



## GEOENVIRONMENTAL DESK STUDY REPORT

### North Bierley, WWTW Oakenshaw

Reference

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Date

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KPP Architects. Interchange 26, Interchange Way, Bradford. Proposed Site Plan. Drawing Ref: ICB-KPP-ZZ-DR-A-GA-2002, Rev B. Dated July 2026, for Bond It Group.

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## CONFIDENTIALITY STATEMENT

This report is addressed to and may be relied upon by the following:

Bond IT Group  
Lowfields Business Park  
ELLAND  
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This report has been prepared for the sole use and reliance of the above-named party. This report shall not be relied upon or transferred to any other parties without the express written authorisation of JPG (Leeds) Limited. No responsibility will be accepted where this report is used, either in its entirety or in part, by any other party.

## DOCUMENT HISTORY

| Revision | Date       | Revision Details | Status | Author(s) | Approved |
|----------|------------|------------------|--------|-----------|----------|
| P01      | 25.09.2026 | First Issue      | Final  | DMH       | RMR      |



## EXECUTIVE SUMMARY

|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Site Address         | North Bierley, WWTW, Oakenshaw                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| NGR                  | National Grid Reference 418114, 427087.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Current Site Use     | The site comprises an irregular shaped parcel of land, measuring approximately 330m along its north to south axis and 85m along its east to west axis, occupying an overall area of approximately 3.05 hectares. The northern part of the site comprises four former filter beds, one empty, one partially empty and two full of gravel and cobbles of suspected slag/clinker. A concrete plinth with metal infrastructure is located at the northern end of the filter beds in the centre, at the former location of above ground storage tanks. The southern end of the site is fenced off with palisade fencing, trending east in west in the central part of the site, and a locked gate. A stockpile is shown adjacent to the southern boundary, comprising grass and semi-mature vegetation. The remainder of the southern area is low lying, comprising grass with overgrown areas of semi-mature vegetation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Proposed Development | It is proposed to redevelop the site for commercial end use.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Site History         | On the earliest available plan, dated 1854, the site is shown as an open field. On the 1892/94 plans, a coal pit and tramways are shown in the northern and central parts of the site. On the 1932/33 plans, the tramways are no longer shown. Surface depressions remain from the former coal pit and Spensborough U.D. Council Sewage Works, comprising filter beds, settling tanks, storm tanks and humus tanks, is shown in the southern part of the site. On the 1938 and 1948 plans, filter beds and tanks are shown in the northern part of the site. By the 1973/74 plans, any structures/infrastructures in the southern part of the site are no longer shown. The filter beds and tanks in the northern part of the site remain. By the 2010 plans and aerial images, dated 2011 to 2025, the filter beds are left abandoned, and the tanks have been removed. The site remains abandoned to the present day.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Site Setting         | <p><b>Geology</b> – Based on the GS Report and the BGS publications, made ground is shown in the southern part of the site and worked ground is shown in the northern part of the site. Furthermore, based on the review of historical maps, aerial images and the site walkover, made ground is evident across most of the site. Alluvium deposits are shown along the eastern boundary of the site. The underlying bedrock is shown to comprise mudstone, siltstone and sandstone of the Lower Pennine Middle Coal Measures Formation. Clifton Rock, recorded as sandstone, is shown to abut the eastern boundary of the site. A fault is shown 188m to the south west of the site, trending south east to north west, displacement unknown.</p> <p><b>Mining</b> - The site is located in a Mining Remediation Authority high development risk area. The Whinmoor coal seam is recorded to have been worked beneath the property, at a depth of 2.0m, with an extraction thickness of 0.66m. The Black Bed coal seam is recorded to have been worked beneath the property, at a depths of between 58m and 70m, with an extraction thickness of between 0.71m and 2.16m. The Better Bed coal seam is recorded to have been worked beneath the property, at depths of between 92m to 115m, with an extraction thickness of between 0.46m and 0.56m. The Whinmoor coal seam is recorded to outcrop in the central part of the site. There are two recorded Mining Remediation Authority mine entries (418427-005 and 418427-011) within the centre of the site. Mine entry 418427-005 was located at E4188127.60 and N427113.73. A 2.5m circular feature was exposed at a depth of 3.6m bgl. Mine entry 418427-005 was located at E4188127.60 and N427113.73. A 2.5m circular feature was exposed at a depth of 3.6m bgl.</p> <p><b>Quarry/Mineral Extraction</b> – There is one recorded historical BritPit located on the site. This is shown as Hunsworth Little Wood and the commodity was coal.</p> <p><b>Hydrogeology</b> - The underlying alluvium deposits and Pennine Middle Coal Measures Formation are classified as Secondary A Aquifers. There is one recorded active licenced groundwater abstraction within 1km of the site. This is located 347m to the south west of the site at Cleckheaton &amp; District Gold Club. The site does not lie within an Environment Agency Groundwater Source Protection Zone.</p> <p><b>Hydrology</b> – The closest surface water feature is an inland river located in the northern part of the site, trending south east to north west. Hunsworth Beck is located 24m to the north east of the site, trending north to south. There are no recorded active licenced surface water abstractions within 1km of the site. Information on the gov.uk website and provided in the GS report indicates that most of the site does lie within Flood Zone 2 area and the central and southern western parts of the site lie within Flood Zone 3 area.</p> <p><b>Landfills and Waste</b> – There are no recorded active or recently closed landfill sites within 500m of the site. There are two recorded historical landfill sites within 500m of the site. Both are associated with Hunsworth Dyeing Company Limited, located 320m and 348m to the south east of the site. There are no recorded active licenced waste sites within 500m of the site. There are two recorded waste exemptions within 500m of the site. Both are located 406m to the north east of the site and both relate to 'recovery of textiles'.</p> <p><b>Radon</b> – No radon protective measures are required for new properties constructed on the site.</p> |



|                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                | Unexploded Ordnance (UXO) – The online Zetica UXO risk maps show the site to be located in an area of low UXO risk.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Environmental Risk Assessment</b>                                                                                                                           | Based on the conceptual site model, the site is considered to be low to moderate risk with respect to contamination in soils, groundwater and hazardous ground gases. This designation will be largely dependent on the nature of any made ground and hazardous ground gases present on or adjacent to the site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Preliminary Engineering Assessment</b>                                                                                                                      | <p>Mining - The risk of ground instability from shallow coal workings and/or mine entries is considered to be moderate to high. It is recommended that further ground investigative works are carried out to delineate the shallow coal workings beneath the proposed development in the southern part for the site and to confirm the MRA mine entries depth, infill material and rockhead level.</p> <p>Earthworks – Based on the site walkover and proposed development layout it is considered that a cut and fill earthwork operation will be required in order to create a level development platform. Any earthworks should be carried out in accordance with the Manual of Contract Documents for Highway Works, National Highways, Geotechnics Construction CC601 Earthworks. Geotechnics Design CD601 Design of Earthworks and Pavement Construction CC201 Pavement Foundation Construction.</p> <p>Foundations and Ground Floor Slab – The made ground is unsuitable in its current condition for the support of structural loads due to variations in material properties. In order to develop the site, consideration should be given to ground improvement, e.g. vibro-stone columns/controlled modulus columns or alternatively piled foundations.</p> <p>Groundwater - The presence of groundwater will need to be assessed as part of any ground investigation.</p> <p>Obstructions - Based on the coal mining legacy and site's development history, i.e. sewage works, the presence of significant near surface obstructions are anticipated.</p> <p>Roads, Pavements and Hardstanding Surfaces - It is recommended that, at this stage, a conservative bearing value for the subgrade is assumed until the nature of the subgrade can be physically assessed.</p> <p>Chemical Attack on Buried Ground - Samples of made and natural ground should be obtained and submitted to the laboratory for testing in order to assess the sulphate content and acidity and hence the concrete class required for buried concrete to the latest standard.</p> |
| <b>Further Work Required</b>                                                                                                                                   | Based on the findings of this Desk Study Report, we would recommend carrying out a Phase 2 Geoenvironmental Ground Investigation. On completion of the investigation, a Phase 2 Geoenvironmental Ground Investigation Report, to include an updated coal mining risk assessment and controlled waters risk assessment, should be completed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| This sheet is intended as a summary only of the assessment of the site in relation to ground condition. It does not provide a definitive engineering analysis. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |



## 1.0 INTRODUCTION

### 1.1 Instruction

JPG (Leeds) Limited (JPG) has been instructed by Bond IT Group to provide a geoenvironmental desk study report for a proposed commercial development at North Bierley, WWTW, Oakenshaw.

### 1.2 Objectives

The main objective of the geoenvironmental desk study is to identify potential geotechnical and environmental issues that may represent potential constraints to the proposed development.

### 1.3 Scope of Works

The scope of works for the geoenvironmental desk study includes the following:

- Site inspection and description.
- Review of contemporary and historical Ordnance Survey publications and available aerial photographs.
- Consultations with regulatory authorities, where appropriate.
- Review of geological publications (including hydrology, hydrogeology and soil survey publications, where appropriate).
- Review of previous reports.
- Review of the radon status of the site.
- An environmental database search.
- Outline environmental risk assessment.
- Preliminary engineering recommendations with respect to foundations, ground floor and pavement design.
- Recommendations for further work, where appropriate; and
- Presentation of the findings in a tabular non-technical summary.

### 1.4 Location

The site is located directly to the north of the M62 (Junction 26), to the west of the M606 (Junction 1) and approximately 6km to the south of Bradford city centre. The approximate centre of the site is located at national grid reference (NGR) 418114, 427087.

A site location plan is provided as Figure 1 in Appendix A.



## 1.5 Site Description and Topography

A site walkover was carried out by a JPG engineer on 16 September 2026.

The site comprises an irregular shaped parcel of land, measuring approximately 330m along its north to south axis and 85m along its east to west axis, occupying an overall area of approximately 3.05 hectares.

The northern part of the site comprises four former filter beds, one empty, one partially empty and two full of gravel and cobbles of suspected slag/clinker. A concrete plinth with metal infrastructure is located at the northern end of the filter beds in the centre, at the former location of above ground storage tanks.

The southern end of the site is fenced off with palisade fencing, trending east in west in the central part of the site, and a locked gate. A stockpile is shown adjacent to the southern boundary, comprising grass and semi-mature vegetation. The remainder of the southern area is low lying, comprising grass with overgrown areas of semi-mature vegetation.

Access to site is gained off Interchange Way from the northwestern corner of the site. Concrete blocks and two metal bollards are positioned at the entrance onto site.

Overhead electricity cables are located 25m to the north of the site, trending east to west.

The site is bound to the north by a gravel path, beyond which is Advanced Supply Change Group and to the east by gravel path, pumping station and Hunsworth Beck, beyond which is open fields. The site is bound to the south by M62 motorway and slip road and to the west by a metal palisade fencing and grassland, beyond which the M606 motorway and slip road.

An aerial photograph of the site is provided as Figure 2 in Appendix A. A selection of photographs of the site is provided in Appendix B.

## 1.6 Development Proposals

It is proposed to redevelop the site for commercial end use. A proposed site plan is referenced below, and a copy is provided in Appendix A.

- KPP Architects. Interchange 26, Interchange Way, Bradford. Proposed Site Plan. Drawing Ref: ICB-KPP-ZZ-DR-A-GA-2002, Rev B. Dated July 2026, for Bond It Group.

## 1.7 Limitations

The general limitations to the nature of the investigation are provided in Appendix E.



## 2.0 SITE HISTORY

### 2.1 Review of Historical Ordnance Survey Mapping and Aerial Images

Historical maps and aerial images for the site were obtained from GroundSure (GS), and additional aerial images were viewed on-line on Google Earth Pro (GEP).

These were reviewed to establish the previous uses of the site and identify any potentially contaminative historical uses or potential geotechnical constraints to the proposed development.

A summary of the relevant map and aerial imagery information is provided in Table 2.1. Copies of the Ordnance Survey (OS) maps are provided in Appendix C.

Table 2.1 – Summary of Relevant Historical Map and Aerial Imagery Information

| Date(s) & Scale                                                 | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1854 1:10,560                                                   | The site is shown to comprise an open field.<br>Open fields are shown to the north, south and west of the site.<br>Hunsworth Beck is shown 25m to the east of the site.<br>Bradford Road is shown 200m to the west of the site.<br>The West Riding Union Railway is shown 500m to the west of the site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 1892 1:10,560 & 1893/94 1:2,500                                 | An old coal pit is shown in the centre of the site as three separate excavations. A tramway is shown entering the site from the north and splits into five directions in the north central part of the site. One tramway continues southwards exiting the southern boundary (main route), one heads south west exiting the western boundary and the other three terminate at the excavations. A footpath trending east to west is shown in the southern part of the site.<br>Hunsworth Mills are shown 250m to the south east of the site.<br>Taylor's Lift (pumping engine) is shown 150m to the south of the site.<br>A chemical works is shown 250m to the south west of the site.<br>North Bierley Joint Hospital is shown 240m to the west of the site.<br>West Riding Union Railway is shown as the L&Y.R. Cleckheaton Branch.<br>Valley Pit (coal and ironstone) is shown 200m to the north west of the site. |
| 1905 1:10,560 & 1907/08 1:2,500                                 | The three tramways which terminate at the excavations are no longer shown.<br>Bradford Corporation Sewage Works is shown 25m to the north east of the site.<br>Sugden Beck is shown adjacent to the southern boundary of the site.<br>The chemical works to the south west is shown as Spen Valley Chemical Works.<br>Grove Rope Works is shown 250m to the south west of the site.<br>Valley Pit is no longer shown.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 1932 1:10,560 & 1933 1:2,500                                    | The remaining tramway routes are no longer shown. Surface depressions, associated with the former coal pits, are shown in the centre of the site. Spenborough U.D. Council Sewage Works, comprising filter beds, settling tanks, storm tanks and humus tanks, is shown in the southern part of the site.<br>Trees are shown adjacent to the northern boundary of the site.<br>Sludge beds are shown adjacent to the eastern boundary of the site.<br>A septic tank is shown adjacent to the southwestern boundary of the site.<br>A golf course and club house are shown 240m to the west of the site.<br>North Bierly Joint Hospital is shown as Isolation Hospital.                                                                                                                                                                                                                                                |
| 1938 1:2,500, 1938 1:10,560 & 1948 1:10,560                     | Rectangular filter beds are shown in the northern part of the site and a set of tanks abut the northern boundary. Sludge beds are shown in the east central part of the site. A path is shown to run the length of the eastern boundary, trending north to south.<br>The sludge beds to the east are no longer shown, instead humus tanks are shown.<br>Taylor's Lift is no longer shown, instead an old shaft is shown.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 1955 1:10,560, 1956/57 1:1,250, 1957/58 1:2,500 & 1967 1:10,560 | No significant changes are shown on the site.<br>Chain Bar Garage is shown 250m to the south east of the site.<br>Isolation Hospital is shown as North Bierley Hospital.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 1973 1:2,500, 1973/74 1:1,250 & 1974 1:10,000                   | None of the buildings or infrastructure in the southern part of the site are shown. The footpath in the southern part of the site is no longer shown.<br>North Bierley Water Pollution Control Works, including circular filter beds, settling tanks and storm tanks, is shown to the north of the site.<br>Sludge beds are shown 50m to the east of the site, beyond Hunsworth Beck.<br>The M62 (including Junction 26 roundabout) and associated embankments are shown                                                                                                                                                                                                                                                                                                                                                                                                                                             |



| Date(s) & Scale                                                                 | Description                                                                                                                                                                                                                                                                                               |
|---------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                 | to the south of the site.<br>The M606 and associated embankment are shown 50m to the west of the site.<br>Hunsworth Mills are now shown as a works.<br>Chain Bar Garage, Spen Valley Chemical Works and Grove Rope Works are no longer shown.                                                             |
| 1983 1:10,000                                                                   | No significant changes are shown on the site.<br>Additional circular filter beds are shown 100m to the north east of the site.                                                                                                                                                                            |
| 1990 1:10,000 & 1992/95 1:1,250                                                 | Another tank abuts the northern boundary of the site. A path is shown to border the filter beds.<br>A building is shown adjacent to the eastern boundary. Access is gained via the path along the eastern boundary of the site.<br>The railway to the west of the site is shown as dismantled.            |
| GS September 1999, 2001 1:10,000, GEP December 2002 to June 2004 & 2003 1:1,250 | The northern part of the site comprises filter beds and tanks and the southern part is shown as open overgrown grassland. An embankment/linear stockpile is shown in the south central part of the site, trending east to west.<br>West 26 Industrial Estate is shown 250m to the south east of the site. |
| 2010 1:10,000, GEP September 2011 to July 2013 & GS March 2012.                 | The tanks are no longer shown, and the filter beds appear abandoned.<br>The sewage works to the north appears abandoned.<br>An area of hardstanding is shown adjacent to the southern boundary of the site.                                                                                               |
| 2015 1:10,000, GEP April 2015 to April 2020 & GS July 2018.                     | No significant changes are shown on the site.                                                                                                                                                                                                                                                             |
| GS May 2021 & GEP July 2021 to January 2022                                     | No significant changes are shown on the site.<br>An earthwork operation is shown to the north of the site.                                                                                                                                                                                                |
| GEP July 2022 to April 2025 & 2025 1:10,000                                     | No significant changes are shown on the site.<br>A warehouse unit is shown to the north of the site.<br>Interchange Way is shown to the north west of the site.<br>A pumping station is shown adjacent to the eastern boundary of the site, access is gained via Interchange Way.                         |

## 2.2 Summary of Site History

On the earliest available plan, dated 1854, the site is shown as an open field.

On the 1892/94 plans, a coal pit and tramways are shown in the northern and central parts of the site.

On the 1932/33 plans, the tramways are no longer shown. Surface depressions remain from the former coal pit and Spenborough U.D. Council Sewage Works, comprising filter beds, settling tanks, storm tanks and humus tanks, is shown in the southern part of the site.

On the 1938 and 1948 plans, filter beds and tanks are shown in the northern part of the site.

By the 1973/74 plans, any structures/infrastructures in the southern part of the site are no longer shown. The filter beds and tanks in the northern part of the site remain.

By the 2010 plans and aerial images, dated 2011 to 2025, the filter beds are left abandoned, and the tanks have been removed. The site remains abandoned to the present day.



## 3.0 SITE SETTING

### 3.1 Geology

The GroundSure (GS) Report and the following British Geology Survey (BGS) geological publications have been consulted:

- BGS, Sheet 77, Huddersfield, Solid and Drift, 1:50,000. Published 2003.
- BGS, Sheet SE12NE, Cleckheaton, Solid and Drift, 1:10,000. Published 1999.
- BGS Geology Viewer (<https://www.bgs.ac.uk/map-viewers/bgs-geology-viewer/>).
- BGS Onshore GeoIndex (<http://mapapps2.bgs.ac.uk/geoindex/home.html>).
- BGS, Lexicon of Named Rock Units.

Based on the GS Report and the BGS publications, made ground is shown in the southern part of the site and worked ground is shown in the northern part of the site. Furthermore, based on the review of historical maps, aerial images and the site walkover, made ground is evident across most of the site.

Alluvium deposits are shown along the eastern boundary of the site.

The underlying bedrock is shown to comprise mudstone, siltstone and sandstone of the Lower Pennine Middle Coal Measures Formation. Clifton Rock, recorded as sandstone, is shown to abut the eastern boundary of the site.

A fault is shown 188m to the south west of the site, trending south east to north west, displacement unknown.

### 3.2 Historical Boreholes

Historical borehole information has been obtained online from the BGS Onshore GeoIndex.

Two historical trial pits and five historical boreholes are recorded on the site. Copies of the records are provided in Appendix D.

Ground conditions typically comprise topsoil to depths of between 0.12m and 0.20m bgl, underlain by firm to stiff, brown and grey, slightly sandy, slightly gravelly, silty clay and medium dense to dense, brown, slightly clayey, sandy fine to coarse gravel with cobbles and boulders to depths of between 4.70m and 11.70m bgl. Bedrock (encountered only in the historical borehole records) was recorded as weathered, grey, very weak to weak mudstone, weathered, dark grey, moderately strong to strong siltstone and weathered, grey, strong sandstone to depths of between 7.80m and 35.05m bgl.

Groundwater was encountered at depths of between 5.30m and 10.50m bgl.



### 3.3 Coal Mining

The site is located in a Mining Remediation Authority (MRA) high development risk area.

A review of the coal mining legacy of the site is provided in Section 3.13.

### 3.4 Quarrying/Mineral Extraction

The GS report provides information from the British Pits (BritPits) database, which is a database maintained by the BGS of currently active and closed surface and underground mineral workings.

There is one recorded historical BritPit located on the site. This is shown as Hunsworth Little Wood and the commodity was coal.

There are six recorded surface ground workings recorded on the site. The workings included, unspecified heaps (1938), old coal pit (1905), refuse heaps (1892), filter beds (1955-83), sewage works (1905-67) and sewage tanks (1938-48).

There is one recorded underground working located on the site. The working is shown as an old coal pit (1905).

### 3.5 Hydrogeology

The underlying alluvium deposits and Pennine Middle Coal Measures Formation are classified as Secondary A Aquifers. These are described as *'permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.'*

The GS report indicates that the risk of groundwater flooding occurring on most of the site is negligible and along the eastern boundary is moderate. The risk of groundwater flooding occurring at the site should be assessed based on site specific information.

There is one recorded active licenced groundwater abstraction within 1km of the site. This is located 347m to the south west of the site at Cleckheaton & District Gold Club. Groundwater is extracted from a borehole and used for spray irrigation. The licence number is 2/27/13/212/R01, it has an annual abstraction volume of 6,750m<sup>3</sup> and a maximum daily volume of 168m<sup>3</sup>.

There are no recorded licenced potable water abstractions within 2km of the site.

There are no recorded active licenced discharge consents to groundwater within 500m of the site.

The site does not lie within an Environment Agency Groundwater Source Protection Zone (SPZ).



### 3.6 Hydrology

The closest surface water feature is an inland river (not influenced by normal tidal action) located in the northern part of the site, trending south east to north west. Hunsworth Beck is located 24m to the north east of the site, trending north to south.

There are no recorded active licenced surface water abstractions within 1km of the site.

There are two recorded active licensed discharge consents to controlled waters within 500m of the site. The closest is located 31m to the north east of the site at Moorend Sewage pumping station, Whitehall Road, Cleckheaton. The Permit Number is NPSWQD009807 and the body of water receiving is Hunsworth Beck.

There are no records of any pollutant releases to surface waters (red list) within 500m of the site.

Information on the gov.uk website and provided in the GS report indicates that most of the site does lie within Flood Zone 2 area and the central and southern western parts of the site lie within Flood Zone 3 area.

There are no records of historical flood events occurring on the site.

The GS report indicates that the highest risk of surface water flooding occurring on the site is 1 in 30-years with a depth greater than 1.0m. The risk of surface water flooding occurring at the site should be assessed based on site specific information.

A flood risk assessment will be required by the Local Authority as part of any planning application for the site.

### 3.7 Pollution Incidents

There are seven Category 2 (significant) Environment Agency recorded Pollution Incidents within 500m of the site. These are summarised in Table 3.7.1 below.

Table 3.7.1 Records of the Category 2 Pollution Incidents within 500m of the site

| Distance & Direction | Incident Date | Incident Identification | Pollutant                  | Impact |
|----------------------|---------------|-------------------------|----------------------------|--------|
| 171m South East      | 10.02.2021    | 1890376                 | Organic Chemicals/Products | Water  |
| 224m South East      | 17.02.2021    | 1892420                 | Organic Chemicals/Products | Water  |
| 231m East            | 27.9.2004     | 268643                  | Oils and Fuel              | Water  |
| 242m South           | 16.10.2024    | 2314636                 | Contaminated Water         | Land   |
| 318m North           | 12.03.2008    | 570569                  | Sewage Materials           | Water  |
| 330m South           | 21.06.2015    | 1347118                 | Inert Materials and Wastes | Water  |
| 382m South East      | 02.02.2006    | 374958                  | Oils and Fuel              | Water  |



### 3.8 Environmental Permits and Registers

There are no recorded active or historical Control of Major Accidents Hazard (COMAH) or historical Notification of Installations Handling Hazardous Substances (NIHHS) sites within 500m of the site.

There are no recorded historical Licenced Industrial Activities/Integrated Pollution Control (IPC) authorisations within 500m of the site.

There are no recorded active Part A (1) licensed industrial activities within 500m of the site.

There are no active Part A (2) licensed pollutant releases recorded within 500m of the site.

There is one active Part B licensed pollutant release recorded within 500m of the site. The release is located 387m to the south east of the site at Cleckheaton Service Station, Centurion Way, Cleckheaton. The process involves unloading of petrol into storage at a service station.

There are no recorded active radioactive substance authorisations within 500m of the site.

There are no records of any pollutant releases (discharges of special category effluents) to the public sewer within 500m of the site.

There are no records of any active List 1 Dangerous Substance discharges within 500m of the site.

There are six active records of List 2 Dangerous Substance discharges within 500m of the site. These are summarised in Table 3.8.1 below.

Table 3.8.1 Records of the List 2 Dangerous Substance Discharges within 500m of the site

| Distance & Direction | Name                                          | Receiving Water | Authorised Substances                      |
|----------------------|-----------------------------------------------|-----------------|--------------------------------------------|
| 83m North East       | Ciba Speciality Chemicals, Bradford, BD12 0JZ | -               | Chromium, Copper, Cyanide, nickel, Zinc    |
|                      | Bulmer and Lumb Group Limited, BD6 2NE        | -               | Chromium, Permethrin, Sulcofuron           |
|                      | A. H. Marks & Co. Limited. Wyke, Bradford     | -               | Toluene                                    |
|                      | Rigby Cold Drawn Products, Low Moor           | -               | Chromium, Copper, Nickel, Zinc             |
| 242m South           | New List 2 Water Site 11                      | Stubs Beck      | 2-methyl-4-chlorophenoxyacetic acid (MCPA) |
| 251m South East      | New List 2 Water Site 9                       | Spen River      | MCPA), Mecoprop                            |

There are no records of sites determined as Contaminated Land under Part 2A of the Environmental Protection Act (EPA) 1990 within 500m of the site.



### 3.9 Landfills and Waste

The GS report includes information on recorded active, recently closed and historical landfill sites supplied by the EA, Local Authority and the BGS.

There are no recorded active or recently closed landfill sites within 500m of the site.

There are two recorded historical landfill sites within 500m of the site. These are summarised in Table 3.9.1 below.

Table 3.9.1 Records of the Recorded Historical Landfill Sites within 500m of the site

| Distance & Direction | Site Address / Licence Holder                                           | Waste Type & Site Reference                                         | Licence Issue / Surrender | First / Last Recorded   |
|----------------------|-------------------------------------------------------------------------|---------------------------------------------------------------------|---------------------------|-------------------------|
| 320m South East      | Land off Whitehall Road, Cleckheaton / Hunsworth Dyeing Company Limited | Inert and Commercial & 4700/0222                                    | 02.04.1980 / 28.04.1994   | 30.04.1980 / 31.12.1991 |
| 348m South East      | Land off Whitehall Road, Cleckheaton / Hunsworth Dyeing Company Limited | Inert, Industrial, Special and Liquid Sludge & 4700/0043, 4700/0272 | 03.05.1977 / 25.05.1994   | 01.01.1919 / 31.03.1994 |

There are no recorded active licenced waste sites within 500m of the site.

There are two recorded waste exemptions within 500m of the site. Both are located 406m to the north east of the site and both relate to '*recovery of textiles*'.

### 3.10 Additional Information

There are no historical petrol stations or garages within 500m of the site.

### 3.11 Radon Risks

The site is not in a radon affected area as defined by Public Health England with less than 1% of properties above the action level. In accordance with the Building Research Establishment (BRE) publication BR211, no radon protective measures are required for new properties constructed on the site.

### 3.12 Unexploded Ordnance

The online Zetica UXO risk maps show the site to be located in an area of low UXO risk.

### 3.13 Previous Reports

Previous reports, including a Desk Study Report, two Ground Investigation Reports and a Coal Mining Risk Assessment have been undertaken. The reports cover the proposed site and wider area. The reports are referenced below.

- Wardell Armstrong. Former North Bierley WWTW. Phase II Geo-Environmental Assessment. Job No. SH10534. Report Ref: RPT-002C. Dated November 2017 for Keyland Developments Limited.



- Wardell Armstrong. North Bierley Phase 2 Land. Phase I Geoenvironmental Desk Study. Job No. LD10258. Report Ref: 001 V1.0. Dated June 2021 for Keyland Developments Limited.
- Wardell Armstrong. North Bierley Phase 2 Land. Coal Mining Risk Assessment. Report Ref: JC/LD10258/LET-003. Dated June 2021 for Keyland Developments Limited.
- Wardell Armstrong. North Bierley Phase 2 Land. Preliminary Ground Investigation Report. Job No. LD11087. Report Ref: 001 V1.0. Dated April 2025 for Keyland Developments Limited.

Pertinent additional information, contained in these previous reports is summarised below.

#### Phase II Geo-Environmental Assessment – Dated November 2017.

The ground investigation works were carried out between 16 and 20 May 2011. The ground investigation comprised seven cable percussive boreholes to 10m bgl with rotary open hole follow on to 30m bgl, ten window sample boreholes to 5m bgl and nineteen trial pits to 4m bgl.

Ground conditions typically comprised made ground, consisting of soft to firm, orangish brown and black, sandy, gravelly, cobbly clay and loose to dense, grey, black and brown, clayey, cobbly, sandy gravel or gravelly sand to depths of between 0.4m and 8.4m bgl. The natural materials typically comprised soft to stiff, orangish brown and mottled grey, sandy, gravelly, cobbly clay to depths of between 1.4m and 10.5m bgl. Rockhead, comprising sandstone and mudstone, was proven to 30m bgl.

Groundwater was recorded during the monitoring period at depths of between 1.48m and 9.60m bgl.

*'No intact coal seams were encountered during the rotary drilling in the south of the site. However, there was evidence of broken/soft ground accompanied by loss of flush, which may indicate the presence of workings. The broken ground was observed at depths of between 11.3m and 16.7m bgl.'*

#### Coal Mining Risk Assessment – Dated June 2021.

Note: The Coal Authority (CA) officially changed its name to the Mining Remediation Authority (MRA) in November 2024. Therefore, this assessment, dated June 2021, references the CA.

*'There are two recorded CA mine entries (418427-005 and 418427-011) within the centre of the site. The CA have no records of any kind of treatment details, and the shaft diameters are indicated to be 2.5m.'*

*'There is also a third abandoned mine entry that is recorded within the central section of the site from the BGS County Map (Ref: Yorkshire 232NW, dated 1926) that records the depth to the Better Bed Coal as 342ft (~104m). No other details are known about this mine shaft.'*



The Consultants Coal Mining Report provides details of the recorded underground mining activity within the site boundary. A summary of the recorded underground coal workings, as detailed in the Consultants Coal Mining Report, are provided in Table 3.13.1 below.

Table 3.13.1 – Summary of Recorded Underground Coal Workings beneath the Site

| Coal Seam  | Shallowest Depth of Recorded Workings Beneath the Site (m bgl) | Direction to Working | Recorded Extraction Thickness (m) & Dip Direction of seam worked | Year Last Mined |
|------------|----------------------------------------------------------------|----------------------|------------------------------------------------------------------|-----------------|
| Whinmoor   | 2                                                              | Beneath Property     | 0.66 & East                                                      | 1929            |
| Black Bed  | 58                                                             | Beneath Property     | 2.16 & East                                                      | 1874            |
|            | 62                                                             |                      | 0.76 & East                                                      | 1886            |
|            | 63                                                             |                      | 0.71 & East                                                      | 1890            |
|            | 70                                                             |                      | 1.70 & East                                                      | 1864            |
| Better Bed | 92                                                             | Beneath Property     | 0.56 & East                                                      | 1868            |
|            | 96                                                             |                      | 0.56 & South East                                                | 1884            |
|            | 107                                                            | South West           | 0.61 & South East                                                | 1867            |
|            | 115                                                            | Beneath Property     | 0.46 & South East                                                | 1867            |

bgl – Below Ground Level

*'The site lies within a CA Development High Risk area and within an area where the CA believes that probable unrecorded shallow coal mine workings are present, possibly associated with the Shertcliffe coal seam, up to 0.6m thick, and/or Whinmoor coal seam, up to 0.8m thick. The Shertcliffe coal seam is recorded to have been worked out in the local area, but the Whinmoor coal seam has only been recorded to have been worked from outcrop as it was considered an inferior coal.'*

The report provides CA abandonment plans for the Black Bed and Better Bed coal seams. Workings in both seams are presented below the proposed development footprint.

*'While the CA does not hold any records of mine gas emissions within 500m of the enquiry boundary there are two mine shafts recorded at the site that could act as a pathway for the migration of gas.'*

*'The Consultants Mining Report states that no coal mining licenses are recorded within 200m of the site and that future underground mining is not recorded.'*

*'The Consultants Mining Report states that no faults, fissure or breaklines are recorded for the site.'*

*'Site investigation works will be required to further assess the potential for unrecorded shallow coal mine workings at the site.'*

*'Intrusive investigations will be required to conclusively prove the location and characteristics of the mine entries so that a substantive scheme of stabilisation can be determined.'*



## Preliminary Ground Investigation Report – Dated April 2025.

Note: The CA officially changed its name to the MRA in November 2024. Therefore, this report, dated April 2025, references the MRA.

The ground investigation works were carried out between 9 and 20 December 2024. The ground investigation comprised three cable percussive boreholes with rotary open hole follow on to depths of between 25.5m and 35m bgl, six window sample boreholes to depths of between 2.5m and 5.45m bgl, thirteen trial pits to depths of between 0.1m and 2.5m bgl and twenty one trial trenches to depths of between 0.7m and 3.9m bgl.

Ground conditions typically comprised topsoil overlying made ground, consisting of brown, sandy, clayey fine to coarse gravel or soft to firm, brown and grey, slightly sandy, slightly gravelly clay or silty clay to depths of between 0.1m and 8.4m bgl, typically to 3m bgl.

The granular constituents comprised, sandstone, brick, concrete, clinker, shale, mudstone, tile, ceramic, slag, slate, siltstone, mudstone and coal.

Probable colliery spoil, comprising brown to dark grey, very sandy, clayey, fine to coarse gravel with cobbles was encountered to depths of between 0.1m and 2.85m bgl. The possible colliery spoil was stated to have been *'mainly encountered within the central section of the site where the former coal pits and mine shafts were located and where ground levels are indicated to have been raised.'*

A mound in the southern part of the site, typically comprised soft to firm, brown and grey, sandy, gravelly clay with cobbles. The mound was encountered to depths of between 1.0m and 8.4m bgl.

A single trial pit was undertaken in the easternmost former filter bed to a depth of 2.1m bgl. The material comprised dark grey to black, angular cobbles of suspected slag to 2.0m bgl, which was underlain with a possible filtration layer comprising cobbles of terracotta tiles to 2.05m bgl. Beneath the filtration layer, the ground comprised black, sandy, clayey, angular, fine to coarse gravel of suspected slag, concrete and tile to 2.1m bgl. This strata layer comprised a strong sewage odour.

Concrete and subbase materials were encountered in the westernmost former filter bed at the location of the former humus tanks. Concrete was encountered from ground level to 0.3m bgl.

Probable cohesive alluvium deposits, typically comprised very soft to soft, light brown, grey and orangish brown, slightly sandy, silty clay or clayey silt with occasional gravel, were encountered along the eastern boundary to depths of between 0.15m and 2.2m bgl.

Probable head deposits, typically comprised fine to stiff, brown and grey, slightly sandy, gravelly clay with medium cobble and low boulder content, was encountered to depths of between 0.4m and 10.5m bgl. The granular constituents comprised sandstone, mudstone, shale and coal.



Probable glaciofluvial deposits, typically comprised firm to stiff, light brown, slightly sandy, gravelly clay with cobbles or brown clayey, angular to rounded, fine to coarse gravel, were encountered to depths of between 1.3m and 7.4m bgl. The granular constituents comprised sandstone, mudstone, shale and coal.

Bedrock of the Pennine Lower Coal Measures Formation, typically comprised weak to medium strong, grey to dark grey, silty mudstone, siltstone and fine to medium grained sandstone, was proven to depths of between 3.6m and 23.8m bgl.

Bedrock of the Clifton Rock, typically comprised medium strong to strong, light grey, fine to medium grained sandstone, was proven to depths of between 12.7m and 35m bgl.

No intact coal seams were encountered during the ground investigation.

'During the rotary drilling works, zones of core loss, minimal recovery (<25%), partial recovery (25% to 50%) and no recovery were recorded during the ground investigation at depths of between 7.6m to 35m bgl.'

Groundwater during the ground investigation was encountered between 0.2m and 9.6m bgl.

All three recorded mine entries, 418427-005, 418427-011 and the mine entry recorded on the BGS Yorkshire 232NW map, were investigated.

The mine entry 418427-005 was located at E4188127.60 and N427113.73. A 2.5m circular feature was exposed at a depth of 3.6m bgl.

The mine entry 418427-011 was located at E418132.94 and N427106.54. A 2.5m by 2.0m rectangular feature was exposed at depths of between 2.2m and 2.6m bgl.

The mine entry recorded on the BGS Yorkshire 232NW map was not located during the ground investigation. The report states, '*it's likely that the BGS mine shafts are duplicates of the shafts recorded by the MRA.*'

*'The shallow soils encountered at the site recorded concentrations of contaminants below either their respective commercial screening values and/or below their respective Limit of Detection (LOD).'*

*'In the shallow groundwater encountered within the made ground and within the underlying shallow natural strata, there are localised/isolated exceedances of Environmental Quality Standards (EQS) screening values for metals (cadmium, chromium, copper, nickel, lead and zinc), heavier end TPH fractions, PAH compounds and a single historical exceedance of Bis(2-ethylhexyl) phthalate.'*



*'In the groundwater within the underlying bedrock, there were marginal exceedances of UK Drinking Water Standards (DWS) screening values for Benzo(a)pyrene and Benzo(a)anthracene. Many of the determinands noted within the shallow perched groundwater within made ground and the shallow natural strata were absent within bedrock. This indicates a lack of hydraulic continuity between the shallower and deeper groundwater. Despite the anticipated low risk to controlled water, further assessments are recommended to substantiate the above and fully discount the risks. Surface water samples should be obtained from Hunsworth Beck and tested to allow for a site specific assessment to be undertaken to establish if those metal exceedances identified would actually pose a risk to this surface water receptor.'*

*'Considering the available gas monitoring data, ground conditions and site history, a Characteristic Situation (CS) 2 classification is considered appropriate for the site at this stage and that ground gas protection measures would be required for new buildings.'*

*'Due to the variable strength, compressibility, and nature of the made ground, cohesive alluvium, and underlying natural strata, these materials are generally unsuitable as founding strata in their current state. A piled foundation solution into competent rockhead is therefore likely to be required.'*

*'Due to the widespread presence of made ground and variability in the underlying natural strata, suspended floor slabs are likely to be required to mitigate the risk of both total and differential settlement.'*

*'The risk from unrecorded shallow coal workings is considered low across the central and eastern parts of the site, but moderate to high within the western and southwestern areas, where possible workings within the Shertcliffe and/or Whinmoor coal seams have been identified.'*

*'It is recommended that further assessment be undertaken to delineate areas where competent rock cover is less than 10 times the coal seam thickness.'*



## 4.0 ENVIRONMENTAL RISK ASSESSMENT

### 4.1 Introduction

The statutory definition of contaminated land is given in the Environmental Protection Act, Part 2A, Section 78, 1990, which was introduced by the Environment Act, Section 57, Department of Environment, 1995 and is defined as:

Land, which appears to the Local Authority in whose area it is situated, to be in such a condition, by reason of substances in, on or under the land that:

- Significant harm is being caused or there is a significant possibility of such harm being caused (where harm is defined as harm to health of living organisms or other interference with the ecological systems of which they form a part and, in the case of man, includes harm to his property); and/or
- Significant pollution of controlled waters is being caused, or there is a significant possibility of such pollution being caused (by the land).

The presence of contaminated materials on a site is generally only of concern if an actual or potentially unacceptable risk exists. The potential for harm to occur requires three conditions to be satisfied:

- Sources – The presence of substances (potential contaminants/pollutants), in or under the ground, that may cause harm or pollution.
- Receptors - The presence of a receptor which may be harmed, e.g. the water environment or humans, buildings, fauna and flora; and
- Pathway - The existence of a linkage between the Source and the Receptor.

In summary, the presence of measurable concentrations of contaminants within the ground and subsurface environment does not automatically imply that a contamination problem exists, since contamination must be defined in terms of pollutant linkages and an unacceptable risk of harm to available receptors.

The nature and importance of both pathways and receptors, which are relevant to a particular site, will vary according to the sensitivity of the intended end use of the site and the site's characteristics and environmental setting.

Legislation and guidance on the assessment of contaminated sites acknowledges the need for a tiered risk-based approach. This is set out in the Environment Agency's manual Land Contamination: Risk Management (LCRM), published in October 2020 and last updated on 12 June 2025.



The LCRM outlines the following stages of risk assessment:

|                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Tier 1: Preliminary risk assessment (PRA)            | As part of this assessment, the overall site objectives are defined. Current and historical information about the site and the potential contaminants expected to be present are assessed and an outline conceptual model (CM) is developed. The risks are assessed qualitatively, and the findings reported in the PRA (or desk study). The report recommends what further works would be required in order to assess whether the site is suitable for its proposed use. |
| Tier 2: Generic quantitative risk assessment (GQRA)  | The GQRA uses Generic Assessment Criteria and a standard set of generic assumptions based on specific end uses in order to assess the risks to receptors. It includes the collection of more detailed information including laboratory analysis of soil and water samples in order to inform and assess the risks.                                                                                                                                                        |
| Tier 3: Detailed quantitative risk assessment (DQRA) | If pollutant linkages are confirmed as part of the GQRA, these are known as relevant pollutant linkages (RPLs) and further detailed assessment is required. At this tier, detailed site-specific information is collected to estimate the risk or to develop site-specific assessment criteria (SSAC). This may include collecting information about the receptor.                                                                                                        |

This Geoenvironmental Desk Study Report comprises a Tier 1 PRA.

## 4.2 Potential Sources

The following potentially contaminative sources may be present on or adjacent to the site:

- Made ground associated with former coal pits, tramways and sewage works.
- Potential leaks and/or spills associated with the former potential sources which were present on the site, e.g. coal pits, tramways and sewage works (including tanks and filter beds).
- Made ground and potential leaks and/or spills associated with off-site sources, e.g. sewage works to the north and adjacent motorways (M62 to the south and M606 to the west).

Reference has been made to Department of the Environment Industry Profile, 'Sewage works and sewage farms', 1995.

Potential contaminants which could be present on the site are listed below:

- Metals, metalloids and their compounds.
- Inorganic compounds, e.g. arsenic.
- Asbestos fibres/asbestos containing materials.



- Organic compounds including polycyclic aromatic hydrocarbons (PAH) and petroleum hydrocarbons (TPH).
- Volatile organic compounds (VOC) and semi-volatile organic compounds (SVOC).
- Pesticides/herbicides.
- Micro-organisms (pathogens), e.g. salmonella.
- Treatment chemicals, e.g. acids/alkalis; and
- Hazardous ground gases/soil vapours.

### 4.3 Potential Pathways

Based on the available information and the proposed development of the site for a commercial end use, the following potential exposure pathways will require consideration, both during the development works and on completion of construction:

- Ingestion and/or dermal contact with contaminated soil and groundwater.
- Inhalation of hazardous ground gases/soil vapours/asbestos fibres.
- Leaching/migration of potential contaminants from soil into groundwater via surface infiltration, drainage and/or groundwater flow.
- Permeation of water supply pipes and other services by organic and aggressive contaminants; and
- Uptake of contaminants by planting in landscape areas.

### 4.4 Potential Receptors

The potential receptors considered are:

- Development workers and future maintenance workers involved in excavations, e.g. for foundations or where services are being installed or repaired following development.
- Future end users of the site, e.g. employees and members of the public.
- Adjacent end users of the site, e.g. employees and members of the public.
- Controlled waters, i.e. Inland River, Hunsworth Beck and the underlying Secondary A Aquifers (superficial and bedrock deposits).
- Buildings and infrastructure; and
- Planting in landscaped areas.



## 4.5 Pollutant Linkage Assessment

A potential pollutant linkage assessment has been completed and is summarised in the Conceptual Site Model, which is provided in Section 4.6. Based on the proposed commercial end use and history of the site, the following potential pollutant linkages may be present:

- Development and maintenance workers and future site end users could come into contact with soils and groundwater containing elevated concentrations of potential contaminants and hazardous ground gases/soil vapours.
- Controlled waters could become contaminated due to leaching and migration of potential contaminants from the made ground.
- Buildings and services could be affected by potential contaminants in the made ground; and
- Plants in landscaped areas could be affected by phytotoxic elements in the made ground.

These are based on current site conditions and do not consider exposure pathways following any remediation of the site.



## 4.6 Conceptual Site Model & Risk Rating

The conceptual model is summarised in Table 4.6 below.

Table 4.6 Preliminary Conceptual Model

| Source                                                                                                                                                                                  | Pathway                                                                                                                               | Receptor                                                                                                                                   | Risk Rating     | Comments                                                                                                                                                                                                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| On-site Sources                                                                                                                                                                         | Ingestion.                                                                                                                            | Development Workers.                                                                                                                       | Low to Moderate | Ground investigation to confirm the thicknesses and nature of the made ground and establish the concentrations of potential contaminants.                                                                                       |
| Made ground associated with former coal pits, tramways and sewage works.                                                                                                                | Dermal contact.                                                                                                                       | Future Maintenance Workers.                                                                                                                |                 | Appropriate health and safety procedures to be in place during the construction phase of the development.                                                                                                                       |
| Potential leaks and/or spills associated with the former potential sources which were present on the site, e.g. coal pits, tramways and sewage works (including tanks and filter beds). | Inhalation.                                                                                                                           | Future Site Users, i.e. employees.                                                                                                         |                 | Remedial measures to be implemented as required to be protective of future site users.                                                                                                                                          |
|                                                                                                                                                                                         |                                                                                                                                       | Adjacent Site Users, i.e. Members of the public.                                                                                           |                 |                                                                                                                                                                                                                                 |
| Off-site Sources                                                                                                                                                                        | Leaching / migration of potential contaminants from soil into groundwater via surface infiltration, drainage and/or groundwater flow. | Controlled Waters<br><br>Surface Water Inland River and Hunsworth Beck.<br><br>Groundwater Secondary A Aquifers – Superficial and Bedrock. | Low to Moderate | Ground investigation to confirm the presence of groundwater and establish the concentrations of potentially leachable contaminants present.                                                                                     |
| Made ground and potential leaks and/or spills associated with off-site sources, e.g. sewage works to the north and adjacent motorways (M62 to the south and M606 to the west).          |                                                                                                                                       |                                                                                                                                            |                 | There is one recorded active licenced groundwater abstraction within 1km of the site. This located 347m to the south west of the site at Cleckheaton & District Golf Club.                                                      |
|                                                                                                                                                                                         |                                                                                                                                       |                                                                                                                                            |                 | The site does not lie within an Environment Agency Groundwater Source Protection Zone (SPZ).                                                                                                                                    |
|                                                                                                                                                                                         |                                                                                                                                       |                                                                                                                                            |                 | There are no active licenced surface water abstractions within 1km of the site.                                                                                                                                                 |
| Aggressive Contaminants in Soil/Water                                                                                                                                                   | Direct contact.                                                                                                                       | Construction Materials Concrete and Services, e.g. water supply pipes.                                                                     | Low             | There are two recorded active licensed discharge consents to controlled waters within 500m of the site. The closest is located 31m to the north east of the site at Moorend Sewage pumping station, Whitehall Road, Cleckheaton |
| Areas of Phytotoxic Contamination                                                                                                                                                       | Root uptake.                                                                                                                          | Vegetation Landscaping areas.                                                                                                              | Low             | Samples of made and natural ground should be obtained and submitted to the laboratory for testing in order to assess the sulphate content and acidity.                                                                          |
|                                                                                                                                                                                         |                                                                                                                                       |                                                                                                                                            |                 | Ground investigation and sampling to establish levels of any phytotoxic contamination present.                                                                                                                                  |



## 4.7 Risk Classification

Based on the conceptual site model, the site is considered to be low to moderate risk with respect to contamination in soils, groundwater and hazardous ground gases. This designation will be largely dependent on the nature of any made ground and hazardous ground gases present on or adjacent to the site.

In order to assess further and classify the risks to human health, groundwater, surface water and buildings/services, a Phase 2 geoenvironmental ground investigation, to include a Tier 2 Generic Quantitative Risk Assessment, will be required. The Phase 2 geoenvironmental ground investigation will include chemical analysis of soils, leachate and groundwater as well as hazardous ground gas monitoring.



## 5.0 PRELIMINARY ENGINEERING ASSESSMENT

### 5.1 Development Proposals

It is proposed to redevelop the site for commercial end use. A proposed site plan is referenced below, and a copy is provided in Appendix A.

- KPP Architects. Interchange 26, Interchange Way, Bradford. Proposed Site Plan. Drawing Ref: ICB-KPP-ZZ-DR-A-GA-2002, Rev B. Dated July 2026, for Bond IT Group.

### 5.2 Coal Mining and Mineral Extraction

Note: The CA officially changed its name to the MRA in November 2024. Therefore, the summary below references the CA as the consultants coal mining report is dated May 2021.

The CA consultants coal mining report, recorded the following:

- The Whinmoor coal seam is recorded to have been worked beneath the property, at a depth of 2.0m, with an extraction thickness of 0.66m. The Black Bed coal seam is recorded to have been worked beneath the property, at a depths of between 58m and 70m, with an extraction thickness of between 0.71m and 2.16m. The Better Bed coal seam is recorded to have been worked beneath the property, at depths of between 92m to 115m, with an extraction thickness of between 0.46m and 0.56m.
- The Whinmoor coal seam is recorded to outcrop in the central part of the site.
- There are probable unrecorded shallow coal workings beneath the site.
- There are two recorded CA mine entries (418427-005 and 418427-011) within the centre of the site. The CA have no records of any kind of treatment being afforded to these mine shafts and the shaft diameters are indicated to be 2.5m.
- There are no faults, fissures or breaklines recorded on the site.
- There are no opencast mines recorded within 500m of the enquiry boundary.
- There are no coal authority managed tips recorded within 500m of the site.
- There are no site investigations recorded within 50m of the enquiry boundary.
- There are no mines gases recorded within 500m of the site.
- The CA has not received a damage notice or claim for the subject property, or any property within 50m of the enquiry boundary, since 31 October 1994.

The coal mining risk assessment also recorded the following:

- A third abandoned mine entry is recorded within the central section of the site as noted on the BGS County Map (Ref: Yorkshire 232NW dated 1926). The plan records the depth to the Better Bed Coal as 342ft (~104m). No other details are known about this mine shaft.



- Site investigation works will be required to further assess the potential for unrecorded shallow coal mine workings at the site.
- Intrusive investigations will also be required to conclusively prove the location and characteristics of the mine entries.

A Preliminary Ground Investigation Report, dated April 2025, was undertaken and the following conclusions were stated:

- No intact coal seams were encountered during the ground investigation.
- During the rotary drilling works, zones of core loss, minimal recovery (<25%), partial recovery (25% to 50%) and no recovery were recorded during the ground investigation at depths of between 7.60m to 35.00m bgl.
- Mine entry 418427-005 was located at E4188127.60 and N427113.73. A 2.5m circular feature was exposed at a depth of 3.6m bgl.
- Mine entry 418427-011 was located at E418132.94 and N427106.54. A 2.5m by 2.0m rectangular feature was exposed at depths of between 2.2m and 2.6m bgl.
- The mine entry recorded on the BGS Yorkshire 232NW map was not located during the ground investigation. The report states, *'it's likely that the BGS mine shafts are duplicates of the shafts recorded by the MRA.'*
- Based on current data, the risk from unrecorded shallow coal workings is considered low across the central and eastern parts of the site, but moderate to high within the western and southwestern areas, where possible workings within the Shertcliffe and/or Whinmoor coal seams have been identified.
- It is recommended that further assessment be undertaken to delineate areas where competent rock cover is less than 10 times the coal seam thickness.
- Two mine entries, (418427-005 and 418427-011) have been identified in excavations. However, the MRA may require additional investigative works. Final mine shaft treatment designs will need to be informed by further intrusive investigation to confirm shaft depth, infill material and rockhead level, and must be agreed with and signed off by the MRA.

Based on the information above, the risk of ground instability from shallow coal workings and/or mine entries is considered to be moderate to high. It is recommended that further ground investigative works are carried out to delineate the shallow coal workings beneath the proposed development in the southern part for the site and to confirm the MRA mine entries depth, infill material and rockhead level.

### 5.3 Earthworks

Based on the site walkover and proposed development layout it is considered that a cut and fill earthwork operation will be required in order to create a level development platform.



Any earthworks should be carried out in accordance with the Manual of Contract Documents for Highway Works, National Highways, Geotechnics Construction CC601 Earthworks. Geotechnics Design CD601 Design of Earthworks and Pavement Construction CC201 Pavement Foundation Construction.

If required, geotechnical testing of site-won materials should be carried out as part of any ground investigation to confirm their suitability for re-use in earthworks.

## 5.4 Foundations and Ground Floor Slab

Based on the information provided, ground conditions are likely to comprise made ground, to depths of between 0.1m and 8.4m bgl, typically 3m bgl. This was underlain by '*probable*' superficial deposits, comprising alluvium, head and glaciofluvial deposits, to depths of between 0.15m and 10.5m bgl. This was in turn underlain by weathered and/or competent Pennine Middle Coal Measures strata which was proven to depths of between 3.6m and 35m bgl.

The made ground is unsuitable in its current condition for the support of structural loads due to variations in material properties.

In order to develop the site, consideration should be given to ground improvement, e.g. vibro-stone columns/controlled modulus columns or alternatively piled foundations.

The site has a history of mining, and it is recommended that the ground stability with respect to shallow coal seams and coal workings should be investigated beneath the footprint of any proposed new building in the southern part of the site.

Foundation design and ground floor design should be confirmed as part of a ground investigation.

## 5.5 Groundwater

The presence of groundwater will need to be assessed as part of any ground investigation.

## 5.6 Obstructions

Based on the coal mining legacy and site's development history, i.e. sewage works, the presence of significant near surface obstructions are anticipated.

In addition, the presence of live services crossing the site should be confirmed prior to carrying out a ground investigation.

## 5.7 Roads, Pavements and Hardstanding Surfaces

It is recommended that, at this stage, a conservative bearing value for the subgrade is assumed until the nature of the subgrade can be physically assessed.



Any earthworks should be designed to achieve a suitable CBR value for the proposed development.

## 5.8 Chemical Attack on Buried Ground

Samples of made and natural ground should be obtained and submitted to the laboratory for testing in order to assess the sulphate content and acidity and hence the concrete class required for buried concrete to the latest standard.



## 6.0 FURTHER INVESTIGATIONS

Based on the findings of this Geoenvironmental Desk Study Report, we would recommend the following scope of investigative works.

- Obtain updated MRA Reports and Mine Entry Data Sheets.
- Trial pits in order to target relict structures, obtain samples from the stockpile in the south for geotechnical testing and samples of suspected slag from the filter beds for laboratory testing.
- Rotary open hole boreholes, to approximate depths of 30m bgl, to investigate and delineate the underground coal workings in the southern part of the site.
- Rotary open hole boreholes to determine the depth to the base of MRA mine entries, 418427-005 and 418427-011.
- Cable percussive and window sample boreholes with in-situ SPT tests to provide geotechnical information and inform foundation design. Selected boreholes should be installed with hazardous ground gas and groundwater monitoring wells.
- Cone Penetration Tests (CPT) to assess the strength and density and confirm geotechnical parameters of the soils. Dissipation tests will be carried out at selected locations to determine the settlement characteristics.
- Surface water testing of Hunsworth Beck, and additional groundwater testing beneath the site including the southern stockpile to confirm the presence or absence of contamination.
- Geotechnical testing to classify materials and inform foundation design and geochemical testing to assess the Aggressive Chemical Environment for Concrete classification. Laboratory testing to include petrological, expansion and chemical for the suspected slag samples.
- Monitoring of gas and groundwater wells for hazardous ground gases, methane, carbon dioxide, oxygen, flow rate and groundwater level.

On completion of the above, a Phase 2 Geoenvironmental Ground Investigation Report, to include an updated coal mining risk assessment and controlled waters risk assessment, should be completed.



## Appendix A Figures and Drawing

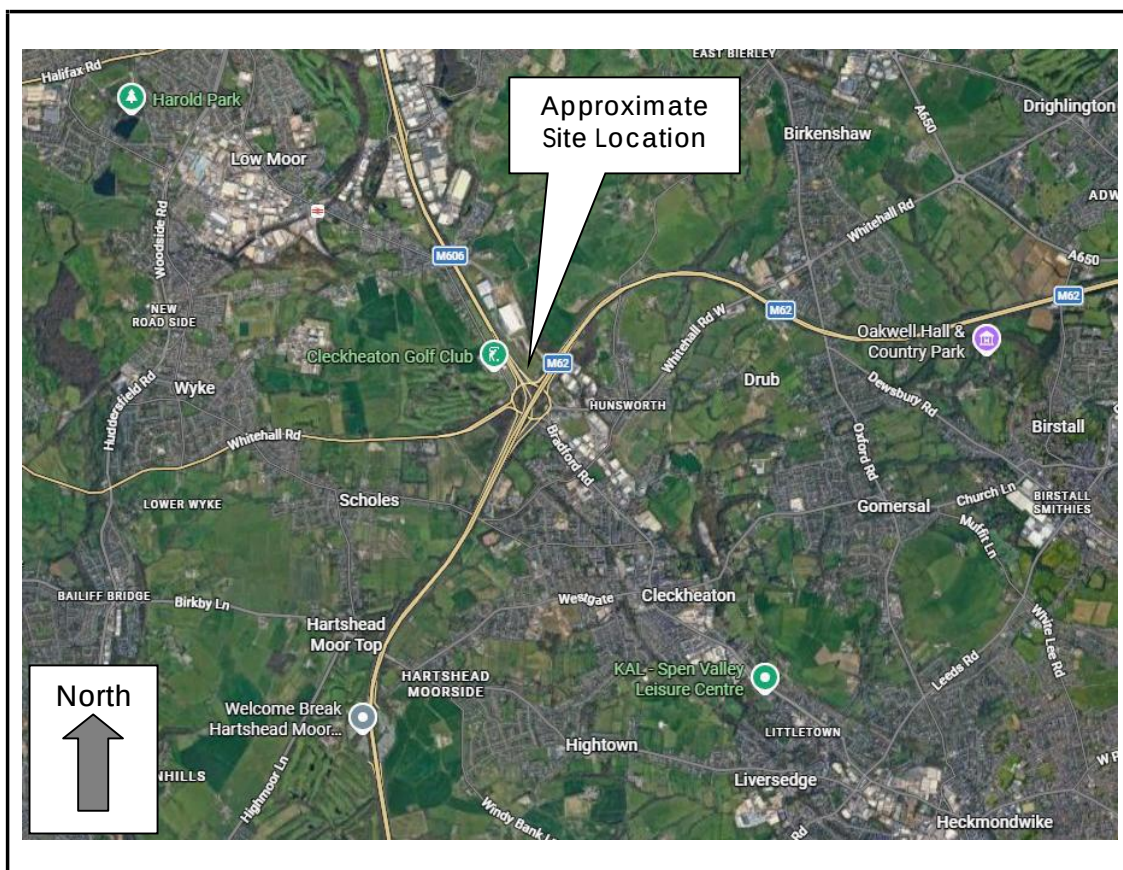


Figure 1 – Site Location Plan

|            |                                |
|------------|--------------------------------|
| Site       | North Bierley, WWTW, Oakenshaw |
| Client     | Bond IT Group                  |
| Job Number | 5414                           |
| Scale      | NTS                            |

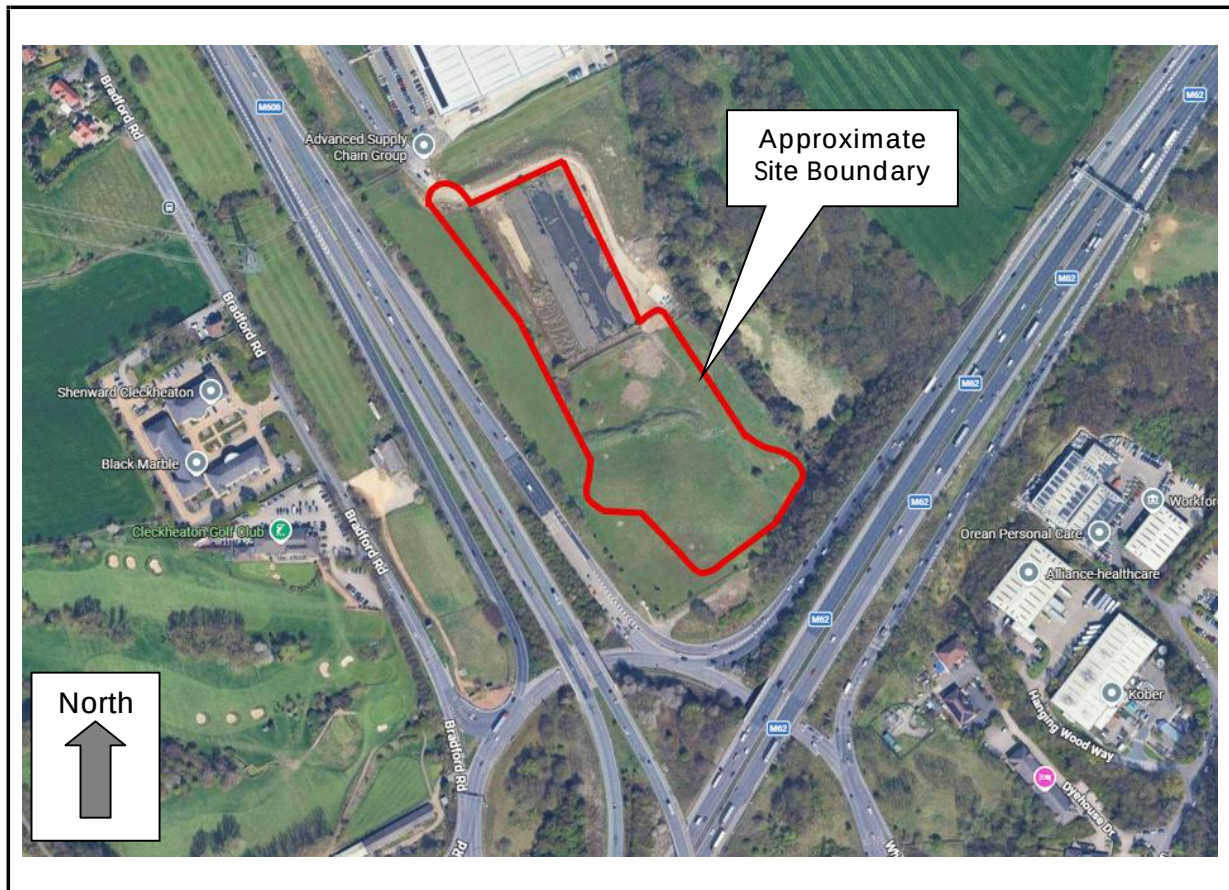
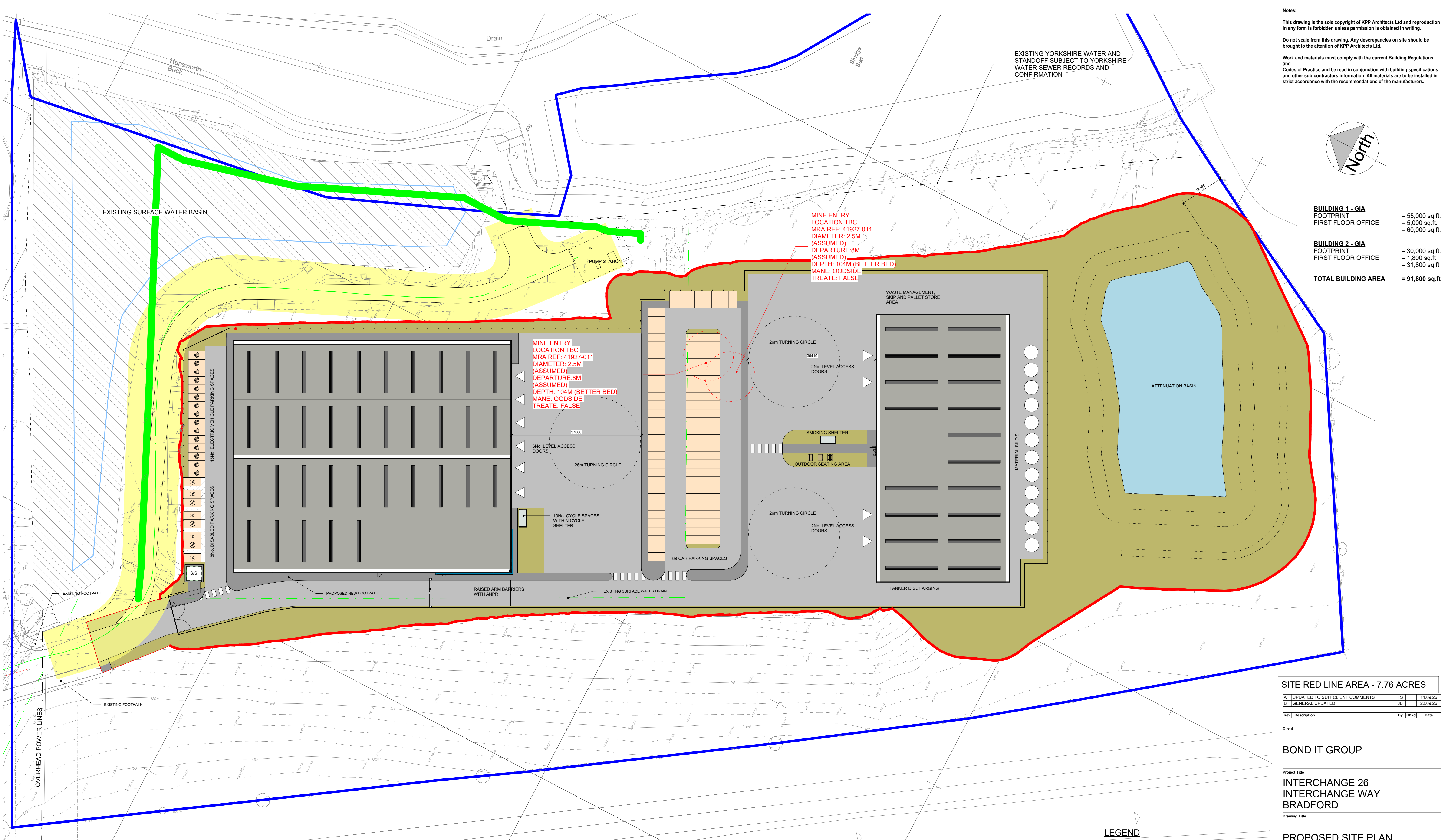


Figure 2 – Aerial Photograph

|            |                                |
|------------|--------------------------------|
| Site       | North Bierley, WWTW, Oakenshaw |
| Client     | Bond IT Group                  |
| Job Number | 5414                           |
| Scale      | NTS                            |

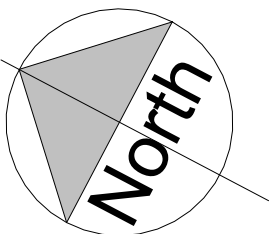


Notes:

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Do not scale from this drawing. Any discrepancies on site should be brought to the attention of KPP Architects Ltd.

Work and materials must comply with the current Building Regulations and Codes of Practice and be read in conjunction with building specifications and other sub-contractors information. All materials are to be installed in strict accordance with the recommendations of the manufacturers.



|                            |                       |  |
|----------------------------|-----------------------|--|
| <b>BUILDING 1 - GIA</b>    |                       |  |
| FOOTPRINT                  | = 55,000 sq.ft.       |  |
| FIRST FLOOR OFFICE         | = 5,000 sq.ft.        |  |
|                            | = 60,000 sq.ft.       |  |
| <b>BUILDING 2 - GIA</b>    |                       |  |
| FOOTPRINT                  | = 30,000 sq.ft.       |  |
| FIRST FLOOR OFFICE         | = 1,800 sq.ft.        |  |
|                            | = 31,800 sq.ft.       |  |
| <b>TOTAL BUILDING AREA</b> | <b>= 91,800 sq.ft</b> |  |

MINE ENTRY  
LOCATION TBC  
MRA REF: 41927-011  
DIAMETER: 2.5M  
(ASSUMED)  
DEPARTURE: 8M  
(ASSUMED)  
DEPTH: 104M (BETTER BED)  
MANE: OODSIDE  
TREATE: FALSE

MINE ENTRY  
LOCATION TBC  
MRA REF: 41927-011  
DIAMETER: 2.5M  
(ASSUMED)  
DEPARTURE: 8M  
(ASSUMED)  
DEPTH: 104M (BETTER BED)  
MANE: OODSIDE  
TREATE: FALSE

LEGEND

|  |                                |
|--|--------------------------------|
|  | EXISTING UNDERGROUND CABLES    |
|  | EXISTING DRAIN                 |
|  | OVERHEAD CABLES                |
|  | EASEMENT ZONE FOR PUMP STATION |
|  | YORKSHIRE WATER STANDOFF       |

SITE RED LINE AREA - 7.76 ACRES

|   |                                 |    |          |
|---|---------------------------------|----|----------|
| A | UPDATED TO SUIT CLIENT COMMENTS | FS | 14.09.26 |
| B | GENERAL UPDATED                 | JB | 22.09.26 |

| Rev | Description | By | Chkd | Date |
|-----|-------------|----|------|------|
|-----|-------------|----|------|------|

Client

BOND IT GROUP

Project Title  
**INTERCHANGE 26  
INTERCHANGE WAY  
BRADFORD**

Drawing Title

PROPOSED SITE PLAN

**KPP**  
ARCHITECTS

Lodge House  
12 Town Street  
Horsforth, Leeds LS18 4RJ

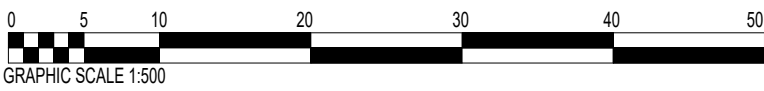
T : +44 (0) 113 2390460  
E : architects@kpp-leeds.co.uk  
W : www.kpp-leeds.co.uk

| Scale        | Size | Date    | Drawn | Checked |
|--------------|------|---------|-------|---------|
| As indicated | A1   | JULY'26 | JM    | .       |

Status  
**PLANNING**

|                            |                      |
|----------------------------|----------------------|
| KPP Job No.<br><b>2499</b> | Revision<br><b>B</b> |
|----------------------------|----------------------|

Project Originator Level Type Role Class Number  
**ICB-KPP-ZZ-DR-A-GA- 2002**





## Appendix B Site Photographs



Photograph 1: View Looking South at the Access Road onto Site.



Photograph 2: View Looking South at One of the Full Filter Bed.



Photograph 3: View Looking South at Second Full Filter Bed.



Photograph 4: View Looking South at a Partially Empty Filter Bed.



Photograph 5: View Looking South at an Empty Filter Bed.



Photograph 6: View Looking at infrastructure associated with the Former Above Ground Storage Tanks.



Photograph 7: View Looking at the Palisade fencing and Locked Gate, trending east to west, in the centre of the site.



Photograph 8: View Looking at the Stockpile Adjacent to the Southern Boundary of the site.



Photograph 9: View Looking at the Adjacent Water Pumping Station.



Photograph 10: View Looking at an Outfall into the Hunsworth Beck.



Photograph 11: View Looking at Concrete Utility Structure.



Photograph 12: View Looking at manhole associated with the Pumping Station.



## Appendix C Historical Maps

In partnership with



|                  |                                   |
|------------------|-----------------------------------|
| Site details:    | --                                |
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| Report ref:      | CMAFS-JPG-1295835-42593-040926HIS |
| Grid ref:        | 418114.07, 427087.48              |
| Production date: | 4 September 2026                  |

|                    |               |
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| <b>Scale:</b>      | 1:10,560      |
| <b>Printed at:</b> | 1:10,560      |

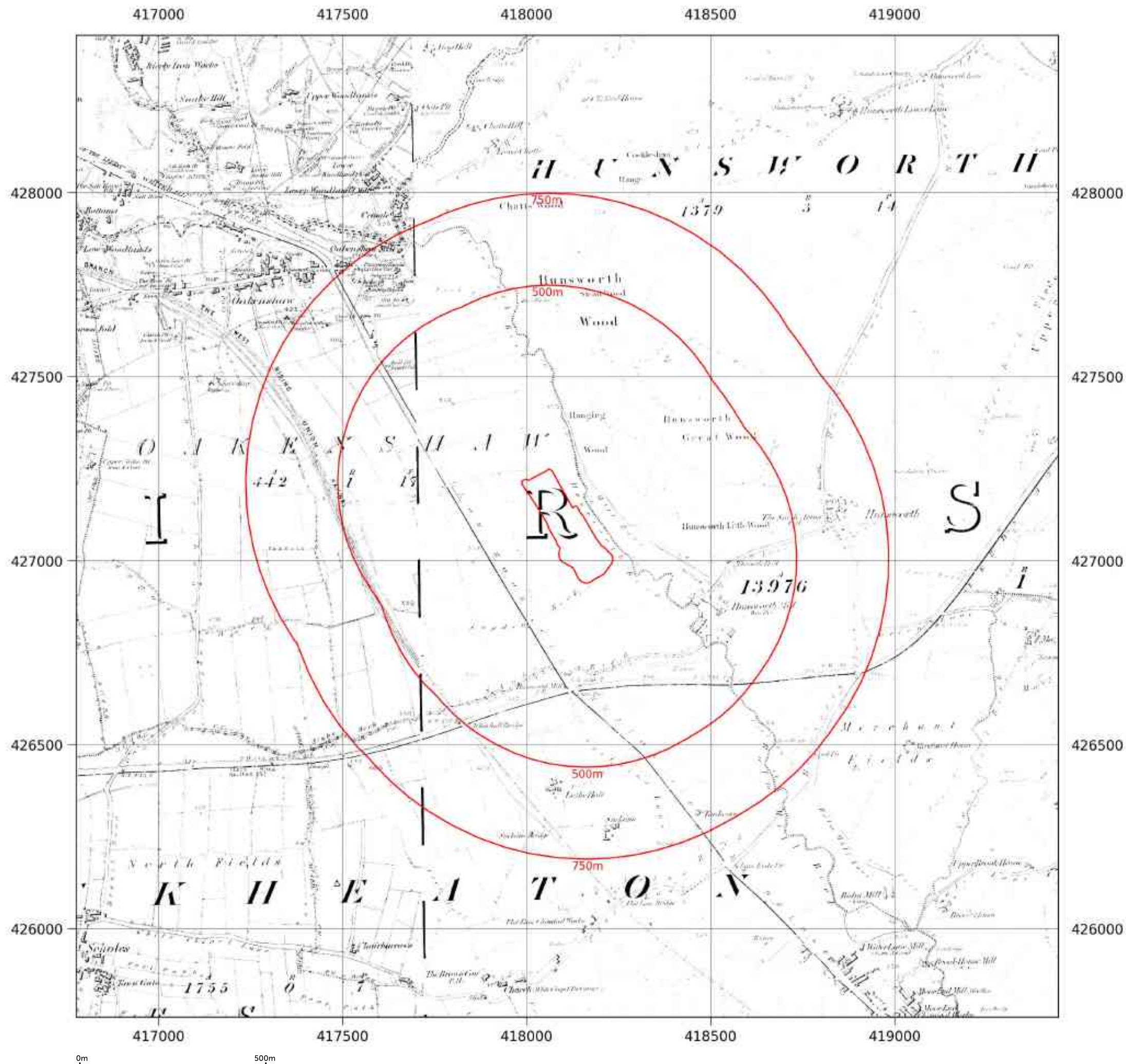


|                |                |
|----------------|----------------|
| Date: 1854     | Date: 1854     |
| Surveyed: 1849 | Surveyed: 1847 |
| Edition: 1854  | Edition: 1854  |

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[info@groundsurre.com](mailto:info@groundsurre.com)

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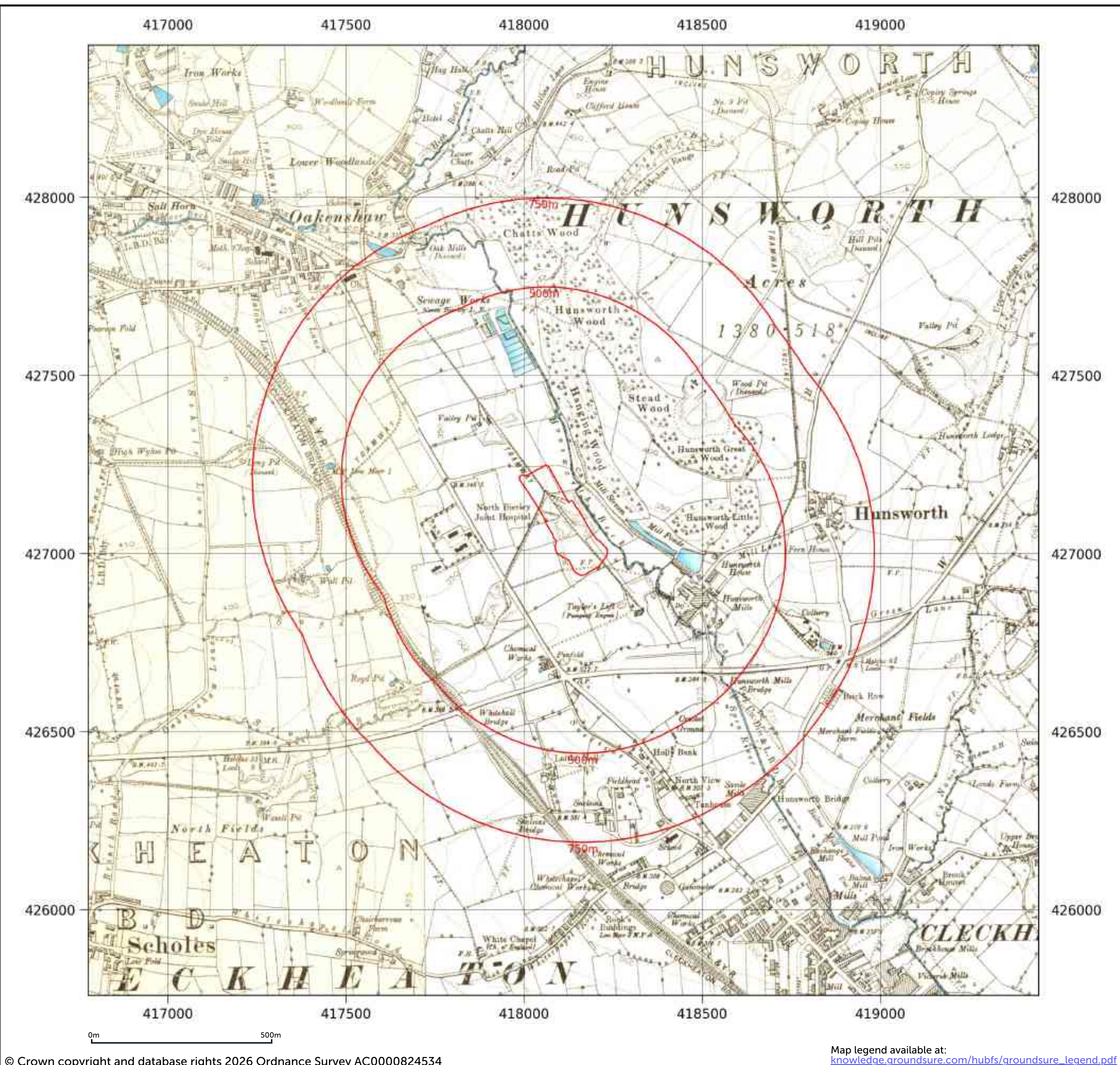
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 Production date: 4 September 2026

Map name: County Series  
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 Printed at: 1:10,560



Date: 1892  
 Surveyed: 1892  
 Revised: 1892

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 01273 257 755





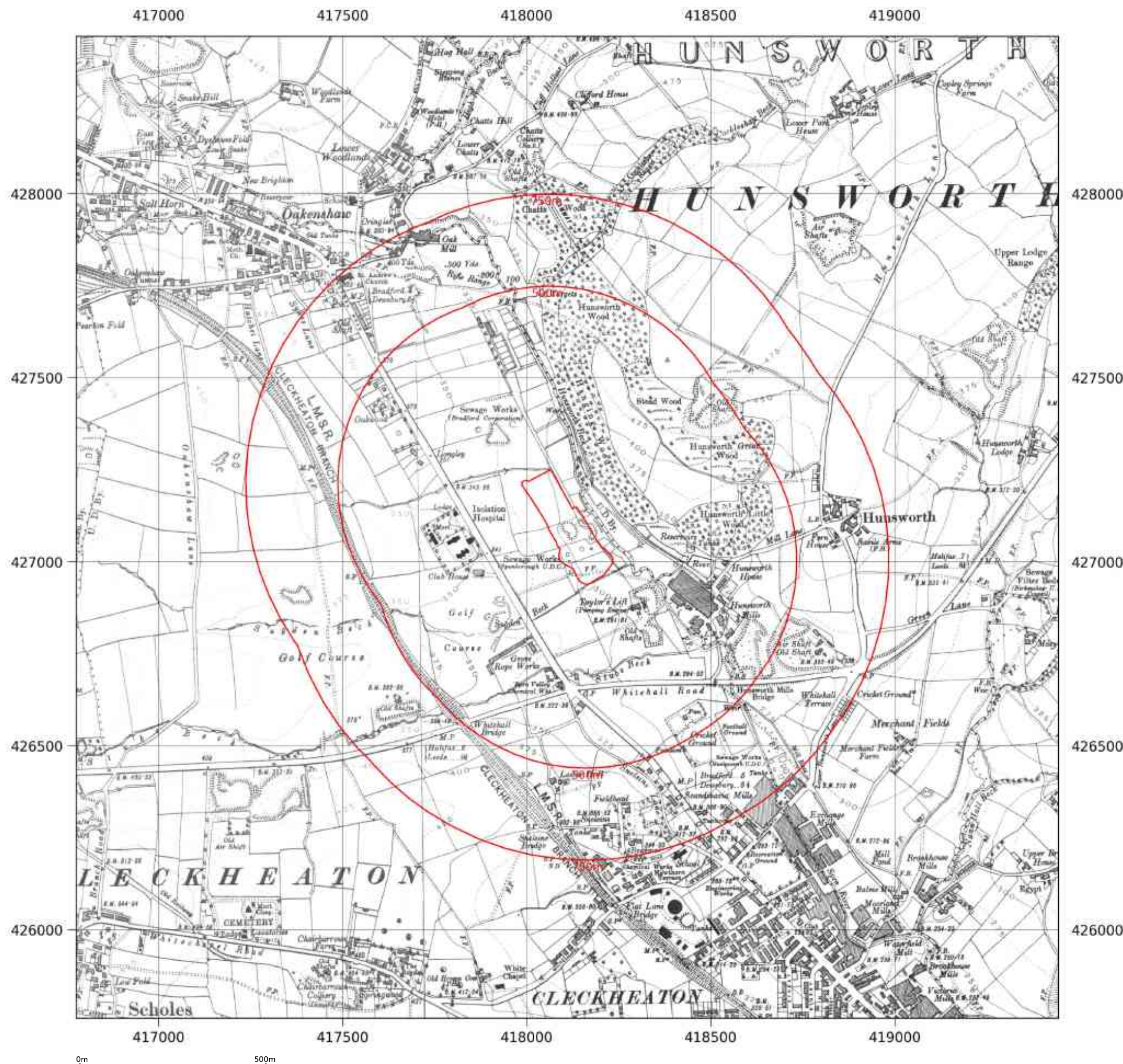
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Date: 1932  
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 Revised: 1932

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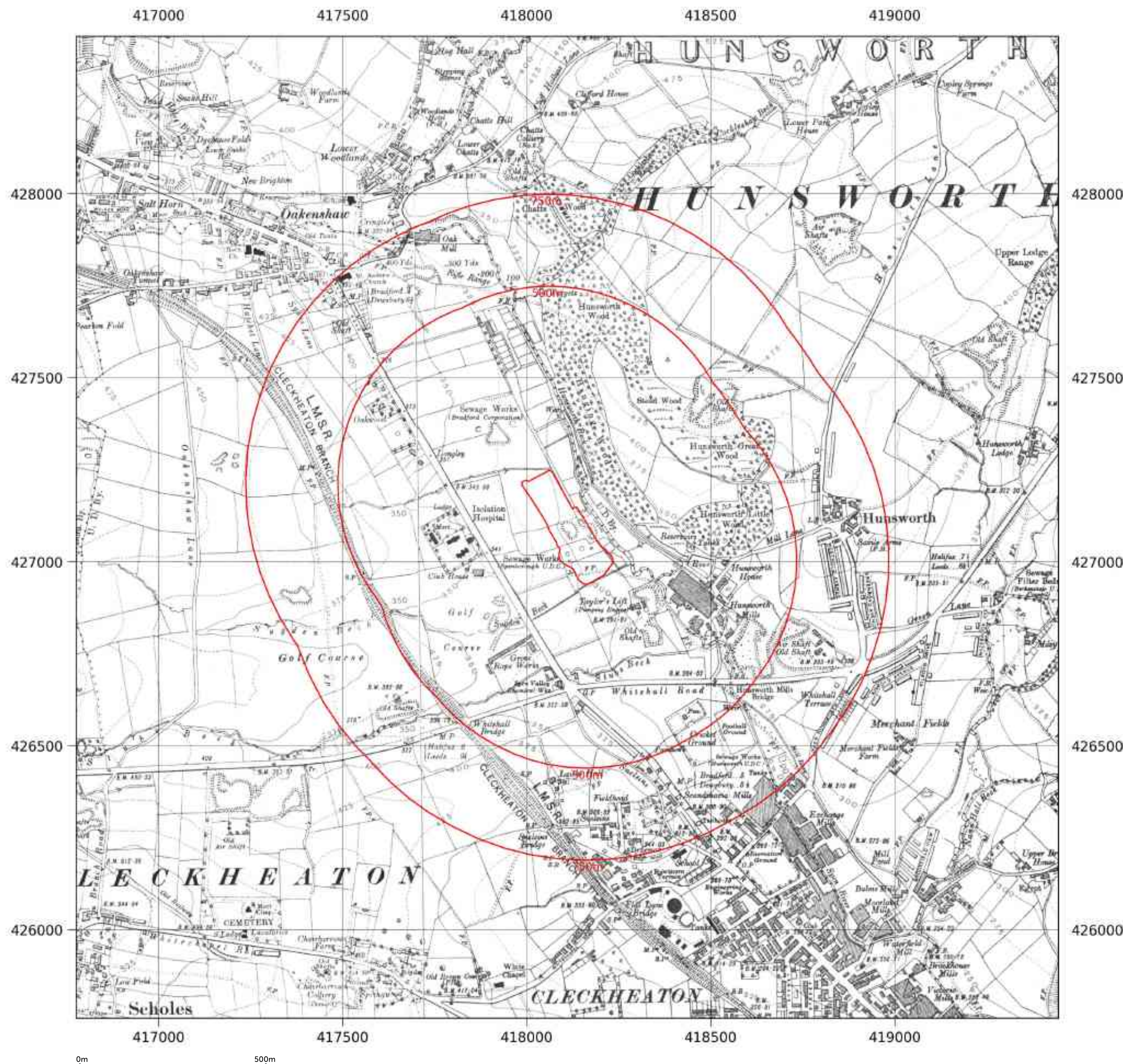
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Map name: County Series  
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Date: 1938  
 Surveyed: 1850  
 Revised: 1938  
 Edition: 1938

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Site details: --  
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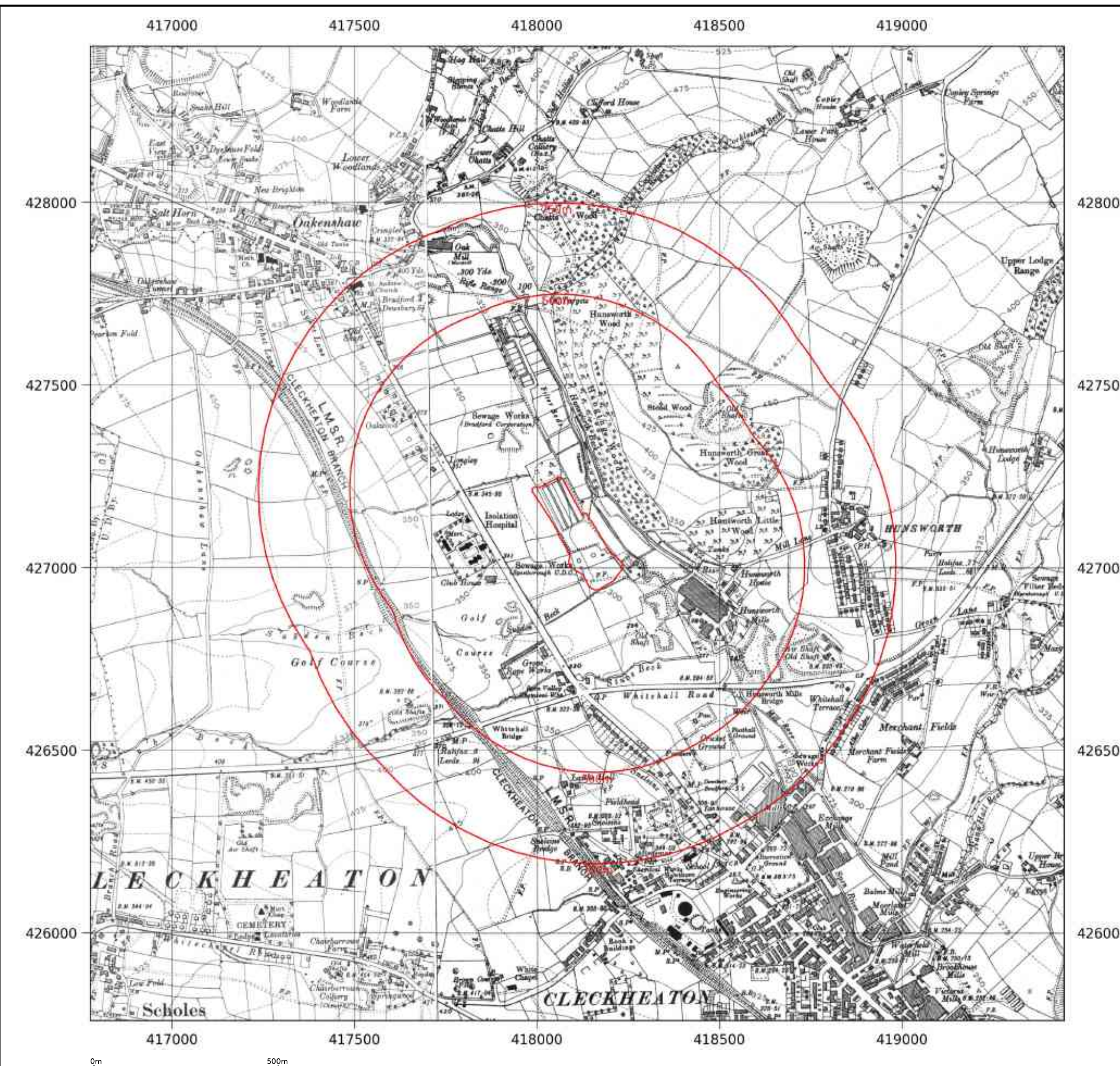
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 Surveyed: 1850  
 Revised: 1948

Date: 1948  
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 Levelled: 1931

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In partnership with



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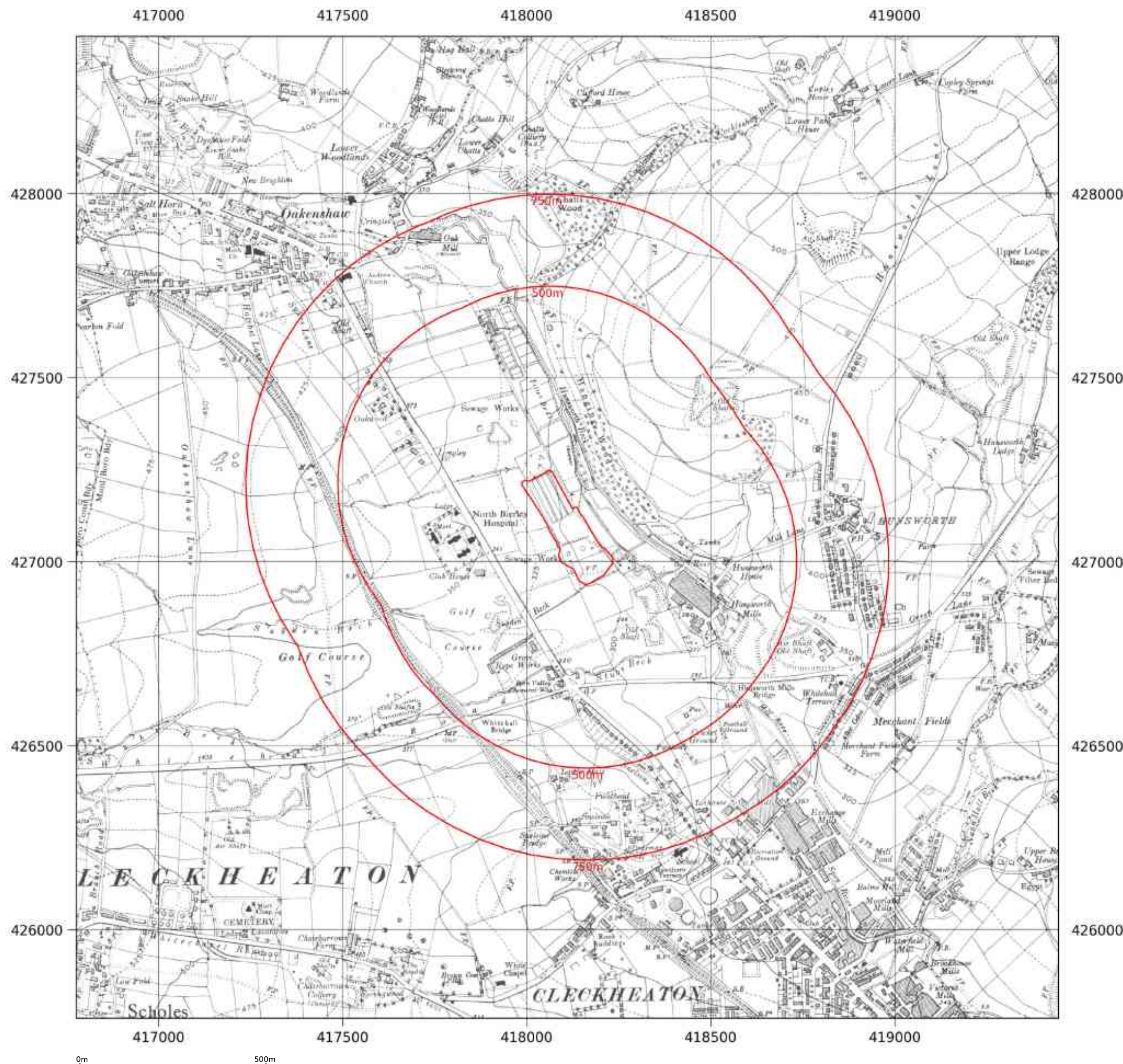
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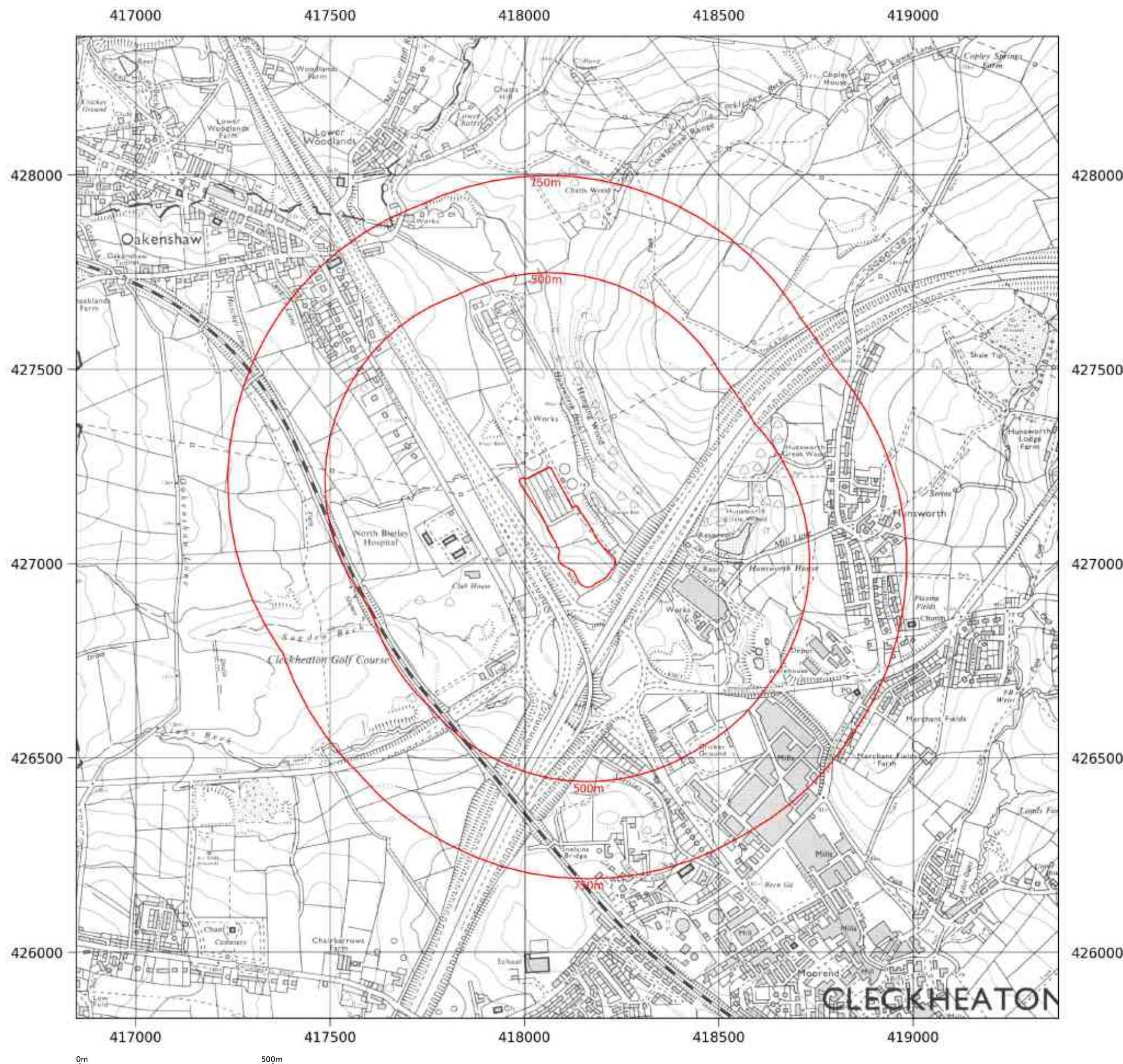
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 Printed at: 1:10,000



Date: 1974  
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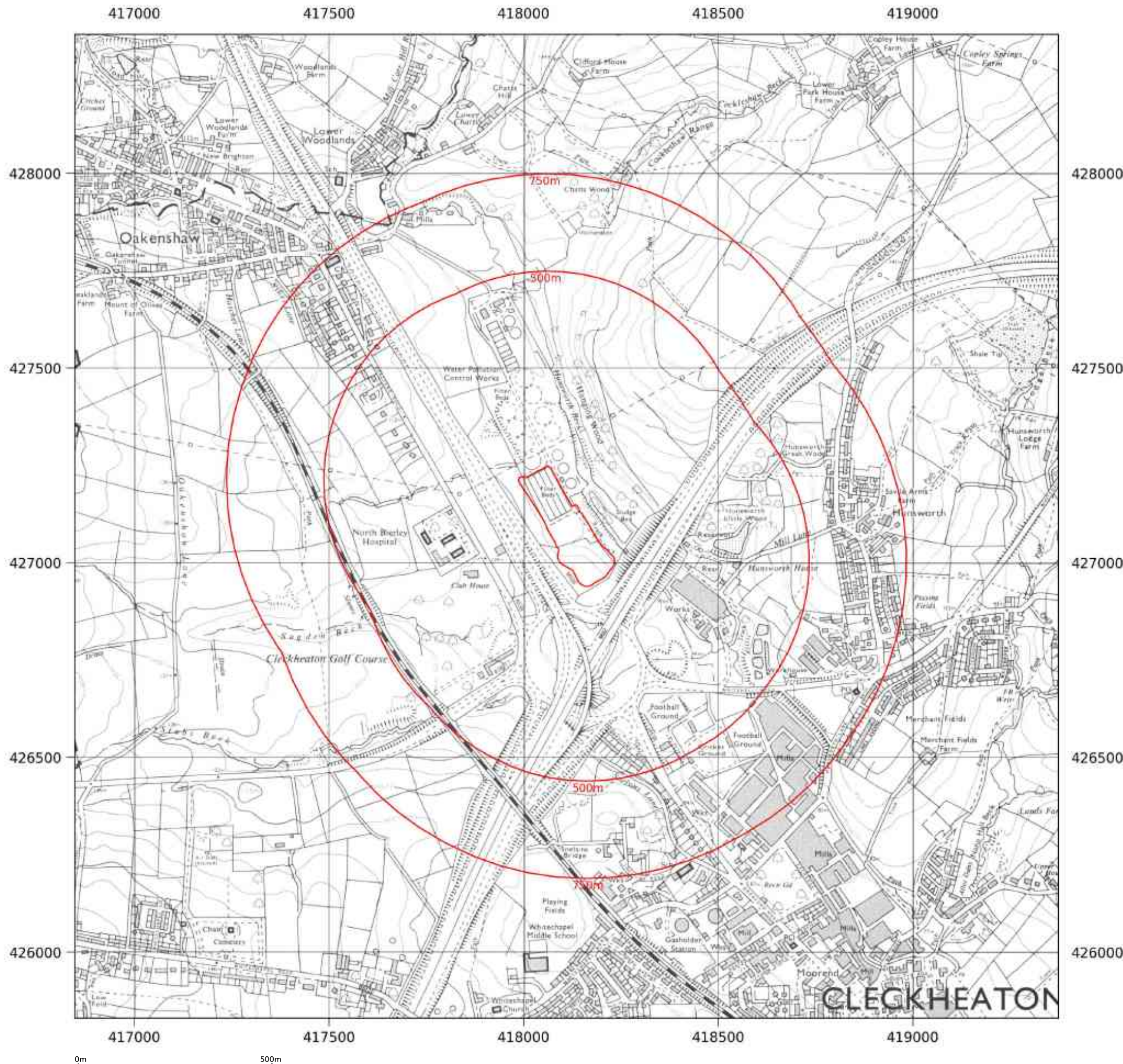
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 Revised: 1983

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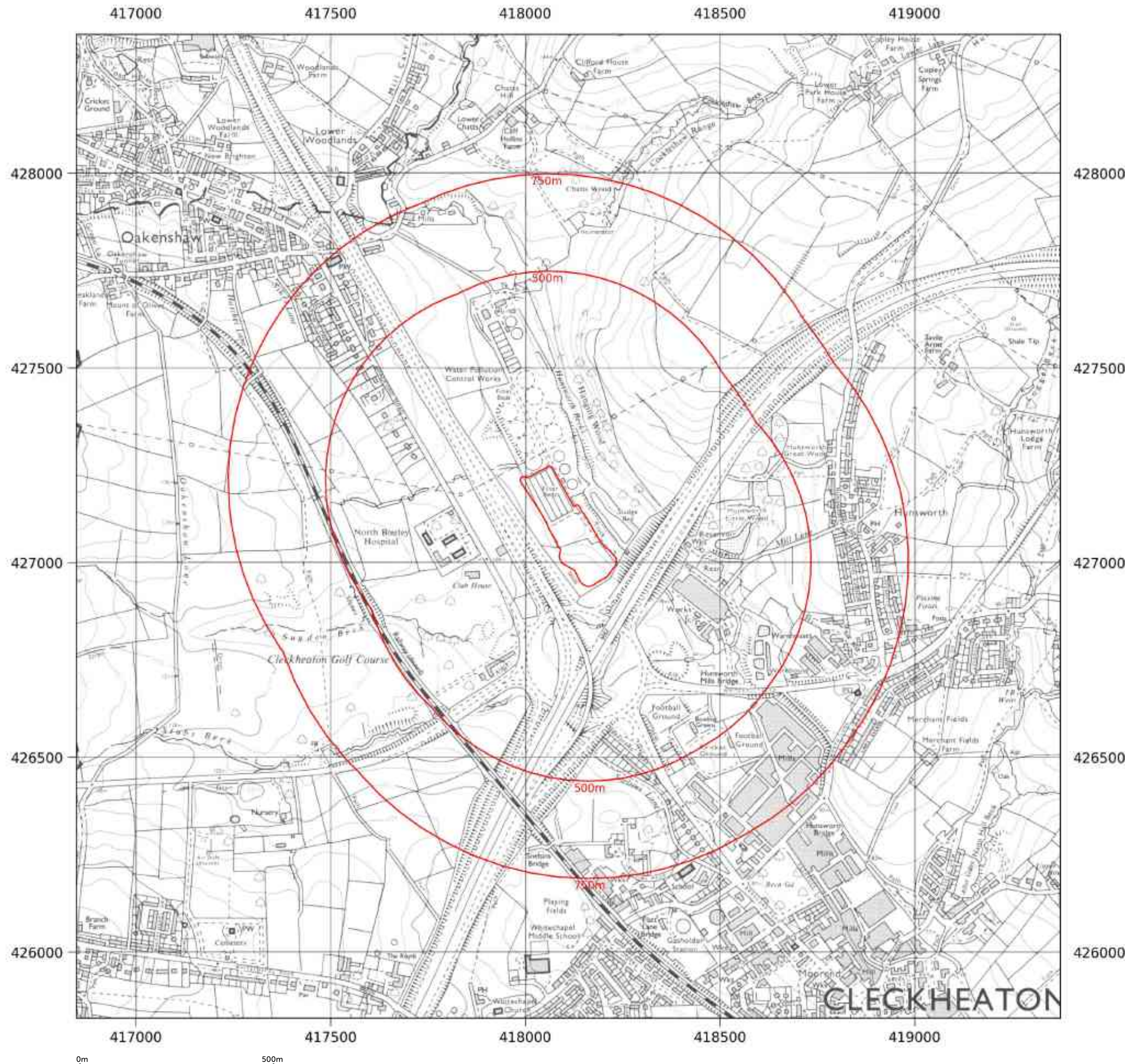
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 Printed at: 1:10,000



Date: 1990  
 Surveyed: 1987  
 Revised: 1990

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Date: 2001

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 Scale: 1:10,000  
 Printed at: 1:10,000



Date: 2010

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Date: 2015

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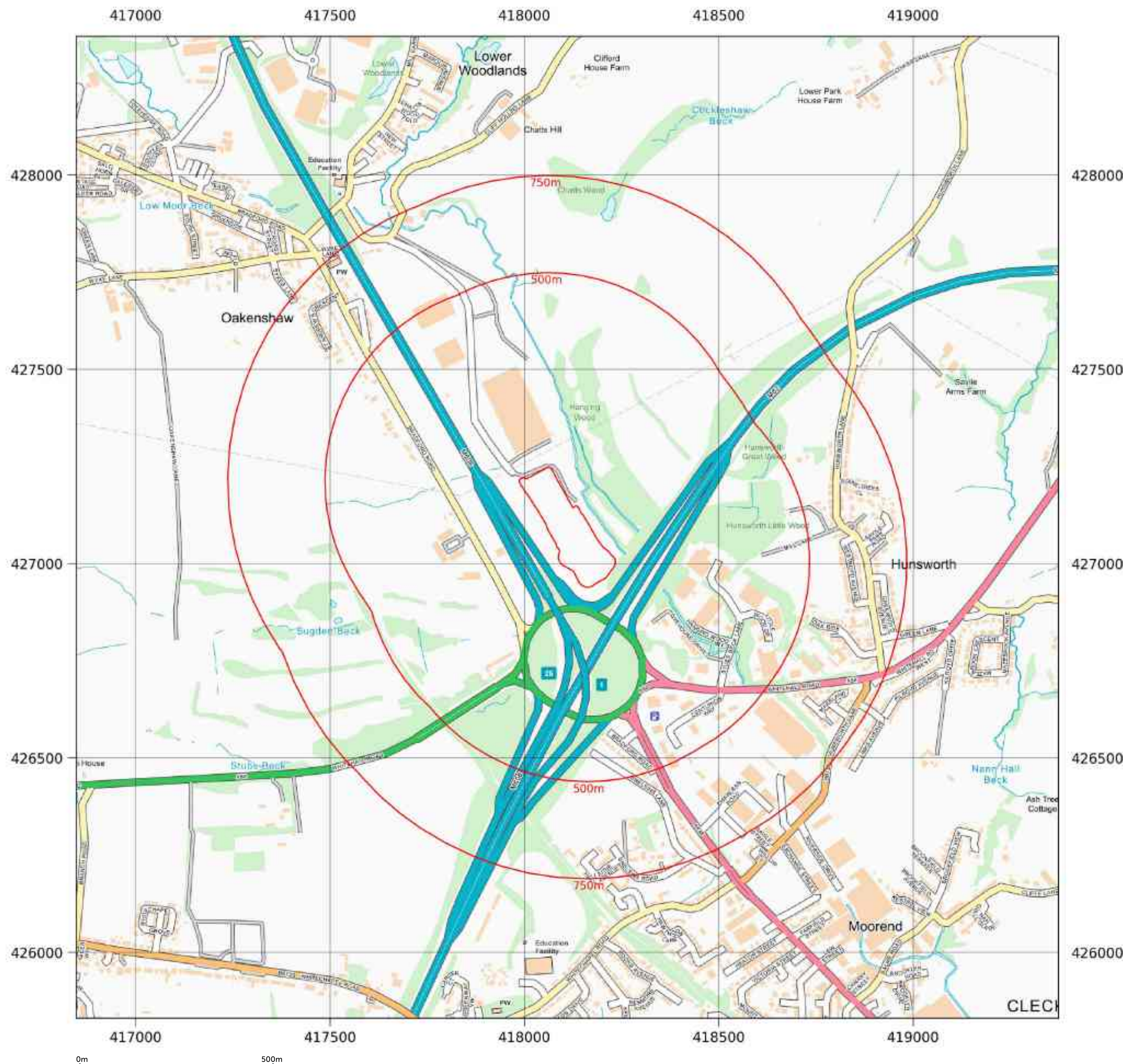
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Date: 2025

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 01273 257 755



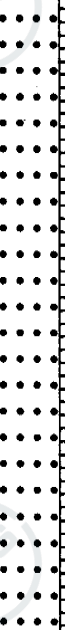


## Appendix D BGS Borehole Records

| Soil Mechanics                                                                                                                                                                                                                                                                                                                                                                                                                                      |                | SERNE 910                                                |                                  | BOREHOLE No. 27                                                            |                              |           |                                                                 |   |                         |           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------------------------------------------|----------------------------------|----------------------------------------------------------------------------|------------------------------|-----------|-----------------------------------------------------------------|---|-------------------------|-----------|
| Equipment & Methods<br>Hand excavated inspection pit to 1.00m. Cable tool boring, 150mm diameter to 7.30m. Rotary core drilling, 92mm diameter using Edeco H40, air/mist flush.                                                                                                                                                                                                                                                                     |                | Location No. 7808<br>Location M52 (EAST)/M606 LINK ROADS |                                  | Sheet 1 of 4                                                               |                              |           |                                                                 |   |                         |           |
| Carried out for<br>Department of Transport                                                                                                                                                                                                                                                                                                                                                                                                          |                | Ground Level<br>87.63 m A.O.D.                           |                                  | Coordinates<br>8244.38m E<br>7004.64m N<br>Date<br>02.02.93<br>to 11.02.93 |                              |           |                                                                 |   |                         |           |
| Description                                                                                                                                                                                                                                                                                                                                                                                                                                         | Reduced Level  | Legend                                                   | Depth (Thick)                    | Samples/Tests                                                              |                              |           | Field Records                                                   |   |                         |           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                |                                                          |                                  | Depth                                                                      | Sample Type No.              | Test      |                                                                 |   |                         |           |
| TOPSOIL                                                                                                                                                                                                                                                                                                                                                                                                                                             | 87.63<br>87.48 |                                                          | (0.15)<br>0.15<br>(0.35)<br>0.50 | 0.15 - 0.50                                                                | B 1                          |           |                                                                 |   |                         |           |
| Firm dark brown slightly sandy very silty CLAY with occasional fibrous plant matter                                                                                                                                                                                                                                                                                                                                                                 | 87.13          |                                                          | 0.50                             | 0.50 - 1.00                                                                | B 2                          |           |                                                                 |   |                         |           |
| Medium dense light brown angular fine to coarse GRAVEL of strong sandstone with some, becoming much below 1.20m clayey sand                                                                                                                                                                                                                                                                                                                         |                |                                                          | (1.60)                           | 1.00 - 1.20<br>1.20 - 1.65<br>1.20 - 1.70                                  | D 3<br>D 4<br>B 5            | S<br>N=15 | 6,5/3,5,3,4                                                     |   |                         |           |
| Stiff brown sandy CLAY with some angular fine to coarse gravel of strong sandstone                                                                                                                                                                                                                                                                                                                                                                  | 85.53          |                                                          | 2.10                             | 1.90<br>2.10 - 2.55                                                        | D 6<br>B 7                   | C<br>N=27 | 5,3/9,9,5,4                                                     |   |                         |           |
| Dense brown angular to subangular fine to coarse GRAVEL of strong sandstone with a little sandy clay.                                                                                                                                                                                                                                                                                                                                               | 84.93          |                                                          | 2.70                             | 2.70<br>2.70<br>3.00 - 3.45<br>3.00 - 3.50                                 | D 8<br>W 14<br>B 9           | C<br>N=34 | 6,5/7,8,9,10                                                    |   |                         |           |
| Dense dark grey angular to subrounded fine to coarse GRAVEL and COBBLES of strong sandstone with some sandy clay.                                                                                                                                                                                                                                                                                                                                   | 84.13          |                                                          | 3.50                             | 4.00 - 4.45<br>4.00 - 4.50<br>4.70                                         |                              | C<br>N=38 | 7,11/11,10,8,9                                                  |   |                         |           |
| Very dense dark grey angular to subrounded generally fine to medium GRAVEL of strong sandstone Foreman reports occasional boulders.                                                                                                                                                                                                                                                                                                                 | 82.23          | Angular to rounded gravel with a little sandy clay       | 5.40                             | 5.00 - 5.40<br>5.00 - 5.40<br>5.40 - 5.70                                  | U -<br>B 12<br>B 13          |           | 120 blows<br>No recovery<br>12,27/50 for 50mm<br>K=5x10-6 m/sec |   |                         |           |
| Grey highly weathered MUDSTONE, very weak to weak recovered as fine to coarse angular to subangular gravel with a little clay.                                                                                                                                                                                                                                                                                                                      | 81.63          |                                                          | 6.00                             | 6.00<br>6.00 - 6.50<br>6.50 - 6.90<br>6.50 - 7.00                          | D 15<br>B 16<br>D 17<br>B 18 | S<br>50   | 11,14/17,17,14<br>for 50mm                                      |   |                         |           |
| Grey highly weathered MUDSTONE, very weak to weak, extremely to very closely fractured, predominantly non-intact, recovered as grey flat slightly clayey gravel size fragments. Discontinuities:<br>1. Non-intact, randomly orientated, planar to irregular and smooth.                                                                                                                                                                             | 80.33          | Assumed zone of core loss                                | 7.30                             | 7.00 - 7.30                                                                | D 19                         | S<br>50   | 9,16/21,29 for 60mm                                             |   |                         |           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                |                                                          | (4.80)                           | 7.90 - 10.00                                                               | 50                           | 77        | 5                                                               | 0 | NI<br>NI<br>50<br>(>25) | CRF 0.22m |
| Remarks<br>1. Chiselling from 5.40 to 5.60m, 1 hour 15 mins; 5.60 to 5.70m, 30 mins;<br>5.70 to 6.00m, 45 mins; 6.10 to 6.50m, 1 hour and 6.50 to 7.00m, 45 mins<br>2. Rising head carried out at 5.60m.<br>Notes:<br>Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics<br>All depths and reduced levels in metres. Thicknesses given in brackets in depth column. |                |                                                          |                                  |                                                                            |                              |           | Logged by<br>AJQ/TDW<br>Scale<br>1:50<br>Fig.<br>32             |   |                         |           |

| Soil Mechanics                                                                                                                                                                                                                                                                                                                                                                        |                             | SE12NE 910                                                  |               | BOREHOLE No.27            |                     |                                |     |     |    |                |                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-------------------------------------------------------------|---------------|---------------------------|---------------------|--------------------------------|-----|-----|----|----------------|---------------------------|
| Equipment & Methods<br>As sheet 1                                                                                                                                                                                                                                                                                                                                                     |                             | Location No. 7808<br>Location<br>M62 (EAST)/M606 LINK ROADS |               | Sheet 2 of 4              |                     |                                |     |     |    |                |                           |
| Carried out for<br>Department of Transport                                                                                                                                                                                                                                                                                                                                            |                             | Ground Level                                                |               | Coordinates<br>As sheet 1 |                     |                                |     |     |    |                |                           |
| Date                                                                                                                                                                                                                                                                                                                                                                                  |                             |                                                             |               |                           |                     |                                |     |     |    |                |                           |
| Description                                                                                                                                                                                                                                                                                                                                                                           | Reduced Level               | Legend                                                      | Depth (Thick) | Drilling Records          | Mechanical core log | Field Records and Test Results |     |     |    |                |                           |
|                                                                                                                                                                                                                                                                                                                                                                                       |                             |                                                             |               | Depth                     | W                   | TCR                            | SCR | RQD | If |                |                           |
| Grey MUDSTONE (As sheet 1)                                                                                                                                                                                                                                                                                                                                                            |                             |                                                             |               |                           |                     |                                |     |     |    |                |                           |
| Dark grey to black fissle highly weathered MUDSTONE, weak to moderately weak, extremely closely fractured. Recovered as flat gravel size fragments.                                                                                                                                                                                                                                   |                             |                                                             | (4.80)        | 10.00 - 11.68             | 40                  | 100                            | 0   | 0   |    | NI 50 (>25)    | CRF 0.22m                 |
| Brown, locally black MUDSTONE, very weak to weak, extremely to closely fractured. Occasional fossilised organic debris (SEATEARTH)                                                                                                                                                                                                                                                    | 75.53                       |                                                             | 12.10 (0.30)  | 11.68 - 12.80             | 50                  | 89                             | 15  | 9   |    | NI 100 (>25)   | Gas test at 11.68m 24 LEL |
| Carbonaceous mudstone/coal?                                                                                                                                                                                                                                                                                                                                                           | 75.23                       |                                                             | 12.40 (0.40)  |                           |                     |                                |     |     |    | NI 100 (>25)   |                           |
| Dark grey thinly bedded slightly weathered SILTSTONE, moderately strong, closely fractured. Occasional thin laminae of grey sandstone. Discontinuities:<br>1. Subhorizontal, planar and smooth.<br>2. Subvertical, medium spaced, irregular to smooth.                                                                                                                                | 74.83                       | x x x                                                       | 12.80         |                           |                     |                                |     |     |    | NI 130 250 (8) |                           |
|                                                                                                                                                                                                                                                                                                                                                                                       |                             | x x x                                                       | (1.40)        |                           |                     |                                |     |     |    |                |                           |
|                                                                                                                                                                                                                                                                                                                                                                                       | 73.43                       | x x x                                                       | 14.20         | 12.80 - 15.85             |                     | 98                             | 65  | 49  |    | NI 200 300 (5) |                           |
| Grey and dark grey very thinly to medium interbedded slightly weathered SILTSTONE and SANDSTONE, strong, closely to medium fractured. Discontinuities:<br>1. Subhorizontal, planar and smooth with occasional clay lining<br>2. Subvertical, medium spaced irregular and rough to smooth.                                                                                             |                             | x x x                                                       | (2.90)        |                           |                     |                                |     |     |    |                |                           |
| 3 No. subvertical fractures. Infill of gravel size fragments with a little clay                                                                                                                                                                                                                                                                                                       |                             | x x x                                                       |               |                           |                     |                                |     |     |    |                |                           |
|                                                                                                                                                                                                                                                                                                                                                                                       | 70.53                       | x x x                                                       | 17.10         | 15.85 - 18.90             |                     | 99                             | 73  | 67  |    | NI 200 400 (5) |                           |
| Grey fine to medium grained thinly to medium bedded slightly weathered SANDSTONE, very strong, closely to medium fractured. Occasional very closely to medium spaced thin laminae of dark grey siltstone. Discontinuities:<br>1. Subhorizontal, very closely to medium spaced planar rough and clay lined.<br>2. Subvertical, closely to widely spaced planar to irregular and rough. |                             | .                                                           | (7.90)        |                           |                     |                                |     |     |    |                |                           |
|                                                                                                                                                                                                                                                                                                                                                                                       |                             | .                                                           |               | 18.90 - 21.98             |                     | 99                             | 79  | 52  |    |                |                           |
| Remarks                                                                                                                                                                                                                                                                                                                                                                               | Logged by<br>AJQ/TDW        |                                                             |               |                           |                     |                                |     |     |    |                |                           |
| Notes:                                                                                                                                                                                                                                                                                                                                                                                | Scale<br>1:50               |                                                             |               |                           |                     |                                |     |     |    |                |                           |
| Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics<br>All depths and reduced levels in metres. Thicknesses given in brackets in depth column.                                                                                                                                                         | Fig. 32                     |                                                             |               |                           |                     |                                |     |     |    |                |                           |
|                                                                                                                                                                                                                                                                                                                                                                                       | 05.07.93/15.01 (Ver 4.1.27) |                                                             |               |                           |                     |                                |     |     |    |                |                           |



|  <b>Soil Mechanics</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               | <b>SE12NE910</b>                                                                   |                     | <b>BOREHOLE No.27</b>             |               |                     |     |     |                         |                                 |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |              |       |   |      |      |      |              |       |      |      |      |      |  |       |      |       |       |      |  |       |      |       |       |      |  |       |      |       |       |   |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------------------------------------------------------------------------------|---------------------|-----------------------------------|---------------|---------------------|-----|-----|-------------------------|---------------------------------|------|------|-------------------|---------------------|--------------------|---------|------|--|--|--|--|--|-------|---|------|---|------|--------------|-------|---|------|---|------|---------------|-------|---|------|------|------|--------------|-------|---|------|------|------|--------------|-------|------|------|------|------|--|-------|------|-------|-------|------|--|-------|------|-------|-------|------|--|-------|------|-------|-------|---|--|
| Equipment & Methods<br>As sheet 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               | Location No. 7808<br>Location<br>M62 (EAST)/M606 LINK ROADS                        |                     | Sheet 3 of 4                      |               |                     |     |     |                         |                                 |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |              |       |   |      |      |      |              |       |      |      |      |      |  |       |      |       |       |      |  |       |      |       |       |      |  |       |      |       |       |   |  |
| Carried out for<br>Department of Transport                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               | Ground Level                                                                       |                     | Coordinates<br>Date<br>As sheet 1 |               |                     |     |     |                         |                                 |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |              |       |   |      |      |      |              |       |      |      |      |      |  |       |      |       |       |      |  |       |      |       |       |      |  |       |      |       |       |   |  |
| Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Reduced Level | Legend                                                                             | Depth (Thick)       | Drilling Records                  |               | Mechanical core log |     |     |                         | Field Records and Test Results  |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |              |       |   |      |      |      |              |       |      |      |      |      |  |       |      |       |       |      |  |       |      |       |       |      |  |       |      |       |       |   |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |                                                                                    |                     | Depth                             | W             | TCR                 | SCR | RQD | If                      |                                 |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |              |       |   |      |      |      |              |       |      |      |      |      |  |       |      |       |       |      |  |       |      |       |       |      |  |       |      |       |       |   |  |
| Grey SANDSTONE<br>(As sheet 2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               |  |                     | 18.90 - 21.98                     |               |                     | 99  | 79  | 52                      |                                 |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |              |       |   |      |      |      |              |       |      |      |      |      |  |       |      |       |       |      |  |       |      |       |       |      |  |       |      |       |       |   |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |                                                                                    |                     | (7.90 pen)                        | 90            |                     |     |     | N1<br>200<br>400<br>(5) |                                 |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |              |       |   |      |      |      |              |       |      |      |      |      |  |       |      |       |       |      |  |       |      |       |       |      |  |       |      |       |       |   |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |                                                                                    |                     | 21.98 - 25.00                     |               |                     | 100 | 86  | 69                      | Gas test at<br>25.00m<br>2% LEL |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |              |       |   |      |      |      |              |       |      |      |      |      |  |       |      |       |       |      |  |       |      |       |       |      |  |       |      |       |       |   |  |
| BOREHOLE ENDS AT 25.00 m.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |                                                                                    |                     | 62.63                             | 25.00         |                     |     |     |                         |                                 |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |              |       |   |      |      |      |              |       |      |      |      |      |  |       |      |       |       |      |  |       |      |       |       |      |  |       |      |       |       |   |  |
| <table border="1"><caption>Water Level Observations During Boring</caption><thead><tr><th>Date</th><th>Time</th><th>Depth of Hole (m)</th><th>Depth of Casing (m)</th><th>Depth to Water (m)</th><th>Remarks</th></tr></thead><tbody><tr><td>1993</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>02.02</td><td>-</td><td>2.70</td><td>-</td><td>2.70</td><td>Water strike</td></tr><tr><td>02.02</td><td>-</td><td>2.70</td><td>-</td><td>1.20</td><td>After 20 mins</td></tr><tr><td>02.02</td><td>-</td><td>5.70</td><td>5.70</td><td>1.20</td><td>End of shift</td></tr><tr><td>03.02</td><td>-</td><td>7.30</td><td>6.50</td><td>0.60</td><td>End of shift</td></tr><tr><td>10.02</td><td>0800</td><td>7.90</td><td>7.70</td><td>0.60</td><td></td></tr><tr><td>10.02</td><td>1800</td><td>12.80</td><td>11.00</td><td>1.80</td><td></td></tr><tr><td>11.02</td><td>0800</td><td>12.80</td><td>11.00</td><td>0.60</td><td></td></tr><tr><td>11.02</td><td>1800</td><td>25.00</td><td>11.40</td><td>-</td><td></td></tr></tbody></table> |               |                                                                                    |                     |                                   |               |                     |     |     |                         |                                 | Date | Time | Depth of Hole (m) | Depth of Casing (m) | Depth to Water (m) | Remarks | 1993 |  |  |  |  |  | 02.02 | - | 2.70 | - | 2.70 | Water strike | 02.02 | - | 2.70 | - | 1.20 | After 20 mins | 02.02 | - | 5.70 | 5.70 | 1.20 | End of shift | 03.02 | - | 7.30 | 6.50 | 0.60 | End of shift | 10.02 | 0800 | 7.90 | 7.70 | 0.60 |  | 10.02 | 1800 | 12.80 | 11.00 | 1.80 |  | 11.02 | 0800 | 12.80 | 11.00 | 0.60 |  | 11.02 | 1800 | 25.00 | 11.40 | - |  |
| Date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Time          | Depth of Hole (m)                                                                  | Depth of Casing (m) | Depth to Water (m)                | Remarks       |                     |     |     |                         |                                 |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |              |       |   |      |      |      |              |       |      |      |      |      |  |       |      |       |       |      |  |       |      |       |       |      |  |       |      |       |       |   |  |
| 1993                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |                                                                                    |                     |                                   |               |                     |     |     |                         |                                 |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |              |       |   |      |      |      |              |       |      |      |      |      |  |       |      |       |       |      |  |       |      |       |       |      |  |       |      |       |       |   |  |
| 02.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | -             | 2.70                                                                               | -                   | 2.70                              | Water strike  |                     |     |     |                         |                                 |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |              |       |   |      |      |      |              |       |      |      |      |      |  |       |      |       |       |      |  |       |      |       |       |      |  |       |      |       |       |   |  |
| 02.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | -             | 2.70                                                                               | -                   | 1.20                              | After 20 mins |                     |     |     |                         |                                 |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |              |       |   |      |      |      |              |       |      |      |      |      |  |       |      |       |       |      |  |       |      |       |       |      |  |       |      |       |       |   |  |
| 02.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | -             | 5.70                                                                               | 5.70                | 1.20                              | End of shift  |                     |     |     |                         |                                 |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |              |       |   |      |      |      |              |       |      |      |      |      |  |       |      |       |       |      |  |       |      |       |       |      |  |       |      |       |       |   |  |
| 03.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | -             | 7.30                                                                               | 6.50                | 0.60                              | End of shift  |                     |     |     |                         |                                 |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |              |       |   |      |      |      |              |       |      |      |      |      |  |       |      |       |       |      |  |       |      |       |       |      |  |       |      |       |       |   |  |
| 10.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0800          | 7.90                                                                               | 7.70                | 0.60                              |               |                     |     |     |                         |                                 |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |              |       |   |      |      |      |              |       |      |      |      |      |  |       |      |       |       |      |  |       |      |       |       |      |  |       |      |       |       |   |  |
| 10.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1800          | 12.80                                                                              | 11.00               | 1.80                              |               |                     |     |     |                         |                                 |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |              |       |   |      |      |      |              |       |      |      |      |      |  |       |      |       |       |      |  |       |      |       |       |      |  |       |      |       |       |   |  |
| 11.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0800          | 12.80                                                                              | 11.00               | 0.60                              |               |                     |     |     |                         |                                 |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |              |       |   |      |      |      |              |       |      |      |      |      |  |       |      |       |       |      |  |       |      |       |       |      |  |       |      |       |       |   |  |
| 11.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1800          | 25.00                                                                              | 11.40               | -                                 |               |                     |     |     |                         |                                 |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |              |       |   |      |      |      |              |       |      |      |      |      |  |       |      |       |       |      |  |       |      |       |       |      |  |       |      |       |       |   |  |
| Remarks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               |                                                                                    |                     |                                   |               |                     |     |     |                         | Logged by<br>A.JQ/TDM           |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |              |       |   |      |      |      |              |       |      |      |      |      |  |       |      |       |       |      |  |       |      |       |       |      |  |       |      |       |       |   |  |
| Notes:<br>Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics<br>All depths and reduced levels in metres. Thicknesses given in brackets in depth column.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               |                                                                                    |                     |                                   |               |                     |     |     |                         | Scale<br>1:50<br>Fig.<br>32     |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |              |       |   |      |      |      |              |       |      |      |      |      |  |       |      |       |       |      |  |       |      |       |       |      |  |       |      |       |       |   |  |

|                                                            |  |  |  |  |  |                        |  |  |                                        |  |  |
|------------------------------------------------------------|--|--|--|--|--|------------------------|--|--|----------------------------------------|--|--|
| <b>Soil Mechanics</b>                                      |  |  |  |  |  | <b>BOREHOLE No. 27</b> |  |  |                                        |  |  |
|                                                            |  |  |  |  |  | Sheet 4 of 4           |  |  |                                        |  |  |
| Location No. 7808<br>Location M62 (EAST) / M606 LINK ROADS |  |  |  |  |  |                        |  |  | Type of installation Slotted standpipe |  |  |
|                                                            |  |  |  |  |  |                        |  |  | Date of installation 11.2.93           |  |  |
| Carried out for Department of Transport                    |  |  |  |  |  |                        |  |  | Internal diameter of tubing 19 mm      |  |  |
|                                                            |  |  |  |  |  |                        |  |  | Length of filter 6000 mm               |  |  |
|                                                            |  |  |  |  |  |                        |  |  | Diameter of filter 120 mm              |  |  |

| Depth (m)                       |       | SUMMARY OF INSTALLATION |
|---------------------------------|-------|-------------------------|
| From                            | To    |                         |
| Surface protection : Gas barrel |       |                         |
| 0.00                            | 1.00  | Concrete                |
| 1.00                            | 1.50  | Bentonite seal          |
| 2.00                            | 7.00  | Slotted section         |
| 1.50                            | 7.50  | Gravel                  |
| 7.50                            | 8.50  | Bentonite seal          |
| 8.50                            | 25.00 | Bentonite/Cement Grout  |
|                                 |       |                         |
|                                 |       |                         |
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|                                 |       |                         |
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|                                 |       |                         |
|                                 |       |                         |

| Legend | Depth below Ground level(m) |
|--------|-----------------------------|
|        |                             |
| a      | a                           |
| d      | d                           |
| c      | c                           |
| d      | d                           |
| e      | e                           |

**key**

a Concrete

d Bentonite seal

b Sand filter

e Bentonite/cement grout

c Gravel filter

f Backfill

**Remarks**

- Ground level and coordinates as sheet 1

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DETAILS OF INSTRUMENTS

|                                                                                                                                                                                                                                                                                                                                                                                                        |                |                  |                                                           |                                                                           |                      |                                 |                                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------------|-----------------------------------------------------------|---------------------------------------------------------------------------|----------------------|---------------------------------|---------------------------------------------------------------|
| Soil Mechanics                                                                                                                                                                                                                                                                                                                                                                                         |                |                  |                                                           |                                                                           |                      |                                 |                                                               |
| BOREHOLE No.28<br>Sheet 1 of 4                                                                                                                                                                                                                                                                                                                                                                         |                |                  |                                                           |                                                                           |                      |                                 |                                                               |
| Equipment & Methods<br><br>Hand excavated inspection pit to 1.20m. Cable tool boring,<br>150mm diameter to 8.05m. Rotary core drilling, 92mm<br>diameter using Edeco T30, air/mist flush.                                                                                                                                                                                                              |                |                  |                                                           | Location No.    7808<br>Location<br><div>M62 (EAST)/M606 LINK ROADS</div> |                      |                                 |                                                               |
| Carried out for<br>Department of Transport                                                                                                                                                                                                                                                                                                                                                             |                |                  |                                                           | Ground Level<br>88.32 m A.O.D.                                            |                      | Date<br>01.02.93<br>to 16.02.93 |                                                               |
| Description                                                                                                                                                                                                                                                                                                                                                                                            | Reduced Level  | Legend           | Depth (Thick)                                             | Samples/Tests                                                             |                      |                                 | Field Records                                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                        |                |                  |                                                           | Depth                                                                     | Type                 | No.                             | Test                                                          |
| TOPSOIL                                                                                                                                                                                                                                                                                                                                                                                                | 88.32<br>88.17 | (0.15)<br>0.15   | 0.15 - 0.50                                               | B                                                                         | 1                    |                                 |                                                               |
| MADE GROUND (Stiff brown grey sandy clay with a little angular to subangular fine to coarse gravel of brick and siltstone with occasional cobbles of brick) Soft dark grey organic very silty clay                                                                                                                                                                                                     | 87.42          | (0.75)<br>0.90   | 0.50 - 1.00<br>1.00 - 1.45                                | B<br>U                                                                    | 2<br>3               |                                 |                                                               |
| Soft to firm green brown v silty sl sandy CLAY, with occ rootlets and organic odour                                                                                                                                                                                                                                                                                                                    |                | (1.80)           | 1.50<br>1.70                                              | D<br>D                                                                    | 4<br>5               |                                 |                                                               |
| Medium dense brown subangular to subrounded generally fine to medium GRAVEL of moderately weak to moderately strong sandstone, with some clayey sand                                                                                                                                                                                                                                                   | 85.62          | (2.70)<br>(0.40) | 2.00 - 1.45<br>2.00 - 2.50                                | -<br>B                                                                    | -<br>6               |                                 |                                                               |
| Stiff grey and dark grey mottled slightly sandy CLAY with some to much fine to coarse angular to subrounded gravel of moderately strong sandstone and occasional carbonaceous mudstone                                                                                                                                                                                                                 | 85.22          | 3.10<br>(0.80)   | 2.50 - 2.95<br>2.70                                       | U<br>W                                                                    | 7<br>21              |                                 |                                                               |
|                                                                                                                                                                                                                                                                                                                                                                                                        | 84.42          | 3.90             | 3.00<br>3.10<br>3.20 - 3.65                               | D<br>D<br>B                                                               | 8<br>9<br>10         | C<br>N=23                       | 7,8/5,7,6,5                                                   |
| Dense to very dense grey angular to subrounded fine to coarse GRAVEL of strong to very strong siltstone with some very silty clay, and occasional cobbles Angular to rounded slightly clayey gravel                                                                                                                                                                                                    |                | (2.30)           | 3.20 - 3.70<br>3.90                                       | -<br>D                                                                    | -<br>11              |                                 |                                                               |
|                                                                                                                                                                                                                                                                                                                                                                                                        |                |                  | 4.20 - 4.45<br>4.20 - 4.50<br>4.50 - 4.95                 | U<br>B<br>B                                                               | -<br>12<br>13        | N=40                            | 100 blows<br>No recovery<br>9,13/10,10,11,9<br>K=5x10-6 m/sec |
|                                                                                                                                                                                                                                                                                                                                                                                                        |                |                  | 4.50 - 5.00                                               | B                                                                         | 13                   |                                 |                                                               |
|                                                                                                                                                                                                                                                                                                                                                                                                        |                |                  | 5.20                                                      | D                                                                         | 14                   | C<br>S0                         | 11,14/15,21,14<br>for 10mm                                    |
|                                                                                                                                                                                                                                                                                                                                                                                                        | 82.12          | 6.20             | 5.50 - 5.90<br>5.50 - 6.00                                | B<br>B                                                                    | 15<br>16             | S<br>50                         |                                                               |
| Grey highly weathered MUDSTONE, weak to moderately weak, recovered as angular to subangular fine to coarse gravel with a little sand and with some clay to 7.00m.                                                                                                                                                                                                                                      |                | (1.85)           | 6.20<br>6.50 - 7.00<br>7.00 - 7.20<br>7.00 - 7.50<br>7.20 | D<br>B<br>B<br>D                                                          | 16<br>17<br>18<br>19 | S<br>50                         | 12,21/50 for 60mm                                             |
| Grey thinly to thickly laminated moderately weathered SILTSTONE, very weak to weak with occasional highly weathered thin beds Recovered as soft to firm clay with some gravel of siltstone.                                                                                                                                                                                                            | 80.27          | 8.05             | 7.60 - 8.05                                               | D                                                                         | 20                   | S<br>N=52                       | 11,12/16,14,12,10                                             |
|                                                                                                                                                                                                                                                                                                                                                                                                        |                |                  | 8.00 - 9.00                                               |                                                                           |                      |                                 |                                                               |
| Grey thinly laminated moderately weathered MUDSTONE, weak, extremely to very closely fractured. 9.30m, becoming dark grey and carbonaceous. Discontinuities: 1. Non-intact, randomly orientated, PL and SH                                                                                                                                                                                             | 79.32          | 9.00<br>(0.58)   | 9.00 - 10.50                                              |                                                                           |                      |                                 |                                                               |
| SILTSTONE (As sheet 2)                                                                                                                                                                                                                                                                                                                                                                                 | 78.74          | 9.58<br>(0.72)   |                                                           |                                                                           |                      |                                 |                                                               |
| Remarks<br>1. Chiselling from 3.80 to 3.90m, 30 mins; 4.50 to 4.80m, 15 mins;<br>4.80 to 5.00m, 15 mins; 5.70 to 5.90m, 30 mins and 7.20 to 7.30m, 15 mins.<br>Notes:<br>Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics<br>All depths and reduced levels in metres. Thicknesses given in brackets in depth column. |                |                  |                                                           |                                                                           |                      |                                 |                                                               |
| Logged by<br>AJQ                                                                                                                                                                                                                                                                                                                                                                                       |                |                  |                                                           |                                                                           |                      |                                 |                                                               |
| Scale<br>1:50                                                                                                                                                                                                                                                                                                                                                                                          |                |                  |                                                           |                                                                           |                      |                                 |                                                               |
| Fig. 33                                                                                                                                                                                                                                                                                                                                                                                                |                |                  |                                                           |                                                                           |                      |                                 |                                                               |

| Soil Mechanics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |       | SE12NE 911                                                  |              | BOREHOLE No.28      |                                            |                                                                   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------------------------------------------------------------|--------------|---------------------|--------------------------------------------|-------------------------------------------------------------------|
| Equipment & Methods<br>As sheet 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       | Location No. 7808<br>Location<br>M62 (EAST)/M606 LINK ROADS |              | Sheet 2 of 4        |                                            |                                                                   |
| Carried out for<br>Department of Transport                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |       | Ground Level                                                |              | Coordinates<br>Date |                                            |                                                                   |
| Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |       | Reduced Level                                               | Legend       | Depth (Thick)       | Drilling Records<br>Depth W TCR SCR RQD If |                                                                   |
| <p>Grey moderately weathered SILTSTONE, very weak to weak, extremely to very closely fractured, with some dark grey fossil plant fragments. Discontinuities: curved smooth polished. (SEATEARTH)</p> <p>Ironstone nodules</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 78.02 | x x x                                                       | (0.72)       | 9.00 - 10.50        | 93 11 9                                    | NI/NI/130 (>25)<br>50/90 (>25)<br>CRF 0.57m                       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 77.82 | x x x                                                       | 10.30 (0.20) |                     |                                            |                                                                   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |       |                                                             | 10.50        |                     |                                            |                                                                   |
| <p>Grey thickly laminated to thinly bedded moderately to slightly weathered, slightly sandy SILTSTONE, moderately weak, very closely to closely fractured. With occasional fossil plants. Discontinuities:<br/>1. Horizontal, planar, smooth with 10mm soft clay infill.</p>                                                                                                                                                                                                                                                                                                                                                                                                                             |       |                                                             | (2.30)       | 10.50 - 11.40       | 100 76 13                                  |                                                                   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 75.52 |                                                             | 12.80        | 11.40 - 12.80       | 82 76 29                                   | NI 90 160 (11)                                                    |
| <p>Grey fine grained thinly laminated to thinly bedded slightly weathered silty SANDSTONE, strong to very strong. Closely fractured. Discontinuities:<br/>1. 90 deg vertical, uneven, rough (452mm persistence). 2. 0 deg horizontal, planar rough.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |                                                             |              | 12.80 - 14.90       | 97 95 62                                   |                                                                   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |       |                                                             |              | 14.90 - 17.90       | 98 98 70                                   | NI 200 310 (5)                                                    |
| <p>Grey fine to medium grained thinly laminated slightly weathered micaceous SANDSTONE, strong, closely to medium fractured with a little to some dark grey laminations of mudstone exhibiting cross bedding, lode and flame structures and occasional fossil plant fragments.</p> <p>Below 14.90m, with occasional lamiantions. Discontinuities: 1. 0 deg horizontal, planar, smooth with occasional soft clay infill. 2. 70-80 deg subvertical planar, rough (300mm persistence) iron stained.</p> <p>Very thin bed of very strong ironstone.</p> <p>80 deg, subvertical slickensided, slightly polished planar fracture, with mineral precipitate on srufaces. Horizontal displacement Non-intact</p> |       |                                                             | (18.68)      | 17.90 - 19.30       | 91 91 60                                   | Gas test at 19.30m 1% LEL                                         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |       |                                                             |              | 19.30 - 20.85       | 99 82 52                                   |                                                                   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |       |                                                             |              |                     |                                            |                                                                   |
| <p>Remarks</p> <p>2. Backfilled with grout on completion.</p> <p>3. Rising head test carried out at 4.50m.</p> <p>Notes:<br/>Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics<br/>All depths and reduced levels in metres. Thicknesses given in brackets in depth column.</p>                                                                                                                                                                                                                                                                                                                                          |       |                                                             |              |                     |                                            | <p>Logged by<br/>AJQ</p> <p>Scale<br/>1:50</p> <p>Fig.<br/>33</p> |

| Soil Mechanics                                                                                                                                                                                                                                                                                                                                                                                                                  |               | SE12NE 911                                                  |               | BOREHOLE No.28            |     |                     |     |                 |    |                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------------------------------------------------------------|---------------|---------------------------|-----|---------------------|-----|-----------------|----|--------------------------------|
| Equipment & Methods<br>As sheet 1                                                                                                                                                                                                                                                                                                                                                                                               |               | Location No. 7808<br>Location<br>M62 (EAST)/M606 LINK ROADS |               | Sheet 3 of 4              |     |                     |     |                 |    |                                |
| Carried out for<br>Department of Transport                                                                                                                                                                                                                                                                                                                                                                                      |               | Ground Level                                                |               | Coordinates<br>As sheet 1 |     |                     |     |                 |    |                                |
| Date                                                                                                                                                                                                                                                                                                                                                                                                                            |               |                                                             |               |                           |     |                     |     |                 |    |                                |
| Description                                                                                                                                                                                                                                                                                                                                                                                                                     | Reduced Level | Legend                                                      | Depth (Thick) | Drilling Records          |     | Mechanical core log |     |                 |    | Field Records and Test Results |
|                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |                                                             |               | Depth                     | W   | TCR                 | SCR | RQD             | If |                                |
| <p>Non-intact. Very silty clay infill with occasional comminuted sandstone infill.</p> <p>SANDSTONE (As sheet 2)</p> <p>Below 20.50m, with occasional 80 deg incipient fractures.</p> <p>Below 23.85m, with occasional carbonaceous and micaceous laminations</p> <p>Below 27.00m, becoming light grey with occasional thin beds of siltstone.</p> <p>Intersecting 80 deg subvertical fracture, planar (130 deg intersect).</p> |               | •••••                                                       | 19.30 - 20.85 |                           | 99  | 82                  | 52  | NI 200 310 (5)  |    |                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                 |               | •••••                                                       | 20.85 - 22.30 |                           | 100 | 99                  | 57  | NI 270 420 (4)  |    |                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                 |               | •••••                                                       | 22.30 - 23.85 |                           | 98  | 97                  | 77  |                 |    |                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                 |               | •••••                                                       | 23.85 - 25.30 | 100                       | 100 | 71                  |     |                 |    |                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                 |               | •••••                                                       | 25.30 - 26.75 |                           | 94  | 94                  | 66  | NI 180 260 (5)  |    |                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                 |               | •••••                                                       | 26.75 - 28.25 |                           | 97  | 69                  | 33  | NI              |    |                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                 |               | •••••                                                       | 28.25 - 29.80 |                           | 99  | 77                  | 52  | NI 100 200 (10) |    |                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                 |               | •••••                                                       | 29.80 - 31.30 |                           | 100 | 97                  | 31  |                 |    |                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                 |               | •••••                                                       |               |                           |     |                     |     |                 |    |                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                 |               | •••••                                                       |               |                           |     |                     |     |                 |    |                                |
| Remarks                                                                                                                                                                                                                                                                                                                                                                                                                         |               | Logged by<br>AJQ<br>Scale<br>1:50<br>Fig. 33                |               |                           |     |                     |     |                 |    |                                |
| Notes:<br>Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics<br>All depths and reduced levels in metres. Thicknesses given in brackets in depth column.                                                                                                                                                                                         |               | 05.07.93/15.17 (Ver 4.1.27)                                 |               |                           |     |                     |     |                 |    |                                |

|  <b>Soil Mechanics</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      | <b>BOREHOLE No.28</b><br>Sheet 4 of 4                                                                                                          |                                                                                                                                                                      |                    |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |               |       |      |      |      |      |                |       |   |       |   |   |             |       |      |       |      |      |              |       |      |       |      |      |                |       |      |       |      |      |                 |                            |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------------|--------------------|---------|------|--|--|--|--|--|-------|---|------|---|------|--------------|-------|---|------|---|------|---------------|-------|---|------|------|------|---------------|-------|------|------|------|------|----------------|-------|---|-------|---|---|-------------|-------|------|-------|------|------|--------------|-------|------|-------|------|------|----------------|-------|------|-------|------|------|-----------------|----------------------------|--|
| Equipment & Methods<br>As sheet 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      | Location No. 7808<br>Location<br>M62 (EAST)/M606 LINK ROADS                                                                                    |                                                                                                                                                                      |                    |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |               |       |      |      |      |      |                |       |   |       |   |   |             |       |      |       |      |      |              |       |      |       |      |      |                |       |      |       |      |      |                 |                            |  |
| Carried out for<br>Department of Transport                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      | Ground Level<br>Coordinates<br>Date<br>As sheet 1                                                                                              |                                                                                                                                                                      |                    |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |               |       |      |      |      |      |                |       |   |       |   |   |             |       |      |       |      |      |              |       |      |       |      |      |                |       |      |       |      |      |                 |                            |  |
| Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      | Reduced Level                                                                                                                                  | Legend<br>Depth (Thick)<br>Drilling Records<br>Mechanical core log<br>Field Records and Test Results                                                                 |                    |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |               |       |      |      |      |      |                |       |   |       |   |   |             |       |      |       |      |      |              |       |      |       |      |      |                |       |      |       |      |      |                 |                            |  |
| STONE (As sheet 3)<br><br>Grey thinly to thickly laminated moderately weathered SILTSTONE, moderately weak, closely fractured.<br>Below 32.30m, becoming highly to moderately weathered.<br>Discontinuities:<br>1. Subhorizontal, planar and smooth.<br>2. 60 deg inclined, planar and smooth.<br><br>Becoming dark grey and interlaminated with siltstone, moderately strong to strong.<br>Medium bed of very strong ironstone. Extremely to very closely fractured. Non-intact.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      | (18.68)<br><br><br><br><br><br><br><br><br><br>56.84<br><br><br><br><br><br><br><br><br><br>55.62<br><br><br><br><br><br><br><br><br><br>53.32 | 29.80 - 31.30<br><br><br><br><br><br><br><br><br><br>31.30 - 32.70<br><br><br><br><br><br><br><br><br><br>32.70 - 35.00<br><br><br><br><br><br><br><br><br><br>35.00 |                    |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |               |       |      |      |      |      |                |       |   |       |   |   |             |       |      |       |      |      |              |       |      |       |      |      |                |       |      |       |      |      |                 |                            |  |
| BOREHOLE ENDS AT 35.00 m.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      | Water Level Observations During Boring                                                                                                         |                                                                                                                                                                      |                    |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |               |       |      |      |      |      |                |       |   |       |   |   |             |       |      |       |      |      |              |       |      |       |      |      |                |       |      |       |      |      |                 |                            |  |
| <table border="1"> <thead> <tr> <th>Date</th> <th>Time</th> <th>Depth of Hole (m)</th> <th>Depth of Casing (m)</th> <th>Depth to Water (m)</th> <th>Remarks</th> </tr> </thead> <tbody> <tr> <td>1993</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>01.02</td> <td>-</td> <td>2.70</td> <td>-</td> <td>2.70</td> <td>Water strike</td> </tr> <tr> <td>01.02</td> <td>-</td> <td>2.70</td> <td>-</td> <td>1.20</td> <td>After 20 mins</td> </tr> <tr> <td>01.02</td> <td>-</td> <td>8.05</td> <td>7.30</td> <td>5.30</td> <td>End of boring</td> </tr> <tr> <td>15.02</td> <td>0800</td> <td>8.00</td> <td>7.60</td> <td>2.30</td> <td>Start of shift</td> </tr> <tr> <td>15.02</td> <td>-</td> <td>11.70</td> <td>-</td> <td>-</td> <td>Water entry</td> </tr> <tr> <td>15.02</td> <td>1800</td> <td>19.30</td> <td>9.00</td> <td>1.30</td> <td>End of shift</td> </tr> <tr> <td>16.02</td> <td>0800</td> <td>19.30</td> <td>9.00</td> <td>1.18</td> <td>Start of shift</td> </tr> <tr> <td>16.02</td> <td>1800</td> <td>35.00</td> <td>9.00</td> <td>1.60</td> <td>End of borehole</td> </tr> </tbody> </table> |      | Date                                                                                                                                           | Time                                                                                                                                                                 | Depth of Hole (m)  | Depth of Casing (m) | Depth to Water (m) | Remarks | 1993 |  |  |  |  |  | 01.02 | - | 2.70 | - | 2.70 | Water strike | 01.02 | - | 2.70 | - | 1.20 | After 20 mins | 01.02 | - | 8.05 | 7.30 | 5.30 | End of boring | 15.02 | 0800 | 8.00 | 7.60 | 2.30 | Start of shift | 15.02 | - | 11.70 | - | - | Water entry | 15.02 | 1800 | 19.30 | 9.00 | 1.30 | End of shift | 16.02 | 0800 | 19.30 | 9.00 | 1.18 | Start of shift | 16.02 | 1800 | 35.00 | 9.00 | 1.60 | End of borehole | Logged by<br>Scale<br>1:50 |  |
| Date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Time | Depth of Hole (m)                                                                                                                              | Depth of Casing (m)                                                                                                                                                  | Depth to Water (m) | Remarks             |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |               |       |      |      |      |      |                |       |   |       |   |   |             |       |      |       |      |      |              |       |      |       |      |      |                |       |      |       |      |      |                 |                            |  |
| 1993                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |                                                                                                                                                |                                                                                                                                                                      |                    |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |               |       |      |      |      |      |                |       |   |       |   |   |             |       |      |       |      |      |              |       |      |       |      |      |                |       |      |       |      |      |                 |                            |  |
| 01.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | -    | 2.70                                                                                                                                           | -                                                                                                                                                                    | 2.70               | Water strike        |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |               |       |      |      |      |      |                |       |   |       |   |   |             |       |      |       |      |      |              |       |      |       |      |      |                |       |      |       |      |      |                 |                            |  |
| 01.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | -    | 2.70                                                                                                                                           | -                                                                                                                                                                    | 1.20               | After 20 mins       |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |               |       |      |      |      |      |                |       |   |       |   |   |             |       |      |       |      |      |              |       |      |       |      |      |                |       |      |       |      |      |                 |                            |  |
| 01.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | -    | 8.05                                                                                                                                           | 7.30                                                                                                                                                                 | 5.30               | End of boring       |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |               |       |      |      |      |      |                |       |   |       |   |   |             |       |      |       |      |      |              |       |      |       |      |      |                |       |      |       |      |      |                 |                            |  |
| 15.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0800 | 8.00                                                                                                                                           | 7.60                                                                                                                                                                 | 2.30               | Start of shift      |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |               |       |      |      |      |      |                |       |   |       |   |   |             |       |      |       |      |      |              |       |      |       |      |      |                |       |      |       |      |      |                 |                            |  |
| 15.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | -    | 11.70                                                                                                                                          | -                                                                                                                                                                    | -                  | Water entry         |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |               |       |      |      |      |      |                |       |   |       |   |   |             |       |      |       |      |      |              |       |      |       |      |      |                |       |      |       |      |      |                 |                            |  |
| 15.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1800 | 19.30                                                                                                                                          | 9.00                                                                                                                                                                 | 1.30               | End of shift        |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |               |       |      |      |      |      |                |       |   |       |   |   |             |       |      |       |      |      |              |       |      |       |      |      |                |       |      |       |      |      |                 |                            |  |
| 16.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0800 | 19.30                                                                                                                                          | 9.00                                                                                                                                                                 | 1.18               | Start of shift      |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |               |       |      |      |      |      |                |       |   |       |   |   |             |       |      |       |      |      |              |       |      |       |      |      |                |       |      |       |      |      |                 |                            |  |
| 16.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1800 | 35.00                                                                                                                                          | 9.00                                                                                                                                                                 | 1.60               | End of borehole     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |               |       |      |      |      |      |                |       |   |       |   |   |             |       |      |       |      |      |              |       |      |       |      |      |                |       |      |       |      |      |                 |                            |  |
| Notes:<br>Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics<br>All depths and reduced levels in metres. Thicknesses given in brackets in depth column.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      | Fig. 33                                                                                                                                        |                                                                                                                                                                      |                    |                     |                    |         |      |  |  |  |  |  |       |   |      |   |      |              |       |   |      |   |      |               |       |   |      |      |      |               |       |      |      |      |      |                |       |   |       |   |   |             |       |      |       |      |      |              |       |      |       |      |      |                |       |      |       |      |      |                 |                            |  |

| Soil Mechanics                                                                                                                                                                            |                | BOREHOLE No.29                                                                                                        |                |               |                 |           |                                                                |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------------------------------------------------------------------------------------------------------------------|----------------|---------------|-----------------|-----------|----------------------------------------------------------------|
| <b>Equipment &amp; Methods</b><br>Cable tool boring, 150mm diameter to 13.08m.<br>Rotary core drilling, 92mm diameter using Edeco T30, air/mist flush.                                    |                | <b>Location No.</b> 7808<br><b>Location</b> M62 (EAST)/M606 LINK ROADS<br>SE12NE 912<br>18184 26972<br>Sheet 1 of 4   |                |               |                 |           |                                                                |
| <b>Carried out for</b><br>Department of Transport                                                                                                                                         |                | <b>Ground Level</b> 96.22 = A.O.D.<br><b>Coordinates</b> 8188.39m E<br>6970.95m N<br><b>Date</b> 22.01.93 to 24.01.93 |                |               |                 |           |                                                                |
| Description                                                                                                                                                                               | Reduced Level  | Legend                                                                                                                | Depth (Thick)  | Samples/Tests |                 |           | Field Records                                                  |
|                                                                                                                                                                                           |                |                                                                                                                       |                | Depth         | Sample Type No. | Test      |                                                                |
| TOPSOIL (Driller's description)                                                                                                                                                           | 96.22<br>96.02 |                                                                                                                       | (0.20)<br>0.20 | 0.20 - 0.50   | B 1             |           |                                                                |
| MADE GROUND Grey brown clay with a little angular fine to medium gravel of very weak to weak siltstone.                                                                                   |                |                                                                                                                       | (0.70)         | 0.50 - 1.00   | B 2             |           |                                                                |
| MADE GROUND (Stiff grey clay with some fine to coarse angular to subangular gravel and cobbles of weak to moderately strong siltstone)                                                    | 95.32          |                                                                                                                       | 0.90           | 1.00 - 1.45   | B 3             | S<br>N=16 | 6,8/4,5,4,3                                                    |
|                                                                                                                                                                                           |                |                                                                                                                       | (0.80)         | 1.00 - 1.50   | B 3             |           |                                                                |
| MADE GROUND (Stiff dark grey mottled grey clay with some fine to medium angular to subangular gravel of weak mudstone and coal. Below about 2.70m, becoming brown with sandstone gravel). | 94.52          |                                                                                                                       | 1.70           | 1.70          | D 4             |           |                                                                |
|                                                                                                                                                                                           |                |                                                                                                                       |                | 2.00 - 2.45   | U 5             |           | 91 blows<br>0.30m recovery                                     |
|                                                                                                                                                                                           |                |                                                                                                                       | (1.90)         | 2.50          | D 6             |           |                                                                |
|                                                                                                                                                                                           |                |                                                                                                                       |                | 2.70          | D 7             |           |                                                                |
|                                                                                                                                                                                           |                |                                                                                                                       |                | 3.00 - 3.50   | U 8             |           | 71 blows<br>0.40m recovery                                     |
| Orange brown fine to coarse gravel of strong sandstone.                                                                                                                                   | 92.62          |                                                                                                                       | 3.60           | 3.50          | D 9             |           |                                                                |
|                                                                                                                                                                                           |                |                                                                                                                       |                | 3.70          | D 10            |           |                                                                |
| MADE GROUND (Stiff brown grey very silty clay with angular fine to coarse gravel of strong sandstone and gravel of mudstone) With a trace of brick gravel                                 |                |                                                                                                                       | (1.70)         | 4.00 - 4.45   | B 11            | C<br>N=29 | 17,19/5,9,7,8<br>U100 attempted, no penetration after 30 blows |
|                                                                                                                                                                                           |                |                                                                                                                       |                | 4.00 - 4.50   | U -             |           |                                                                |
|                                                                                                                                                                                           |                |                                                                                                                       |                | 4.70          | D 12            |           |                                                                |
|                                                                                                                                                                                           | 90.92          |                                                                                                                       | 5.30           | 5.00 - 5.45   | U 13            |           | 81 blows<br>0.40m recovery                                     |
|                                                                                                                                                                                           |                |                                                                                                                       |                | 5.50          | D 14            |           |                                                                |
| MADE GROUND (Stiff to very stiff grey very silty clay, with much angular fine to medium gravel of weak to very weak mudstone and siltstone).                                              |                |                                                                                                                       | (1.50)         | 6.00          | D 15            |           |                                                                |
|                                                                                                                                                                                           |                |                                                                                                                       |                | 6.50 - 6.95   | U 16            |           | 92 blows<br>0.40m recovery                                     |
| Stiff dark brown grey very silty CLAY with occasional fibrous rootlets. (BURIED TOPSOIL)                                                                                                  | 89.42          |                                                                                                                       | 6.80           | 7.00          | D 17            |           |                                                                |
|                                                                                                                                                                                           |                |                                                                                                                       | (0.80)         |               |                 |           |                                                                |
|                                                                                                                                                                                           | 88.62          |                                                                                                                       | 7.60           | 7.60          | D 18            |           |                                                                |
| Very stiff orange brown, blue grey and dark grey mottled very silty CLAY, with a trace of fibrous plant rootlets and fine gravel of coal                                                  | 88.32          |                                                                                                                       | (0.30)         | 7.60 - 8.10   | U 19            |           | 88 blows<br>0.40m recovery                                     |
|                                                                                                                                                                                           |                |                                                                                                                       | 7.90           | 8.10          | D 20            |           |                                                                |
|                                                                                                                                                                                           |                |                                                                                                                       |                | 8.50          | D 21            |           |                                                                |
| Gravel with some sandy clay                                                                                                                                                               |                |                                                                                                                       | (3.80)         | 9.00 - 9.45   |                 | C<br>N=33 | 6,11/7,8,9,9                                                   |
| Very stiff grey mottled orange brown sandy CLAY with some angular to subangular fine to medium gravel of moderately strong sandstone and mudstone.                                        |                |                                                                                                                       |                | 9.00 - 9.50   | B 22            |           |                                                                |
|                                                                                                                                                                                           |                |                                                                                                                       |                | 10.00         | D 23            |           |                                                                |
| <b>Remarks</b><br>1. Chiselling from 4.00 to 4.30m, 30 mins; 8.90 to 9.00m, 15 mins and 12.30 to 13.00m, 1 hour.                                                                          |                |                                                                                                                       |                |               |                 |           | <b>Logged by</b><br>AJQ                                        |
| <b>Notes:</b><br>Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics 05.07.93/15.23 (Ver 4.1.27)           |                |                                                                                                                       |                |               |                 |           | <b>Scale</b><br>1:50                                           |
| <b>Fig.</b><br>34                                                                                                                                                                         |                |                                                                                                                       |                |               |                 |           |                                                                |



| Soil Mechanics                                                                                                                                                 |               | SE12NE 912                                                  |               | BOREHOLE No.29            |             |     |               |                             |                               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------------------------------------------------------------|---------------|---------------------------|-------------|-----|---------------|-----------------------------|-------------------------------|
| Equipment & Methods<br>As sheet 1                                                                                                                              |               | Location No. 7808<br>Location<br>M62 (EAST)/M606 LINK ROADS |               | Sheet: 2 of 4             |             |     |               |                             |                               |
| Carried out for<br>Department of Transport                                                                                                                     |               | Ground Level                                                |               | Coordinates<br>As sheet 1 |             |     |               |                             |                               |
| Date                                                                                                                                                           |               |                                                             |               |                           |             |     |               |                             |                               |
| Description                                                                                                                                                    | Reduced Level | Legend                                                      | Depth (Thick) | Samples/Tests             |             |     | Field Records |                             |                               |
|                                                                                                                                                                |               |                                                             |               | Depth                     | Sample Type | No. | Test          |                             |                               |
| CLAY (As sheet 1)<br>Very sandy clayey gravel                                                                                                                  |               |                                                             | (3.80)        | 10.50 - 10.95             | U           | 24  |               | 135 blows<br>0.40m recovery |                               |
|                                                                                                                                                                |               |                                                             |               | 11.00                     | D           | 25  |               |                             |                               |
|                                                                                                                                                                |               |                                                             |               | 11.20                     | W           | 30  |               |                             |                               |
|                                                                                                                                                                |               |                                                             |               | 11.50                     | D           | 26  |               |                             |                               |
|                                                                                                                                                                | 84.52         |                                                             | 11.70         |                           |             |     |               |                             |                               |
| Grey highly weathered MUDSTONE weak to very weak. Recovered as angular fine to coarse gravel.                                                                  |               |                                                             | (1.38)        | 12.00 - 12.32             | D           | 27  | S 49          | 5,9/15,21,13 for 25mm       |                               |
|                                                                                                                                                                |               |                                                             |               | 12.00 - 12.50             | B           | 28  |               |                             |                               |
|                                                                                                                                                                |               |                                                             |               | 12.80 - 13.08             | D           | 29  | S 50          | 14,18/21,29 for 50mm        |                               |
| NI, recovered as clay with a little gravel.                                                                                                                    | 83.14         | x x x                                                       | 13.08         |                           | W           | TCR | SCR           | RQD                         | If                            |
|                                                                                                                                                                |               | x x x                                                       |               | 13.00 - 13.50             | 100         | 100 | 12            | 0                           |                               |
| Grey slightly to moderately weathered thinly bedded SILTSTONE, very weak to moderately weak, extremely to very closely fractured.                              |               | x x x                                                       |               | 13.50 - 14.00             | 0           | 100 | 0             | 0                           |                               |
| Intact                                                                                                                                                         |               | x x x                                                       | (2.22)        |                           |             |     |               |                             | NI<br>NI 100<br>(>25)         |
| (Possibly DISTURBED)                                                                                                                                           |               | x x x                                                       |               | 14.00 - 15.10             | 0           | 100 | 37            | 18                          |                               |
| NI, recovered as gravel.                                                                                                                                       |               | x x x                                                       |               |                           |             |     |               |                             |                               |
|                                                                                                                                                                | 80.92         | x x x                                                       | 15.30         |                           |             |     |               |                             |                               |
| NI, recovered as clayey gravel.                                                                                                                                |               |                                                             |               | 15.10 - 16.10             | 0           | 100 | 0             | 0                           |                               |
| NI, recovered as clayey gravel.                                                                                                                                |               |                                                             |               |                           |             |     |               |                             |                               |
| Grey to dark grey highly weathered MUDSTONE, very weak, very closely fractured.                                                                                |               |                                                             |               | 16.10 - 17.10             | 0           | 100 | 18            | 0                           | NI<br>NI 30<br>(>25)          |
| (Possibly DISTURBED)                                                                                                                                           |               |                                                             | (3.20)        |                           |             |     |               |                             |                               |
| No recovery                                                                                                                                                    |               |                                                             |               | 17.10 - 17.70             | 100         | 0   | 0             | 0                           | Gas test at 17.10m, 1% LEL    |
| NI, recovered as gravel of black mudstone.                                                                                                                     |               |                                                             |               |                           |             |     |               |                             |                               |
| Grey to dark grey carbonaceous MUDSTONE, very weak. Recovered as gravelly clay.                                                                                |               |                                                             |               | 17.70 - 18.80             | 100         | 73  | 26            | 0                           |                               |
|                                                                                                                                                                | 77.72         |                                                             | 18.50         |                           |             |     |               |                             |                               |
|                                                                                                                                                                |               |                                                             | (0.35)        |                           |             |     |               |                             | NI                            |
| Grey moderately weathered thinly bedded SILTSTONE, weak to moderately weak very closely fractured with occasional dark grey plant remains. (SEATEARTH)         | 77.37         | x x x                                                       | 18.85         |                           |             |     |               |                             |                               |
|                                                                                                                                                                |               | x x x                                                       | (0.45)        |                           |             |     |               |                             | NI<br>NI 130<br>(>25)         |
|                                                                                                                                                                | 76.92         | x x x                                                       | 19.30         | 18.80 - 20.40             | 100         | 94  | 67            | 67                          | NI<br>NI 90<br>NI 200<br>(10) |
|                                                                                                                                                                |               | x x x                                                       | (3.20)        |                           |             |     |               |                             |                               |
| SILTSTONE (As sheet 3)                                                                                                                                         |               | x x x                                                       |               |                           |             |     |               |                             |                               |
| Remarks                                                                                                                                                        |               |                                                             |               |                           |             |     |               | Logged by<br>AJQ            |                               |
| Notes:                                                                                                                                                         |               |                                                             |               |                           |             |     |               | Scale<br>1:50               |                               |
| Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics 05.07.93/15.23 (Ver 4.1.27) |               |                                                             |               |                           |             |     |               | Fig.<br>34                  |                               |



| Soil Mechanics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               | BOREHOLE No. 29                                                                                                                |                     |                    |                       |                     |      |                   |                          |                                |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------------------------------------------------------------------------------------------------------------------|---------------------|--------------------|-----------------------|---------------------|------|-------------------|--------------------------|--------------------------------|---------|------|--|--|--|--|--|-------|---|------|------|------|--|-------|---|------|------|---|--|-------|---|-------|-------|-------|-------------------|-------|---|-------|-------|-------|--------|-------|------|-------|-------|------|-------------|-------|------|-------|-------|------|-----------------------|-------|------|-------|-------|------|--|-------|------|-------|-------|------|--|--|--|--|--|--|
| Equipment & Methods<br>As sheet 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |               | Location No. 7808<br>Location<br>M62 (EAST)/M606 LINK ROADS                                                                    |                     |                    |                       |                     |      |                   |                          |                                |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
| Carried out for<br>Department of Transport                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |               | Ground Level<br>Coordinates<br>Date<br>As sheet 1                                                                              |                     |                    |                       |                     |      |                   |                          |                                |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
| Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Reduced Level | Legend                                                                                                                         | Depth (Thick)       | Drilling Records   |                       | Mechanical core log |      |                   |                          | Field Records and Test Results |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                                                                                                                                |                     | Depth              | W                     | TCR                 | SCR  | RQD               | If                       |                                |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
| Dark grey thinly bedded moderately to slightly weathered SILTSTONE, weak to moderately strong, closely fractured. Discontinuities, 1. subhorizontal, planar and smooth, with occasional soft clay infill (<10mm).<br><br>Below 21.70m, occasional thin laminae and thin beds of fine sandstone.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 73.72         | x x x<br>x x x<br>x x x<br>x x x<br>x x x<br>x x x<br>x x x<br>x x x<br>x x x<br>x x x                                         | (3.20)              | 18.80 - 20.40      | 100                   | 94                  | 67   | 67                | NI<br>90<br>200<br>(10)  | Gas test at 23.10m, 1% LEL     |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                                                                                                                                |                     | 20.40 - 21.70      | 100                   | 96                  | 73   | 49                |                          |                                |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                                                                                                                                |                     | 21.70 - 23.10      | 100                   | 100                 | 78   | 66                |                          |                                |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                                                                                                                                |                     | 23.10 - 24.60      | 100                   | 100                 | 95   | 91                |                          |                                |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                                                                                                                                |                     |                    |                       |                     |      |                   |                          |                                |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                                                                                                                                |                     |                    |                       |                     |      |                   |                          |                                |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                                                                                                                                |                     |                    |                       |                     |      |                   |                          |                                |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                                                                                                                                |                     |                    |                       |                     |      |                   |                          |                                |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                                                                                                                                |                     |                    |                       |                     |      |                   |                          |                                |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                                                                                                                                |                     |                    |                       |                     |      |                   |                          |                                |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
| Light grey fine to medium grained thinly to thickly laminated very thinly bedded slightly weathered SANDSTONE, strong, closely to medium fractured.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 71.62         | • • • • •<br>• • • • •<br>• • • • •<br>• • • • •<br>• • • • •<br>• • • • •<br>• • • • •<br>• • • • •<br>• • • • •<br>• • • • • | (2.10 pen)          | 23.10 - 24.60      | 100                   | 100                 | 95   | 91                | NI<br>100<br>300<br>(10) |                                |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
| BOREHOLE ENDS AT 24.60 m.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |                                                                                                                                |                     | 24.60              |                       |                     |      |                   |                          |                                |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
| <table border="1"><caption>Water Level Observations During Boring</caption><thead><tr><th>Date</th><th>Time</th><th>Depth of Hole (m)</th><th>Depth of Casing (m)</th><th>Depth to Water (m)</th><th>Remarks</th></tr></thead><tbody><tr><td>1993</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>22.01</td><td>-</td><td>3.00</td><td>3.00</td><td>2.90</td><td></td></tr><tr><td>23.01</td><td>-</td><td>3.00</td><td>3.00</td><td>-</td><td></td></tr><tr><td>23.01</td><td>-</td><td>10.50</td><td>10.50</td><td>10.50</td><td>No water observed</td></tr><tr><td>23.01</td><td>-</td><td>10.50</td><td>10.50</td><td>10.50</td><td>Sealed</td></tr><tr><td>29.01</td><td>1000</td><td>13.00</td><td>13.00</td><td>7.85</td><td>Water entry</td></tr><tr><td>29.01</td><td>1400</td><td>17.10</td><td>17.10</td><td>1.45</td><td>No rise after 20 mins</td></tr><tr><td>01.02</td><td>1035</td><td>17.10</td><td>17.10</td><td>7.88</td><td></td></tr><tr><td>01.02</td><td>1715</td><td>24.60</td><td>17.10</td><td>9.53</td><td></td></tr></tbody></table> |               |                                                                                                                                |                     |                    |                       | Date                | Time | Depth of Hole (m) | Depth of Casing (m)      | Depth to Water (m)             | Remarks | 1993 |  |  |  |  |  | 22.01 | - | 3.00 | 3.00 | 2.90 |  | 23.01 | - | 3.00 | 3.00 | - |  | 23.01 | - | 10.50 | 10.50 | 10.50 | No water observed | 23.01 | - | 10.50 | 10.50 | 10.50 | Sealed | 29.01 | 1000 | 13.00 | 13.00 | 7.85 | Water entry | 29.01 | 1400 | 17.10 | 17.10 | 1.45 | No rise after 20 mins | 01.02 | 1035 | 17.10 | 17.10 | 7.88 |  | 01.02 | 1715 | 24.60 | 17.10 | 9.53 |  |  |  |  |  |  |
| Date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Time          | Depth of Hole (m)                                                                                                              | Depth of Casing (m) | Depth to Water (m) | Remarks               |                     |      |                   |                          |                                |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
| 1993                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               |                                                                                                                                |                     |                    |                       |                     |      |                   |                          |                                |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
| 22.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | -             | 3.00                                                                                                                           | 3.00                | 2.90               |                       |                     |      |                   |                          |                                |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
| 23.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | -             | 3.00                                                                                                                           | 3.00                | -                  |                       |                     |      |                   |                          |                                |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
| 23.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | -             | 10.50                                                                                                                          | 10.50               | 10.50              | No water observed     |                     |      |                   |                          |                                |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
| 23.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | -             | 10.50                                                                                                                          | 10.50               | 10.50              | Sealed                |                     |      |                   |                          |                                |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
| 29.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1000          | 13.00                                                                                                                          | 13.00               | 7.85               | Water entry           |                     |      |                   |                          |                                |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
| 29.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1400          | 17.10                                                                                                                          | 17.10               | 1.45               | No rise after 20 mins |                     |      |                   |                          |                                |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
| 01.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1035          | 17.10                                                                                                                          | 17.10               | 7.88               |                       |                     |      |                   |                          |                                |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
| 01.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1715          | 24.60                                                                                                                          | 17.10               | 9.53               |                       |                     |      |                   |                          |                                |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
| Remarks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               |                                                                                                                                |                     |                    |                       |                     |      |                   |                          |                                |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
| Notes:<br>Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics<br>All depths and reduced levels in metres. Thicknesses given in brackets in depth column.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               |                                                                                                                                |                     |                    |                       |                     |      |                   |                          |                                |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |
| Logged by<br>AJQ<br>Scale<br>1:50<br>Fig. 34                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |               |                                                                                                                                |                     |                    |                       |                     |      |                   |                          |                                |         |      |  |  |  |  |  |       |   |      |      |      |  |       |   |      |      |   |  |       |   |       |       |       |                   |       |   |       |       |       |        |       |      |       |       |      |             |       |      |       |       |      |                       |       |      |       |       |      |  |       |      |       |       |      |  |  |  |  |  |  |

|                                                            |                                                                                                                                                                                     |                        |
|------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| <b>Soil Mechanics</b>                                      | <b>SEIZNE 912</b>                                                                                                                                                                   | <b>BOREHOLE No. 29</b> |
| Location No. 7808<br>Location M62 (EAST) / M606 LINK ROADS | Type of installation Slotted standpipe<br>Date of installation 2.2.93<br>Internal diameter of tubing 19/ 19 mm<br>Length of filter 12000/ 6600 mm<br>Diameter of filter 150/ 120 mm | Sheet 4 of 4           |
| Carried out for Department of Transport                    |                                                                                                                                                                                     |                        |

| Depth (m) |       | <b>SUMMARY OF INSTALLATION</b>  |
|-----------|-------|---------------------------------|
| From      | To    |                                 |
|           |       | Surface protection : Gas barrel |
| 0.00      | .50   | Concrete                        |
| .50       | 2.00  | Bentonite seal                  |
| 7.50      | 12.50 | Slotted section                 |
| 2.00      | 13.00 | Gravel                          |
| 13.00     | 18.00 | Bentonite seal                  |
| 19.00     | 24.00 | Slotted section                 |
| 18.00     | 24.60 | Gravel                          |
|           |       |                                 |
|           |       |                                 |
|           |       |                                 |
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|           |       |                                 |
|           |       |                                 |
|           |       |                                 |
|           |       |                                 |
|           |       |                                 |

| Legend | Depth below Ground level(m) |
|--------|-----------------------------|
| a      | .50                         |
| d      | 2.00                        |
| c      | 13.00                       |
| d      | 18.00                       |
| c      | 24.00                       |
| c      | 24.60                       |

key

a Concrete

d Bentonite seal

b Sand filter

e Bentonite/cement grout

c Gravel filter

f Backfill

Remarks

- Ground level and coordinates as sheet 1

(C) Soil Mechanics V1.0 04-08-1993 15:32:06

## DETAILS OF INSTRUMENTS

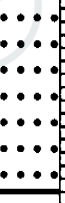
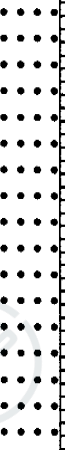
| Soil Mechanics                                                                                                                                                                                                                                                                                           |                                                                                                                    | BOREHOLE No. 30                                                                                                       |                |               |                 |           |                                               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|----------------|---------------|-----------------|-----------|-----------------------------------------------|
| <b>Equipment &amp; Methods</b><br>Hand excavated inspection pit to 1.20m. Cable tool boring, 150mm diameter to 11.80m. Rotary core drilling, 92mm diameter using Edeco T30, air/mist flush.                                                                                                              |                                                                                                                    | <b>Location No.</b> 7808<br><b>Location</b> M62 (EAST)/M606 LINK ROADS<br>SE12NE 913<br>18136 26974.                  |                |               |                 |           |                                               |
| <b>Carried out for</b><br>Department of Transport                                                                                                                                                                                                                                                        |                                                                                                                    | <b>Ground Level</b> 96.76 = A.O.D.<br><b>Coordinates</b> 8141.71m E<br>6973.31m N<br><b>Date</b> 21.01.93 to 03.02.93 |                |               |                 |           |                                               |
| Description                                                                                                                                                                                                                                                                                              | Reduced Level                                                                                                      | Legend                                                                                                                | Depth (Thick)  | Samples/Tests |                 |           | Field Records                                 |
|                                                                                                                                                                                                                                                                                                          |                                                                                                                    |                                                                                                                       |                | Depth         | Sample Type No. | Test      |                                               |
| TOPSOIL                                                                                                                                                                                                                                                                                                  | 96.76<br>96.61                                                                                                     |                                                                                                                       | (0.15)<br>0.15 | 0.15 - 0.50   | B 1             |           |                                               |
| MADE GROUND (Very stiff grey brown very silty clay with much angular to subrounded fine to coarse gravel of strong sandstone and moderately strong mudstone)<br><br>Occasional cobbles of strong sandstone and organic odour.                                                                            |                                                                                                                    |                                                                                                                       |                | 0.50 - 1.00   | B 2             | C<br>N=45 | 7,12/15,9,11,10                               |
|                                                                                                                                                                                                                                                                                                          |                                                                                                                    |                                                                                                                       | (1.95)         | 1.00 - 1.45   | B 3             |           |                                               |
|                                                                                                                                                                                                                                                                                                          |                                                                                                                    |                                                                                                                       |                | 1.00 - 1.50   | B 3             |           |                                               |
|                                                                                                                                                                                                                                                                                                          |                                                                                                                    |                                                                                                                       |                | 1.70          | D 4             |           |                                               |
| MADE GROUND (Firm to stiff very silty clay with subangular gravel of very weak siltstone.<br><br>A trace of brick gravel<br><br>Below about 3.50m, with a trace of subrounded fine to coarse gravel of strong sandstone                                                                                  | 94.66                                                                                                              |                                                                                                                       | 2.10           | 2.00 - 2.50   | U 5             |           | 105 blows<br>0.30m recovery                   |
|                                                                                                                                                                                                                                                                                                          |                                                                                                                    |                                                                                                                       |                | 2.50          | D 6             |           |                                               |
|                                                                                                                                                                                                                                                                                                          |                                                                                                                    |                                                                                                                       |                | 2.70          | D 7             |           |                                               |
|                                                                                                                                                                                                                                                                                                          |                                                                                                                    |                                                                                                                       |                | 3.00 - 3.50   | U 8             |           | 71 blows<br>0.40m recovery                    |
|                                                                                                                                                                                                                                                                                                          |                                                                                                                    |                                                                                                                       |                | 3.50          | D 9             |           |                                               |
|                                                                                                                                                                                                                                                                                                          |                                                                                                                    |                                                                                                                       | (3.10)         | 3.80          | D 10            |           |                                               |
|                                                                                                                                                                                                                                                                                                          |                                                                                                                    |                                                                                                                       |                | 4.00 - 4.50   | U 11            |           | 65 blows<br>0.40m recovery                    |
| Stiff dark grey organic very clayey SILT with occasional fibrous matter, diameter <3mm<br><br>(POSSIBLE BURIED TOPSOIL)<br><br>Stiff very silty clay with occasional fine gravel of very weak sandstone and coal                                                                                         | 91.56                                                                                                              |                                                                                                                       | 5.20           | 5.00 - 5.50   | U 14            |           | 120 blows<br>0.40m recovery                   |
|                                                                                                                                                                                                                                                                                                          |                                                                                                                    |                                                                                                                       |                | 5.50          | D 15            |           |                                               |
|                                                                                                                                                                                                                                                                                                          |                                                                                                                    |                                                                                                                       | (1.90)         | 6.00          | D 16            |           |                                               |
|                                                                                                                                                                                                                                                                                                          |                                                                                                                    |                                                                                                                       |                | 6.50 - 7.00   | U 17            |           | 111 blows<br>0.35m recovery                   |
| Stiff yellow brown mottled grey very silty sandy CLAY with some rounded fine to medium gravel of moderately strong to strong sandstone, occasional gravel of weak coal<br><br>Orange brown<br><br>Occasional fine to coarse gravel of thinly laminated mudstone<br><br>Below about 8.50m, becoming brown | 89.66                                                                                                              |                                                                                                                       | 7.10           | 7.00          | D 18            |           |                                               |
|                                                                                                                                                                                                                                                                                                          |                                                                                                                    |                                                                                                                       |                | 7.50          | D 19            |           |                                               |
|                                                                                                                                                                                                                                                                                                          |                                                                                                                    |                                                                                                                       |                | 7.60 - 8.00   | U 20            |           | 150 blows<br>0.35m recovery                   |
|                                                                                                                                                                                                                                                                                                          |                                                                                                                    |                                                                                                                       |                | 8.00          | D 21            |           |                                               |
|                                                                                                                                                                                                                                                                                                          |                                                                                                                    |                                                                                                                       | (3.10)         | 8.50          | D 22            |           |                                               |
|                                                                                                                                                                                                                                                                                                          |                                                                                                                    |                                                                                                                       |                | 9.00 - 9.45   | D 23            | S<br>N=24 | 4,8/6,6,5,7                                   |
|                                                                                                                                                                                                                                                                                                          |                                                                                                                    |                                                                                                                       |                | 9.00 - 9.50   | B 24            |           |                                               |
|                                                                                                                                                                                                                                                                                                          | <b>Remarks</b><br>1. Chiselling from 1.20 to 1.60m, 30 mins; 10.80 to 11.20m, 15 mins and 11.20 to 11.70m, 1 hour. |                                                                                                                       |                |               |                 |           |                                               |
| <b>Notes:</b><br>Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics 05.07.93/15.46 (Ver 4.1.27)                                                                                                                          |                                                                                                                    |                                                                                                                       |                |               |                 |           | <b>Scale</b><br>1:50<br><br><b>Fig.</b><br>35 |

| Soil Mechanics                                                                                                                                                                                                |               | SE12NE 913                                                  |                 | BOREHOLE No.30 |                 | Sheet 2 of 5 |                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------------------------------------------------------------|-----------------|----------------|-----------------|--------------|---------------------------|
| Equipment & Methods<br>As sheet 1                                                                                                                                                                             |               | Location No. 7808<br>Location<br>M62 (EAST)/M606 LINK ROADS |                 |                |                 |              |                           |
| Carried out for<br>Department of Transport                                                                                                                                                                    |               | Ground Level                                                |                 | Coordinates    |                 | Date         |                           |
|                                                                                                                                                                                                               |               | As sheet 1                                                  |                 | As sheet 1     |                 |              |                           |
| Description                                                                                                                                                                                                   | Reduced Level | Legend                                                      | Depth (Thick)   | Samples/Tests  |                 |              | Field Records             |
|                                                                                                                                                                                                               |               |                                                             |                 | Depth          | Sample Type No. | Test         |                           |
| Very silty CLAY (As sheet 1)                                                                                                                                                                                  | 86.56         |                                                             | (3.10)<br>10.20 | 10.20 - 10.70  | D 25            | C 50         | 8,11/12,13,15,10 for 25mm |
| Stiff grey very silty CLAY with much subangular fine to coarse gravel of weak to strong sandstone                                                                                                             | 86.16         |                                                             | (0.40)<br>10.60 | 10.30 - 10.80  | B 26            |              |                           |
| Grey fine to coarse thinly laminated sandstone GRAVEL, moderately weak                                                                                                                                        | 85.56         |                                                             | (0.60)<br>11.20 | 11.20 - 11.70  | B 27            |              | 17,21/50 for 50mm         |
| Recovered as soft with a little to some fine to medium gravel of mudstone and a little fine to medium gravel of sandstone.                                                                                    | 84.96         |                                                             | (0.60)<br>11.80 | 11.70 - 11.80  | D 28            | S (50)       |                           |
| Grey highly weathered MUDSTONE, very weak extremely closely fractured, recovered as slightly clayey fine to coarse gravel. Fractures: planar and rough to smooth.                                             |               |                                                             |                 | 11.80 - 12.60  | 100 97          | - -          | NI                        |
| Very thin bed of very strong ironstone                                                                                                                                                                        |               |                                                             |                 | 12.60 - 14.10  | 92 28           | -            |                           |
| Grey thinly laminated highly weathered MUDSTONE and SILTSTONE recovered as soft to firm clay with much angular fine to coarse very weak to weak gravel.                                                       |               |                                                             | (4.50)          | 14.10 - 15.60  | 81 23           | -            | NI                        |
| Coarse gravel size fragments of very strong ironstone                                                                                                                                                         |               |                                                             |                 | 15.60 - 15.80  | - -             | -            |                           |
| Dark grey thinly to thickly laminated moderately weathered slightly carbonaceous MUDSTONE, weak to moderately weak. Recovered as 10-30mm tabular gravel.                                                      | 80.46         |                                                             | 16.30 (0.25)    | 15.80 - 17.30  | 97 17           | -            | NI/NI/30 (>25)            |
| Grey thinly to thickly laminated moderately weathered SILTSTONE, weak very closely fractured with some dark grey fossil plant fragments. Discontinuities: Curved and smooth polished. (SEATEARTH)             | 80.21         | x x x                                                       | 16.55 (0.50)    |                |                 |              | NI NI 90 (>25)            |
| Completely weathered thin bed                                                                                                                                                                                 | 79.71         | x x x                                                       | 17.05           | 17.30 - 18.80  | 92 51           | -            | NI 60 90 (17)             |
|                                                                                                                                                                                                               |               | x x x                                                       | (2.67)          | 18.80 - 20.30  | 89 68           | 16           |                           |
| Grey sandy moderately to slightly weathered SILTSTONE, moderately weak to moderately strong. Closely fractured. Discontinuities: 1. Subhorizontal, planar and smooth with occasional soft clay infill (<5mm). | 77.04         | x x x                                                       | 19.72           |                |                 |              |                           |
| SANDSTONE (As sheet 2)                                                                                                                                                                                        |               |                                                             |                 |                |                 |              |                           |
| Remarks                                                                                                                                                                                                       |               |                                                             |                 |                |                 |              | Logged by                 |
| 2. Chiselling from 10.80 to 11.20m, 15 mins and 11.20 to 11.70m, 1 hour.                                                                                                                                      |               |                                                             |                 |                |                 |              | AJQ                       |
| 3. Water sample taken at 20.30m.                                                                                                                                                                              |               |                                                             |                 |                |                 |              | Scale                     |
| Notes:                                                                                                                                                                                                        |               |                                                             |                 |                |                 |              | 1:50                      |
| Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics 16.07.93/10.34 (Ver 4.1.27)                                                |               |                                                             |                 |                |                 |              | Fig. 35                   |



| Soil Mechanics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               | SE12NE913                                                                             |                | BOREHOLE No.30              |     |                     |     |                                |                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------|----------------|-----------------------------|-----|---------------------|-----|--------------------------------|----------------|
| Equipment & Methods<br>As sheet 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               | Location No. 7808<br>Location<br>M62 (EAST)/M606 LINK ROADS                           |                | Sheet 3 of 5                |     |                     |     |                                |                |
| Carried out for<br>Department of Transport                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               | Ground Level                                                                          |                | Coordinates<br>As sheet 1   |     |                     |     |                                |                |
| Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Reduced Level | Legend                                                                                | Depth (Thick)  | Drilling Records            |     | Mechanical core log |     | Field Records and Test Results |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |                                                                                       |                | Depth                       | M   | TCR                 | SCR |                                | RQD            |
| <p>Light grey fine to medium grained thinly laminated slightly weathered micaceous SANDSTONE, very strong, closely to medium fractured, with cross bedding, lode and flame structures and some dark grey laminations</p> <p>Below 26.00m, discontinuities becoming very closely to closely spaced predominantly 80 deg, planar and parallel with occasional clayey sand infill. Occasional fractures are incipient exhibiting fresh surfaces.</p> <p>Below 29.30m, occasional laminations. Discontinuities:<br/>1. Horizontal, planar, smooth.<br/>2. 80-90 deg, planar slightly uneven with occasional infill (30-50mm) of clay and sandstone gravel.</p> |               | <p>55 deg intersecting discontinuities</p> <p>55 deg intersecting discontinuities</p> | <p>(11.78)</p> | 18.80 - 20.30               | 100 | 89                  | 68  | 16                             | N1 140 240 (7) |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |                                                                                       |                | 20.30 - 21.80               |     | 99                  | 87  | 33                             |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |                                                                                       |                | 21.80 - 23.30               |     | 98                  | 76  | 63                             |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |                                                                                       |                | 23.30 - 24.80               |     | 100                 | 79  | 60                             |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |                                                                                       |                | 24.80 - 26.30               |     | 97                  | 72  | 53                             |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |                                                                                       |                | 26.30 - 27.80               |     | 99                  | 32  | -                              |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |                                                                                       |                | 27.80 - 29.30               |     | 95                  | 35  | 9                              |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |                                                                                       |                | 29.30 - 30.05               |     | 83                  | 35  | 17                             |                |
| Remarks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               | Logged by<br>AJQ                                                                      |                | Scale<br>1:50               |     |                     |     |                                |                |
| Notes:<br>Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics<br>All depths and reduced levels in metres. Thicknesses given in brackets in depth column.                                                                                                                                                                                                                                                                                                                                                                                                                    |               | Fig. 35                                                                               |                | 08.07.93/15.47 (Ver 4.1.27) |     |                     |     |                                |                |



|  <b>Soil Mechanics</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               | <b>BOREHOLE No.30</b>                                                              |                     |                    |                                           |                     |     |     |                           |                                |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |      |   |              |       |   |      |      |      |                                           |       |   |       |       |   |                   |       |      |       |       |      |         |       |   |       |       |   |                |       |      |       |       |      |             |       |      |       |       |      |              |       |      |       |       |   |                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------------------------------------------------------------------------------|---------------------|--------------------|-------------------------------------------|---------------------|-----|-----|---------------------------|--------------------------------|------|------|-------------------|---------------------|--------------------|---------|------|--|--|--|--|--|-------|---|------|------|---|--------------|-------|---|------|------|------|-------------------------------------------|-------|---|-------|-------|---|-------------------|-------|------|-------|-------|------|---------|-------|---|-------|-------|---|----------------|-------|------|-------|-------|------|-------------|-------|------|-------|-------|------|--------------|-------|------|-------|-------|---|----------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |               | <b>SE12NE 913</b>                                                                  |                     |                    |                                           |                     |     |     |                           |                                |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |      |   |              |       |   |      |      |      |                                           |       |   |       |       |   |                   |       |      |       |       |      |         |       |   |       |       |   |                |       |      |       |       |      |             |       |      |       |       |      |              |       |      |       |       |   |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |               | Sheet 4 of 5                                                                       |                     |                    |                                           |                     |     |     |                           |                                |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |      |   |              |       |   |      |      |      |                                           |       |   |       |       |   |                   |       |      |       |       |      |         |       |   |       |       |   |                |       |      |       |       |      |             |       |      |       |       |      |              |       |      |       |       |   |                |
| Equipment & Methods<br>As sheet 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               | Location No. 7808<br>Location<br>M62 (EAST)/M606 LINK ROADS                        |                     |                    |                                           |                     |     |     |                           |                                |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |      |   |              |       |   |      |      |      |                                           |       |   |       |       |   |                   |       |      |       |       |      |         |       |   |       |       |   |                |       |      |       |       |      |             |       |      |       |       |      |              |       |      |       |       |   |                |
| Carried out for<br>Department of Transport                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |               | Ground Level<br>Coordinates<br>Date<br>As sheet 1                                  |                     |                    |                                           |                     |     |     |                           |                                |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |      |   |              |       |   |      |      |      |                                           |       |   |       |       |   |                   |       |      |       |       |      |         |       |   |       |       |   |                |       |      |       |       |      |             |       |      |       |       |      |              |       |      |       |       |   |                |
| Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Reduced Level | Legend                                                                             | Depth (Thick)       | Drilling Records   |                                           | Mechanical core log |     |     |                           | Field Records and Test Results |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |      |   |              |       |   |      |      |      |                                           |       |   |       |       |   |                   |       |      |       |       |      |         |       |   |       |       |   |                |       |      |       |       |      |             |       |      |       |       |      |              |       |      |       |       |   |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |               |                                                                                    |                     | Depth              | W                                         | TCR                 | SCR | RQD | If                        |                                |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |      |   |              |       |   |      |      |      |                                           |       |   |       |       |   |                   |       |      |       |       |      |         |       |   |       |       |   |                |       |      |       |       |      |             |       |      |       |       |      |              |       |      |       |       |   |                |
| SANDSTONE (As sheet 3)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 65.26         |   | (11.78)             | 29.30 - 30.05      |                                           |                     |     |     |                           |                                |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |      |   |              |       |   |      |      |      |                                           |       |   |       |       |   |                   |       |      |       |       |      |         |       |   |       |       |   |                |       |      |       |       |      |             |       |      |       |       |      |              |       |      |       |       |   |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |               |                                                                                    |                     | 30.05 - 31.50      |                                           | 85                  | 59  | 24  | NI 70 140 (14)            |                                |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |      |   |              |       |   |      |      |      |                                           |       |   |       |       |   |                   |       |      |       |       |      |         |       |   |       |       |   |                |       |      |       |       |      |             |       |      |       |       |      |              |       |      |       |       |   |                |
| Light grey fine to medium grained slightly weathered SANDSTONE, very strong, closely fractured with occasional dark grey laminations of coal and carbonaceous mudstone.<br><br>Below 34.10m, with occasional siltstone laminations.<br>Discontinuities: 1. horizontal, planar and smooth.<br>2. 80 - 90 deg, planar slightly uneven with occasional infill (30 - 50mm) of clay and gravel of sandstone.<br><br>Non-intact, recovered as gravel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 65.26         |  | (3.55 pen)          | 31.50 - 33.00      | 100                                       | 99                  | 87  | 63  |                           |                                |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |      |   |              |       |   |      |      |      |                                           |       |   |       |       |   |                   |       |      |       |       |      |         |       |   |       |       |   |                |       |      |       |       |      |             |       |      |       |       |      |              |       |      |       |       |   |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |               |                                                                                    |                     | 33.00 - 34.10      |                                           | 100                 | 57  | 22  | NI 95 200 (11)            |                                |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |      |   |              |       |   |      |      |      |                                           |       |   |       |       |   |                   |       |      |       |       |      |         |       |   |       |       |   |                |       |      |       |       |      |             |       |      |       |       |      |              |       |      |       |       |   |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |               |                                                                                    |                     | 34.10 - 35.05      |                                           | 99                  | 62  | 28  | Gas test at 35.05m 1% LEL |                                |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |      |   |              |       |   |      |      |      |                                           |       |   |       |       |   |                   |       |      |       |       |      |         |       |   |       |       |   |                |       |      |       |       |      |             |       |      |       |       |      |              |       |      |       |       |   |                |
| BOREHOLE ENDS AT 35.05 m.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               | 61.71                                                                              | 35.05               |                    |                                           |                     |     |     |                           |                                |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |      |   |              |       |   |      |      |      |                                           |       |   |       |       |   |                   |       |      |       |       |      |         |       |   |       |       |   |                |       |      |       |       |      |             |       |      |       |       |      |              |       |      |       |       |   |                |
| <table border="1"><caption>Water Level Observations During Boring</caption><thead><tr><th>Date</th><th>Time</th><th>Depth of Hole (m)</th><th>Depth of Casing (m)</th><th>Depth to Water (m)</th><th>Remarks</th></tr></thead><tbody><tr><td>1993</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>21.01</td><td>-</td><td>9.50</td><td>9.00</td><td>-</td><td>End of shift</td></tr><tr><td>22.01</td><td>-</td><td>9.50</td><td>9.00</td><td>9.40</td><td>Overnight seepage, possibly surface water</td></tr><tr><td>22.01</td><td>-</td><td>11.80</td><td>10.50</td><td>-</td><td>No water observed</td></tr><tr><td>02.02</td><td>0800</td><td>11.80</td><td>11.80</td><td>9.53</td><td>Sealed.</td></tr><tr><td>02.02</td><td>-</td><td>20.30</td><td>15.80</td><td>-</td><td>Start of shift</td></tr><tr><td>02.02</td><td>1800</td><td>26.30</td><td>15.80</td><td>9.35</td><td>Water entry</td></tr><tr><td>03.02</td><td>0800</td><td>26.30</td><td>15.80</td><td>9.40</td><td>End of shift</td></tr><tr><td>03.02</td><td>1800</td><td>35.05</td><td>15.80</td><td>-</td><td>Start of shift</td></tr></tbody></table> |               |                                                                                    |                     |                    |                                           |                     |     |     |                           |                                | Date | Time | Depth of Hole (m) | Depth of Casing (m) | Depth to Water (m) | Remarks | 1993 |  |  |  |  |  | 21.01 | - | 9.50 | 9.00 | - | End of shift | 22.01 | - | 9.50 | 9.00 | 9.40 | Overnight seepage, possibly surface water | 22.01 | - | 11.80 | 10.50 | - | No water observed | 02.02 | 0800 | 11.80 | 11.80 | 9.53 | Sealed. | 02.02 | - | 20.30 | 15.80 | - | Start of shift | 02.02 | 1800 | 26.30 | 15.80 | 9.35 | Water entry | 03.02 | 0800 | 26.30 | 15.80 | 9.40 | End of shift | 03.02 | 1800 | 35.05 | 15.80 | - | Start of shift |
| Date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Time          | Depth of Hole (m)                                                                  | Depth of Casing (m) | Depth to Water (m) | Remarks                                   |                     |     |     |                           |                                |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |      |   |              |       |   |      |      |      |                                           |       |   |       |       |   |                   |       |      |       |       |      |         |       |   |       |       |   |                |       |      |       |       |      |             |       |      |       |       |      |              |       |      |       |       |   |                |
| 1993                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |               |                                                                                    |                     |                    |                                           |                     |     |     |                           |                                |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |      |   |              |       |   |      |      |      |                                           |       |   |       |       |   |                   |       |      |       |       |      |         |       |   |       |       |   |                |       |      |       |       |      |             |       |      |       |       |      |              |       |      |       |       |   |                |
| 21.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | -             | 9.50                                                                               | 9.00                | -                  | End of shift                              |                     |     |     |                           |                                |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |      |   |              |       |   |      |      |      |                                           |       |   |       |       |   |                   |       |      |       |       |      |         |       |   |       |       |   |                |       |      |       |       |      |             |       |      |       |       |      |              |       |      |       |       |   |                |
| 22.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | -             | 9.50                                                                               | 9.00                | 9.40               | Overnight seepage, possibly surface water |                     |     |     |                           |                                |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |      |   |              |       |   |      |      |      |                                           |       |   |       |       |   |                   |       |      |       |       |      |         |       |   |       |       |   |                |       |      |       |       |      |             |       |      |       |       |      |              |       |      |       |       |   |                |
| 22.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | -             | 11.80                                                                              | 10.50               | -                  | No water observed                         |                     |     |     |                           |                                |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |      |   |              |       |   |      |      |      |                                           |       |   |       |       |   |                   |       |      |       |       |      |         |       |   |       |       |   |                |       |      |       |       |      |             |       |      |       |       |      |              |       |      |       |       |   |                |
| 02.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0800          | 11.80                                                                              | 11.80               | 9.53               | Sealed.                                   |                     |     |     |                           |                                |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |      |   |              |       |   |      |      |      |                                           |       |   |       |       |   |                   |       |      |       |       |      |         |       |   |       |       |   |                |       |      |       |       |      |             |       |      |       |       |      |              |       |      |       |       |   |                |
| 02.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | -             | 20.30                                                                              | 15.80               | -                  | Start of shift                            |                     |     |     |                           |                                |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |      |   |              |       |   |      |      |      |                                           |       |   |       |       |   |                   |       |      |       |       |      |         |       |   |       |       |   |                |       |      |       |       |      |             |       |      |       |       |      |              |       |      |       |       |   |                |
| 02.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1800          | 26.30                                                                              | 15.80               | 9.35               | Water entry                               |                     |     |     |                           |                                |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |      |   |              |       |   |      |      |      |                                           |       |   |       |       |   |                   |       |      |       |       |      |         |       |   |       |       |   |                |       |      |       |       |      |             |       |      |       |       |      |              |       |      |       |       |   |                |
| 03.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0800          | 26.30                                                                              | 15.80               | 9.40               | End of shift                              |                     |     |     |                           |                                |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |      |   |              |       |   |      |      |      |                                           |       |   |       |       |   |                   |       |      |       |       |      |         |       |   |       |       |   |                |       |      |       |       |      |             |       |      |       |       |      |              |       |      |       |       |   |                |
| 03.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1800          | 35.05                                                                              | 15.80               | -                  | Start of shift                            |                     |     |     |                           |                                |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |      |   |              |       |   |      |      |      |                                           |       |   |       |       |   |                   |       |      |       |       |      |         |       |   |       |       |   |                |       |      |       |       |      |             |       |      |       |       |      |              |       |      |       |       |   |                |
| Remarks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |                                                                                    |                     |                    |                                           |                     |     |     |                           | Logged by<br>AJQ               |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |      |   |              |       |   |      |      |      |                                           |       |   |       |       |   |                   |       |      |       |       |      |         |       |   |       |       |   |                |       |      |       |       |      |             |       |      |       |       |      |              |       |      |       |       |   |                |
| Notes:<br>Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics<br>All depths and reduced levels in metres. Thicknesses given in brackets in depth column.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |                                                                                    |                     |                    |                                           |                     |     |     |                           | Scale<br>1:50                  |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |      |   |              |       |   |      |      |      |                                           |       |   |       |       |   |                   |       |      |       |       |      |         |       |   |       |       |   |                |       |      |       |       |      |             |       |      |       |       |      |              |       |      |       |       |   |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |               |                                                                                    |                     |                    |                                           |                     |     |     |                           | Fig.<br>35                     |      |      |                   |                     |                    |         |      |  |  |  |  |  |       |   |      |      |   |              |       |   |      |      |      |                                           |       |   |       |       |   |                   |       |      |       |       |      |         |       |   |       |       |   |                |       |      |       |       |      |             |       |      |       |       |      |              |       |      |       |       |   |                |

|                                                            |  |  |  |                                        |  |                 |  |
|------------------------------------------------------------|--|--|--|----------------------------------------|--|-----------------|--|
| Soil Mechanics                                             |  |  |  |                                        |  | BOREHOLE No. 30 |  |
|                                                            |  |  |  |                                        |  | Sheet 5 of 5    |  |
| Location No. 7808<br>Location M62 (EAST) / M606 LINK ROADS |  |  |  | Type of installation Slotted standpipe |  |                 |  |
|                                                            |  |  |  | Date of installation 3.2.93            |  |                 |  |
| Carried out for Department of Transport                    |  |  |  | Internal diameter of tubing 19 mm      |  |                 |  |
|                                                            |  |  |  | Length of filter 10000 mm              |  |                 |  |
|                                                            |  |  |  | Diameter of filter 120 mm              |  |                 |  |

| Depth (m) |       | SUMMARY OF INSTALLATION         |
|-----------|-------|---------------------------------|
| From      | To    |                                 |
|           |       | Surface protection : Gas barrel |
| 0.00      | 1.50  | Concrete                        |
| 1.50      | 2.50  | Bentonite seal                  |
| 3.00      | 12.00 | Slotted section                 |
| 2.50      | 12.50 | Gravel                          |
| 12.50     | 13.50 | Bentonite seal                  |
| 13.50     | 35.05 | Bentonite/Cement Grout          |
|           |       |                                 |
|           |       |                                 |
|           |       |                                 |
|           |       |                                 |
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|           |       |                                 |
|           |       |                                 |
|           |       |                                 |
|           |       |                                 |
|           |       |                                 |

Legend      Depth below Ground level(m)

key

**a**

 Concrete

**d**

 Bentonite seal

**b**

 Sand filter

**e**

 Bentonite/cement grout

**c**

 Gravel filter

**f**

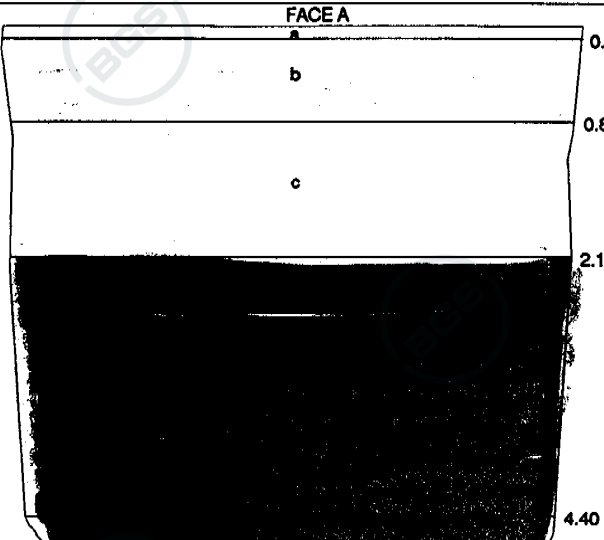
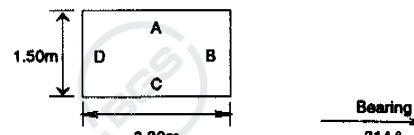
 Backfill

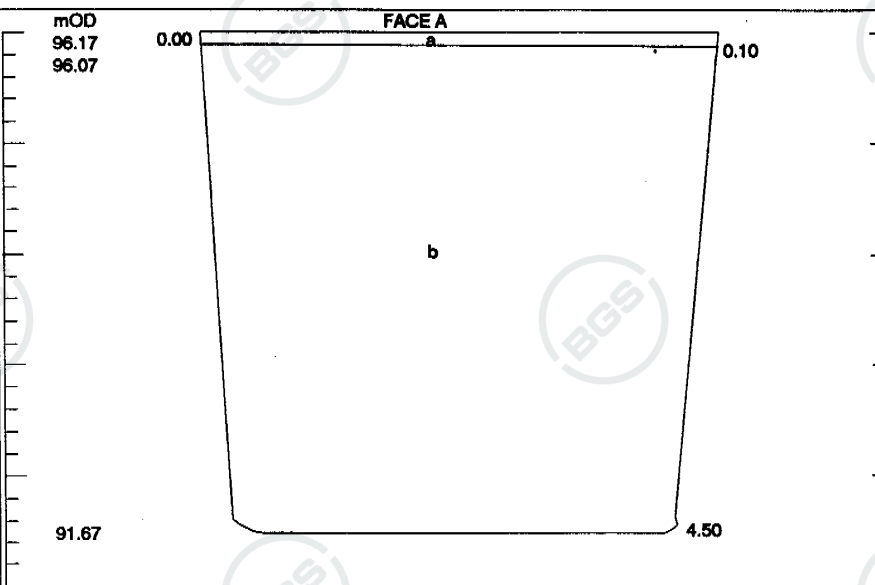
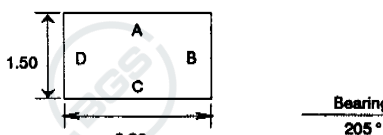
Remarks

- Ground level and coordinates as sheet 1

(C) Soil Mechanics V1.0 04-08-1993 15:35:41

DETAILS OF INSTRUMENTS

| Soil Mechanics                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |                  | SE12NE 961                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  | TRIAL PIT No. 125<br>Sheet 1 of 1 |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----------------------------------|--|
| <b>Equipment and Methods</b><br>Machine dug to 4.70m, using a Komatsu PC210LC No support used<br>Logged on excavated material below 1.20m<br>Carried out for<br>Department of Transport                                                                                                                                                                                                                                                |                  |                  | <b>Location No.</b> 7808<br><b>Location</b> M62 (EAST) – M606 LINK ROADS<br><b>Ground Level</b> 87.85m OD<br><b>Coordinates</b> 8232.84m E<br>6995.78m N<br><b>Date</b> Dug : 10.1.93<br>Logged : 10.1.93                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |                                   |  |
| <b>Sample Type</b>                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>Sample No</b> | <b>Depth (m)</b> | Sketch of Faces                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |                                   |  |
| B                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1                | 0.40 – 0.60      | <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">           mOD<br/>           87.85<br/>           87.73<br/>           87.00<br/>           85.75<br/>           83.45<br/>           83.15         </div> <div style="flex-grow: 1;">  </div> <div style="margin-left: 10px; text-align: right;">           0.00<br/>           0.12<br/>           0.85<br/>           2.10<br/>           4.40<br/>           4.70         </div> </div> <p>Hand vane at 1.00m all 3 readings were 140+kN/m² using large vane</p> |  |                                   |  |
| B                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2                | 1.20 – 1.40      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |                                   |  |
| B                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3                | 2.30 – 2.50      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |                                   |  |
| W                                                                                                                                                                                                                                                                                                                                                                                                                                      | 5                | 4.50             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |                                   |  |
| B                                                                                                                                                                                                                                                                                                                                                                                                                                      | 4                | 4.40 – 4.70      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |                                   |  |
| <b>Strata</b>                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                  | <b>Strata Description</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |                                   |  |
| a                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |                  | Firm dark brown slightly sandy very silty CLAY with a little angular to rounded fine to coarse assorted gravel and occasional roots/rootlets. (TOPSOIL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |                                   |  |
| b                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |                  | MADE GROUND (Stiff grey brown slightly sandy clay with a little angular to rounded fine to coarse assorted gravel. Occasional cobbles, boulders, brick fragments and roots/rootlets).                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                                   |  |
| c                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |                  | MADE GROUND (Firm locally stiff dark grey and greyish brown slightly sandy very silty clay, with a little locally some angular to rounded fine to coarse assorted gravel. Occasional cobbles, roots/rootlets and pockets of partially decomposed organic debris. Timber fragments at 1.40m.                                                                                                                                                                                                                                                                                                                                                 |  |                                   |  |
| d                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |                  | Brown angular to rounded assorted GRAVEL and COBBLES with much clayey sand. Occasional boulders.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |                                   |  |
| e                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |                  | Firm to stiff grey slightly sandy CLAY with a little to some angular to subrounded fine to coarse assorted gravel.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |                                   |  |
| <b>Notes:</b><br><div style="display: flex; justify-content: space-between;"> <div style="width: 45%;">           Ease of excavation : Easy<br/>           Variability of faces : All faces similar<br/>           Groundwater : Fast seepage below 1.40m         </div> <div style="width: 45%;">           Stability of faces : Unstable below 1.40m<br/>           Weather : Cold, cloudy, occasional showers         </div> </div> |                  |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |                                   |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                  | Plan (not to scale)<br>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |                                   |  |
| <b>Materials are described in accordance with Appendices.</b><br>For explanation of symbols and abbreviations see Fig 1.                                                                                                                                                                                                                                                                                                               |                  |                  | <b>Logged by</b><br>RVH                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  | <b>Fig.</b><br>91                 |  |

| <b>Soil Mechanics</b>                                                                                                                     |           |             | SE12NE 962                                                                                                                                                                                                                                                                                                    |  | TRIAL PIT No. 126<br>Sheet 1 of 1                |  |
|-------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------|--|
| <b>Equipment and Methods</b><br>Machine dug to 4.50m using a Komatsu PC21OLC. No support used<br>Logged on excavated material below 1.20m |           |             | <b>Location No.</b> 7808<br><b>Location</b> M62 (EAST)/M606 LINK ROADS                                                                                                                                                                                                                                        |  |                                                  |  |
| <b>Carried out for</b><br>Department of Transport                                                                                         |           |             | <b>Ground Level</b><br>96.17m OD                                                                                                                                                                                                                                                                              |  | <b>Coordinates</b><br>8144.86m E<br>7007.00m N   |  |
|                                                                                                                                           |           |             |                                                                                                                                                                                                                                                                                                               |  | <b>Date</b><br>Dug : 10.1.93<br>Logged : 10.1.93 |  |
| Sample Type                                                                                                                               | Sample No | Depth (m)   | Sketch of Faces                                                                                                                                                                                                                                                                                               |  |                                                  |  |
| B                                                                                                                                         | 1         | 0.50 – 0.70 |                                                                                                                                                                                                                            |  |                                                  |  |
| B                                                                                                                                         | 2         | 1.30 – 1.60 |                                                                                                                                                                                                                                                                                                               |  |                                                  |  |
| B                                                                                                                                         | 3         | 2.60 – 2.80 |                                                                                                                                                                                                                                                                                                               |  |                                                  |  |
| B                                                                                                                                         | 4         | 3.50 – 3.80 |                                                                                                                                                                                                                                                                                                               |  |                                                  |  |
| Strata                                                                                                                                    |           |             | Strata Description                                                                                                                                                                                                                                                                                            |  |                                                  |  |
| a                                                                                                                                         |           |             | Firm dark brown slightly sandy very silty CLAY with a little angular to rounded fine to coarse assorted gravel and occasional roots/rootlets.<br>(TOPSOIL)                                                                                                                                                    |  |                                                  |  |
| b                                                                                                                                         |           |             | MADE GROUND (Firm to stiff greyish brown and grey slightly sandy clay with some to much angular to rounded fine to coarse assorted gravel. Occasional cobbles, boulders and fragments of brick, concrete, clinker, plastic, metal and timber.<br>2.40 to 3.00m, mottled orangish brown, light grey and brown. |  |                                                  |  |
| <b>Notes:</b><br><br>Ease of excavation : Easy<br>Variability of faces : All faces similar<br>Groundwater : None observed                 |           |             | Plan (not to scale)<br><br>                                                                                                                                                                                              |  |                                                  |  |
| Materials are described in accordance with Appendices.<br>For explanation of symbols and abbreviations see Fig 1.                         |           |             | <b>Logged by</b><br>RVH                                                                                                                                                                                                                                                                                       |  | <b>Fig.</b><br>92                                |  |



## Appendix E Notes on Limitations



#### General

JPG (Leeds) Ltd have 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 JPG (Leeds) Ltd; a charge may be levied against such approval.

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- b) This document to any third party with whom an agreement has not been executed.

#### Phase I Desk Study Reports

The work undertaken to provide the basis of this report comprised a study of available documented information from a variety of sources (including the Client), together with (where appropriate) a brief walk over inspection of the site and meetings and discussions with relevant authorities and other interested parties. The opinions given in this report have been dictated by the finite data on which they are based and are relevant only to the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. Should additional information become available which may affect the opinions expressed in this report, JPG (Leeds) Ltd reserves the right to review such information and, if warranted, to modify the opinions accordingly.

It should be noted that any risks identified in this report are perceived risks based on the information reviewed; actual risks can only be assessed following a physical investigation of the site.

#### Phase II Geo-Environmental Investigations

The investigation of the site has been carried out to provide sufficient information concerning the type and degree of contamination, geotechnical characteristics and ground and groundwater conditions to allow a reasonable assessment of the environmental risks together with engineering and development implications.

The objectives of the investigation have been limited to establishing the risks associated with potential human receptors, building materials, the environment (including adjacent land) and controlled waters (surface water and groundwater).

The number of sampling points and the methods of sampling and testing do not preclude the existence of localised "hotspots" of contamination where concentrations may be significantly higher than those actually encountered.

The risk assessment and opinions provided, inter alia, take into consideration currently available guidance values relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values.

The scope of the investigation was selected on the basis of the specific development proposed by the Client and may be inappropriate to another form of development or scheme.

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