GROUND CONTAMINATION INVESTIGATION AND ASSESSMENT

PHASE 1 - DESK STUDY

for the proposed

Residential development

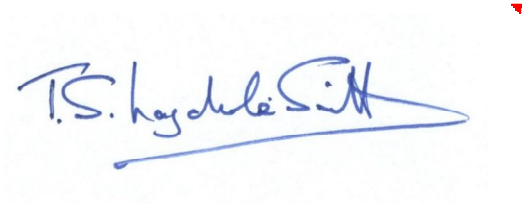
at

Tattershall Road,
Boston
PE21 9LP

frontispiece **– oblique view to south**

L-S&Co Project Number:	**63 016**
Status of Report:	**FINAL**
Date of Issue:	**July 13th, 2017**

Langdale-Smith & Co Limited
Engineering and Environmental Geologists

L-S&Co Project Number:	**63 016**
Report on:	Phase 1 Desk Study
Report at:	land opp. 1 Sherwood Avenue on Tattershall Road, Boston PE21 9LP
Report for:	Tyler Properties, Toft Mill, Toft Lane, Wrangle PE22 9HG
Prepared by:	 **T.S. Langdale-Smith MSc C.Geol**
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CONTENTS

EXECUTIVE SUMMARY		
L-S&Co Project:		63 016
Planning reference:		B/11/0379
Site:		land opp. 1 Sherwood Avenue on Tattershall Road, Boston PE21 9LP
NGR:		532180 344950
Dimensions and level:		north tapering isoceles triangle, 18 m x 40 m, 2.7 m AOD, rising to north
Geographical location:		flat flood land now urbanised and residential, between embanked railway line and road
Geology and hydrogeology:		bedrock Mudstone overlain by Boulder Clay and then Tidal Flat deposits
Hydrology:		No surface water, river flood zone 3a
Current description:		derelict overgrown land
Former use:		unused but next to railway line
Proposed use:		Single residence with garden
Work undertaken:		Phase1 Desk Study review
Sources:		non-leaching metal and PAH in Fill
Receptors:		siteworkers and then residents
Pathways:		Direct exposure
		No sub-surface migration
Recommendations:		use barrier system to break Direct Exposure pathway, Validate when complete

1. INTRODUCTION

1.1 Background

It is proposed to redevelop the strip of land on Tattershall Road, Boston, with 1 No. dwelling with a detached garage and small garden.

The proximity to the Railway Line creates a potential for ground contamination.

At the request of Justin Rushworth, on behalf of Tyler Properties, a contaminated land investigation was implemented.

1.2 Objectives and limitations

The method of risk assessment that is consistent with the UK environmental legislation and policies, including the planning process, is set out in the CLR11 document and comprises of three stages of increasingly detailed and therefore, more site specific, risk assessment:

- Preliminary;
- Generic quantitative; and then
- Detailed quantitative.

This report contains the findings from the Phase 1 - Desk Study, undertaken as part of the Preliminary Risk Assessment and following the guidance notes and to the standards set out in references below.

The factors that can affect the condition of the ground at the site are considered in sections 2 and 3. They are brought together in section 4 and are represented by constructing a preliminary site-specific Conceptual Exposure Model (CEM) which is then be used in section 5 to make a Qualitative Risk Assessment (QIRA) for the proposed development.

This report has been prepared solely for the use of the client and/or his agent on the basis of exchange of proposals and instructions, and Langdale-Smith and Co Limited accepts no responsibility or liability for use of this report by any party other than the person for whom it was commissioned, or for the consequences of the report being used for any other purpose other than that for which it was commissioned.

Should any third party wish to use or rely on the contents of the report, written approval should be sought and it is strongly recommended that independent advice is sought with respect to its specific proposals or requirements.

The conclusions and recommendations in this report represent our professional opinion, derived from currently accepted industry practices, exercising all reasonable skill and care to be expected of a professional engineering and environmental consultancy of similar size and experience.

The assessments and judgements given in this report are directed by both the finite quantity of data on which they are based and the proposed works to which they are addressed, taking account of the resources devoted to it by agreement with the client or agent, whether in writing or subsequent verbal instructions.

Environmental Desk Studies comprise a study of readily available information obtained from various identified sources, authorities and parties. The information reviewed is not exhaustive and is accepted in good faith as providing representative and true data pertaining to site conditions.

Any identified risks in Desk Study reports are ‘perceived risks’ based on the information available at that time. Actual risks can only be assessed after carrying out a physical intrusive investigation.

1.3 Information sources used

The following sources of information were used to compile this report:
- in-house research procedures;
- Google, Geostor, Old Maps;
- BGS, EA;
- interviews with current and former owners; and
- local and archive knowledge.

1.4 References

BS10175:2011	*Investigation of contaminated land*
BS5930:1999	*Code of practice for site investigations*
EA P5-065/TR:2000	*Technical aspects of site investigation*
EA P5-066/TR:2000	*Secondary model procedure for the development of appropriate soil sampling strategies for contaminated land*
EA TR20:1999	*Methodology for the development of remedial targets for soil and groundwater to protect water resources*
EA/NHBC R&D Report 66:2000	*Guidance for the safe development of housing on land affected by contamination*
EA TR P336 (BR414)	*Protective measures for housing on gas-contaminated land*
EA R&D Publication 8:1997	*The physical properties of major aquifers in England and Wales*
EA R&D Publication 68:1997	*The physical properties of minor aquifers in England and Wales*
DEFRA CLR 1-12	*CLR reports*
DEFRA TOX1-10	*Toxicology reports*
CIRIA SP103:1995	*Remedial treatment for contaminated land - site investigation and assessment*
DoE Profiles:1995	*Guidance on industry specific contaminants*
Inst. Petroleum 1998	*Guidelines for the investigation and remediation of petroleum retail sites*
BR211:1999	*Radon: guidance on protective measures for new developments*
BR212:1991	*Construction of new buildings on gas contaminated land*
LQM:2002	*Contaminated land management*
QRA field guides	*Descriptions of shallow soil environments*

1.5 Definition of terms

ACM/CBA: Asbestos Containing Material/Cement Bound Asbestos

AST/UST: Aboveground/Underground Storage Tank

Bgl: below ground level

Conceptual Model: Textual and/or schematic hypothesis of the nature and sources of contamination, potential migration pathways (including description of the ground and groundwater) and potential receptors, developed on the basis of the Preliminary Investigation and refined during subsequent phases of the investigation which is an essential part of the \Risk Assessment.

Contamination: The presence of a substance which is in, or under land, and which has the potential to cause harm or to cause pollution of controlled water

Controlled Water: Inland freshwater (any lake, pond or water course above the freshwater limit, water contained in underground strata and any coastal water between the highest tide or freshwater limit to the three mile limit of territorial waters.

Harm: Adverse affect of the health of living organisms, or other interference with ecological systems of which they form part, and, in the case of humans, including property

Hazard: Inherently dangerous quality of a substance, procedure or event.

Pathway: Mechanism or route by which a contaminant comes into with, or otherwise affects, a receptor

Pollution linkage: A complete source/pathway/receptor scenario

Receptor: Persons, living organisms, ecological systems, controlled waters, atmosphere, structures and utilities that could be adversely affected by the contaminants.

Risk: Probability of the occurrence of, and magnitude of the consequences of, an unwanted adverse affect of the receptor

Risk Assessment: Process of establishing, the existence, nature and significance of the risk

Significant harm: Defined in Draft Circular on Contaminated Land, DETR 2000

Source: Location from which contamination is, or was, derived

2. SITE PERSPECTIVE

2.1 Location and description

The site is regionally located 1 km northwest of Boston town centre near to the canalised River Witham and locally the site is located between Tattershall Road and the Boston-Skegness railway line and opposite Sherwood Avenue.

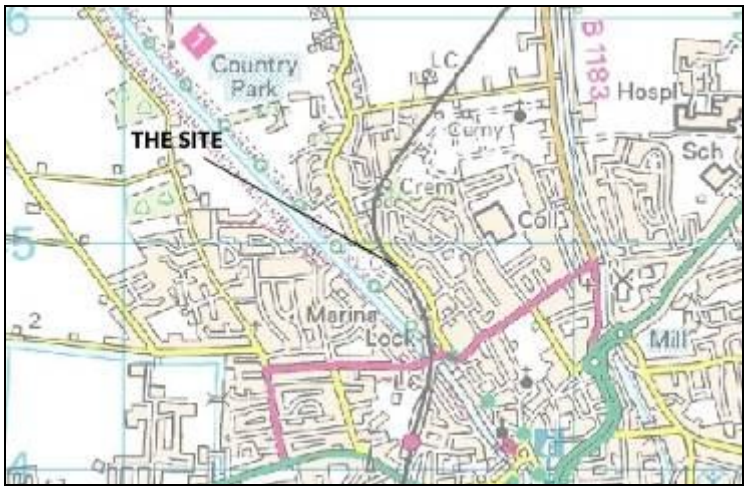

Fig 1 – location of site

The site is centred at NGR: $^{5}32180$ $^{3}44950$ and is at approximately 3.0 m AOD.

The Site comprises a narrow north-tapering isosceles triangle of flat overgrown land, 18 m wide and extending 40 m northwards (~350 m^2). It is part of a lager plot that extended a further 80 m to the south that has since been developed with residences.

The west side is marked by the railway embankment, which is some 2.5 m above site level and the tracks are 10 m from the boundary.

The east boundary is the Tattershall Road, from which access is gained. The road rises towards the north in order to cross over the railway line, causing the taper of the plot footprint.

Fig 2 – aerial view

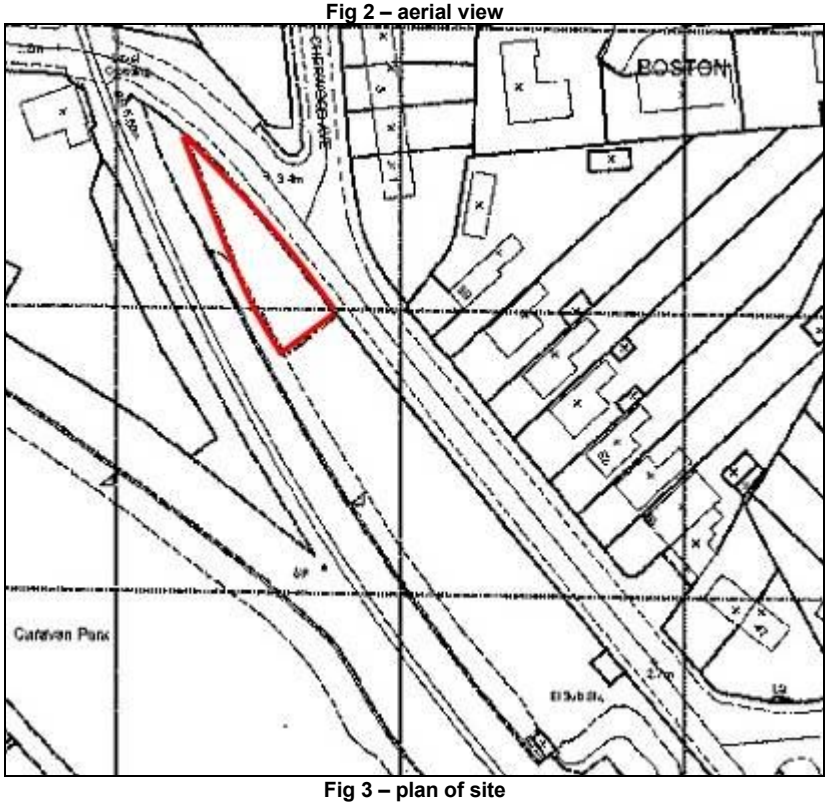

Fig 3 – plan of site

Fig 4 – view to north from south side of site

Fig 5 – view to west from Tatershall Road

Fig 6 – Google street view from 2011 when site was not overgrown

Beyond the south side of the site is the new residential development.

Fig 7 – view southwest of new development to the south

2.3 History

A study of the historical OS maps reveals little industrial development in the region, as would be expected from such a rural location. The railway line was built by 1889 through farmland and the site comprised a strip of woodland bounded by the railway and the road, a layout seen to this day.

Some 200 m to the south on the west side of, and therefore separated by, the railway embankment was he Grand Sluice Iron Works, in disuse. In 1905 another iron works is shown to be active and continuing through to 1956. The site of the works was very small, less than 50 m square.

The urban development of Boston reached the fields to the east of the site with a caravan park during the 1950s and the existing housing development by 1974.

The railway appeared to cross Tattershall Road with an over-bridge until the early 1950s, at which time the road was built up so the junction with the railway was a level crossing.

The site was formerly the northern part of a plot extending over 100 m to the south alongside the railway line.

That land has since been successfully developed by Invicta Developments with residential dwellings and gardens under planning reference B/11/0379.

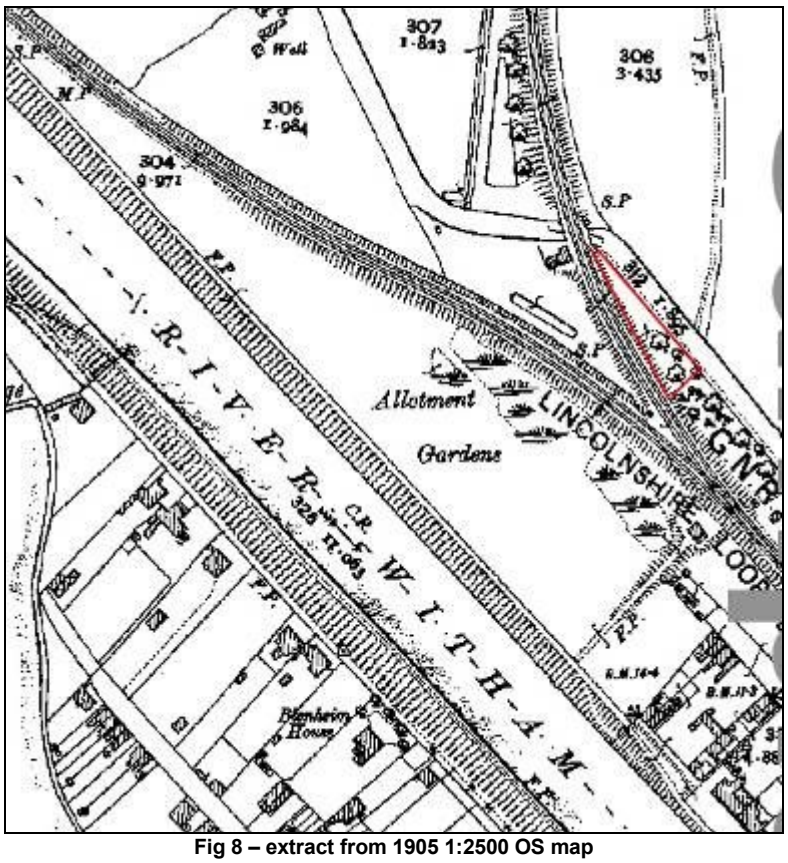

Fig 8 – extract from 1905 1:2500 OS map

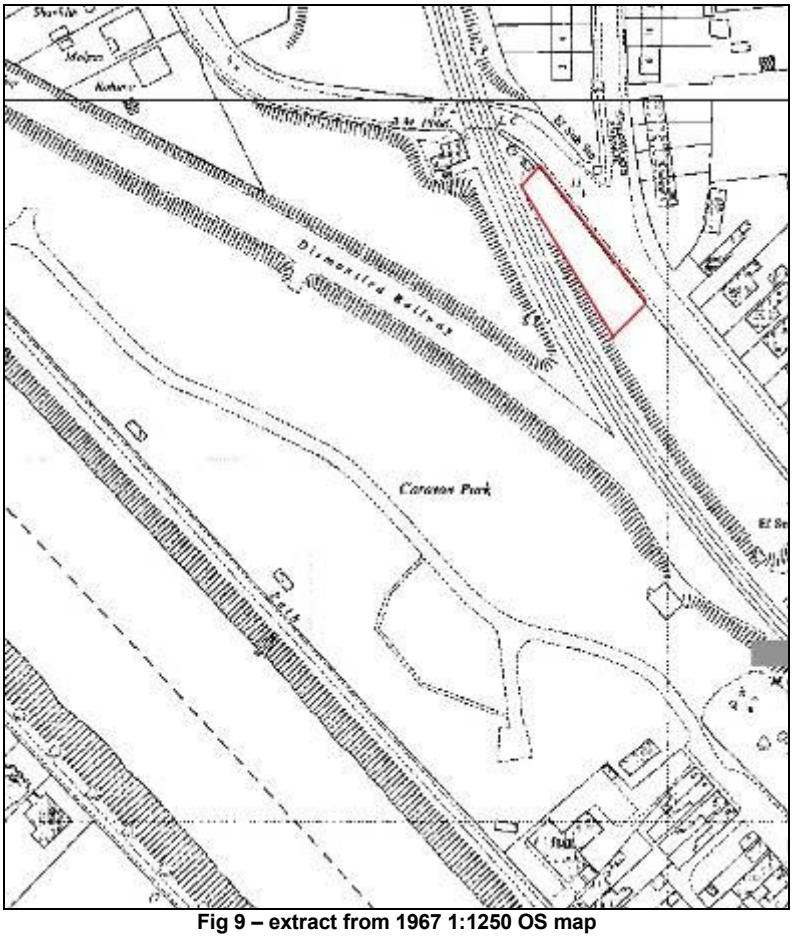

Fig 9 – extract from 1967 1:1250 OS map

2.4 Previous investigations

The site has been subject to a Ground Inspection in December 1999 and a Ground Investigation in July 2000, both undertaken by T.S. Langdale-Smith.

The Ground Inspection comprised of 2 No. trialpits to 2.0 m bgl and chemical analysis for the ICRCL suite (i.e. metals, metalloids, TPH and PAH).

The ground encountered comprised of approximately 1.3 m of ash and other inert household debris with topsoil Fill, overlying *soft silty organic Clay*.

The report concluded that the levels of contamination in the Fill for As, Bo, Cu, Hg, Ni, Pb, Se, Zn and the PAH: anthracene, flouranthene, pyrene and chrysene exceeded the *ICRCL LTTL* and would be a hazard to future site residents from Direct Exposure.

The contaminants are typical of those found in hearth ash and some pesticides.

The contamination did not extend into the underlying *soft organic silty Clay* suggesting that it would be contained on the site by the impermeable natural ground and not be a hazard to groundwater.

The Ground Investigation comprised of 1 No. cable-percussion borehole to 15 m bgl to derive Geotechnical parameters for foundation design and encountered 2 m of Fill overlying 3.5 m of *soft wet brown clayey Silt* and then *wet silty fine Sand* to 10 m bgl, with stiff Boulder Clay at 12.9 m bgl.

2.5 Potential contamination sources from current and previous use

2.5.1 Current use

The site is securely fenced and unused and there is no potential from the current use.

2.5.2 Previous use

The site has the potential to be contaminated from hearth ash within the Fill that has been spread across the site.

Previous investigations have shown that the Fill is up to 1.3 m thick and contains hazardous concentrations of As, Bo, Cu, Hg, Ni, Pb, Se, Zn and the PAH: anthracene, flouranthene, pyrene and chrysene.

3. ENVIRONMENTAL CONDITIONS

3.1 Geology and hydrogeology

The 1:50 000 BGS map for the region (Sheet 128 – Boston) shows the geology at the Site to comprise the bedrock Jurassic Ancholme Clay Group overlain by the Recent Tidal Flat deposits of the Lincolnshire Outmarsh and then with Glacial Till which is known to be present, at depth.

3.1.1 Ancholme Clay Group (AmG)

The Ancholme Clay Group comprises of overconsolidated, fissured, laminated, silty clays and are traditionally divided, in ascending order, into the Oxford Clay, Ampthill Clay and the Kimmeridge Clay. Beds of fine grained clayey limestone, siltstone or sandstone (*e.g.* Elsham Sandstone) sometimes with calcareous nodules, may be found through the sequence, varying in thickness from cm to m. The clays weather from the surface and reduce in consistency to firm or even soft.

3.1.2 Glacial Till

Glacial Till (Boulder Clay) from the area is typically cohesive in character having been derived from the local clay bedrock and contains abundant granular material, as a result of mixing with the harder chalk bedrock, and is often characterised by a varying content of chalk debris. The Till is generally *stiff* with apparent high degrees of over-consolidation although it may contain, or overlie, other glacial materials that can be much softer. Glacial materials are irregular in deposition so that extrapolation is not always reliable. They are also associated with sand and gravel which may be found beneath or within the general sequence and can often be water bearing.

3.1.3 Tidal Flat deposits

Most of the Recent (Flandrian) deposits in the region are associated with the post-glacial rise in sea level as the Pleistocene ice sheets melted. From the end of the Devensian (10.3-7 kya) the sea level rose from 65 m to <10 m below OD, and then more slowly during the next 3,500 years until it stabilised at OD, fluctuating by 2 m or so.

The sea entered the region about 7.5 kya and since then has laid up to 15 m of estuarine and marine clay, silt and sand and gravel on the underlying glacial tills and sand and gravels. When the ice first retreated the rivers cut deeply into the undulating till landscape left by the ice, to produce a branching system of narrow steep-sided valleys as low as 20 m below OD. At first the incursion of the sea would have filled the valleys but then wave action would have begun to modify the till surface before burial.

The glacial surface slopes gently eastwards, from 5 to 10-15 m below OD, contrasting with a much steeper slope on the west margin where the till surface rises to ground level, forming the Middle Marsh. The sharp rise suggests a wave-cut platform, although a valley has been suggested on the till surface leading towards Saltfleet, implying that there was a period when the till was exposed for long enough for surface drainage to become established before full inundation.

The sea reached its maximum lateral extent in the district about 3,500 years ago when sea level was about the same as it is now. Subsequent fluvial deposition has extended the coastline.

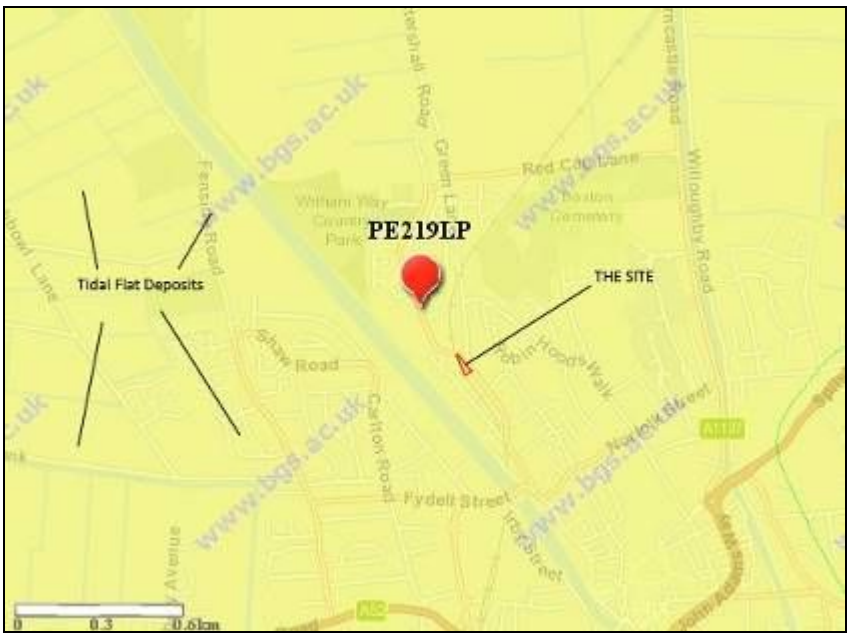

Fig 10 - Geology of the site

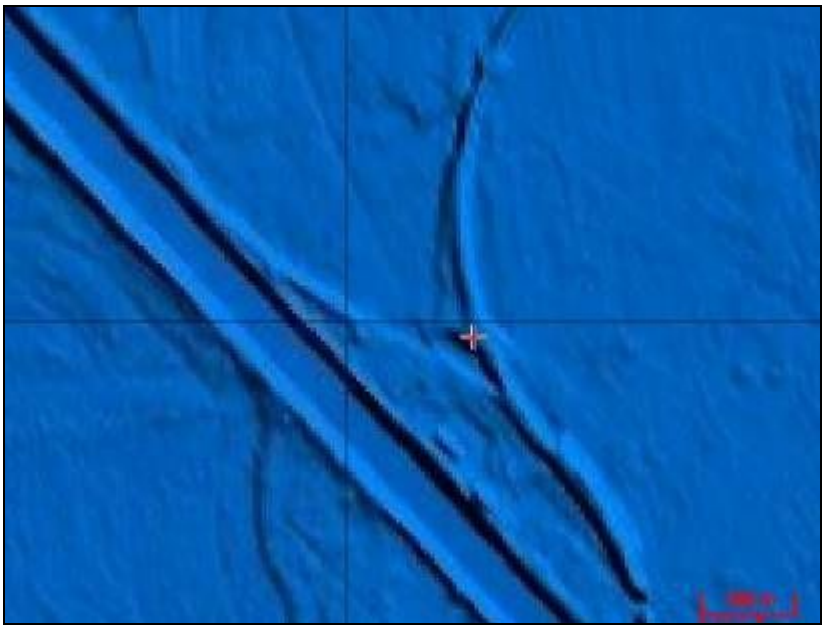

Fig 11 – regional terrain

3.2 Hydrology and flood risk

There are no surface water courses that can be affected by run-off from the site and, due to the sloping surface of the site, the site is not at risk from surface water run-off flooding.

Fig 12 – surface water flood risk

Fig 13 – view northwards along Tattershall Road as it rises to railway crossing

The site is in Flood Zone 3a and is protected from flooding by flood defences, which includes the railway embankment.

A Flood Risk Assessment was made by BSP Consulting in 2008 for plot 8 of the new development to the south of the subject site, with plot 8 being immediately next to the subject site.

The natural ground level at plot 8 was 2.73 m AOD and the railway line was at 5.35 m AOD.

The predicted inundation depth was 2.969 m AOD with allowance for the effects of climate change so it was recommended, for the proposed development at plot 8, that:
- the minimum FFL should be 2.969 m AOD;
- flood resilient construction should be used for the ground floor; and
- facility for emergency egress from the top floor should be installed.

3.3 Ground gas

3.3.1 Radon

The site is not at risk from radon gas.

3.3.2 Methane

There can be a potential for the generation of methane from the decomposition of the organic matter (*i.e.* Peat) encountered at approximately 10 m bgl beneath the site.

The gas will be unable to migrate to the surface through the overlying unconsolidated impermeable silty Clay strata.

3.4 Assessment of environmental conditions

There are no natural sources of contamination at this site.

The natural ground is impermeable.

Site hazard	Tattershall Road, Boston PE21 9LP
Flood warning/alert area	Yes - flood zone 3
Surface water flooding	None
Groundwater	No
Nitrate Vulnerable Zone	Surface water
Drinking water safeguard zone	None
Landfill sites 200 m radius	None
Pollution incidents 200 m radius	No
Ground gas	None
Mining risk	None

Table 1 – Environment Agency hazard matrix

4. CONCEPTUAL EXPOSURE MODEL

4.1 Sources

There are no potential sources of contamination from current use.

The level of the site was raised in the 1950s, so that Tattershall Road/railway line became a level crossing, by the emplacement of Fill.

Previous investigations have shown that the Fill contains hazardous concentrations of As, Bo, Cu, Hg, Ni, Pb, Se, Zn and the PAH: anthracene, flouranthene, pyrene and chrysene, probably derived from Hearth Ash which would have been used as part of the 'ground raising' Fill.

4.2 Receptors

The site is currently securely fenced and unused, so that any access will be short term.

4.3 Pathways

Based on the CLEA human health risk assessment models, the generic pathways for human receptors are:
- Indoor and Outdoor inhalation of soil vapour and fugitive dust;
- Ingestion of home grown vegetables and of soil attached to the vegetables;
- Outdoor exposure to soil through skin; and
- Indoor and Outdoor ingestion of contaminated dust and soil.

The generic potential pathways for contamination of controlled waters are via:
- Surface water run-off; and
- Infiltration through the un-saturated and saturated zones.

It is very likely that some or the majority of the pathways are not relevant.

5. ASSESSMENT AND RECOMMENDATIONS

5.1 Proposed development

It is proposed to build a two-storey dwelling with detached garage and some garden on the subject site.

The building will be mounted on a pile foundation and the entire site will be raised to be above the projected flood inundation level of 2.969 m AOD.

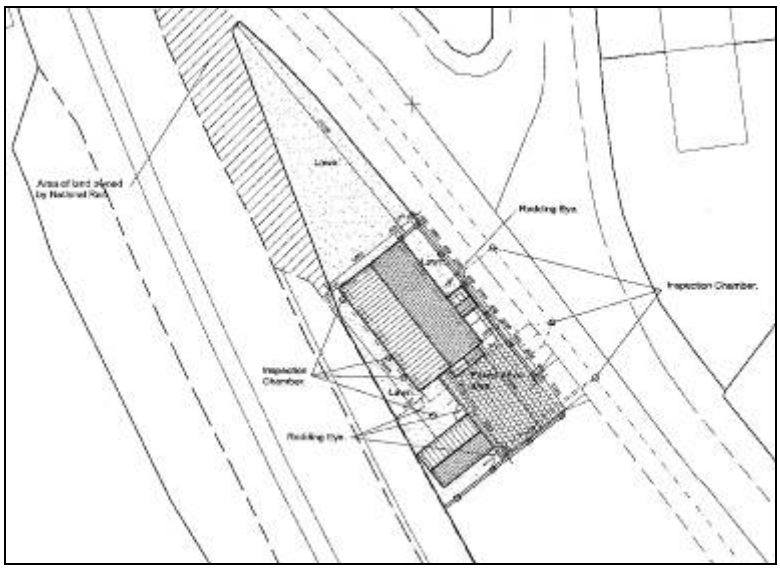

Fig 17 – proposed residential development

5.2 Qualitative risk assessment for the proposed development

5.2.1 Sources

There are sources of contamination in the Fill making up the ground at the site.

5.2.2 Receptors

The proposed development will introduce Receptors to the site, as:
- site workers; and, subsequently
- residential users.

The natural ground beneath the Fill is impermeable and is not a sensitive Receptor.

5.2.3 Pathways

The pathway of Direct Exposure will be created during the construction process, when the surface is cleared of existing vegetation and the ground is disturbed, exposing the Fill.

5.3 Recommendations for remediation

The site can be made safe for the proposed development by breaking the pathway of Direct Exposure to the existing Fill by using a barrier system.

The barrier should comprise of:
- inert Fill to be imported to raise the site level;
- the hard surface of the building footprint and pavements;
- metal-coated drinking water service pipes; and
- 0.5 m of Topsoil that has certification of suitability.

The final build will ensure that the Fill beneath the site is not exposed to future residential users

Exposure to any contaminated Fill will be during foundation and service installation and will be short term only.

The ground should be inspected by a Suitable Qualified Person when exposed.

Surplus Fill should be treated as contaminated waste and be subject to a WAC test before disposal.

5.4 Recommendations for verification

It will be necessary to prove that the remedial methods recommended and approved have been implemented and/or installed correctly.

This can be achieved with:
- drawings and plans;
- photographs; and
- receipts and waybills.

The information should be presented in a Validation Report, if required by the regulatory authority.

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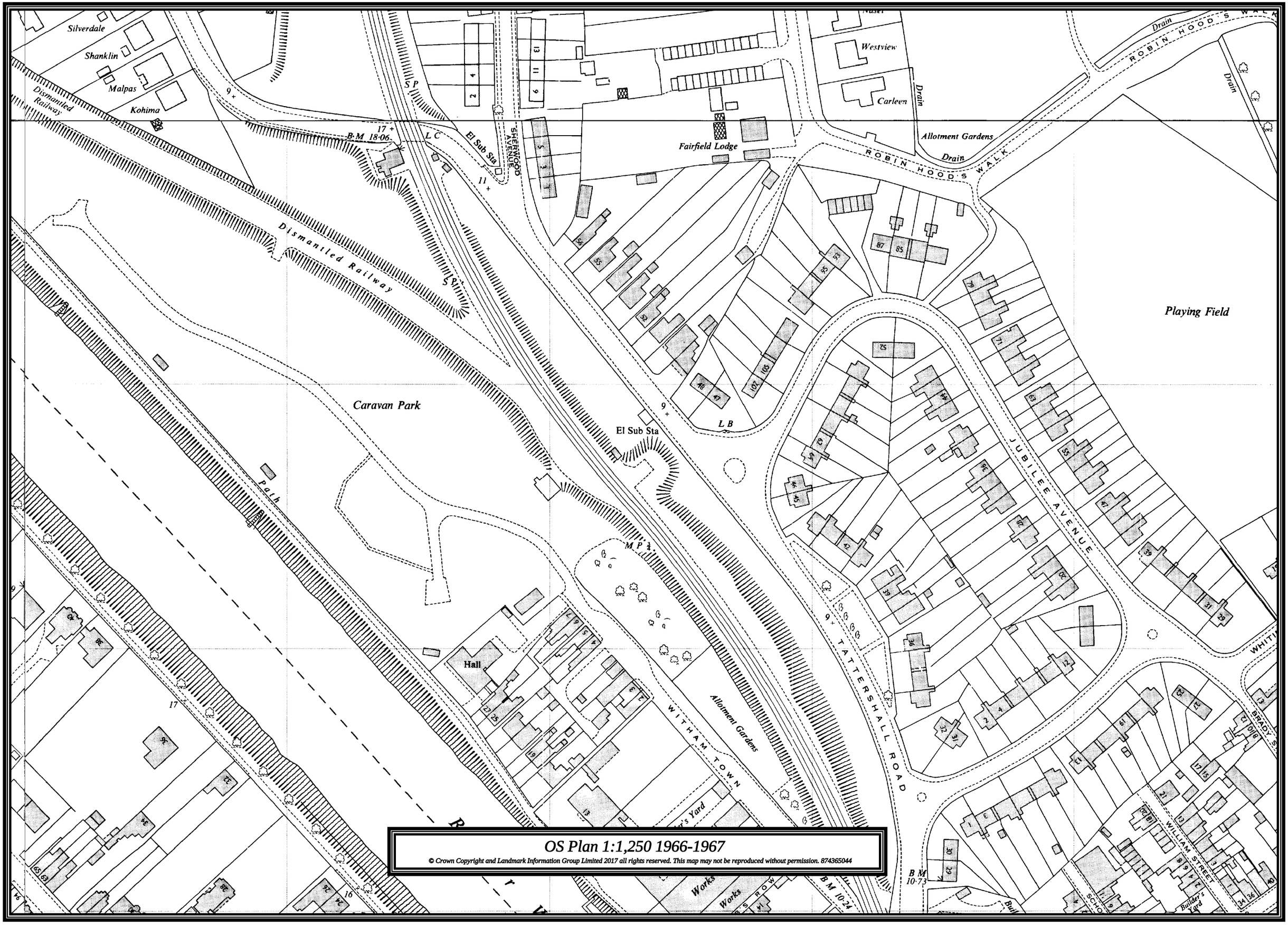

OS Plan 1:1,250 1966-1967

N

294 3·272
M.P
F.P.
Pump
F.B.
181 12·085
230 3·210
231 3·205
229 ·357
Well
305 2·201
307 1·823
Well
308 3·435
F.P.
182a 1·420
Robin Hood's Walk
226 ·195
227 2·237
228 2·172
232 2·980
S.P
M.P
306 1·984
304 9·971
309 3·929
225 1·445
310 1·521
233 2·241
S.P
F.P.
312 1·895
S.P
C.R.
311 1·036
F.P.
R·I·V·E·R W·I·T·H·A·M
Witham Cottage
Allotment Gardens
LINCOLNSHIRE LOOP LINE
G.N.R.
S.B
329 3·869
Well
328 2·996
333 2·810
332 1·612
Stone Yard
330 5·459
Sluice
F.P.
B.M.14·4
B.M.11·3
S.P
331 4·889
WITHAM TOWN
Blenheim House
B.M.11·2
Sunday School
B.M.9·9
Pump
B.M.11·6
Feather Bed Factory
B.M.12·7
Borough Iron Works
Witham Tavern
B.M.13·3
B.M.12·2
B.M.10·8
B.M.9·7
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B.M.14·1

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