

A site walkover was undertaken by Grange GeoConsulting on the 21st of October 2021.The findings of this visit are presented in Table 2.1.

Development proposals include the demolition of all existing structures, the removal of existing concrete hardstanding and the construction of two new 1-2-storey structures across the northern and southern sections of the site which will form a contractor's yard/office, and a storage unit for the nearby Farm Shop respectively. In addition, vehicle parking areas and access roads will be constructed using permeable paving materials, and exterior yard areas (underlain by gravel) will be constructed across the western and south-western sections. A planning application (ref. H17-0005-21) was submitted for this development to South Holland District Council, which was granted subject to condition on 29th March 2021.

1.2 Objectives

The overall objectives of the investigation were to undertake a Desk Study and Preliminary Risk Assessment of the site to inform the Client of the ground conditions and any potential

environmental or geotechnical risks associated with the redevelopment of the site for commercial use, and to address Condition 3 of the planning application (ref. H17-0005-21).

1.3 Scope of Works

The scope of works was outlined by Grange GeoConsulting Limited in our fee proposal and scope of works document issued to the Client on the 23rd September 2021. Authorisation to proceed with this report was given by James Kirk, of Kirk Homes Ltd. in October 2021.

The scope of the Phase 1 investigation is summarised below.

- A site walkover by a Grange GeoConsulting Ltd representative;
- A review of all desk-based client information concerning the site history, photographs, and site records;
- A review of topographical, geological, and hydrogeological maps;
- A review of historical site maps to identify any former potentially contaminative uses of the site and immediately surrounding areas, and an assessment of the potential contaminants associated with those uses;
- Purchase and review of a Landmark Information Group Envirocheck Report for the site in order to identify any potential risks associated with flooding, local landfill sites, pollution incidents etc. which may have had the potential to impact the site;
- Formulation of a Conceptual Site Model including the clear and tabulated identification of potential pollution linkages;
- A Qualitative Risk Assessment; and
- A review of the geological conditions and their effects on foundation design and possible impacts during future construction.

1.4 Provided Drawings

The following information has been provided by the Client to support the completion of this Phase 1 Desk Study Report:

- An Existing Site Plan (1:500 scale) produced by P&R Architects Ltd on behalf of Kirk Homes (Mr J Kirk) - Drawing Ref. 3872-S02 dated December 2020.
- A Proposed Site Plan (1:200 scale) produced by P&R Architects Ltd on behalf of Kirk Homes (Mr J Kirk) - Drawing Ref. 3872-P01 dated December 2020.
- An Elevation Drawing (1:100 scale) produced by P&R Architects Ltd on behalf of Kirk Homes (Mr J Kirk) - Drawing Ref. 3872-P02 dated December 2020.

Copies of these drawings are included in Appendix A.

1.5 Limitations

This report is based upon information obtained from third party sources, together with observations from the site walkover. The third-party data has been accepted at face value and has not been independently verified. Grange GeoConsulting Ltd can therefore give no warranty, representation, or assurance as to the accuracy or completeness of such information.

This report has been prepared for the sole internal use and reliance of the Client, Kirk Homes Ltd, and shall not be relied upon by other parties without the express written authority of Grange GeoConsulting Ltd. If an unauthorised third party comes into possession of this report, then they rely on it at their own risk.

2.0 PHASE 1 DESK STUDY

A number of published sources have been obtained and consulted in order to inform the desk study, including a Landmark Information Group Envirocheck Report for the site (reference 286605371_1_1) which is presented in Appendix B. The search area referenced within the Envirocheck report corresponds with the proposed development (redline) boundary.

Other publicly available information has been utilised, including Google Earth and internet search engines. A site walkover has also been undertaken to supplement this desk-based review.

2.1 Site Description and Walkover Survey

A site walkover was undertaken on the 21st of October 2021 by a Grange GeoConsulting Ltd representative to identify any potential hazards and receptors. Photographs taken during the site walkover are presented in Appendix C. A description of the current site conditions is summarised in Table 2.1.

Table 2.1: Site Description

Item	Brief description
Land area	Approximately 0.41 hectares (4,100m²).
Elevation and topography	The site surrounding areas were relatively flat and level. The elevation of the site is approximately 4.0m AOD.
Geomorphic features	There was no evidence of erosion or mass movement on or near the site during the site walkover.
Site access	Pedestrian and vehicular access onto the site is possible from Scoldhall Lane to the east. A concrete yard situated across the eastern periphery of the site enables on-site vehicle parking and manoeuvring. The western and northern boundaries of the site are not delineated by barriers or fences, and it is possible for pedestrians and agricultural machinery to access the site from adjacent land in these directions.
Present land use	At the time of the walkover the western and southern sections of the site were occupied by open ground. The majority of this area comprised rough unmanaged scrub, and was not under cultivation. Vehicle tracks were noted across the central and west of the site, indicating that the site has been used by farm vehicles to access cultivated fields located off-site to the west. The nature of these tracks would suggest that the underlying substrate is relatively soft. Toward the north-east of the site was a single storey agricultural building of breeze block construction, with a high (3-4m) sloping roof of cement sheet construction. The cement sheeting appeared in poor condition. The roof was damaged in a number of locations, and had collapsed entirely toward the centre of the building. Vegetative growth was recorded alongside the southern and northern elevations of the building, however access to the interior remained possible via wooden sliding doors toward the east and west of the property. At the time of the investigation the weatherproof interior sections of the building were used for the storage of palletised timber products, agricultural supplies, farming equipment (mechanical plough/rotavator), metal racking, domestic ornaments, plastic pots, and a small stockpile of soil. A small quantity of metal racking was stored within the section of the building where the roofing had collapsed. The interior floor slab was of concrete construction, and was locally cracked and damaged.

Item	Brief description
	An external concrete slab occupied the east of the site adjacent to Scoldhall Lane. This slab was extensively cracked, and appeared in relatively poor condition. The slab occupied the area between the road and the agricultural building, and extended further to the south, parallel with Scoldhall Lane. Immediately east of the agricultural building at the time of the investigation was a HGV trailer, which appeared to be in poor mechanical condition. The rear half of the trailer was situated on the concrete yard area. The front of the trailer overlapped onto open ground. Within the trailer were a number of empty plastic baskets/containers. Adjacent, were a number of metal racks (on which were plastic trays containing potted plants), stacked wooden pallets, and three discarded chest freezer units. South of the building, situated on and adjacent to the concrete yard were piles of waste metal, rubber, ceramic, concrete and timber artefacts. A stockpile of soil, gravel and cobbles was also noted in this area. A larger, heavily vegetated stockpile was recorded further to the west, close to the building. Due to the nature of the vegetation, the material within this stockpile could not be further examined.
Contamination evidence	Aside from the potential sources described above, no visual or olfactory evidence of contamination was identified during the site walkover.
Site boundaries and surrounding land use	The site is bound to the west and north by agricultural fields which were at the time of the investigation under cultivation. Immediately east of the site, and delineating the eastern boundary was Scoldhall Lane, beyond which were additional agricultural fields. The southern site boundary was marked by a 2-3m high hedgerow. Immediately beyond the hedge was a residential property (single-storey (with dormer), of brick construction) with an adjacent garden and driveway. A wooden outbuilding associated with this property was situated approximately 2m south of the site. Further to the south, approximately 35m from the site was a small farm shop. The main farm shop building was of brick construction, single-storey, with a pitched roof constructed from cement sheeting. A car park with a gravel substrate was noted adjacent to the main building.

2.2 Site History

Detailed maps and aerial photographs of the site and surrounding area dated 1887 to 2021 (at scales of 1:2,500, 1:10,000 and 1:10,560) have been provided as part of the Envirocheck Report for the site, and have been reviewed. This review has been undertaken to identify any former land uses at and within the area surrounding the site that may have geotechnical or geo-environmental implications for the proposed development. The findings are summarised in Table 2.2.

Table 2.2: Key Features from Historical Mapping

Map date and Scale	Key on-site features	Key off-site features
1887 to 1889 (1:2,500 and 1:10,560)	The site comprised undeveloped agricultural land at this time. A field boundary crossed the northern periphery. Scoldhall Lane had been constructed, however may have overlapped onto the eastern edge of the site (depending on map accuracy).	Several large residential properties were noted approximately 100m east (Coalbeach House) and north (Red House) of the site. Both of these houses had considerable grounds, with large ponds/surface water features. The surrounds were predominantly agricultural at this time. Of particular note were large orchards identified approximately 100m south, and 120m east. A small farmhouse (Thary Farm) was situated 350m to the south-west. Field drainage was noted 80m south of the site, running east to west. A railway line was recorded 250m south-east of the site, running south-west to north-east through the region. A disused Flax Mill was noted approximately 900m to the south-east. This formed the extent of local industrial use at this time.
1904 to 1906 (1:2,500 and 1:10,560)	No changes were noted on site.	The Flax Mill to the south-east, and the orchard to the south were no longer shown by this time.
1931 to 1932 (1:2,500 and 1:10,560)	No changes were noted on site.	Coalbeach House to the east was referred to as Coalbeach Farm by this time. Drainage channels were noted around the perimeter of this property.
1951 and 1956 (1:10,560)	No changes were noted on site.	Small scale residential development had occurred adjacent to the railway track approximately 650m south of the site. This area was at this time referred to as Surfleet Seas End.
1973 to 1977 (1:2,500 and 1:10,000)	The existing on-site buildings had been constructed by this time. In addition, two large glasshouses had been built across the central and western sections of the site, extending off site to the west.	The on-site structures were serviced by a track which connected the western section of the site to a small complex which had been constructed to the south adjacent the intersection between Coalbeach Lane and Scoldhall Lane. The nature of this complex is not recorded, however it is considered possible that this was a previous iteration of the existing farm shop. Small sewage works had been constructed 350m south, 600m west, and 650m east of the site. A haulage depot was also recorded at this time, approximately 500m south. Pig and Poultry farm complexes were noted 350m north-west, 550m south and 550m south-east respectively. The railway line to the south-east had been dismantled, however a former associated embankment remained.
1987 to 1990 (1:2,500 and 1:10,000)	No changes were noted on site.	The track which previously connected the site and the structures south were no longer present.

Map date and Scale	Key on-site features	Key off-site features
1995 to 1996 (1:2,500)	No changes were noted on site.	The A152 located approximately 120m south of the site had been constructed by 1996.
2000 (1:10,000)	The glasshouses occupying the majority of the site were shown as a single structure at this time.	The sewage works to the east, and haulage depot to the south were no longer shown. A reedbed was recorded approximately 300m south.
2006 (1:10,000)	No changes were noted on site.	The farm shop currently situated south of the site had expanded, creating the existing layout/configuration.
2021 (1:10,000)	The glasshouse which previously occupied the centre and west of the site had been demolished. The site was as present.	The residential dwelling south of the site had been constructed by this time.

2.3 Unexploded Ordnance

In general accordance with the CIRIA report C681 (Stone *et al* 2009) a non-UXO specialist screening exercise has been carried out for the site as detailed below.

The Zetica UXB map for the site indicates that the site is in an area with a low bomb risk. This is likely to be due to the rural location of the site, and a lack of potential strategic targets noted by Zetica in the local area. Low-risk regions are characterised by a bomb density of 15 bombs per 1,000 acres or less.

A copy of the Zetica UXO map is presented in Appendix D. Based on the findings, further action to mitigate the risk is considered prudent by Zetica, although not essential.

2.4 Geology

Whilst worked or artificial ground has not been identified at or in the immediate vicinity of the site, due to its development history, it is considered possible that nominal thicknesses of Made Ground may be present.

The British Geological Survey (BGS) indicates the site to be underlain by superficial Tidal Flat deposits of Quaternary age. These are generally detrital sedimentary deposits of shallow marine origin resulting from the repeated covering and uncovering of marshy land within the intertidal zone, and are typically described as soft silty clay with subordinate layers of sand, gravel, and peat.

The bedrock underlying the site is recorded to comprise mudstone from the Oxford Clay Formation, of Jurassic age (157 to 166 million years ago). These materials are detrital and shallow marine in origin, forming interbedded coarse to fine grained strata. floodplains and levees of a river or estuary. Locally these deposits are typically described as grey silica rich mudstones with sporadic beds of limestone nodules.

The BGS have published logs for trial pits excavated to support the construction of the A152 approximately 120m south of the site. The closest of these trial pits (BGS ref TF22NE60) recorded a sequence of topsoil (medium dense light brown sandy silt) to 0.3m bgl, underlain by medium dense light brown silty fine to medium SAND to the base of the excavation at 2.1m bgl.

2.5 Mining and Mineral Extraction

The site is listed within the Envirocheck Report as being within an area that ‘might not be affected by coal mining’. No further investigation has therefore been undertaken with respect to coal mining as part of the current investigation.

No hazards have been recorded with respect to ‘non-coal’ mining within the vicinity of the site.

No BGS Recorded Mineral Sites have been identified by Envirocheck within 500m of the site.

2.6 Ground Stability

The potential ground stability hazards associated with the geology at the site, as outlined in the Envirocheck Report, have been summarised below:

- Collapsible Ground – No Hazard
- Compressible Ground – Moderate Hazard
- Ground Dissolution – No Hazard
- Landslide Ground Instability – Very Low
- Running Sand – Moderate Hazard
- Shrinking or Swelling Clay – Low Hazard

Moderate hazards have been recorded at the site with respect to compressible ground and running sand. It is anticipated that both of these hazards relate to the presence of superficial Tidal Flat deposits which are recorded by the BGS to underlie the site.

2.7 Soil Chemistry

Estimated soil chemistry data has been provided by the BGS, and presented within the Envirocheck Report. A review of this data has been undertaken and is summarised in Table 2.3.

Table 2.3: Soil Chemistry

Soil Chemistry	Average Concentrations (mg/kg)
Arsenic	<15 mg/kg
Cadmium	<1.8 mg/kg
Chromium	40-60 mg/kg
Lead	<100 mg/kg
Nickel	15-30 mg/kg

The estimated soil chemistry for arsenic, cadmium, chromium (assuming trivalent), lead and nickel do not exceed residential with plant uptake Generic Assessment Criteria (GAC), which include Soil Guidance Values (SGVs) (CL:aire), Category 4 Screening Levels (C4SLs) (DEFRA) and the 2014 Land Quality Management (LQM) / Chartered Institute of Environmental Health (CIEH) Suitable for Use Levels for Human Health Risk Assessment (S4ULs).

Whilst the proposed development does not include a residential component, the adopted GACs for this end use are the most conservative generic criteria available, and have been used for screening purposes as a worst case.

No site-specific data, referred to by the BGS as ‘Measured Urban Soil Chemistry’ has been recorded within 500m of the site.

2.8 Radon

The Indicative Atlas of Radon for England and Wales and the Envirocheck Report indicate that the site is within a Lower Probability Radon Area (with less than 1% of homes estimated to be at or above the Action Level). Therefore, the BGS and the Building Research Establishment Radon Guidance Document indicate basic radon protection measures are unlikely to be required in the construction of new buildings at the site.

2.9 Hydrogeology

Both the superficial Tidal Flat deposits and the bedrock from the Oxford Clay Formation which are recorded to underlie the site have been classified by the Environment Agency as Unproductive units. These are horizons which exhibit low permeability, and have negligible significance for water supply or river base flow.

Envirocheck record no risk associated with the presence of soluble rocks at the site.

No groundwater abstraction consents have been recorded within 500m. The site is not located within a Source Protection Zone (SPZ) and there are no SPZs recorded within a 1km radius.

One groundwater discharge consent has been issued within 500m. This consent relates to the release of agricultural and surface drainage/runoff from a property located approximately 313m north of the site (Red House Farm). Licence to discharge was first granted in April 1999, and the consent is understood to remain active.

No Water Industry Act referrals have been recorded with respect to groundwater discharges within 1km.

2.10 Hydrology

The nearest surface water feature recorded by Envirocheck is a drainage channel situated approximately 4m east of the site. Drainage channels are situated adjacent to many of the agricultural field units and roads throughout the region. These drainage channels, in general, appear in hydraulic connectivity with principal local watercourses, including the River Glen, which flows west to east and passes the site to the south at a distance of approximately 600m, and the River Welland, which flows south-west to north-east past the site at a distance of 1.7km. The River Welland is partially channelised through the region, and flows into The Wash approximately 16km north-east of the site.

No surface water abstraction consents have been recorded within 500m of the site.

Four surface water discharge consents have been issued within 500m. The closest consent relates to the discharge of final treated effluent from a residential property located 294m south-west of the site. The receiving water is referred to as Fen Drain. The three remaining consents are held by Anglian Water enabling the discharge of storm sewage overflow, and sewerage emergency discharge to Fen Drain approximately 410m south-west of the site. Each of these consents are considered active.

River quality data, obtained by the Environment Agency as part of the GQA assessment scheme for a section of the River Glen between Surfleet and Blue Gowt Drain, resulted in the classification of the watercourse as Grade C (Fairly Good).

No Integrated Pollution Control (IPC), Integrated Pollution Prevention and Control (IPCC), or Local Authority Pollution Prevention Control (LAPPC) authorisations have been recorded within 500m of the site.

One pollution incident has been recorded by Envirocheck within 500m. This incident occurred on 22nd October 1997 and involved the release of crude sewage from a residential property located 416m south-west of the site into a freshwater stream. The cause of this incident, which was recorded by the Environment Agency as a Category 3 (minor) event, was understood to be leaking pipework.

No Water Industry Act referrals have been recorded with respect to discharges to surface water receptors within 500m of the site.

There are no records of enforcement and prohibition notices or prosecutions relating to authorised processes listed within 500m of the site within the Envirocheck Report.

2.11 Flood Risk

No data regarding groundwater flood susceptibility has been provided by the BGS. This may be due to the presence of 'unproductive' superficial and solid geological units underlying the site.

The site is located both within a Zone 2 and Zone 3 floodplain, indicating that the annual probability of river or tidal flooding is greater than 1:100yr. The site is recorded by Envirocheck to be at risk of flooding and extreme flooding from rivers of seas without defences, based on fluvial models.

According to the Environment Agency's RoFRaS (Risk of Flooding from Rivers and Sea) database, the flood risk at the site has been categorised 'Medium'.

No flood defences, areas benefitting from flood defences, or areas used for flood storage were recorded within 250m of the site.

No further consideration of flood risk is given in this report. Specialist flood risk advice should be sought with regards to drainage and flooding. Based on the information obtained, it may be necessary to undertake a formal flood risk assessment to support the proposed development.

2.12 Waste Management and Hazardous Substances

No BGS recorded, Local Authority recorded, or historical landfill sites have been identified by Envirocheck within 1km of the site.

There are no records of licensed waste management facilities, registered waste transfer sites or treatment or disposal sites within 1km of the site.

No records of potentially infilled land (water or non-water) have been identified within 1km.

No records of explosive sites, planning hazardous substance consents or enforcements, Control of Major Accident Hazards (COMAH) or Notification of Installations Handling Hazardous Substances (NIHHS) sites have been identified within 1km of the site.

2.13 Contemporary Trade Directories

One Contemporary Trade Directory Entry has been identified by Envirocheck within 500m of the site. Graphix Design and Print Ltd (printers) were located approximately 383m south-west. This facility is recorded as 'inactive'.

No 'active' trade directory entries, or petrol filling stations have been identified within 500m.

Four manufacturing points of interest have been identified by Envirocheck within 500m of the site. The two closest entries refer to arable farming undertaken at Red House Farm between 142m and 147m north of the site. An unspecified works unit/factory is recorded 402m south-west of the site. The final entry refers to a 'piggery' (pig farm) approximately 427m north-west of the site.

2.14 Sensitive Land Uses

During the site walkover, no evidence of invasive weeds, including Japanese Knotweed, was observed. Although a visual inspection was carried out, this does not represent a full invasive weeds survey and as such may need to be carried out by a specialist at a later date.

The site is located within a surface water Nitrate Vulnerable Zone (NVZ) associated with the River Glen.

No areas of greenbelt, Local Nature Reserves, National Parks, Ancient Woodland, Sites of Special Scientific Interest (SSSI), or Areas Outstanding Natural Beauty (AONB) have been recorded within 1km of the site.

3.0 PRELIMINARY RISK ASSESSMENT AND EXPOSURE MODEL

A Conceptual Model represents the possible relationships between potential contaminant sources, pathways, and receptors in line with the Statutory Guidance to Part 2a of the Environmental Protection Act 1990. The following Preliminary Risk Assessment is based on the results of the Desk Study and the site walkover.

3.1 Potential Contamination Sources and Contaminants of Concern

On-site

Potential contaminant sources identified at the site are outlined below:

- Based on the historical course of development identified at the site it is considered possible that a nominal thickness of Made Ground may be present. Depending on type and origin it is considered possible that this Made Ground may be contaminative. Potential associated contaminants of concern include PAHs, TPHs, heavy metals, semi-metals and metal compounds, pH, and asbestos.

- It is considered possible that the Tidal Flat deposits which underlie the site could (as a result of deposition characteristics) possess a significant organic component, resulting in ground gas generation potential.

- The site walkover identified an agricultural building across the northern and eastern sections of the site, which was of breezeblock construction with a sloping cement sheet roof. The cement sheet roof, which is considered a possible source of asbestos contamination, appeared to be locally damaged, and in one area had collapsed.

- The interior of the agricultural building was used to store mechanical farming equipment (rotavator/plough). Whilst this equipment was considered a possible contamination source, due to its relatively small scale, any associated spillages or leaks are considered likely to be extremely limited. No petroleum or oil storage tanks/containers were encountered during the walkover. Possible contaminants of concern could include TPHs, fuel (petroleum, Diesel), lubricant oils, BTEX, and MTBE.

- A HGV trailer was recorded on site during the site walkover. This trailer appeared to be in relatively poor condition, and could be considered a possible source of localised contamination due to leaks or spillages of lubrication oils, or brake fluid. There was no evidence that an associated truck/cab, which would be considered a more significant source due to the presence of an engine and fuel tanks, had been stored on site.

- Several stockpiles of soil and refuse were noted to the south of the agricultural building. The examination of these stockpiles was limited due to the presence of vegetation. Depending on the source of these soils, potential contaminants of concern could include PAHs, TPHs, heavy metals, semi-metals and metal compounds, pH, and asbestos. The refuse piles did not appear on initial inspection to contain waste which would be considered significantly contaminative.

- Sections of the site are understood, from a review of historical maps, to have been under agricultural cultivation. Potential contaminants associated with this use could include pesticides/herbicides. The potential for contamination associated with on-site cultivation may have been limited, however, by the presence of large glasshouses across the site for much of its recent history. Cultivation within these structures is considered less contaminative due to the weatherproofing effect of the building, and the potential presence of an underlying floor slab. It should be noted that no floor slab was recorded n this area during the investigation.

Off-site

The site is located within a predominantly rural area, which has not historically been subject to significant industrial or commercial development. Potential off-site sources of contamination are therefore considered limited. Despite this, several historical and contemporary activities with the potential to impact the site have been identified as part of the Desk Study.

These potential contaminant sources are described and considered below:

- The area surrounding the site has been under agricultural (arable) use for much of its recorded history, and remains so. Potential contaminants associated with this use could include pesticides and herbicides.

- Potentially contaminative historical industry identified during the Desk Study in the vicinity of the site has included; a railway line which ran south-west to north-east past the site at a distance of 250m between 1887 and the 1970's, a haulage depot located approximately 500m south of the site between the 1970's and 2000, sewage treatment works located 350m south and 650m east of the site between 1970's and 2000, pig farms located 350m north-west and 550m south of the site between the 1970's and the present day, and a poultry farm located 550m south-east of the site between the 1970s and present day. Potential contaminants of concern associated with these activities include metals, semi-metals, PAHs, TPHs, fuel (petroleum, Diesel), lubricant oils, BTEX, and MTBE, pH adjusters, asbestos, pathogens, and surfactants. Based on a combination of scale, contamination potential, age, and relative distance, these sources are considered unlikely to represent a significant risk of contamination to the site or proposed development, and have not been considered further.

3.2 Potential Pathways

The potential pathways identified for the site include the following:

- Direct human contact (construction/demolition phase)

- Inhalation (dust and vapours)

- Ingestion (direct, and dust- the cultivation of homegrown produce is considered unlikely following redevelopment)

- Direct contact with aggressive ground conditions

- Leaching and migration of contamination via groundwater and surface water runoff.
- Migration of ground gas and vapours

3.3 Potential Receptors

The potential receptors identified for the site include the following:

- Site end users (future occupational site users, visitors, and neighbours)
- Groundworkers (construction, demolition, and future maintenance workers)
- Building materials (buried concrete and underground services)
- Controlled waters: Surface waters- Drainage channel located 4m east of the site, and hydraulically linked River Glen (overland flow and surface run-off)

3.4 Summary of Potential Contaminant Linkages

Table 3.2 lists the plausible contaminant linkages identified for the site. These are considered as potentially unacceptable risks in line with guidelines published in CLR 11, and additional risk assessment may be required. Linkages have been assessed in general accordance with guidance provided in the CIRIA Report C552 (Rudland *et al* 2001) but with the addition of a 'no linkage' category as detailed in Table 3.1.

It should be noted that whilst the risk assessment process undertaken in this report may identify potential risks to groundworkers (construction and future maintenance workers), consideration of occupational health and safety issues is beyond the scope of this report and needs to be considered separately in the Construction Phase Health and Safety Plan.

Table 3.1: Risk Assessment Process

	Consequence			
Probability	**Severe**	**Medium**	**Mild**	**Minor**
High Likelihood	Very high risk	High risk	Moderate risk	Low risk
Likely	High risk	Moderate risk	Low risk	Very low risk
Low Likelihood	Moderate risk	Low risk	Low risk	Very low risk
Unlikely	Low risk	Very low risk	Very low risk	Very low risk
No Linkage	No risk			

Table 3.2: Preliminary Exposure Model – Source Pathway Receptor Contaminant Linkages

Source(s)	Possible Pathway(s)	Receptor(s)	Probability	Consequence	Risk	Comments
On-Site: Potential Made Ground COC: Metals, Semi-metals, TPHs, PAHs, asbestos, pH adjusters	Direct human contact (demolition and construction phases) Inhalation Ingestion Leaching and migration via groundwater and surface water	Site end users, Construction/ demolition workers, Building Materials, Controlled waters: Surface water	Likely (construction/ demolition workers, controlled waters) Low Likelihood (Site End Users)	Mild	Low	Based on previous development phases the presence of nominal Made Ground is considered possible across the site. The proposed development will comprise commercial use, resulting in occupational exposure scenarios. These scenarios include limited dermal pathways, and attenuated inhalation and ingestion pathways. No landscaping is proposed as part of the development. It is considered likely that workers will come into direct contact with contaminants during the demolition and construction phases. The proposed presence of permeable external areas (gravel and permeable paving) will enable infiltration of meteoric water, and vertical migration of contaminants. The Tidal Flat and Oxford Clay Formation deposits anticipated to underlie the site have been designated Unproductive units by the Environment Agency, and are not considered a significant controlled water receptor. These strata are also likely to exhibit very low permeability, which will favour lateral rather than vertical migration of contaminants. The closest surface water receptor is located 4m east of the site.
On-Site: Potentially Organic Tidal Flat Deposits COC: Ground Gases	Migration of ground gases via permeable soils	Site end users, Groundworkers, Building Materials,	Low Likelihood	Medium	Low	The Tidal Flat deposits underlying the site are considered to potentially possess gas generation potential. The proposed development will comprise commercial use, resulting in occupational exposure scenarios. The end use will include offices with small to moderate room sizes. It is considered possible that workers will come into contact with ground gases during the demolition and construction phases. The proposed presence of permeable external areas (gravel and permeable paving) will enable vertical migration of ground gases. The Tidal Flat and Oxford Clay Formation deposits anticipated to underlie the site have been designated Unproductive units by the Environment Agency. These strata are also likely to exhibit very low permeability, which will limit the mobility of ground gases.

Source(s)	Possible Pathway(s)	Receptor(s)	Probability	Consequence	Risk	Comments
On-Site: Damaged Asbestos Containing Materials within existing agricultural building COC: Asbestos fibres	Direct human contact (demolition and construction phases) Inhalation	Demolition workers	Unlikely	Severe	Low	Potential asbestos containing materials have been identified within the existing on-site structure. Significant damage to these ACMs was observed during the site walkover. Without appropriate mitigation it is considered possible that construction/demolition workers could come into contact with these materials. It is assumed for the purpose of risk assessment that appropriate PPE and methods of working will be adopted by workers, thereby significantly reducing the likelihood of exposure.
On-Site: Spillages and leaks associated with stored agricultural equipment and HGV trailer COC: TPHs, fuel (petroleum, Diesel), lubrication oils, brake fluid, BTEX, and MTBE.	Direct human contact (demolition and construction phases) Inhalation Ingestion Leaching and migration via groundwater and surface water	Site end users, Groundworkers, Building Materials, Controlled waters: Surface water	Likely (construction/ demolition workers, controlled waters) Low Likelihood (Site End Users)	Mild	Low	The storage of agricultural equipment and a vehicle trailer was considered a potential contaminant source. Any associated contamination was considered likely to be small scale and localised. The proposed development will comprise commercial use, resulting in occupational exposure scenarios. These scenarios include limited dermal pathways, and attenuated inhalation and ingestion pathways. No landscaping is proposed as part of the development. It is considered likely that workers will come into direct contact with contaminants during the demolition and construction phases. The proposed presence of permeable external areas (gravel and permeable paving) will enable infiltration of meteoric water, and vertical migration of contaminants. The Tidal Flat and Oxford Clay Formation deposits anticipated to underlie the site have been designated Unproductive units by the Environment Agency, and are not considered a significant controlled water receptor. These strata are also likely to exhibit very low permeability, which will favour lateral rather than vertical migration of contaminants. The closest surface water receptor is located 4m east of the site.

Source(s)	Possible Pathway(s)	Receptor(s)	Probability	Consequence	Risk	Comments
On-Site: Soil/rubble stockpiles COC: Metals, Semi-metals, TPHs, PAHs, asbestos, pH adjusters	Direct human contact (demolition phase) Inhalation Ingestion Leaching and migration via groundwater and surface water	Groundworkers, Building Materials, Controlled waters: Surface water	Likely	Medium	Moderate	Stockpiles of refuse, rubble and soil were noted at the site during the site walkover. The provenance and characteristics of materials within this stockpile could not be confirmed. It is assumed that these stockpiles will be dealt with during the demolition phase of the development. It is considered likely that workers will come into direct contact with contaminants during the demolition phase. The proposed presence of permeable external areas (gravel and permeable paving) will enable infiltration of meteoric water, and vertical migration of contaminants. The Tidal Flat and Oxford Clay Formation deposits anticipated to underlie the site have been designated Unproductive units by the Environment Agency, and are not considered a significant controlled water receptor. These strata are also likely to exhibit very low permeability, which will favour lateral rather than vertical migration of contaminants. The closest surface water receptor is located 4m east of the site.
On and Off-site: Agricultural Use COC: Pesticides/ herbicides	Leaching and lateral migration onto site via groundwater and surface water, Direct human contact (demolition and construction phases) Inhalation Ingestion	Site end users, Groundworkers, Building Materials, Controlled waters: Surface water	Likely (construction/ demolition workers, controlled waters) Low Likelihood (Site End Users)	Mild	Low	The site and surrounding areas have been subject to agricultural use throughout recent recorded history. Continued agricultural use of the surrounding areas was observed during the site walkover. The use of pesticides/herbicides as part of this activity cannot be ruled out. The severity of impact to groundworkers and site end users is limited by occupational exposure, and limited potential for ingestion. The proposed development will comprise commercial use, resulting in occupational exposure scenarios. These scenarios include limited dermal pathways, and attenuated inhalation and ingestion pathways. No landscaping is proposed as part of the development. It is considered likely that workers will come into direct contact with contaminants during the demolition and construction phases. The proposed presence of permeable external areas (gravel and permeable paving) will enable infiltration of meteoric water, and vertical migration of contaminants. The Tidal Flat and Oxford Clay Formation deposits anticipated to underlie the site have been designated Unproductive units by the Environment Agency, and are not considered a significant controlled water receptor. These strata are also likely to exhibit very low permeability, which will favour lateral rather than vertical migration of contaminants. The closest surface water receptor is located 4m east of the site.

4.0 GEOTECHNICAL HAZARD IDENTIFICATION

Envirocheck has identified moderate risks associated with compressible ground and running sand hazards at the site resulting from the anticipated presence of superficial Tidal Flat deposits. A nominal thickness of Made Ground is also anticipated at the site.

No data regarding groundwater flood susceptibility has been provided by the BGS. This may be due to the presence of 'unproductive' superficial and solid geological units which underlie the site.

The site is located within a Zone 2 and Zone 3 floodplain, indicating that the annual probability of river or tidal flooding is greater than 1:100 yrs.

Tidal Flat deposits considered likely to exhibit poor geotechnical competence are likely to be present below the site to a significant depth. It is therefore anticipated that competent founding strata will also be present at relatively increased depth.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Risk Evaluation

Based on historical and current activities and site use, the risk from land contamination at the site is considered **Low** with respect to the majority of potential sources identified. **Moderate** risk has, however, been identified with respect to the presence of stockpiles of unknown provenance which were recorded on-site during the site walkover. These designations have been based on the proposed redevelopment of the site for commercial use. It is considered unlikely that the site would be classified as Contaminated Land under Part 2a of the EPA 1990 however this has not been formally confirmed by the Local Authority.

Table 3.2 provides a summary of the geo-environmental hazards identified and the overall risk associated with each hazard. The overall site risk has been designated using qualitative judgement using the categories provided in Table 5.1.

Table 5.1: Assessed Overall Risk Categories for the Site from Land Contamination

Risk Category	Definition
Very High Risk	A significant contaminant linkage, including actual evidence of significant harm or significant possibility and significant harm, is clearly identifiable at the site (e.g. from visual or documentary evidence) under current conditions, with potential for legal and / or financial consequences for the site owner or other Responsible Person. Remediation advisable based on acute impacts being likely. Immediate action should be considered.
High Risk	A contaminant linkage is identifiable on site under current and future use conditions. Although likely, there is no obvious actual evidence of significant harm or significant possibility and significant harm under current conditions. Extent of risk is therefore subject to confirmation by investigation and risk assessment, and most likely to be deemed significant. Realisation of the risk is likely to present a substantial liability to the site owner or other Responsible Person. Remediation required for redevelopment and may also be required under Part 2A for existing receptors.
Moderate Risk	A contaminant linkage is identifiable on site under current and future use conditions. However, it is not likely to be a significant linkage under current conditions. It is either relatively unlikely that any such harm would be severe, and if any harm were to occur it is more likely, that the harm would be relatively mild. Actual extent of risk subject to confirmation by additional investigation and risk assessment and most likely to lie between no possibility of harm (under current conditions) and significant possibility of significant harm (under conditions created by new use). Remediation may be required for redevelopment.
Low Risk	Potential pathways and receptors exist but history of contaminative use or site conditions indicates that contamination is likely to be of limited extent and below the level of possibility of harm. Unlikely that the site owner or other Responsible Person would face substantial liabilities from such a risk. Precautionary investigations and risk assessment advisable on change of use. Any subsequent remedial works are likely to be relatively limited.
Very Low Risk	No contaminant linkage likely to exist under current or future conditions, but this cannot be completely discounted. If harm is realised, it is likely at worst to be mild or minor. Site not capable of being determined under Part 2A (in accordance with PPS23) where the Local Authority inspects the site. No further action needed.
No Risk	No contaminant linkage exists.

5.2 RECOMMENDATIONS FOR FURTHER WORK

It is recommended that a nominal ground investigation is undertaken in order to examine the potential linkage of concern. This would involve the further investigation, logging, and sampling of on-site stockpiles to identify their chemical characteristics, and the presence of associated contamination.

Due to the potentially poor geotechnical competence of the Tidal Flat deposits, an intrusive geotechnical site investigation will likely be required to support the proposed development.

Whilst not essential, it is recommended that during any such investigation, samples are collected for laboratory chemical analysis in order to confirm the contaminative status of soils and groundwater at the site. In addition, further examination of the ground gas generation potential, and the likely permeability of the Tidal Flat deposits underlying the site is recommended in order to corroborate the preliminary Conceptual Site Model.

It is also strongly recommended that an asbestos survey of the existing buildings is undertaken by a licensed and experienced contractor, and that appropriate mitigation/removal of ACMs is carried out prior to, or as part of the demolition programme.

6.0 REFERENCES

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APPENDICES

Appendix A: DRAWINGS

Appendix B: DESK STUDY RESEARCH INFORMATION

Appendix C: SITE WALKOVER PHOTOGRAPHS

Appendix D: ZETICA UXO PLAN