



ERGO

PHASE I GEO-ENVIRONMENTAL SITE ASSESSMENT

Land at Haverton Hill Road,
Billingham,
TS23 1PZ

Prepared for:



Report Ref: 21-1063-r01
Date Issued: November 2021






ERGO ENVIRONMENTAL LIMITED

Hoults Yard,
Walker Road,
Newcastle upon Tyne,
NE6 2HL

Tel : + 00 (0) 191 389 6200
<http://www.ergoenvironmental.co.uk>

Registered in England
No.: 11162116

QUALITY ASSURANCE

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|----------------------------------|---|
| REMARKS | Final |
| DATE | November 2021 |
| PREPARED BY | J Campbell |
| QUALIFICATIONS | MESci, FGS |
| SIGNATURE |  |
| CHECKED BY | J Malley |
| QUALIFICATIONS | BSc, MSc, MCIWEM C.WEM |
| SIGNATURE |  |
| AUTHORISED BY | J Nairn |
| QUALIFICATIONS | BSc, MSc, MIENvSc, CEnv, FGS |
| SIGNATURE |  |
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EXECUTIVE SUMMARY


| | | |
|--------------------------------|---|---|
| Site Address | Land at Haverton Hill, Billingham, TS23 1PZ. | |
| National Grid Reference | E448279 , N522269. | |
| Site Area | 1.44 Ha. | |
| Current Site Use | <p>The subject site is an irregular shaped parcel of land located off Haverton Hill Road. The site is approximately 1.5miles north of Middlesbrough Town Centre.</p> <p>The site currently comprises disused, derelict land with a hardstanding asphalt road bisecting the north site area which is understood to be a public right of way. 1No. partially buried feature understood to comprise a 'Switch Pump' for the adjacent shipbuilding yard was noted on the southern site boundary. No further structures were present within the site boundary. The site was noted to be predominantly covered in concrete slabs and gravel hardcore with dense self-seeded scrubland present in numerous locations. It is understood the site has undergone a previous phase of post-industrial reclamation.</p> <p>The site was noted to comprise 2no. platforms raised above the bisecting road in the northern site area. The southern platform was noted to be approximately 2.0m above the adjacent rough with the northern c.0.50m above the road feature.</p> <p>2no. stockpiles were noted within the south-eastern and south-western site areas. The south-western stockpile appeared to comprise demolition rubble of concrete boulders and cobbles whilst the south-eastern stockpile was heavily vegetated and prevented inspection of the underlying material within the stockpile. Additionally, a large bund was situated on the western site boundary.</p> | |
| Proposed Development | ERGO understands that the client is considering redevelopment for the subject site for commercial use comprising vehicle workshop with office and showroom area, hardstanding yard areas for parking, storage and washing and buried service utilities infrastructure | |
| Environmental Setting | <i>Drift Geology</i> | Tidal flat Deposits – Clays, Sands & Silts. Glaciolacustrine Deposits (Northern site boundary – Clays and Silts). |
| | <i>Bedrock Geology</i> | Sherwood Sandstone Formation – Sandstone. |
| | <i>Hydrogeology</i> | Drift predominantly Secondary Undifferentiated Aquifer strata with unproductive aquifer strata in the northern site area. Solid bedrock comprises Principal Aquifer. |
| | <i>Hydrology</i> | The Tidal River Tees is located c.70m south of the subject site boundary. |
| | <i>Flood Risk</i> | The site is located within EA Flood Risk Zones 2 and 3. |
| | <i>Ecology & Invasive Species</i> | No evidence of invasive species were identified during the site walkover, however it is recommended confirmation of this is sought from a qualified specialist. |
| | <i>Compressible Ground and Subsidence Hazards</i> | No significant hazard identified in data searches. |
| Site History | Historical mapping suggests that the site comprised tidal flat within the Estuary of the River Tees until c.1897 when it appears the site was reclaimed. The site became heavily industrial within the first half of the 20 th century with shipbuilding, rail infrastructure, electric power station and chemical factory noted until demolition | |


EXECUTIVE SUMMARY


| | |
|--|---|
| Site History (Continued) | <p>and clearance in the 1980s. Evidence suggests the site has undergone landfilling and remediation in recent years</p> <p>It is understood the chemical factory was a source of significant air pollution in the region with the site also being noted to have been bombed during the War.</p> |
| Utility Locations | <p>A formal drainage survey has not been provided.</p> <p>Evidence of manhole covers were identified during the site walkover suggesting the presence of buried utility infrastructure present onsite.</p> <p>A switch pump associated with the adjacent ship yard was also identified within the southern site boundary and is likely to have associated infrastructure.</p> |
| Landfill Sites & Ground Gases | <p>2no. historic landfills are recorded on the site, 1no. of which is located in the northern and western site areas under Haverton Hill Landfill Ltd ref: WV1/L/REE001 recorded to have accepted industrial, commercial and household wastes between 1990 and 2012. The second of these landfill is recorded in the western site area and was licensed to ICI Chemical and Polymers Ltd, ref: 0700/CLE/250 accepting inert waste from 1992.</p> <p>Additionally, 3no. historic waste site and 5no. active waste site are recorded within 250m of the site.</p> |
| UXO | <p>The regional unexploded bomb risk map from Zetica indicates that the site is in an area at moderate risk from possible Unexploded Ordnance (UXO) resulting from the Second World War. (Zetica, 2014).</p> <p>It is considered likely that suitable mitigation measures may be required as part of any subsequent intrusive investigation and any potential redevelopment works.</p> |
| Radon | <p>Unaffected – No special precaution required.</p> |


Geotechnical Risk


Based on the desk study information, the following geotechnical assessment has been made:


- 


Given that the site has previously been reclaimed from tidal flats and has seen several significant previous phases of development, dependent upon the extent of demolition/below ground turnover, it is possible that there may be significant Made Ground fill deposits, relict foundations and buried obstructions present within the subsurface. Any relict foundations and obstructions within the footprint of the proposed structure will require grubbing out, prior to the construction of the proposed development;
- 

Several large structures and a chimney were formerly recorded to be present onsite suggesting the likely presence of significant thicknesses of Made Ground and possible deep foundations to be present;
- 

Investigation of the adjacent site identified several areas of spent slag and foundry waste which would suggest the potential for significant hard digging and may inhibit the advancement of excavations;
- 

The chemical works formerly partially located onsite were noted to produce ammonium nitrate and sulphuric acid, it is considered that the ground conditions may be highly aggressive and require specialist concrete subject to confirmation;
- 

A significant slope is present on the northern site boundary supporting the adjacent Haverton Hill Road, dependent upon the redevelopment proposals a slope stability assessment of this feature may be required;
- 

The site is understood with be located within an area where anhydrite was extracted, however it is considered that the depth to the anhydrite is sufficient to ensure no unacceptable risk is posed to the development;
- 

The site is located within an area where bombs have previously been recorded, there is the potential for further unrecorded bombs to be present within the subsurface which will have to be appropriately assessed and mitigated against to ensure no significant residual risk to the

EXECUTIVE SUMMARY

- proposed development;
- Given the existing variations in topography, it is considered likely that a significant programme of enabling works will be required at the site to create level developable platforms;
 - Investigation will be required in order to assess the underlying Made Ground and natural deposits and undertake in-situ geotechnical testing to determine the likely foundation solution;
 - Significant thicknesses of slag fill have been recorded within nearby boreholes. Slag has potential expansive properties which, if present, will need to be considered as part of any proposed redevelopment;
 - Given the proposed development, and owing to the likely presence of significant thicknesses of Made Ground, an engineered piled foundation/ground improvement solution is anticipated at present, subject to final site levels/loadings etc; and,
 - It is considered likely that significant quantities of contaminated materials will be present at the site which will likely require a significant programme of remediation and enabling works to create an appropriate developmental platform for the site.

Contaminated Land Risk Assessment

Human Health

Given the presence of several significant phases of industrial development at the site, including former shipbuilding yard and electricity power station, chemical works and landfilling activities it is considered likely that Made Ground deposits and previous demolition works may have resulted in contamination of these soils by heavy metals, PAH and TPH contaminants, TBT, PCBs, ammonium nitrate and sulphuric acid and volatile compounds. Although not identified during the site walkover, given the historic site usage and in particular shipbuilding works, it is likely ACM will be present within the subsurface. If present, contamination may pose a short term risk to construction workers and future site users who may come into contact with impacted soils.

It is understood that nearby residential properties formerly present in the vicinity of the site were demolished due to poor air quality associated with the former sulphuric acid works at the site, it is considered possible that earthworks at the site may remobilise these volatile mobile contaminants.

Furthermore, it is understood the former onsite chemical works formerly produced Uranium hexafluoride materials during the Second World War. Uranium based products and the associated raw materials are radioactive and if waste materials associated with these products are present within the subsurface may pose potential ionisation and radiation risks to receptors which may come in to contact with impacted materials.

Given development proposals indicate the presence of predominantly hardstanding impermeable surface and/or buildings, with no areas of soft-standing landscaping it is considered unlikely that future site users will come into contact with impacted soils future commercial site users may come into contact with impacted soils.

Based on the available information and proposed development plan, the potential risk to the development is presently considered to be low-moderate and should be confirmed as part of any subsequent Phase II investigation works.

Controlled Waters

The presence of likely significant thicknesses of Made Ground underlying the site associated with historic land reclamation and landfilling activities, the formerly onsite power station, shipyard, rail infrastructure and chemical works and potentially mobile chemicals including sulphuric acid and ammonium nitrate produced by the chemical works are considered potentially significant sources of mobile contamination at the site.

The underlying secondary undifferentiated drift and principal bedrock aquifers and nearby River Tees are considered potential receptors; however, the sensitivity of the aquifer receptors is considered low in the absence of groundwater abstraction in the vicinity and thick likely low permeability drift deposits offering protection to the underlying principal bedrock aquifer. Furthermore, development proposals indicate the site will predominantly comprise impermeable hardstanding surfaces which will inhibit

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vertical infiltration to the underlying deposits. However the risks to the River Tees will need to be confirmed. and likely brackish nature of the tidal River Tees.

At this stage risks to Controlled water receptors are considered low. Given the site history, it is recommended this is confirmed as part of any subsequent Phase II intrusive works.

Ground Gas

Made Ground underlying the site associated with land reclamation and landfilling activities at the site and demolition works of previous onsite structures as well as potential organic materials within the underlying tidal flat deposits may represent potentially significant sources of hazardous ground gas generation.

Based on the information currently available and given the low sensitivity of the proposed commercial end use comprising predominantly hardstanding impermeable surfaces there is considered to be a moderate risk to the proposed development.

Recommendations

A detailed and comprehensive Phase II intrusive Geo-Environmental Ground Investigation should be undertaken in order to confirm the findings of the initial conceptual site model and value engineer a development solution and determine the requirement for any remediation at the site.

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APPENDICES

Appendix I Limitations

Appendix II Glossary

Appendix III Drawings

Drawing No 21-1063-001 – Site Location Plan

Drawing No 21-1063-002 – Proposed Development Plan

Drawing No 21-1063-003 – Historical Features Plan

Appendix IV Photographs

Appendix V Historical Maps

1. INTRODUCTION

1.1 Background

ERGO Ltd has been jointly commissioned by Ford and Slater to undertake a Phase I Geo-Environmental Site Assessment of a parcel of land located at Haverton Hill Road, Billingham. ERGO Drawing 21-1063-001 within Appendix III display the site location.

This report is required to determine potential contaminated land and geotechnical liabilities associated with a proposed future residential development.

1.2 Proposed Development

ERGO understands that the client is considering redevelopment for the subject site for commercial use comprising vehicle workshop with office and showroom area, hardstanding yard areas for parking, storage and washing and buried service utilities infrastructure.

Drawing 21-1063-002 (Appendix III) identifies the proposed development layout. A snapshot of the proposed development is shown within figure 1.1 below.



Figure 1.1 Snapshot of Proposed Development

1.3 Objectives

The objectives of the Geo-Environmental Investigation are to:

- Review historical plans, geology, hydrogeology, site sensitivity, flood-plain issues, mining records and any local authority information available in order to complete a Desk Study in line with Environment Agency (EA) document and Land Contamination Risk Management (LCRM, 2019);
- Assess the implications of any potential environmental risks, liabilities and development constraints associated with the site in relation to the future use of the site and in relation to off-site receptors;
- Assess the desk study information and where possible, provide preliminary recommendations in relation to foundations, pavement construction and floor slabs; and,
- Provide recommendations regarding future works required and undertake a preliminary pre-construction cost appraisal.

1.4 Limitations

The limitations of this report are presented in Appendix I.

The Groundsure Report was obtained for a wider site area covering c.11.30acres including additional land to the east and south-east of the development area within the wider land package.

1.5 Sources of Information

Background information was sought from the following sources:

- Groundsure Search;
- Historical mapping dated 1857 to 2021. A selection of historical maps are reproduced in Appendix V;
- Online planning records held by Stockton Borough Council;
- Environment Agency Groundwater Vulnerability Map (magic.defra.gov.uk/magicmap.aspx);
- Radon: Guidance on protective measures for new buildings (BRE Document BR 211, 2007); and,
- British Geological Survey Map.

1.6 Confidentiality

ERGO has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from ERGO; a charge may be levied against such approval.

2. SITE SETTING

2.1 Site Details

| | |
|--------------------------------|--|
| Site Address | Land at Haverton Hill, Billingham, TS23 1PZ. |
| National Grid Reference | E448279 , N522269. |
| Site Area | 1.44 Ha. |

All acronyms used within this report are defined in the Glossary presented in Appendix II.

A site location map is presented in Appendix III as Drawing 21-1063-001.

2.2 Current Site Use

ERGO has undertaken a site walkover of the entire site and a description of the key findings is summarised in Table 2.1.

Table 2.1 Site Description

| | |
|------------------------|---|
| Occupancy / Use | <p>The subject site is an irregular shaped parcel of land located off Haverton Hill Road, Billingham, TS23 1PZ. The site is approximately 1.5miles north of Middlesbrough Town Centre.</p> <p>The site currently comprises disused, derelict land with a hardstanding asphalt road bisecting the north site area which is understood to be a public right of way. The site was noted to be predominantly covered in concrete slabs and gravel hardcore with dense self-seeded scrubland present in numerous locations. It is understood the site has undergone a previous phase of post-industrial reclamation.</p> <p>The site was noted to comprise 2no. platforms raised above the bisecting road in the northern site area. The southern platform was noted to be approximately 2.0m above the adjacent rough with the northern c.0.50m above the road feature.</p> <p>2no. stockpiles were noted within the south-eastern and south-western site areas. The south-western stockpile appeared to comprise demolition rubble of concrete boulders and cobbles whilst the south-eastern stockpile was heavily vegetated and prevented inspection of the underlying material within the stockpile. Additionally, a large bund was situated on the western site boundary.</p> |
| Structures | <p>1No. partially buried feature understood to comprise a 'Switch Pump' for the adjacent shipbuilding yard was noted on the southern site boundary. No further structures were present within the site boundary.</p> <p>However, it is considered that the foundations of former structures may be present in the subsurface. The presence of dense scrub vegetation significantly inhibited the observation of these features.</p> |
| Access | <p>Pedestrian and vehicular access can be gained via locked gates on the north-eastern site boundary, these gates are additionally blocked by concrete boulders.</p> <p>A second set of locked gates is present on the south-eastern site boundary enabling access from the adjacent Marine Fabricators site.</p> <p>The southern site boundary comprises palisade fencing with the eastern, western and northern site boundaries open.</p> <p>It is understood that the access track bisecting the northern site area is a PRoW.</p> |
| Topography | <p>The site levels are varied, comprising a steep slope on the northern site boundary, generally falling from north to south, with a platformed area in the central and southern site areas. The platforms were noted to be raised above the bisecting road in the northern site area. The southern platform was noted to be approximately 2.0m above the adjacent rough with the northern c.0.50m above the road feature.</p> <p>A large bund was noted along the western boundary with 2no. stockpiles noted in the southern site area.</p> |

| | | |
|---|---|-----|
| Retaining structures | A retaining wall was noted along the northern boundary supporting the adjacent A1046 (Haverton Hill Road) above the site. | |
| Surface Cover (%) | Buildings: | 1% |
| | Hardstand: | 9% |
| | Soft cover: | 90% |
| Vegetation/ Ecology | Rough self-seeded scrub vegetation is present across the site with areas of dense overgrown bushes to the north east and central areas of the site. No evidence of invasive species were identified during the site walkover, however it is recommended confirmation of this is sought from a qualified specialist. | |
| Hazardous Material Storage | No Above Ground Storage Tanks (AST) or Underground Storage Tanks (UST) were observed at the site during the preliminary site walkover. Given the previously developed nature of the site it is considered possible there may be relict USTs present within the subsurface. The sites former usage as a Shipbuilding Yard, electrical sub-station, landfill and chemical works may have resulted in the presence of significant hazardous waste materials stored and deposited onsite. | |
| Asbestos Containing Material (ACM) | No evidence of ACM was noted during the site walkover. However, given the previously developed nature of the site it is possible that ACM may be present in deleterious material stockpiled on site, associated with previous phases of demolition and within Made Ground deposits. | |
| Polychlorinated Biphenyls (PCBs) | There is no equipment identified which may contain PCBs within the site boundary however given the historic site usage including an Electricity Power sub-station, it is possible that PCB equipment may have been previously present and a potential source of PCB contamination. | |
| Waste Storage | The site is understood to have been formerly reclaimed from the Tees tidal flats and later landfilled with various wastes. Additionally, stockpiles and bunds of demolition rubble were noted to be present onsite. | |
| Utilities | It is understood that a formal utility survey has not been completed. Evidence of manhole covers were identified during the site walkover suggesting the presence of buried utility infrastructure present onsite. A switch pump associated with the adjacent ship yard was also identified within the southern site boundary and is likely to have associated infrastructure. | |

2.3 Surrounding Area

The surrounding area land uses are summarised in Table 2.2.

Table 2.2 Surrounding Land Uses



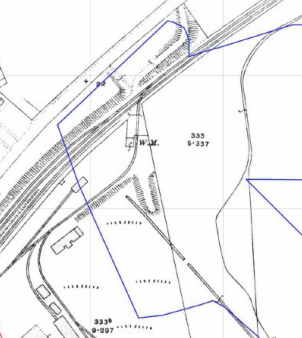
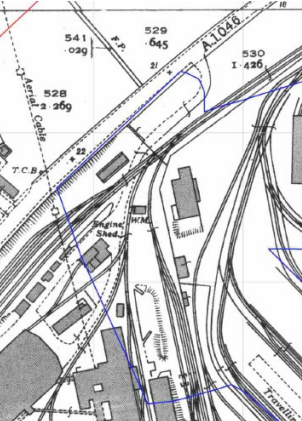
| DIRECTION | LAND USE |
|------------------|---|
| North | Commercial/Industrial Use – Ballast Phoenix Recycling Centre (Waste). |
| East | Industrial Use - Marine Fabricators (Ship Building). |
| South | Industrial Use - Exwold Technology Ltd (Chemical Processing). |
| West | Derelict land (Understood to be a proposed Waste to Energy site). |


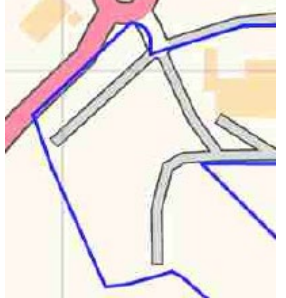
3. SITE HISTORY

3.1 On-Site Historical Development

A review of historical mapping pertinent to the site is summarised in Table 3.1 below. Note the historical map excerpts shown below and presented in Appendix IV display the wider site area. All notes relate to the subject site area rather than the wider site area. In addition, a historical site features are presented on Drawing No 21-1063-003 in Appendix III.

Table 3.1 Site Historical Development

| MAP EDITION | HISTORICAL LAND USE | HISTORICAL MAP EXCERPT |
|---------------------------------------|--|---|
| <p>Pre 1857 – Pre 1897</p> | <p>The site comprises undeveloped land predominantly located within the Tidal Flats of the River Tees estuary.</p> |  |
| <p>Pre 1897- Pre 1916</p> | <p>The site appears to have been reclaimed with from the River Tees. A tramway is noted to cross the northern site boundary A watercourse bisects the site and appears to have been partially culverted through the northern site area.</p> |  |
| <p>Pre 1916 – Pre 1939</p> | <p>Several areas of earthworks are now recorded in the northern and central site areas appearing to be associated with the expanding tramway network onsite. A weigh bridge structure is recorded in the central site area with a further unnamed structure noted on the western site boundary.</p> |  |
| <p>Pre 1939 – Pre 1975</p> | <p>The site appears to have been heavily developed, with numerous tramways and structures now recorded across the site. The structure formerly located on the western site boundary has expanded and is now noted to comprise an Engine Shed. A large structure is recorded in the south-western site area and is understood to comprise the ICI Chemical works Several additional structures of varying size are noted to be present onsite including an engine shed, overhead platform, tank and chimney.</p> |  |

| MAP EDITION | HISTORICAL LAND USE | HISTORICAL MAP EXCERPT |
|------------------------|---|---|
| Pre 1975- Pre 1992 | The site appears to have undergone a phase of demolition. The tramways and majority of onsite buildings are no longer recorded on site. 2no. structures remain in the central site area with an access road present in the northern site area. |  |
| Pre 1992 - Pre 2021 | The sites remaining structures have been demolished. The access track in the northern site area is no longer recorded and appears to have been replaced by a new road. |  |

3.2 Off-Site Historical Development

A review of potentially contaminative uses identified on historical Ordnance Survey maps within a 250m radius of the site is summarised below in Table 3.2.

Table 3.2 Surrounding Potentially Contaminative Land Uses.

| SURROUNDING FEATURE | DISTANCE | DATES | DIRECTION |
|---|----------|---|------------|
| Pioneer Cement Works inc. Tanks, Tramway, Travelling Cranes, Wharves <i>Then expanded</i> <i>Then spoil noted</i> <i>Then demolished</i> | 150m | Pre 1916- Pre 1939 Pre 1939 – Pre 1951 Pre 1951 – Pre 1984 | West |
| ICI Chemical Works inc. tanks, chimney, earthworks <i>Then demolished</i> | 30m | Pre 1939 – Pre 1984 | West |
| Furness Ship Building Yard inc. Travelling Cranes, Tanks, Slipways <i>Then slipways unused</i> | 25m | Pre 1938 – Pre 2000 Pre 2000 – Present | East |
| Pond <i>Then unrecorded</i> | 10m | Pre 1856 – Pre 1916 | North |
| Electric Power Sub-station <i>Then unrecorded</i> | 10m | Pre 1951 – Pre 1973 | West |
| Rail Foundry <i>Then unspecified works inc. works and tank</i> <i>Then partially demolished</i> <i>The unrecorded</i> | 175m | Pre 1923 – Pre 1973 Pre 1973 – Pre 1992 Pre 1992 – Pre 2001 | North West |
| Allotment Gardens <i>Then unrecorded</i> | 240m | Pre 1951 – Pre 1961 | North East |
| Allotment Gardens <i>Then unrecorded</i> | 40m | Pre 1951 – Pre 1961 | North West |
| Electricity Sub-station <i>Then unrecorded</i> | 25m | Pre 1951 – Pre 1961 | North West |
| Unspecified Works | 80m | Pre 1961 – Present | North |

3.3 Planning History

ERGO has undertaken a detailed search of online planning records held by Stockton Borough Council which has indicated the following pertinent information:

21/0228/SCO - Screening opinion for proposed plastics to fuel facility on Land adjacent to the western site boundary of the subject site. Which included a Phase II Site Investigation report completed by Solmek in February 2021 and considered likely to provide a representative summary of the anticipated ground conditions at the site. A brief summary is presented below.

Ground Conditions

Made Ground was proven across the site at depths of 3.70mbgl in the north west of the site deepening towards the south and east to a depth of 11.00mbgl in BH04. The majority of trial pits were terminated within Made Ground deposits. The majority of the Made Ground comprised very soft to firm locally stiff ashy sandy gravelly clay and locally organic clay including brick and concrete rubble, plastic, metal, wood, pottery, tarmac, slag and localised domestic waste. Localised cobbles and boulder size fragments of concrete and sandstone were also recorded.

Fused slag was encountered in TP11 from 1.60mbgl to 2.40mbgl and in BH08 from 3.00mbgl to 3.80mbgl. Concrete was found at 5.00mbgl in BH07 and BH07A where the boreholes were abandoned. A 36" pipe at 4.10mbgl and a metallic object was detected in BH01 at 10.50mbgl.

Natural ground was encountered within several of the deep probeholes and noted to comprise a firm to stiff thinly laminated sandy clays with interbedded sand layers, overlying locally dense sands and gravels to maximum depths of 31.80mbgl.

Solid geology was noted to comprise weathered sandstone at depths of 21.90-31.80mbgl. to maximum depths of 32.20mbgl.

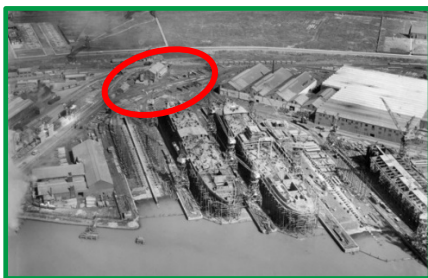
Contamination Risk Assessment

No contaminants of concern above the screening values for a commercial end use were identified. Though the potential risk from hazardous ground gasses were considered to be high.

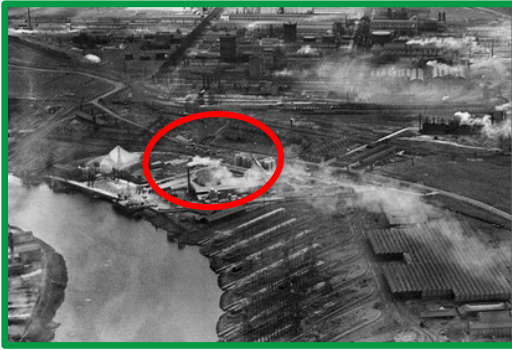
3.4 Anecdotal Evidence

ERGO has undertaken an online search to determine the presence of any anecdotal information pertinent to the site which has determined the following:

- The ICI Chemical Works previously processed Sulphuric acid which caused significant air pollution. Additionally, the site is understood to have produced phosphorus lights, Ammonium Nitrate, ammonium-based munitions and Uranium Hexafluoride products;
- It is understood the site may have undergone remediation via Phytoremediation under Teeside University;
- The site is shown below in 1950, showing the Furness shipyard; and,



- The site is shown below in 1932, showing the ICI factory and shipyard.



4. ENVIRONMENTAL SETTING

4.1 Geology and Hydrogeology

The British Geological Survey (BGS) map for the site, (1:50,000, Solid & Drift edition) and online records indicates the site is underlain by the geological sequence presented in Table 4.1, this information is corroborated by records from BGS boreholes in the vicinity summarised in Table 4.2.

Table 4.1 Summary of Underlying Geology

| GEOLOGICAL UNIT | CLASSIFICATION | DESCRIPTION | AQUIFER CLASSIFICATION |
|-----------------|--|----------------------|----------------------------|
| Made Ground | Made Ground | Undivided | N/A |
| Drift | Tidal Flat Deposits | Sands, Clay and Silt | Secondary Undifferentiated |
| | Glaciolacustrine Deposits (Northern Site Boundary) | Clay & Silt | Unproductive |
| Solid | Sherwood Sandstone Formation | Sandstone | Principal |

Table 4.2 Summary of BGS Borehole Records

| LOCATION | DEPTH | MADE GROUND | DRIFT | SOLID |
|----------|--------|-------------------------------------|---|---|
| On site | 10m | 3.60m - Foundry Waste | Sand, Clay & Gravel 3.60-9.80m Boulder Clay 9.80-10.00mbgl | Not encountered |
| 41m W | 8.0m | 4.70m - Ash, Slag, Brick & Concrete | Sand & Clay 4.70-8.00mbgl. | Not encountered |
| 34m W | 18.50m | 4.20m - Slag, Clinker & Ash | Sand & Clay 4.20-18.50m bgl | Not encountered |
| 48m SW | 8.0m | 5.10m - Slag, Ash, & Rubble | Silt & Clay 5.10-8.00mbgl. | Not encountered |
| 45m N | 253m | N/A | Clay 0.00-28.35mbgl. | Sandstone 28-178mbgl. Marl & Anhydrite 178-252mbgl. Limestone >252mbgl. |
| 58m SW | 53.64m | 1.70m Brick & Wood | Sand, Clay & Gravel 1.70-26.50mbgl | Sandstone >26.50mbgl |

No faults or linear features are noted to be within influencing distance of the site.

The site is understood with be located within an area where anhydrite was extracted, however it is considered that the depth to the anhydrite is sufficient to ensure no unacceptable risk is posed to the development.

The Groundsure Report indicates that the site is not located within a Groundwater Source Protection Zone. Furthermore, there are no groundwater / potable abstractions recorded within 1km of the site.

Based on the local topography, the location of surface watercourses. It is considered likely that shallow groundwater, if present, will flow in a southerly direction, following the topographical gradient towards the nearby River Tees.

4.2 Geotechnical Data

Geotechnical Data presented within a commercially available environmental database is summarised within Table 4.3.

Table 4.3 Summary of Geotechnical Data

| HAZARD | DESIGNATION |
|----------------------|---|
| Shrink-Swell Clay | Very Low Risk. |
| Landslides | Very Low Risk. |
| Ground Dissolution | Negligible Risk. |
| Compressible Ground | Very Low Risk onsite with areas of moderate risk noted on southern site boundary within wider site area and adjacent to the northern site boundary. |
| Collapsible Deposits | Negligible Risk. |
| Running Sand | Very Low Risk within development area. Moderate risk noted on southern site boundary within wider site area. |

4.3 Hydrology

Surface water features within 250m of the subject site are summarised in Table 4.4.

Table 4.4 Surface Water Features

| SURFACE WATER FEATURE | QUALITY | DISTANCE (m) | DIRECTION |
|-----------------------|----------|--------------|-----------|
| River Tees | Moderate | 70m | SE |

The development area is predominately within an area recorded to be low risk of flooding from river and/or coastal flooding, however the south-eastern sector of the wider site area is classed as high risk. The site is partially located within EA Flood risk zones 2 and 3. A historic flood event, occurring in 2013, is reported along the western boundary noted to be caused by an operational failure. There is limited potential for surface water flooding recorded at the site though at a moderate-high risk of groundwater flooding within the eastern sector of the site with a high to moderate-high risk of groundwater flooding noted.

4.4 Radon Risk Potential

The Groundsure Report indicates the site is situated in an area where less than 1% of homes are above the Action Level and that the BGS reports that full radon protective measures are not necessary in the construction of new dwellings or extensions.

4.5 Industrial Land Uses

The site is located within a predominately industrial area, the following records for recent industrial activities are noted:

- Immediately east of the development site is Marine Fabricators, an active Marine Engineering firm with associated electricity sub stations and slipways.
- Recycling centre 57m NW
- Electricity Substation 190m NW
- Bamletts Wharf 207m S
- Maritime Haulage 226m SE

4.6 Sensitive Land Uses

The Teesmouth and Cleveland Coastal SSSI and SPA is recorded c.70m south of the development site adjacent to southern boundary of the wider site area

No other environmentally sensitive land uses have been identified within close proximity to the site.

4.7 Site Sensitivity Assessment



The site is assessed to be located within a **Low/Moderate** sensitivity setting as discussed within Table 4.5.

Table 4.5 Site Sensitivity Assessment

| SENSITIVITY PROFILE | DISCUSSION | RATING |
|---|--|--------------------------|
| Groundwater Source Protection Zone or Drinking Water Safeguard Zone | N/A. | LOW |
| Distance to the closest groundwater abstraction point. | The closest abstraction points are recorded in excess of 1km from the site for none potable use. The closest abstraction for potable use is recorded to be 1663m from the site. | LOW |
| Aquifer Classification in Superficial Drift Deposits. | The underlying superficial deposits are classed as Secondary Undifferentiated/Unproductive and are likely to comprise sands, silts and clays of varying permeabilities to depths of c.28mbgl. | LOW |
| Aquifer classification in Bedrock. | Principal Aquifer strata. The sensitivity of the aquifer is somewhat reduced in the absence of groundwater abstraction and the presence of thick likely low permeability drift deposits which will inhibit vertical migration to the receptor | LOW/ MODERATE |
| Is the site underlain by low permeability Drift to depths in excess of 10.0m? | Borehole records suggest that drift deposits are present to depths of c.28mbgl. comprising sand, silt and clay. | LOW |
| Is the site located within 50m of a surface watercourse? | The nearest surface water course is the River Tees 75m south of the subject site. The river is tidal and likely brackish in nature. | LOW |
| Sensitive land uses within close proximity (e.g. residential, school, nursery, local nature reserves etc.) | There are nearby heavy industrial works adjacent to the eastern boundary and a recycling centre to the north of the site. | LOW |
| Overall Site Environmental Sensitivity | | LOW/ MODERATE |

4.8 Preliminary Geotechnical Assessment

Based on the desk study information, the following geotechnical assessment has been made:

-  Given that the site has previously been reclaimed from tidal flats and has seen several significant previous phases of development, dependent upon the extent of demolition/below ground turnover, it is possible that there may be significant Made Ground fill deposits, relict foundations and buried obstructions present within the subsurface. Any relict foundations and obstructions within the footprint of the proposed structure will require grubbing out, prior to the construction of the proposed development;
-  Several large structures and a chimney were formerly recorded to be present onsite suggesting the likely presence of significant thicknesses of Made Ground and possible deep foundations to be present;

- Investigation of the adjacent site identified several areas of spent slag and foundry waste which would suggest the potential for significant hard digging and may inhibit the advancement of excavations;
- The chemical works formerly partially located onsite were noted to produce ammonium nitrate and sulphuric acid, it is considered that the ground conditions may be highly aggressive and require specialist concrete subject to confirmation;
- A significant slope is present on the northern site boundary supporting the adjacent Haverton Hill Road, dependent upon the redevelopment proposals a slope stability assessment of this feature may be required;
- The site is understood with be located within an area where anhydrite was extracted, however it is considered that the depth to the anhydrite is sufficient to ensure no unacceptable risk is posed to the development;
- The site is located within an area where bombs have previously been recorded, there is the potential for further unrecorded bombs to be present within the subsurface which will have to be appropriately assessed and mitigated against to ensure no significant residual risk to the proposed development;
- Given the existing variations in topography, it is considered likely that a significant programme of enabling works will be required at the site to create level developable platforms;
- Investigation will be required in order to assess the underlying Made Ground and natural deposits and undertake in-situ geotechnical testing to determine the likely foundation solution;
- Significant thicknesses of slag fill have been recorded within nearby boreholes. Slag has potential expansive properties which, if present, will need to be considered as part of any proposed redevelopment;
- Given the proposed development, and owing to the likely presence of significant thicknesses of Made Ground, an engineered piled foundation/ground improvement solution is anticipated at present, subject to final site levels/loadings etc; and,
- It is considered likely that significant quantities of contaminated materials will be present at the site which will likely require a significant programme of remediation and enabling works to create an appropriate developmental platform for the site.

4.9 Unexploded Ordnance

The regional unexploded bomb risk map from Zetica indicates that the site is in an area at moderate risk from possible Unexploded Ordnance (UXO) resulting from the Second World War. (Zetica, 2014). Zetica also note the wider site area to be recorded as a Luftwaffe target.

Anecdotal evidence records indicate the following:

- 19 June 1940, the Billingham, ICI factories were bombed with two soldiers being killed at ICI South Works and water and gas pipes in the surrounding areas being badly damaged causing major disruption.
- 6/7th May 1941 considerable damage was caused to the Davy and United Roll Foundry at Haverton Hill when it was hit by one HE bomb. The Compressor House and plant were completely destroyed seriously affecting the work of the melting, moulding and dressing shops.

In the first instance a preliminary UXO assessment should be undertaken by a qualified specialist.

5. CONSULTATIONS

5.1 Landfill Sites and Waste Treatment Sites

2no. historic landfills are recorded on the site, 1no. of which is located in the northern and western site areas under Haverton Hill Landfill Ltd ref: WV1/L/REE001, recorded to have accepted industrial, commercial and household wastes between 1990 and 2012. The second of these landfill is recorded in the western site area and was licensed to ICI Chemical and Polymers Ltd, ref: 0700/CLE/250 accepting inert waste from 1992, no license surrender date is noted. Additionally, 1no. historic landfill is located 162m south east of the site under Middlesbrough Borough Council, ref: 0700/CLE/058, recorded to have accepted inert, industrial and commercial wastes between 1978 and 1993.

3no. historic waste sites are recorded within 250m of the site;

- 27m northwest - IBA Recycling Plant;
- 88m north - Norton Bottoms Waste Transfer Station; and,
- 213m northwest - Energy from Waste Plant.

5no. active waste site are recorded within 250m of the site;

- 70m north east – Tonks Recycling centre, ref: TON003 accepting 25,000-75,000T of materials;
- 116m southwest – Casebourne, Deposition of waste to land at recovery operation;
- 126m northwest – Haverton Hill Civic Amenity Facility, Household Waste Amenity facility (Energy from Waste);
- 161m north – Scott Bros recycling Ltd, accepting household, commercial and industrial wastes for recycling; and,
- 224m northwest – Haverton Hill Composting Facility.

5.2 Regulatory Database

The information summarised in Table 5.1 has been obtained from a commercially available environmental database. The summary table only includes records from within 250m of the subject site and not otherwise detailed in the report.

Table 5.1 Summary of Environmental Data

| RECORD | ENTRIES WITHIN 250m | DETAILS |
|---|---------------------|--|
| Contaminated Land Register Entries and Notices | 0 | None Identified (N/A). |
| Authorised industrial processes (IPC/IPPC/LAPPC). | 0 | N/A |
| Fuel Stations Entries | 0 | N/A |
| Licensed radioactive substances | 0 | None recorded. Anecdotal evidence suggests the onsite chemical works formerly produced Uranium Hexafluoride products. |
| Enforcements, prohibitions or prosecutions | 0 | N/A |

| | | |
|---|---|---|
| Discharge Consents | 3 | 27m Southeast – Exwold Technology Ltd for the discharge of Process Effluents to the Tees Estuary 119m southwest – Sewage discharges, Site drainage and unspecified effluents to the River Tees 122m SW – Trade Discharge – Tees Valley Energy |
| Pollution Incidents | 2 | 70m East – Feb 2003 – Minor impact to Land and Air. 140m North – July 2003 – Minor Air impact |
| Consents issued under the Planning (Hazardous Substances) Act 1990 | 1 | 30m South - Exwold Technology Ltd. Storage of 18 tonnes very toxic substances and 195 tonnes dangerous to the environment substances. No specific information is present. |
| Control of Major Accident Hazard (COMAH) sites | 2 | 25m East – Historic NIHHS site registered to Bunn Fertiliser Ltd 30m South – COMAH Lower Tier Operator registered to Exwold Technology Ltd. |

6. INITIAL CONCEPTUAL SITE MODEL

6.1 Initial CSM

In accordance with Environment Agency, Land Contamination Risk Management (LCRM, 2019) and BSI 10175 (Code of Practice for Investigation of Potentially Contaminated Land), ERGO Ltd has developed an initial CSM to identify potential contamination sources, migration pathways and receptors within the study area. This is summarised within Table 6.1.

Table 6.1 Initial Conceptual Site Model

| SOURCE | PATHWAY | RECEPTOR |
|---|--|---|
| Human Health | | |
| Heavy metals, PAH contaminants, Semi Volatile Organic Compounds (SVOC), Tributyl Tin (TBT) associated with former ship building yard and PCB contamination associated with onsite Made Ground deposits, demolition materials, the former onsite electric power station, former onsite chemical works, historical tramways and reclamation works and landfilling activities | Dermal Contact and Ingestion Consumption of Home-grown Produce | Construction Workers Commercial End Users |
| <p>Discussion:</p> <p>Given the presence of several significant phases of industrial development at the site, including former shipbuilding yard and electricity power station, chemical works and landfilling activities it is considered likely that Made Ground deposits and previous demolition works may have resulted in contamination of these soils by heavy metals, PAH and TPH contaminants, TBT, PCBs, ammonium nitrate and sulphuric acid.</p> <p>If present, contamination may pose a short term risk to construction workers and future site users who may come into contact with impacted soils.</p> <p>Construction works may come in to impacted soils during earthworks; however, risk can be mitigated through the use of appropriate Personal Protective Equipment (PPE) and the provision of adequate welfare facilities.</p> <p>Given development proposals indicate the presence of predominantly hardstanding impermeable surface with no areas of soft-standing landscaping it is considered unlikely that future site users will come into contact with impacted soils future commercial site users may come into contact with impacted soils.</p> <p>Based on the available information and proposed development plan, the potential risk to the future users of the site is presently considered to be moderate and should be confirmed as part of any subsequent Phase II investigation works. Should any areas of proposed landscaping be incorporated in to the designs, it is likely a clean cover system will be required to be incorporated.</p> | | |
| Volatilise hydrocarbon compounds associated with historic landfilling, chemical works, historic rail infrastructure and land reclamation works, volatile organic deposits associated with the underlying tidal flat deposits, remobilisation of historic mobile volatile contamination and historic ASTs and USTs | Volatilisation / Accumulation, Vapour Inhalation | Construction Workers, Commercial End Users |
| <p>Discussion:</p> <p>Given that the historic site usage including landfilling and land reclamation activities, ICI chemical factory and former onsite ship building works, it is considered likely that Made Ground deposits and</p> | | |

| SOURCE | PATHWAY | RECEPTOR |
|---|---|---|
| <p>(Continued)...</p> <p>previous demolition works may have resulted in contamination of these soils by volatile chemicals. It is considered likely that ASTs and USTs associated with these former uses were present onsite and have been recorded immediately adjacent to the site in mapping records. Additionally, the underlying tidal flats may also contain organic compounds. Furthermore, it is understood that nearby residential properties formerly present in the vicinity of the site were demolished due to poor air quality associated with the former sulphuric acid works at the site, it is considered possible that earthworks at the site may remobilise these volatile mobile contaminants.</p> <p>Volatile hydrocarbon and organic compounds may pose a risk to construction workers if they come into contact with impacted soils during earthworks, Whilst future commercial site end users and adjacent land users may come in to contact with remobilised contaminants within airborne soils and volatile deposits have the potential to accumulate within enclosed spaces.</p> <p>Based on the available information and considering the proposed development, future site users may potentially be exposed to vapours migrating into buildings through service entries or foundation structures. The risk is considered to be moderate at this stage, given the relatively low sensitivity of the proposed end usage. Potential risks to construction works should be able to be mitigated through the use of appropriate PPE. Mitigation measures may be required to ensure no contaminated materials are remobilised to ensure no risks to adjacent and future site end users.</p> | | |
| <p>Asbestos Containing Materials (ACM) within onsite Made Ground deposits, associated with historic land reclamation and landfilling, historic ship building activities and site usage and associated with the demolition of previous onsite structures</p> | <p>Fibre / Dust Inhalation</p> | <p>Construction Workers Commercial End Users Third Party Property</p> |
| <p>Discussion:</p> <p>No ACM was identified during the site walkover. However, it is considered probable that ACM may be present within onsite Made Ground deposits associated with reclamation works and landfilling activities, historic ship building activities and site usage and associated with the demolition of former onsite structures.</p> <p>Disturbance of ACM may give rise to dust generation, posing a risk to adjacent site users, construction workers, and commercial end users. ACM poses a risk through fibre and dust inhalation and if present may pose a risk to construction workers during any future earthworks / demolition and to adjacent third-party property should dust be generated during those works.</p> <p>If present, risks to onsite construction workers should be able to be mitigated through the use of appropriate PPE where applicable and adequate training in the identification of ACM impacted soils.</p> <p>Based on the available information and proposed development plan, the potential risk to the development is presently considered to be low, subject to appropriate management of the materials. Should any areas of proposed landscaping be incorporated in to the designs, it is likely a clean cover system will be required to be incorporated if ACM impacted soils are identified. If ACM impacted materials are identified appropriate management of impacted materials will be required in accordance with guidance outlined in CAR-SOIL TM.</p> | | |
| <p>Potential radioactive materials associated with the former production of Uranium Hexafluoride materials within the onsite chemical works</p> | <p>Ionisation, radiation of materials, Direct contact</p> | <p>Construction Workers Commercial End Users</p> |
| <p>Discussion:</p> <p>It is understood the former onsite chemical works formerly produced Uranium hexafluoride materials during the Second World War.</p> | | |

(Continued)...

Uranium based products and the associated raw materials are radioactive and if waste materials associated with these products are present within the subsurface may pose potential ionisation and radiation risks to receptors which may come in to contact with impacted materials.

At this stage risks to receptors are considered low; however, it is recommended the presence or otherwise of impacted materials is confirmed as part of any subsequent Phase II investigation works.

Hazardous Ground Gases

| | | |
|---|------------------------------------|--|
| <p>Methane and Carbon Dioxide associated with possible onsite fill material associated with land reclamation, historic landfilling, organic materials within tidal flat deposits and Made Ground associated with previous demolition works at the site</p> | <p>Inhalation Accumulation</p> | <p>Construction Workers Commercial End Users</p> |
|---|------------------------------------|--|

Discussion:

Made Ground underlying the site associated with land reclamation and landfilling activities at the site and demolition works of previous onsite structures as well as potential organic materials within the underlying tidal flat deposits may represent potentially significant sources of hazardous ground gas generation.

Ground gas can migrate through permeable strata, foundation structures and/or service ducting and accumulate within confined spaces where they may pose a risk to future commercial site end users. Risks to construction workers are considered negligible.

Based on the information currently available and given the low sensitivity of the proposed commercial end use comprising predominantly hardstanding impermeable surfaces there is considered to be a moderate risk to the proposed development. It is recommended this assessment is confirmed as part of any subsequent intrusive investigation. If a risk is determined present, the installation of protective ground gas mitigation measures will ensure no unacceptable risk to the proposed development.

Controlled Waters

| | | |
|---|---|--|
| <p>Mobile compounds within Made Ground deposits associated with historic site land use including land reclamation, landfilling, tramways, power station, ship building activities and chemical works. Chemical compounds associated with the production of sulphuric acid and ammonium nitrate amongst others.</p> | <p>Vertical / Lateral Migration</p> | <p>Secondary Undifferentiated Aquifer (Drift) Principal Aquifer (Solid) River Tees</p> |
|---|---|--|

Discussion:

The presence of likely significant thicknesses of Made Ground underlying the site associated with historic land reclamation and landfilling activities, the formerly onsite power station, shipyard, rail infrastructure and chemical works and potentially mobile chemicals including sulphuric acid and ammonium nitrate produced by the chemical works are considered potentially significant sources of mobile contamination at the site.

The underlying secondary undifferentiated drift and principal bedrock aquifers are considered potential receptors; however, the sensitivity of the underlying aquifers are considered somewhat reduced in the absence of ground water abstraction in the vicinity of the receptors. Additionally the drift aquifer is considered to be of low and variable productivity and likely of low permeability, recorded at thicknesses of c.20m, offering protection to the underlying principal bedrock aquifer.

The nearby River Tees is considered to be a potential receptor and the risks to this receptor will need to be proven by any subsequent investigation works.

Furthermore, development proposals indicate the site will predominantly comprise impermeable hardstanding surfaces which will inhibit vertical infiltration to the underlying deposits.

(Continued)...

At this stage risks to Controlled water receptors are considered low. Given the site history it is recommended this is confirmed as part of any subsequent Phase II intrusive works.

Buildings and Infrastructure

Elevated pH & Sulphate concentration associated with onsite Made Ground, demolition materials and associated with former ICI Chemical works

Corrosion of
Concrete

Foundations / Concrete

Discussion

Given the history of the site included the preparation of sulphuric acid and ammonium nitrate, in addition to the presence of significant Made Ground materials and likely demolition arisings, it is considered likely that the soil may be significantly aggressive at depth within onsite Made Ground deposits. It is considered that these Made Ground materials should be suitably assessed and considered given variations in pH and sulphate levels within Made Ground deposits may result in corrosion of buried concrete within the proposed development.

Assessment must be undertaken to confirm the levels of pH and sulphate within the site and thus determine the concrete classification.

7. RECOMMENDATIONS

Based on the desk study information, the following recommendations for a subsequent Phase II intrusive are made:

- Deep cable percussive boreholes to confirm the depth and nature of underlying Made Ground deposits, where possible these boreholes should be advanced to the underlying bedrock to confirm the depth of suitable founding stratum;
- Window sample probeholes to investigate Made Ground deposits within the upper 5m of ground levels should reengineering of shallow Made Ground deposits be considered and installation of environmental monitoring well;
- Mechanically excavated trial pits to identify the presence of buried features, relict structures and possible obstructions within Made Ground deposits;
- A detailed and comprehensive chemical assessment of the underlying Made Ground deposits including assessment of pH and Sulphate concentrations within Made ground and deeper nature deposits;
- The completion of a revised conceptual site model to confirm the potential risks to receptors associated with the redevelopment of the site;
- A hazardous ground gas risk assessment, likely to comprise 9no. visits over a 6no. month period as per guidance within Ciria C665; and,
- A UXO survey of all intrusive works.

Additionally, it is recommended that an ecological survey is completed to confirm the absence of any invasive species such as Japanese Knotweed which may result in significant remedial works being required to be undertaken.

Subject to development proposals and anticipated site levels, a slope stability assessment of the feature on the northern site boundary may be required. A cut/fill assessment of the site may also be required.

It is considered likely that the site will require a subsequent Remediation and Enabling Strategy to facilitate the redevelopment of the site with subsequent validation of the works.

Possible detailed quantitative risk assessment may be required should significant contamination be identified which represents a potential risk to controlled waters receptors at the site.

8. CONCLUSIONS

Site Summary

The subject site is an irregular shaped parcel of land located off Haverton Hill Road. The site is approximately 1.5miles north of Middlesbrough Town Centre.

The site currently comprises disused, derelict land with a hardstanding asphalt road in the north site area. 1No. partially buried feature understood to comprise a 'Switch Pump' for the adjacent shipbuilding yard was noted on the southern site boundary.

The site was noted to be predominantly covered in concrete slabs and gravel hardcore with dense self-seeded scrubland present in numerous locations. It is understood the site has undergone a previous phase of post-industrial reclamation.

The site was noted to be predominantly level with a steep slope on the northern site boundary and 2no. platforms in the southern/central site area. 2no. stockpiles were noted within the south-eastern and south-western site areas with a large bund present along the western site boundary.

Historical mapping suggests that the site comprised tidal flat within the Estuary of the River Tees until c.1897 when it appears the site was reclaimed. The site became heavily industrial within the first half of the 20th century with shipbuilding, rail infrastructure, electric power station and chemical factory noted until demolition and clearance in the 1980s. Evidence suggests the site has undergone landfilling and remediation in recent years.

Contamination Issues

| | |
|--------------------------|--|
| <p>Human Health</p> | <p>Due to the previously developed nature of the site, there are several significant potential sources of contamination identified including heavy metals, PAH and TPH contaminants, TBT, PCBs, ammonium nitrate, sulphuric acid, volatile compounds, ACM and uranium hexafluoride.</p> <p>Given development proposals indicate the presence of predominantly hardstanding impermeable surface with no areas of soft-standing landscaping it is considered unlikely that future site users will come into contact with impacted soils future commercial site users may come into contact with impacted soils upon completion of the development.</p> <p>Based on the available information and proposed development plan, the potential risk to the development is presently considered to be low-moderate and should be confirmed as part of any subsequent Phase II investigation works.</p> |
| <p>Controlled Waters</p> | <p>The presence of likely significant thicknesses of Made Ground underlying the site associated with historic land reclamation and landfilling activities, the formerly onsite power station, shipyard, rail infrastructure and chemical works and potentially mobile chemicals including sulphuric acid and ammonium nitrate produced by the chemical works are considered potentially significant sources of mobile contamination at the site.</p> <p>The underlying secondary undifferentiated drift and principal bedrock aquifers and nearby River Tees are considered potential receptors.</p> <p>At this stage risks to Controlled water receptors are considered low-moderate. Given the site history it is recommended this is confirmed as part of any subsequent Phase II intrusive works.</p> |
| <p>Ground Gas</p> | <p>Made Ground underlying the site associated with land reclamation and landfilling activities at the site and demolition works of previous onsite structures as well as potential organic materials within the underlying tidal flat deposits represent potentially significant sources of hazardous ground gas generation.</p> <p>Based on the information currently available and given the low sensitivity of the proposed commercial end use comprising predominantly hardstanding impermeable surfaces there is considered to be a moderate risk to the proposed development.</p> |

Geotechnical Issues

Based on the desk study information, the following geotechnical assessment has been made:

- Given that the site has previously been reclaimed from tidal flat and seen several significant previous phases of development, dependent upon the extent of demolition/below ground turnover, it is possible that there may be significant Made Ground fill deposits, relict foundations and buried obstructions present within the subsurface. Any relict foundations and obstructions within the footprint of the proposed structure will require grubbing out, prior to the construction of the proposed development;
- Several large structures and a chimney were formerly noted to be present onsite suggesting the likely presence of significant thicknesses of Made Ground and possible deep foundations to be present;
- Investigation of the adjacent site identified several areas of spent slag and foundry waste which would suggest the potential for significant hard digging and may inhibit the advancement of foundations;
- The chemical works formerly located partially onsite were noted to produce ammonium nitrate and sulphuric acid, it is considered that the ground conditions may be highly aggressive and require specialist concrete subject to confirmation;
- A significant slope is present on the northern site boundary supporting the adjacent Haverton Hill Road, dependent upon the redevelopment proposals a slope stability assessment of this feature may be required;
- The site is understood to be located within an area where anhydrite was extracted, however it is considered that the depth to the anhydrite is sufficient to ensure no unacceptable risk is posed to the development.
- The site is located within an area where bombs have previously been recorded, there is the potential for further unidentified bombs to be present within the subsurface which will have to be adequately considered and mitigated to ensure no risk to the proposed development;
- Given the existing variations in topography, it is considered likely that a significant programme of cut/fill enabling works will be required at the site to create level developable platforms;
- Investigation will be required in order to assess the underlying Made Ground and natural deposits and undertake in-situ geotechnical testing to determine the likely foundation solution;
- Significant thicknesses of slag fill have been recorded within nearby boreholes. Slag has potential expansive properties which, if present, will need to be considered as part of any proposed redevelopment;
- Given the proposed development and owing to the likely presence of significant thicknesses of Made Ground, an engineered piled foundation is anticipated at present, subject to final site levels/loads etc; and,
- It is considered likely that significant quantities of contaminated materials will be present at the site which will likely require a significant programme of remediation and enabling works to ensure the appropriate development of the site.

Recommendations

Based on the desk study information, the following recommendations for a subsequent Phase II intrusive are made:

- Deep cable percussive boreholes to confirm the depth and nature of underlying Made Ground deposits, where possible these boreholes should be advanced to the underlying bedrock to confirm the depth of suitable founding stratum;
- Window sample probeholes to investigate Made Ground deposits within the upper 5m of ground levels should reengineering of shallow Made Ground deposits be considered and installation of environmental monitoring well;
- Mechanically excavated trial pits to identify the presence of buried features, relict structures and possible obstructions within Made Ground deposits;

- A detailed and comprehensive chemical assessment of the underlying Made Ground deposits including assessment of pH and Sulphate concentrations within Made ground and deeper nature deposits;
- The completion of a revised conceptual site model to confirm the potential risks to receptors associated with the redevelopment of the site;
- A hazardous ground gas risk assessment, likely to comprise 9no. visits over a 6no. month period as per guidance within Ciria C665; and,
- A UXO survey of all intrusive works

Additionally it is recommended that an ecological survey is completed to confirm the absence of any invasive species such as Japanese Knotweed which may result in significant remedial works being required to be undertaken.

Subject to development proposals and anticipated site levels, a slope stability assessment of the feature on the northern site boundary may be required. A cut/fill assessment of the site may also be required.

It is considered likely that the site will require a subsequent Remediation and Enabling Strategy to facilitate the redevelopment of the site with subsequent validation of the works.

END OF REPORT

**APPENDIX I
LIMITATIONS**



1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between ERGO and the Client as indicated in Section 1.2.
2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information it has been assumed it is correct. No attempt has been made to verify the information.
3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination which are enforced by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.
4. During the site walkover reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not been made known or accessible.
5. Access considerations, the presence of services and the activities being carried out on the site limited the locations where sampling locations could be installed and the techniques that could be used.
6. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities.
7. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials this is for indicative purposes only and do not constitute or replace full and proper surveys.
8. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.
9. ERGO cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by ERGO is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by ERGO in this connection without their explicit written agreement there to by ERGO.
10. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.

**APPENDIX II
GLOSSARY**

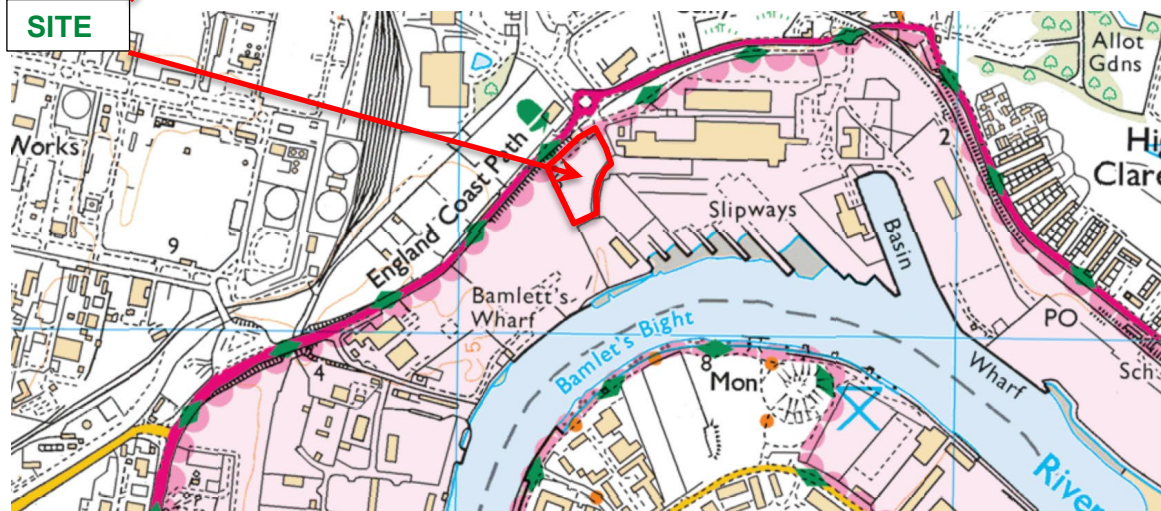


TERMS

| | | | |
|--------------|--|-------------------------|--|
| AST | Above Ground Storage Tank | SGV | Soil Guideline Value |
| BGS | British Geological Survey | SPH | Separate Phase Hydrocarbon |
| BSI | British Standards Institute | TPH CWG | Total Petroleum Hydrocarbon (Criteria Working Group) |
| BTEX | Benzene, Toluene, Ethylbenzene, Xylenes | SPT | Standard Penetration Test |
| CIEH | Chartered Institute of Environmental Health | SVOC | Semi Volatile Organic Compound |
| CIRIA | Construction Industry Research Association | UST | Underground Storage Tank |
| CLEA | Contaminated Land Exposure Assessment | VCCs | Vibro Concrete Columns |
| CSM | Conceptual Site Model | VOC | Volatile Organic Compound |
| DNAPL | Dense Non-Aqueous Phase Liquid (chlorinated solvents, PCB) | WTE | Water Table Elevation |
| DWS | Drinking Water Standard | m | Metres |
| EA | Environment Agency | km | Kilometres |
| EQS | Environmental Quality Standard | % | Percent |
| GAC | General Assessment Criteria | %v/v | Percent volume in air |
| GL | Ground Level | mb | Milli Bars (atmospheric pressure) |
| GSV | Gas Screening Value | l/hr | Litres per hour |
| HCV | Health Criteria Value | µg/l | Micrograms per Litre (parts per billion) |
| ICSM | Initial Conceptual Site Model | ppb | Parts Per Billion |
| LNAPL | Light Non-Aqueous Phase Liquid (petrol, diesel, kerosene) | mg/kg | Milligrams per kilogram (parts per million) |
| ND | Not Detected | ppm | Parts Per Million |
| LMRL | Lower Method Reporting Limit | mg/m³ | Milligram per metre cubed |
| NR | Not Recorded | m bgl | Metres Below Ground Level |
| PAH | Polycyclic Aromatic Hydrocarbon | m bcl | Metre Below Cover Level |
| PCB | Poly-Chlorinated Biphenyl | mAOD | Metres Above Ordnance Datum (sea level) |
| PID | Photo Ionisation Detector | kN/m² | Kilo Newtons per metre squared |
| QA | Quality Assurance | µm | Micro metre |
| SGV | Soil Guideline Value | | |
| | | | |

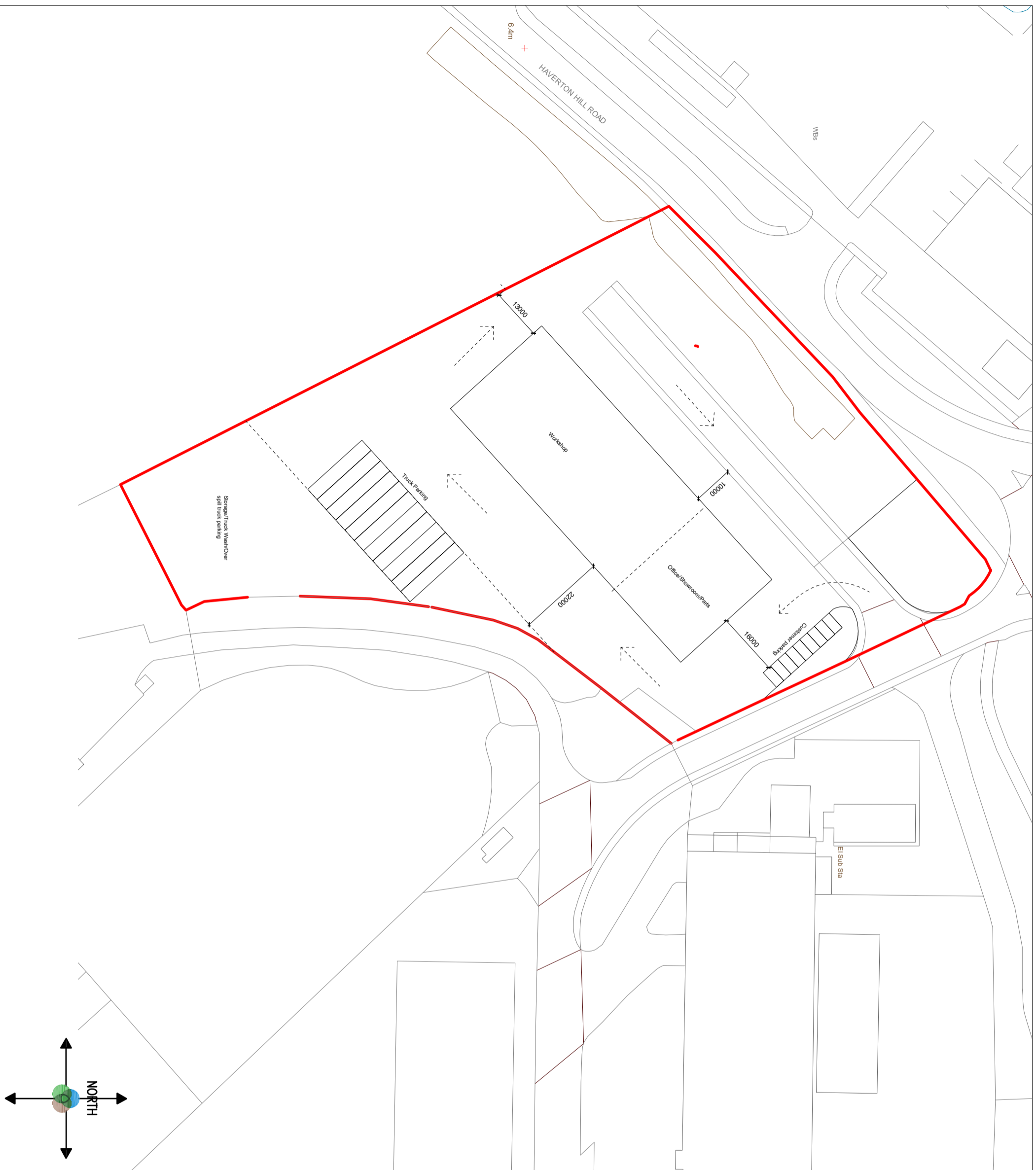
**APPENDIX III
DRAWINGS**





*Drawing 21-1063-001
Site Location Plan*





Key:
Location Symbols

Notes:

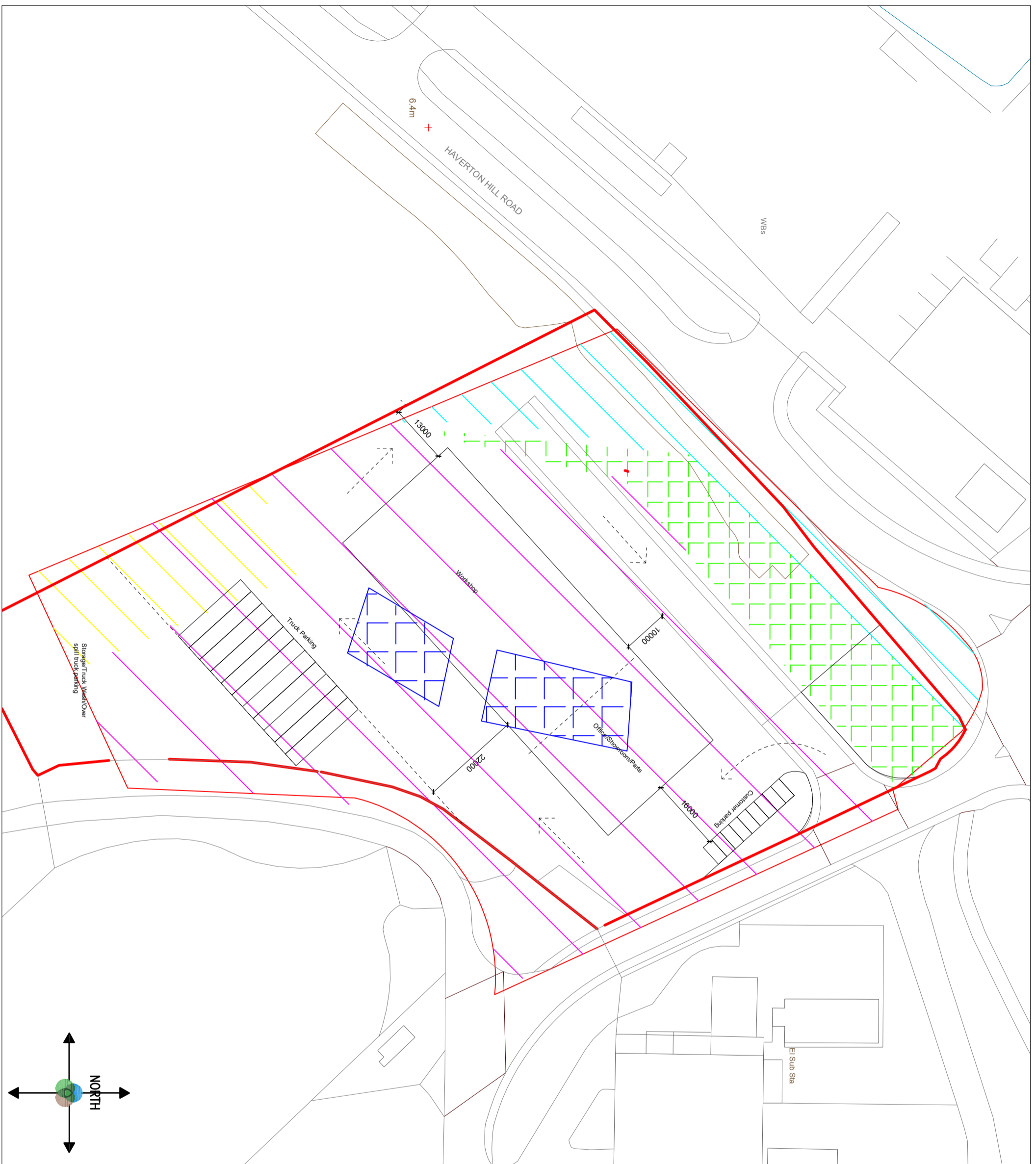
| Phase | Revision | Date | Issue | Drawn | Authorised |
|-------|----------|------------|-------|-------|------------|
| P1 | - | 28/10/2021 | DRAFT | RB | JN |

| | | | | | |
|--------------|-------------------|---------|---------|-------|------------|
| Client: | Ford & Slater Ltd | Job No: | 21-1063 | Date: | 28/10/2021 |
| Drawing No.: | 002 | Scale: | NTS | | |






| | | | |
|------------|--|----------------|-----------------------------------|
| Job Title: | Land at Haverton Hill, Road, Billingham | Drawing Title: | Exploratory Hole Location Plan |
|------------|--|----------------|-----------------------------------|

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Key:

- Location Symbols**
- Historical Features**
-  Rail (Pre 1950 - Pre 1984)
 -  Chimney (Pre 1938 - Pre 2001)
 -  Earthwork (Pre 1856 - Pre 1992)
 -  Chemical Works (Pre 1939 - Pre 1975)
 -  Coastline (Pre 1859 - Pre 1950)

Notes:

| Phase | Revision | Date | Issue | Drawn | Authorised |
|-------|----------|-----------|-------|-------|------------|
| P1 | - | 2/11/2021 | DRAFT | RB | JN |

| | | | | | |
|---|--|-------------|--------------------------|-----------|--|
| Client: | | Job No: | | Date: | |
| Ford and Slater Ltd | | 21-1063 | | 2/11/2021 | |
| Job Title: | | Drawing No: | | Scale: | |
| Land at Haverton Hill, Road, Billingham | | 003 | | NTS | |
| Drawing Title: | | | Historical Features Plan | | |



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**APPENDIX IV
PHOTOGRAPHS**





PLATE 1 – CONCRETE BLOCKS ACROSS ACCESS ROUTE



PLATE 2 – ACCESS ROAD IN NORTHERN SECTION LOOKING WEST



PLATE 3 – GENERAL STATE OF VEGETATION IN THE NORTH, NOTE VEGETATION COVERING RETAINING WALL



PLATE 4 – SLOPE TO THE SOUTHERN PLATFORM, NOTE STOCKPILE



PLATE 5 – RASIED MANHOLE ALONG THE WESTERN BOUNDARY



PLATE 6 – GENERAL STATE OF VEGETATION IN THE SOUTHERN SECTION



PLATE 7 – FENCE ALONG EASTERN BOUNDARY, NOTE PARTIALLY BUILT FENCE

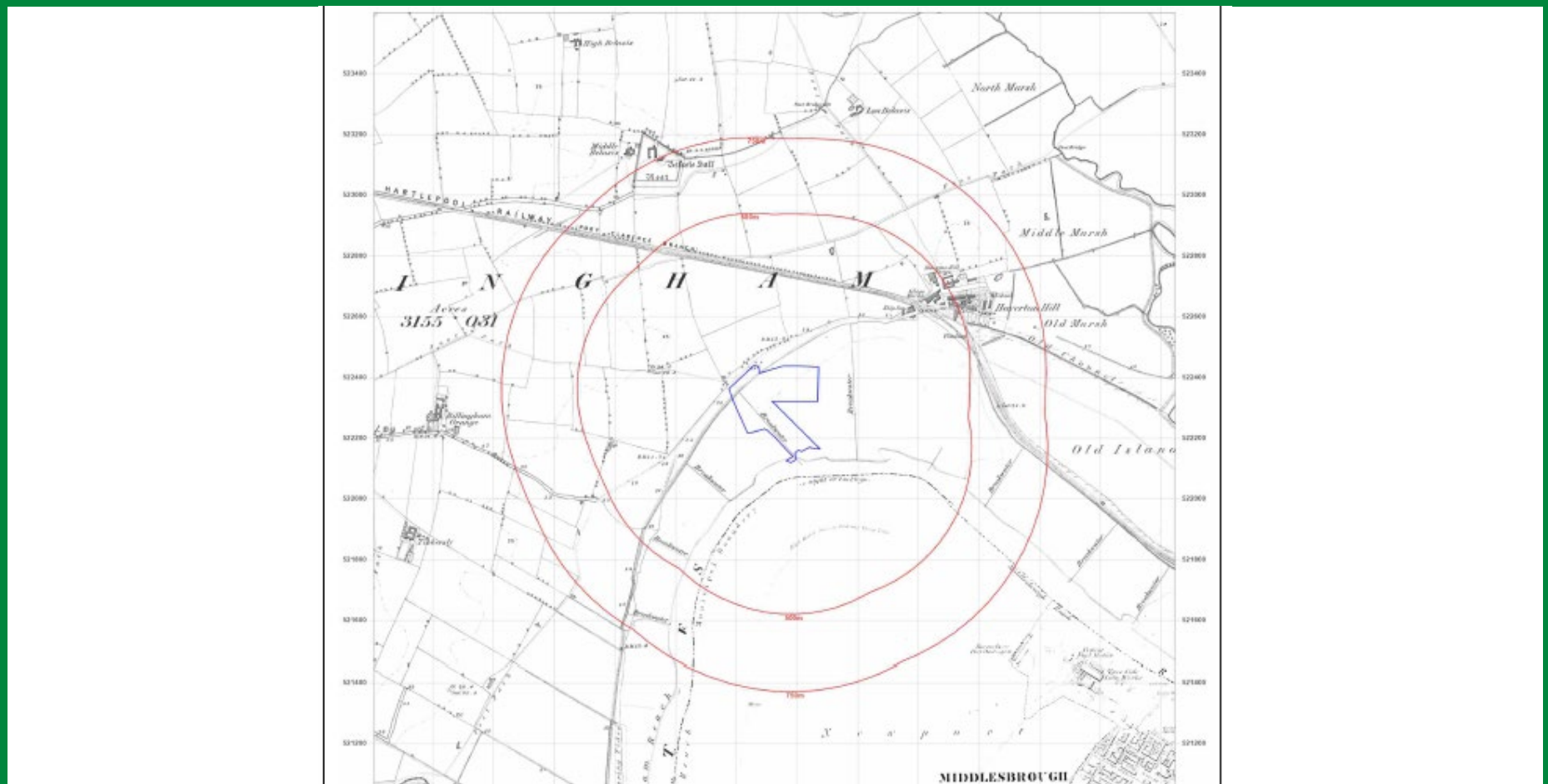


PLATE 8 – MANHOLE ALONG EASTERN BOUNDARY



PLATE 9 – FENCED OFF SERVICE – ANECTDOTAL EVIDENCE SUGGESTS THAT THIS IS A SWITCH PUMP ASSOCIATED WITH NEIGHBOURING SHIP YARD

**APPENDIX V
HISTORICAL MAPS**



Historical Map

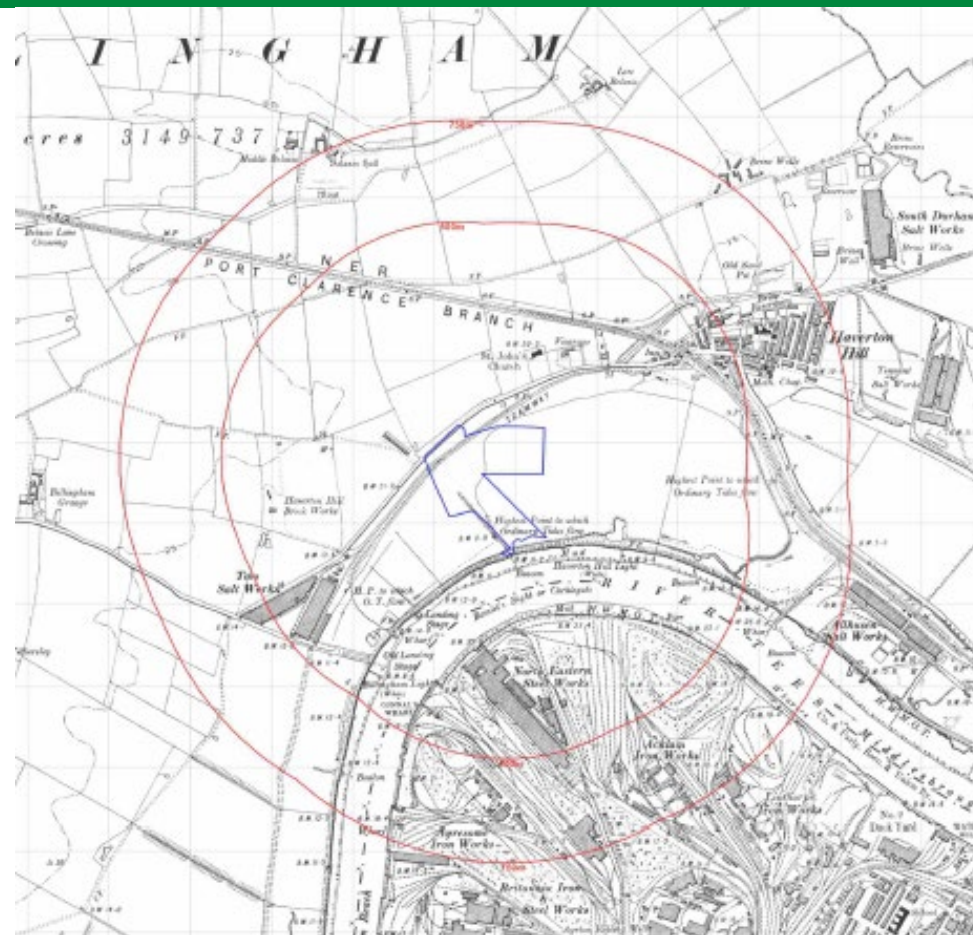
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North





Historical Map

Dated: 1893

Original Scale: 1:10,560





Historical Map

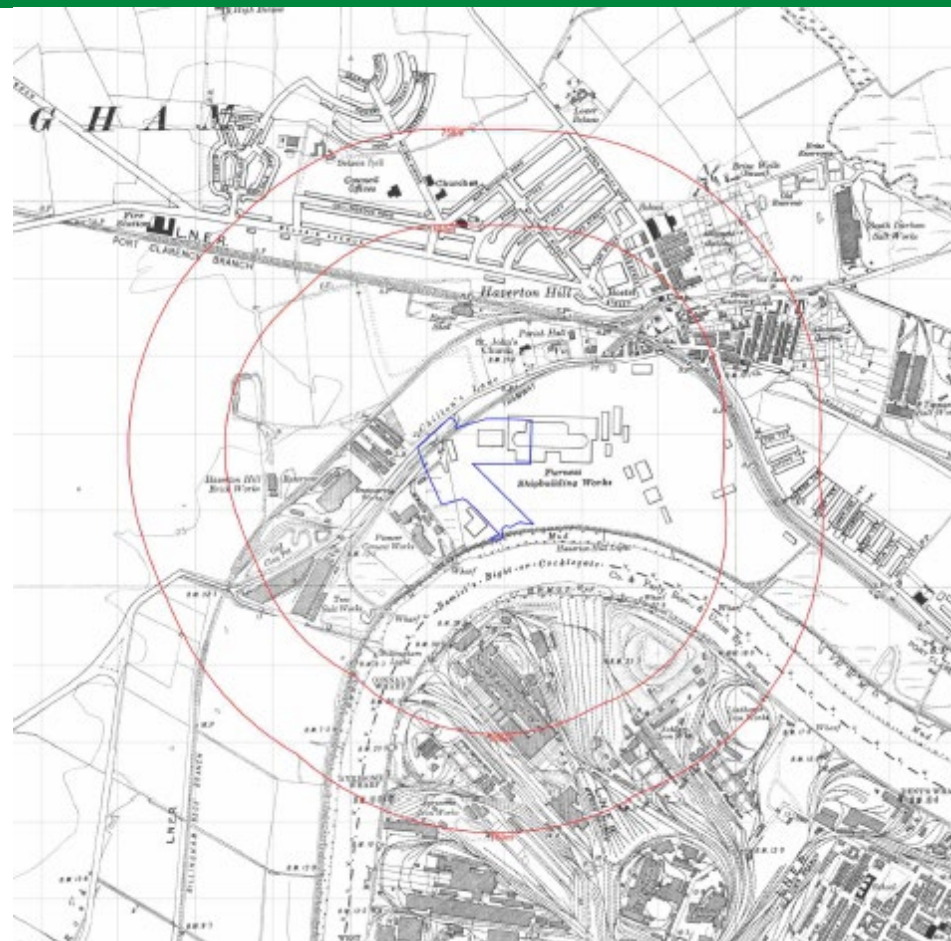
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North





Historical Map

Dated: 1938

Original Scale: 1:10,560



North



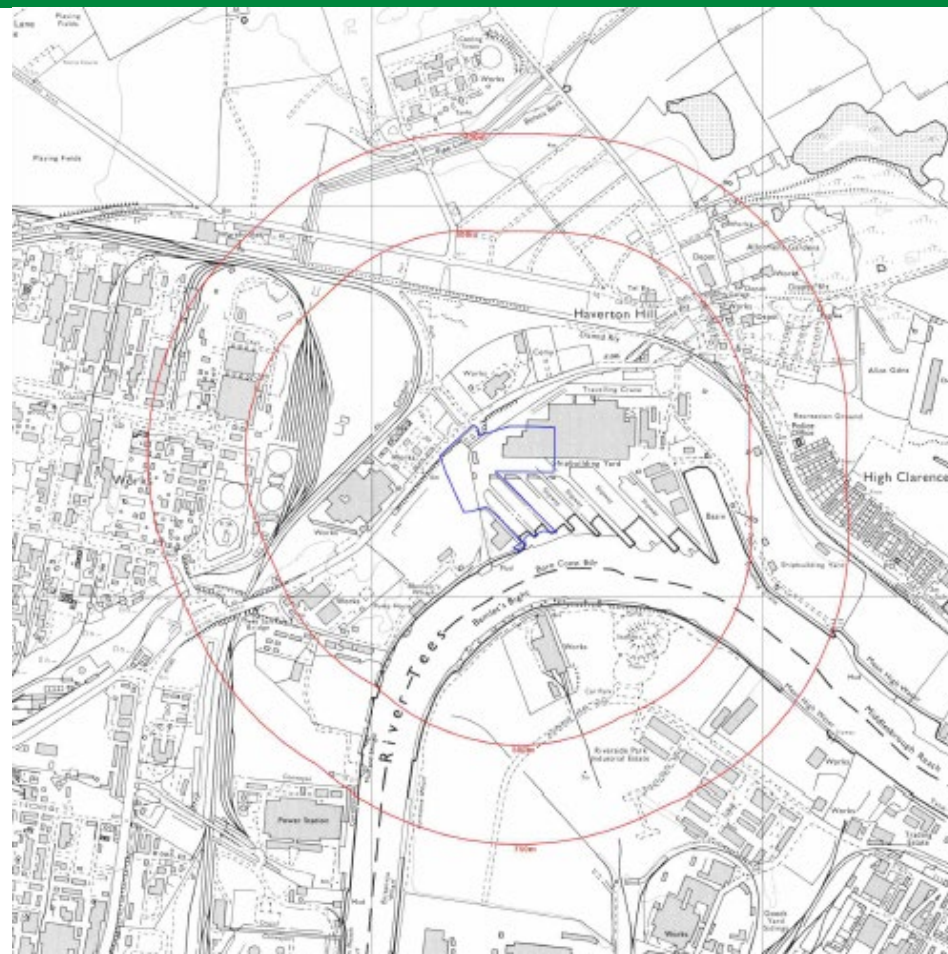


Historical Map

Dated: 1950

Original Scale: 1:10,560





Historical Map

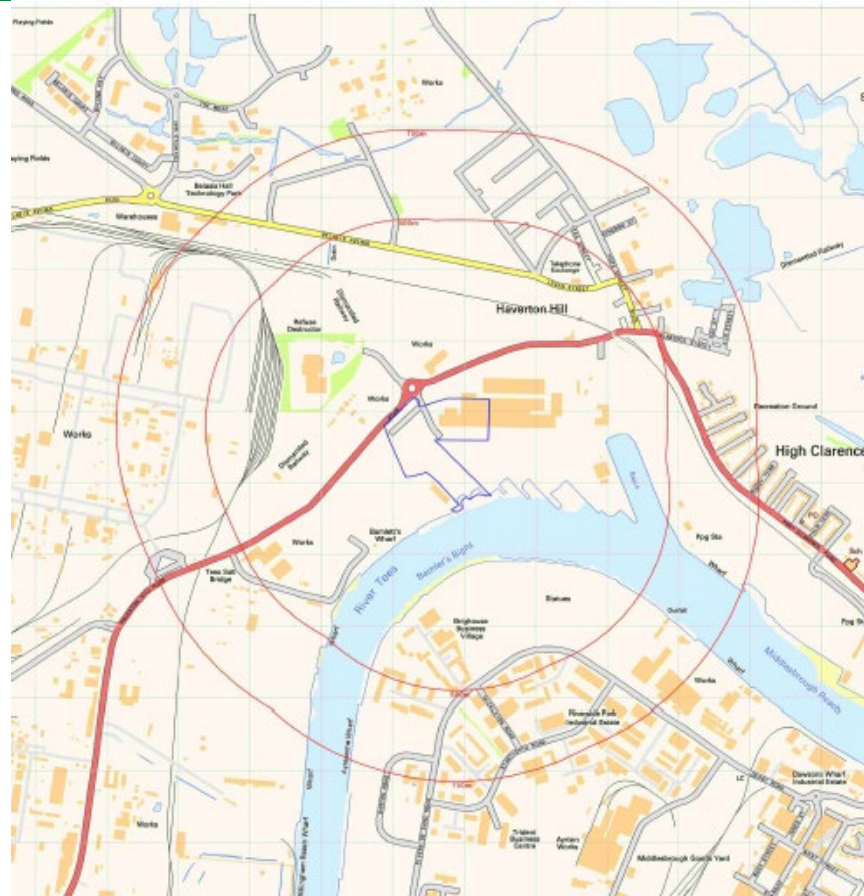
Dated: 1984

Original Scale: 1:10,560



North





Historical Map

Dated: 2001

Original Scale: 1:10,000

