GEOENVIRONMENTAL DESK STUDY REPORT

WENTWORTH PARK ESTATE
TANKERSLEY
S75 3BG

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CONFIDENTIALITY STATEMENT

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

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DOCUMENT HISTORY

VERSION	PURPOSE/DESCRIPTION	DATE
1	Final – For issue to Client	December 2015
2	Final – Latest Site Layout Plan Added	February 2016

EXECUTIVE SUMMARY

Site Address	**Wentworth Park Estate Tankersley**
NGR	Approximate NGR 433303,399790.
Site History	The site was open fields with a sandstone quarry in the central area. From at least 1855 coal mining related activity and a brick works were recorded at the site and on the immediately adjoining land. A reservoir and several industrial type buildings were recorded in the eastern half of the site and a railway line connected the pits east and west of the site.
Site Setting	**Geology** – The geological map shows parts of the central and west part of the site to be restored opencast workings. The site is shown to be underlain Pennine Lower Coal Measures which comprise a sequence of interbedded sandstone, mudstone, siltstone and coal. The Parkgate Rock and another un-named sandstone and two coal seams are recorded at the site. The Fenton coal seam is inferred to cross the central part of site, trending from south east to the north west. Immediately west of the Fenton coal, restored opencast coal workings are indicated and extending to the south of the site. The Parkgate coal seam is inferred to cross the west of site trending from south east to the north west. Immediately west of the Parkgate coal, restored opencast coal workings are indicated and extend to the south of the site. **Mining** – The Coal Authority interactive map viewer has confirmed that the site is located within a Coal Mining Reporting Area. The BGS report indicates that the site has the potential be underlain by coal workings at shallow depth. **Hydrogeology** – The underlying bedrock is classified as Secondary A Aquifers. These are '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. These are generally aquifers formerly classified as Minor Aquifers'. **Hydrology** – The nearest water course is an unnamed secondary river located approximately 130m to the north of the site. **Flooding** – Information on the EA website and presented in the GS report indicates that the site is not within an Environment Agency Zone 2 and Zone 3 floodplain. **Landfill** – There are no records of historic landfill sites within 250m of the site. There is one record of waste treatment, transfer or disposal site at the site and four within 250m of the site for ground workings recorded from map records. **Radon Risks** – The property is not within a Radon Affected Area, as less than 1% of properties are above the Action Level. On this basis, no radon protective measures would be required in the construction of new dwellings or extensions to buildings.
Environmental Risk Assessment	Made ground may be present on site. Based on the site in its current condition and the known history of the site and surrounding land, the following potential pollutant linkages may be present: • Made ground associated with historic coal workings and subsequent infilling of land (on-site). • Hazardous gases associated with the made ground (on-site and off-site). Based on the site in its current condition, the following potential exposure pathways require consideration: • Ingestion and dermal contact with contaminated soil and groundwater. • Inhalation of hazardous gases/soil vapours. • Leaching/migration of contaminants into surface water and groundwater via surface and groundwater flow. • Permeation of water supply pipes and other services by organic and aggressive contaminants; and; • Uptake of contaminants by planting in landscape areas. The potential receptors considered are: • Development workers and future maintenance workers involved in excavations, e.g. foundations or where services are being installed or repaired following development: • Future end users of the site, i.e. employees. • The underlying groundwater and surface water. • Buildings and services; and • Planting in landscape areas. On the basis of the proposed end use and known history of the site, the following potential pollutant linkages may be present: • Development and maintenance workers and site end users, e.g. employees, could come into contact with soils containing elevated concentrations of potential contaminants and hazardous gases. • Any underlying groundwater or surface water could become contaminated due to the leaching and migration of mobile contaminants from within the made ground. • Buildings and services could be affected by potential contaminants in the made ground; and • Planting in landscape areas could be affected by phytotoxic elements within the made ground. These are based on current site conditions and do not consider exposure pathways following any remediation of the site. If the site can be shown to pose no "significant harm" to human health or controlled waters, then the site can be considered to be uncontaminated. Based potential pollutant linkages present on the site, the site should be considered to be a moderate risk with respect to contamination. This designation will be largely dependent on the nature of any made ground present on, or adjacent to the site.

	In order to fully assess and classify the risks to human health, any underlying perched groundwater, surface water and buildings/services, a Phase II intrusive investigation, including chemical testing of soils and groundwater and gas monitoring would be required.
Preliminary Engineering Assessment	**Foundations** – Any made ground may be unsuitable for the support of structural loads due to variations in material properties. If shallow spread foundations were to be used, the made ground would become over-stressed, leading to significant settlements. Foundation loads will require transferring to natural strata of suitable bearing capacity. The selection of foundation type for the proposed development would be governed by the thickness of the made ground and the strength and settlement characteristics of the underlying natural strata, which will need to be confirmed. If the shallow natural strata proves unsuitable, i.e. too weak or compressible, then consideration could be given to the adoption of ground improvement techniques. Former shallow coal workings have been treated by grouting. Some further plot specific investigation will be required to check ground stability. **Ground Floor Construction** - The nature and thickness of any made ground and the properties of the natural soils will need to be investigated to determine if ground bearing floor slabs can be used. **Excavations** - Excavations through any made ground and drift deposits may be unstable in the long term and temporary side support is likely to be required. **Groundwater** - It may be expected that shallow perched groundwater will be encountered within the made ground and drift deposits. The presence of groundwater would need to be assessed as part of any ground investigation. **Obstructions** - Obstructions within the made ground and shallow drift deposits may be encountered. **Roads, Pavements and Hardstanding Surfaces** - It is recommended that at this stage, a conservative bearing value for the subgrade is used, until the nature of the subgrade can be physically assessed. **Chemical Attack on Buried Concrete** - Samples of any 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.
Further Work Required	It is recommended that a ground investigation is carried out to assess the potential environmental and geotechnical constraints to development and should comprise the following: • Trial pitting in order to assess the shallow ground conditions at the site and confirm the composition, extent, depth and nature of the drift deposits and any made ground. • Soakaway tests where required for drainage design. • Cable percussion/window sampling boreholes with in situ tests to provide geotechnical information in order to assess the nature of the sub-surface and confirm the depth and distribution of any made ground. These boreholes will also facilitate the installation of gas and groundwater monitoring wells. • Rotary open hole boreholes to investigate potential instability from past shallow mining. • Chemical analysis of soil and water samples in order to determine the concentrations of potential contamination on the site. • Geotechnical testing to classify materials and inform foundation design and chemical testing to determine the Aggressive Chemical Environment for Concrete classification. • Monitoring of gas and groundwater wells for hazardous gases, methane, carbon dioxide, and oxygen and flow rate to the requirements of the Local Authority.
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 Barmston Developments to carry out a geoenvironmental desk study for a proposed commercial development at Wentworth Park Estate, Tankersley.

1.2 Objectives

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

1.3 Scope of Works

The scope of works for the desk study included the following:

- Site inspection and description.
- Review of any previous reports provided.
- Review of contemporary and historical Ordnance Survey publications.
- Consultations with regulatory authorities where appropriate.
- Review of geological publications.
- Review of the radon status of the site.
- An environmental database search.
- Outline qualitative environmental risk assessment.
- Preliminary recommendations with respect to foundations, ground floor and pavement design.
- Recommendations for further work where appropriate.
- Presentation of the findings in a tabular non-technical summary.

1.4 Location

The site is located adjacent to Carr Lane in Tankersley, with the approximate centre of the site being at NGR 433303, 399790. A site location plan is shown as Figure 1 in Appendix A.

1.5 Site Description and Topography

A site inspection has been carried out by staff from JPG during November 2015 and photographs are contained in Appendix B.

The site has a roughly rectangular shape and covers an area of approximately 9.6ha.

Access to the site is made from Wentworth Way and the A61 to the south of the site.

The site is comprised mostly by three roughly rectangular shaped plateau areas.

The higher level (Area 1) is located in the western part of the site. This is an area of rough open ground which contains two large spoil mounds. The northern boundary is formed in part by a gabion wall.

The intermediate level (Area 2) is located in the central area of the site. This is an area of rough open, ground. The northern boundary is formed in part by a gabion wall. The eastern boundary margin contains a large spoil mound. In situ Coal Measures bedrock strata is exposed along the western margin of this area where earthworks have been carried out to form a near level area.

The lower level (Area 3) is located in the eastern part of the site. This is an area of rough open ground which extends to the south towards the entrance of the site.

An aerial photograph of the site is presented as Figure 2 and selected photographs are contained in Appendix B.

1.6 Previous Reports

The following reports have been reviewed during this investigation:

- Hydrock Consultants. April 2006. Desk Study and Ground Investigation at Plot B, Wentworth Park, Tankersley", (ref: R/C06862/001).
- Hydrock Consultants. March 2008 (Factual Geotechnical Investigation at Plot B, Wentworth Park, Tankersley" (ref: R/06862/005).
- Hydrock Consultants. October 2008 (Factual Geotechnical Investigation of Former Pond Area at Plot B, Wentworth Park, Tankersley" (ref: R/06862/005).
- Hydrock Consultants. January 2009. Validation Report for Stabilisation of Abandoned Mineworkings at Plot B, Wentworth Park, Tankersley" (ref: R/06862/006).

A summary of the desk study and ground investigation ref: R/C06862/001 by Hydrock is given below.

The site was described as 'Plot B' Wentworth Park, located immediately off Wentworth Way, Wentworth Park, Tankersley. Plot B formed the northern part of the Daimler Chrysler facility at Wentworth Park.

At the time of the report, the site was unoccupied but had previously been used as a commercial vehicle storage area. The site covered an area of approximately 9.0ha and was open ground. The site was bound by a 2m to 3m scarp slope that sloped towards Carr Lane to the north, to the east by a scarp slope that sloped down towards a housing development and to the south and west by land owned by Daimler Chrysler. The site was approximately rectangular shaped with the widest portion towards the housing development to the east.

The site decreased in elevation from west to east and had been engineered to create three platforms/levels, decreasing in level by approximately 3m to 4m at each scarp slope. The eastern most and lowest platform was generally flat lying and was covered by tarmac and hardcore with a gatehouse in the far south west corner. The middle level was generally flat lying and comprised marshy ground/grassland with stands of semi mature trees and shrubs. Rubble stockpiles were located along the western boundary. The western most level was conical in profile, sloping to the west, east, south and in part north. The ground comprised limestone hardcore and in the western most section by grassland and woodland/mature trees. All three platforms/levels were bounded by shrubs and semi-mature trees. At the time the site contained one building, a gatehouse located in the south west corner. Remote cameras with integral spotlights and motion sensors were positioned along the northern and eastern boundaries.

The geology was described as made ground over Middle Coal Measures, which include worked seams. The Hydrogeology was described as Middle Coal Measures – Minor Aquifer, vulnerability class – Low.

The Hydrology features included two unnamed ponds within 200m and 500m of the site, the latter being an SSSI. There was one surface water abstraction within 1000m of the site at Wortley Golf Club, 967m north of the site for spray irrigation.

The Envirocheck report indicates that the site was located in a coal mining affected area with low to moderate risk from shallow mining hazards and landslide ground stability hazards.

Coal Authority reports and maps indicated that the coal has been worked at depth below the site and by open cast methods. Inspections were made at the time by Hydrock of the mine abandonment plans at the Coal Authority offices. Underground workings below the site were shown to exist in the Fenton Seam (25m bgl), Parkhead Seam (10m to >40m bgl), Thorncliffe Seam (>50m bgl) and the Siltstone Seam (>50m bgl). The Fenton Seam had been worked at a depth of 25m to 30m below the eastern portion of the site. The Parkhead Seam, according to Coal Authority plans, had been worked in the west of the site at depths of 40m to 10m bgl. The Thorncliffe and Siltstone Seam, according to the Coal Authority plans had been worked across the majority of the site area.

The Fenton Seam had been open cast along the southern boundary of the site to a depth of approximately 6m extending southwards beyond the site boundary.

The review of the historic map information indicated that a sandstone quarry was operated and backfilled in the late nineteenth century along the boundary of the site with Carr Lane. The eastern area of the site was a quarry and brick works from 1893 to 1957. The site had been mined for coal at shallow depths from several seams (Fenton, Parkgate, Thorncliffe and Siltstone) from the mid nineteenth century up until 1960's. Opencast coal workings were undertaken in the western portion of the site during the 1980's. More recently the site had been used as commercial vehicle storage for Daimler Chrysler.

No regulatory enquiries were made at the time of the report preparation.

The ground investigation works comprised 6 No Window Samples, 10 Trial Pits, 23 Rotary Boreholes, 38 Cone Penetration Tests and three Geophysical Resistivity Lines.

Plausible Pollution Linkages from desk study and ground investigation were determined. The conceptual risk model for the site was based on the source, pathway, and receptor approach. Based on the proposed layout at the time, which included commercial units with hardstanding, there were considered to be no plausible pollutant linkages for the site.

No risks were identified to human health, plant growth or controlled waters.

Stability Issues were assessed with respect to the layout of the site and the foundation solutions. The site was shown to contain a substantial thickness of made ground as a result of infilled quarries/ponds as well as a former opencast facility, with sharp changes in thickness across relatively short distances (high walls).

Mineworkings were shown to be present at shallow depth at the site for which it was advised that treatment by drilling and grouting would be required.

Environment Agency flood potential map of the area indicated the site to be in a 1 in 1000 years flood zone.

The report stated that excavations at the site remained stable and with groundwater present at some depth beneath the site, and it was stated that earthworks activities at the site would be relatively straightforward.

It was reported that foundation solutions would need to be developed to overcome significant geotechnical constraints notably, deep areas of fill (to 12m) and also sharp changes in fill depth. The fill materials were likely to require treatment prior to the construction of floor slabs and foundations and depending upon the column/line loads of the proposed buildings and that piled foundations may be required.

It was recommended that the design sulphate class for buried concrete should be DS-1 with the ACEC classification for concrete being AC-1 for the made ground and AC-4z for the underlying Coal Measures.

It was concluded that no remediation was required.

It was stated that protectaline pipework for water supplies would be required at the site.

Based on the information available it was suggested that no special precautionary measures against ground gases were likely to be required at the site, however further monitoring was required.

The report stated that variations in fill depth presented in the report were based on an interpretation of the data obtained. It was possible that the changes in depth occur over shorter distances and with a steeper gradient. Unit specific site investigations and assessments were recommended to be undertaken for sensitive structures which span "high wall" areas.

A summary of the geotechnical investigation report ref R/06862/005 by Hydrock is given below.

The site was described as mostly open land, with an area of woodland to the west, and a scatter of trees and vegetation to the east and along the northern and southern boundaries. The central area of the site had a surface cover of limestone hardcore. The eastern area of the site formed a separate tarmac yard.

The geology was described as comprising made ground over Middle Coal Measures, which include worked coal seams. The Middle Coal Measures were described as a Minor Aquifer, with the vulnerability class being "Low".

The report described two unnamed ponds within 200m and 500m of the site, the latter being an SSSI. There was one surface water abstraction within 1000m of the site, which was for Wortley Golf Club, 967m north west of the site for spray irrigation.

The Envirocheck report indicated that the site was located in a coal mining affected area with low to moderate risk from shallow mining hazards and landslide ground stability hazards. Coal Authority reports and maps indicated that coal had been worked at depth below the site and open cast. It was noted that inspections had been made by Hydrock of the mine abandonment plans at the Coal Authority offices.

The underground workings below the site were shown to exist in the Fenton Seam (25m bgl), Parkhead Seam (10m to >40m bgl), Thorncliffe Seam (>50m bgl) and the Siltstone Seam (>50m bgl). The Fenton Seam had been worked at a depth of 25-30m below the eastern portion of the site. The Parkhead Seam, according to Coal Authority plans, has been worked in the west of the site at depths of 40m to 10m bgl. The Thorncliffe and Siltstone Seam, according to the Coal Authority plans, were shown to have been worked across the majority of the site area.

The Fenton Seam was shown to have been open cast along the southern boundary of the site to a depth of approximately 6m extending southwards beyond the site boundary.

A sandstone quarry was operated and backfilled in the late nineteenth century along the boundary of the site with Carr Lane. The eastern area of the site was a quarry and brick works from 1893 to 1957. The site had been mined for coal at shallow depths from several seams (Fenton, Parkgate, Thorncliffe and Siltstone) from the mid nineteenth century up until the 1960's. Opencast coal working was undertaken in the western portion of the site during the 1980's. Most recently the site had been used as commercial vehicle storage for Daimler Chrysler. At the time of the report the site was recorded as unused.

The report by Hydrock made reference to other reports which are listed as follows:

- *Fugro. February 2006. Geophysical Survey, Wentworth Park, Tankersley. Ref: GEO064005-1 (01).*
- *Hydrock. April 2006. Desk Study and Ground Investigation at Plot B, Wentworth Park, Tankersley. Ref R/06862/001.*
- *Hydrock. May 2007. Further Investigation and Stabilisation of Old Shallow Mineworkings at Plot B, Wentworth Park, Tankersley. Ref: R/06862/003; and*
- *Hydrock. June 2007. Treatment Philosophy for the Stabilisation of Old Shallow Mineworkings at Plot B, Wentworth Park, Tankersley. Ref:R/06862/004).*

1.7 Development Proposals

It is proposed to redevelop the site with four large commercial units.

A proposed site layout plan has been provided. This is referenced below and a copy is presented in Appendix A.

- KPP Architects. November 2015. Tankersley Park, Barnsley. Site Plan. Project 1979. Drawing 201 Rev P6.

1.8 Limitations

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

2.0 SITE HISTORY

Historical plans for the site were obtained from GroundSure (GS). These have been reviewed in order to establish any former uses of the site and identify any potentially contaminative historical uses or potential geotechnical constraints to development.

A summary of the relevant map information is presented in Table 2 and copies of relevant plans are contained in Appendix C.

Table 2 – Summary of Relevant Historical Map Information

Date(s) & Scale	Feature
1855 1:10,560	**The site was enclosed fields immediately south of Carr Lane. Burnley Quarry (Sandstone) is marked adjacent to Carr Lane in the middle of the site.** A complex of buildings marked as a smithy and engine house are marked approximately 100m south east of the site. A railway line is marked approximately 200m south east of the site where the Wharncliffe Silkstone Colliery is denoted. Ironstone pits are marked approximately 250m to 500m south of the site.
1891 1:10,560 1893 1:2,500	**A tramway is marked oriented east to west crossing the centre of the site. Brick fields, a brick kiln and indications of excavation are marked and several buildings shown along with sections of railway track. Two reservoirs are marked in the south eastern part of the site.** Silkstone Colliery (No.2 Pit), several large buildings and a shaft are marked approximately 60m to 120m west of the site. Significant development is shown at the Wharncliffe Silkstone Colliery. A hospital is marked approximately 100m south of the site. A reading room and several large buildings are marked approximately 50m south of the site. Old ironstone pits and an old shaft are marked between 180m to 250m south of the site.
1903 1:10,560 1905 1:2,500	**Spoil heaps are shown at the site around the brick fields.** A larger hospital (Infectious Diseases) is now marked approximately 100m south of the site. Gasometers are marked approximately 250m east of the site.
1931 1:2,500 1929-1930 1:10,560	**Much of the colliery related development is no longer shown. The tramway which cut through the site has been removed. A large excavation is shown in the east of the site with large buildings and chimneys marked along with a rail line.** The hospital is no longer shown and allotments are now indicated.
1938 1:10,560	**No significant changes are shown on or beyond the site.**
1948 1:10,560	**No significant changes are shown on or beyond the site.**
1951 1:10,560 1956 1:2,500	**Large buildings previously noted have been removed in the east of the site. A single building is shown near the eastern site boundary. A large excavation is shown in the eastern part of the site.** No significant changes are shown beyond the site.
1965-1966 1:10,560	**Filled ground (slag heap) and two large ponds are shown in east of the site. The reservoir is also marked at the south east of the site.** The Wharncliffe Silkstone Colliery is no longer shown and is marked as filled ground to the east of the site. No indication of the Silkstone Colliery (No.2 Pit) and buildings are marked.
1977-1980 1:10,000 1981 1:2,500	**The site is largely cleared of evidence of previous development. Trees are shown at the site.** A large building is marked approximately 250m south east of the site. Several new buildings are marked approximately 100m east of the site. The colliery land is marked as a Tip (Disused).
1992 1:10,000 1989 1:2,500	**No significant changes are shown on the site.** A sewage works is shown approximately 10m east of the site. A depot is marked approximately 60m east of the site. A large building is shown approximately 60m south of the site forming part of Wentworth Industrial Park. Several large buildings are shown between 10m to 250m south east of the site.
1993 1:2,500	**No significant changes are shown on or beyond the site.**
2002 1:10,000	**No significant changes are shown on the site.** Green space is shown over a large part of the colliery land to the east of the site.
2010 1:10,000	**No significant changes are shown on or beyond the site.**
2014 1:10,000	**No significant changes are shown on or beyond the site.**

3.0 SITE SETTING

3.1 Geology

The GS report and the following geological publications have been consulted:

- British Geological Survey, Geological mapping, Sheet No: 87 Barnsley. 1:50,000 Scale.
- British Geological Survey, Geological mapping, Sheet No: SK39NW High Green. 1:10,000 Scale.

The site is shown to be underlain Pennine Lower Coal Measures which comprise a sequence of interbedded sandstone, mudstone, siltstone and coal. The geological map shows part of the western edge and part of the central area of the site, to be restored opencast workings.

The Fenton coal seam is inferred to cross the central part of site trending from south east to the north west and dips to the east at 6 degrees. Restored opencast coal workings are indicated to extend to the south of the site.

The Parkgate coal seam is inferred to cross the western edge of the site, which trends south east to the north west. Restored opencast coal workings are indicated to extend to the south of the site.

Further coal seams underlie the site at greater depths and the sequence is recorded as follows:

- Fenton Coal – 4m to 5m including partings.
- Parkgate Coal – 2.7m to 3.1m in three leaves.
- Un-named coal – thin.
- Un-named coal – thin.
- Thorncliffe Coal – 0.7m to 1.5m including partings.

Three former mine shafts are shown to be located close to the western boundary of the site, beyond Carr Lane.

Mining
The Coal Authority interactive map viewer has confirmed that the site in located within a Coal Mining Reporting Area.

A Coal Mining Report has been obtained from the Coal Authority, which states the following:

- According to the available records the property is in the likely zone of influence from workings in 5 seams of coal at shallow to 190m depth, and last worked in 1962

- The property is not in an area for which the Coal Authority has granted or is determining whether to grant a licence to remove coal using underground methods.
- The property is not in the likely zone of influence of any present underground coal workings.
- The property is not in an area that is likely to be affected at the surface from any planned future workings. However, reserves of coal exist in the local area which could be worked at some time in the future.
- There are two known coal mine entries within, or within 20m of, the boundary of the property. The Coal Authority records disclose the following information:
- 433399-057 - was found filled and subsequently drilled and grouted to full depth by Hydrock Consultants for Gladman Developments in 2008
- 433399-058 - was found filled and subsequently drilled and grouted to full depth by Hydrock Consultants for Gladman Developments in 2008. It was proposed that the shaft would be capped but we cannot confirm whether or not this was done.
- The Authority is not aware of any evidence of damage arising due to geological faults or other lines of weakness that have been affected by coal mining.
- The property is within the boundary of an opencast site from which coal has been removed by opencast methods.
- The property does not lie within 200m of the boundary of an opencast site from which coal is being removed by opencast methods.
- The property is not within 800m of the boundary of an opencast site for which the Coal Authority is determining whether to grant or has granted a licence to remove coal by opencast methods.
- There is no record of a mine gas emission requiring action by the Coal Authority.

A copy of the Coal Mining report is presented in Appendix D.

3.2 Hydrogeology

The underlying bedrock is identified as a Secondary A Aquifer. These are '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. These are generally aquifers formerly classified as Minor Aquifers'.

There are no recorded groundwater abstractions within 250m of the site.

There is one recorded potable water abstraction licence within 1km of the site. This was located 414m west of the site at Holly House Farm recovering water for general farming and domestic use.

The site does not lie within 500m of an Environment Agency Groundwater Source Protection Zone.

3.3 Hydrology

The nearest water course is an unnamed secondary river located approximately 130m to the north of the site.

There were no active licenced discharge consents to controlled waters within 500m of the site.

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

Information on the EA website and presented in the GS report indicates that the site is not within an Environment Agency Zone 2 and Zone 3 floodplain.

There are BGS groundwater flooding susceptibility areas within 50m of the site. This classification is based on the limited geological information available to the BGS for the site at the present time. The susceptibility and the risk of groundwater flooding occurring at the site should be reassessed based on site specific information.

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

3.4 Pollution Incidents

There are no List 1 or List 2 recorded pollution incidents within 500m of the site.

3.5 Landfills and Waste

The GS report includes information on active and former landfill sites supplied by the Environment Agency, Landmark, Local Authority and the BGS.

There are no records of historic landfill sites within 250m of the site.

There is one record of waste treatment, transfer or disposal site at the site and four within 250m of the site for ground workings recorded from map records. The on-site record is described as "Ground Workings and Refuse Heap".

3.6 Environmental Permits, Incidents and Registers

There are no records of any historic Integrated Pollution Control (IPC) Authorisations within 500m of the site. There are no records of Integrated Pollution Prevention and Control (IPPC) Authorised Activities within 500m of the site.

There are no records of Part A(1) authorised activities within 500m of the site. There are no active or historic Part A(2) permitted activities (potential to cause air pollution) within 250m of the site.

There are three Part B Permitted Activities (potential to cause air pollution) within 500m of the site. The first two were granted to Mercedes Benz (UK) Ltd, Wentworth Way, Tankersley, for vehicle respraying activities located 132m south east of the site and 189m south of the site. The third permit was granted to A Y & Patel Y (Dewsbury) Limited, Maple Road, Tankersley for Petrol Vapour Recovery.

There are no List 2 Dangerous Substance Inventory Site records within 500m of the site.

There are no records of Water Industry Referrals (potentially harmful discharges to the public sewer) or Red List Discharge Consents (potentially harmful discharges to controlled waters) within 500m of the site.

There are no records of any Category 3 or 4 Radioactive Substances Authorisations within 500m of the site.

There are no active recorded Control of Major Accidents Hazard (COMAH) or Notification of Installations Handling Hazardous Substances (NIHHS) sites within 250m of the site.

There are no sites determined as Contaminated Land under Part IIA EPA 1990 within 500m of the site.

3.7 Radon Risks

The property is not in a Radon Affected Area as less than 1% of properties are above the Action Level. On this basis, no radon protective measures would be required in the construction of new dwellings or extensions to buildings.

3.8 Current Land Use

There were four records of current land uses identified within 250m of the site and these were Industrial Features (Tanks, generic), Electrical Features, Construction Services.

3.9 Petrol and Fuel Sites

There are no active petrol filling station or fuel sites within 500m of the site.

4.0 ENVIRONMENTAL RISK ASSESSMENT

4.1 Introduction

The statutory definition of contaminated land is given in the Environmental Protection Act, Part IIA, 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, 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 of harm exists. The potential for harm to occur requires three conditions to be satisfied:

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

In order to assess the contamination risk at the site, the above rationale has been applied and is discussed in the context of Contamination Sources and Potential Pollutant Linkages.

4.2 Potential Sources

Based on a review of the desk study information, the following potentially contaminative sources may be present on or adjacent to the site:

- Made ground associated with historic coal workings and subsequent infilling of land (on-site).
- Hazardous gases associated with the made ground (on-site and off-site).

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

- Metals, metalloids and their compounds.
- Inorganic compounds.
- Organic compounds, e.g. hydrocarbons (fuels, oils).

- Polycyclic Aromatic Hydrocarbons (PAH).
- Hazardous Gases/Soil Vapours.
- Asbestos.

4.3 Potential Pathways

Based on the site in its current condition, the following potential exposure pathways require consideration:

- Ingestion and dermal contact with contaminated soil and groundwater.
- Inhalation of hazardous gases/soil vapours.
- Leaching/migration of contaminants into surface water and groundwater via surface and groundwater flow.
- Permeation of water supply pipes and other services by organic and aggressive contaminants; and
- Uptake of contaminants by planting.

4.4 Potential Receptors

The potential receptors considered are:

- Development workers and future maintenance workers involved in excavations, e.g. foundations or where services are being installed or repaired following development:
- Future end users of the site, e.g. employees.
- The underlying groundwater and surface water.
- Buildings and services; and
- Planting in landscape areas.

4.5 Pollutant Linkage Assessment

A potential pollutant linkage assessment has been completed and is summarised in the Conceptual Site Model which is presented as Figure 3 in Appendix A. This is based on the proposed redevelopment of the site for a commercial end use.

On the basis of the proposed end use and known history of the site, the following potential pollutant linkages may be present:

- Development and maintenance workers and site end users, e.g. employees, could come into contact with soils containing elevated concentrations of potential contaminants and hazardous gases.

- Any underlying groundwater or surface water could become contaminated due to the leaching and migration of mobile contaminants from within the made ground.
- Buildings and services could be affected by potential contaminants in the made ground; and
- Planting in landscape areas could be affected by phytotoxic elements within the made ground.

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

If the site can be shown to pose no "significant harm" or pollution to controlled waters, then the site can be considered to be uncontaminated.

4.6 Risk Classification

Based potential pollutant linkages present on the site, the site should be considered to be a moderate risk with respect to contamination. This designation will be largely dependent on the nature of any made ground present on or adjacent to the site.

In order to fully assess and classify the risks to human health, any underlying perched groundwater, surface water and buildings/services, a Phase 2 intrusive investigation, including chemical testing of soils and groundwater and gas monitoring would be required.

5.0 PRELIMINARY ENGINEERING ASSESSMENT

5.1 Development Proposals

It is proposed to redevelop the site with three commercial premises.

A proposed site layout plan has been provided. This is referenced below and a copy is presented in Appendix A.

- KPP Architects. November 2015. Tankersley Park, Barnsley. Site Plan. Project 1979. Drawing 201 Rev P6.

5.2 Foundations

Any made ground may be unsuitable for the support of structural loads due to variations in material properties. If shallow spread foundations were to be used, the made ground would become over-stressed, leading to significant settlements. Foundation loads will require transferring to natural strata of suitable bearing capacity.

The selection of foundation type for the proposed development would be governed by the thickness of the made ground and the strength and settlement characteristics of the underlying natural strata, which will need to be confirmed.

If the shallow natural strata proves unsuitable, i.e. too weak or compressible, then consideration could be given to the adoption of ground improvement techniques such as vibro stone columns or piles.

Records indicate that former shallow coal workings have been treated by grouting. Some further plot specific investigation will be required to check ground stability.

5.3 Ground Floor Construction

The nature and thickness of any made ground and the properties of the natural soils will need to be investigated to determine if ground bearing floor slabs can be used.

5.4 Excavations

Excavations through any made ground and drift deposits may be unstable in the long term and temporary side support is likely to be required.

5.5 Groundwater

It may be expected that shallow perched groundwater will be encountered within the made ground and drift deposits. The presence of groundwater would need to be assessed as part of any ground investigation.

5.6 Obstructions

Obstructions within the made ground and shallow drift deposits may be encountered.

5.7 Roads, Pavements and Hardstanding Surfaces

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

5.8 Chemical Attack on Buried Concrete

Samples of any 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.

6.0 FURTHER INVESTIGATIONS

In order to assess the potential environmental and geotechnical constraints to the proposed development. It is recommended that the following investigative works should be carried out:

- Trial pitting in order to assess the shallow ground conditions at the site and confirm the composition, extent, depth and nature of the drift deposits and any made ground.
- Soakaway tests where required for drainage design.
- Cable percussion or window sampling formed boreholes with in situ tests to provide geotechnical information in order to assess the nature of the sub-surface and confirm the depth and distribution of any made ground and should include the former pond area. These boreholes will also facilitate the installation of gas and groundwater monitoring wells.
- Rotary open hole boreholes to investigate potential instability from past shallow mining.
- Chemical analysis of soil and water samples in order to determine the concentrations of potential contamination on the site.
- Geotechnical testing to classify materials and inform foundation design and chemical testing to determine the Aggressive Chemical Environment for Concrete classification.
- Monitoring of gas and groundwater wells for hazardous gases, methane, carbon dioxide, and oxygen and flow rate to the requirements of the Local Authority.

M Townend
BSc MSc FGS CGeol
For and on behalf of JPG (Leeds) Limited

February 2016

Appendix A Figures/Drawings

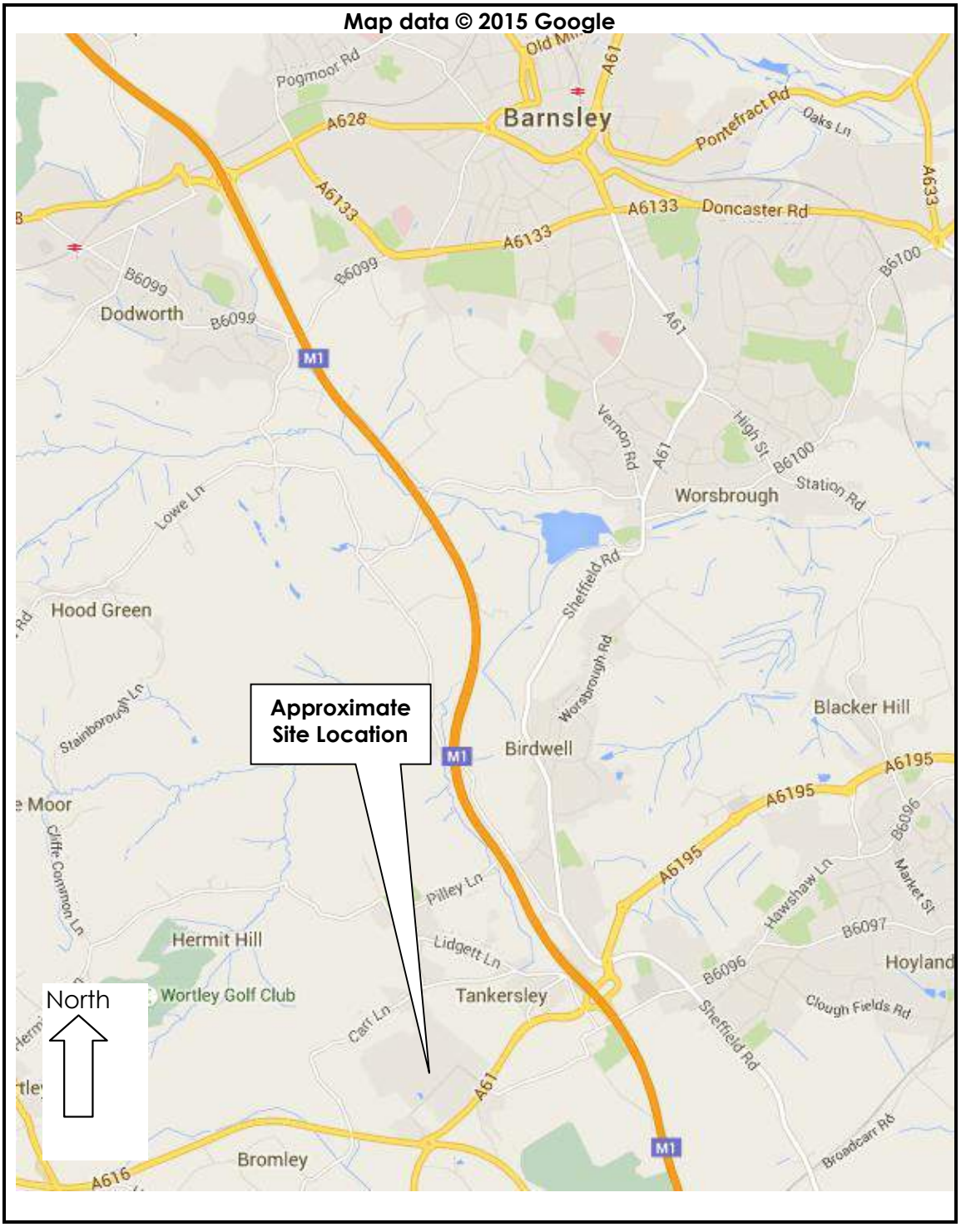
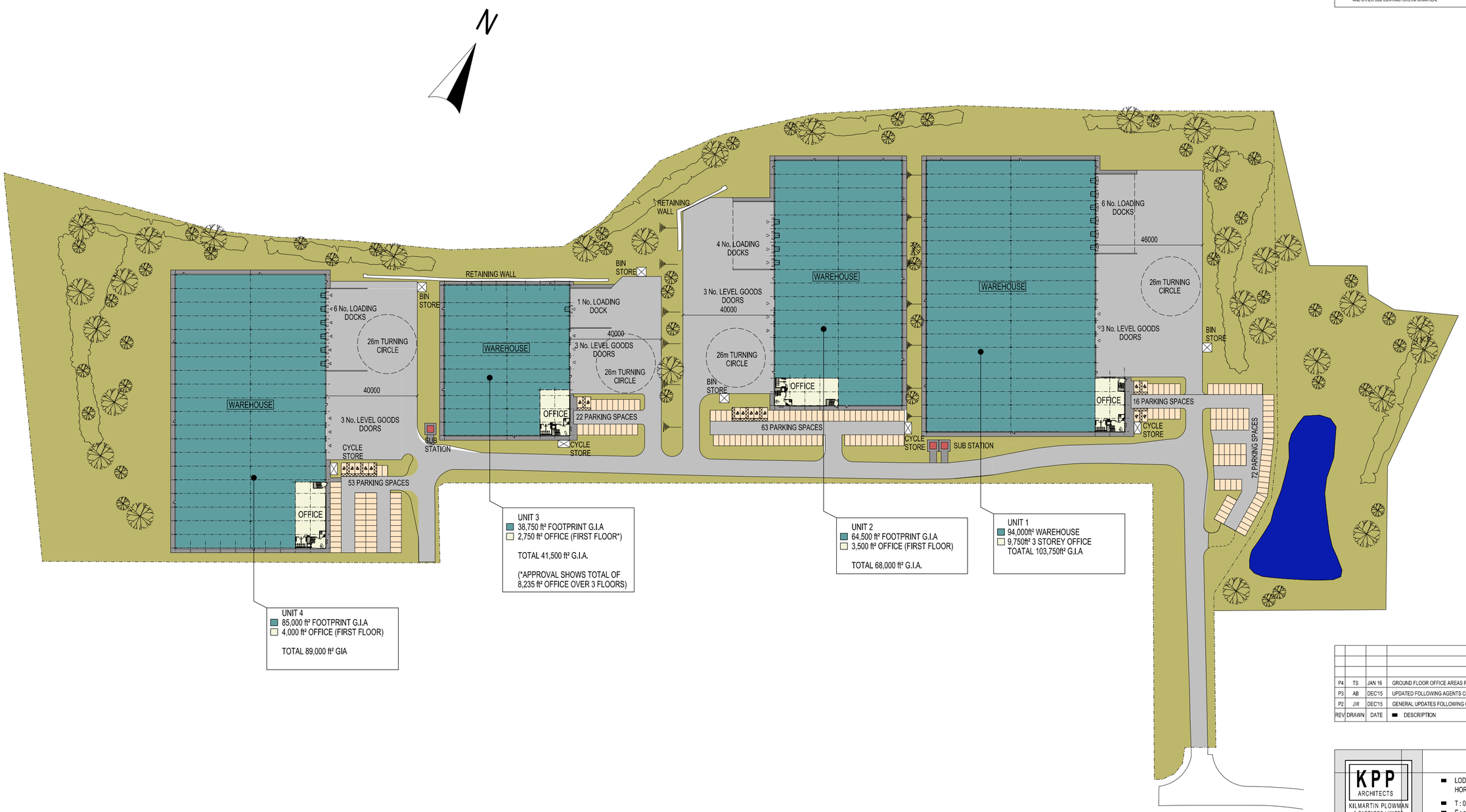


Figure 1 – Site Location Plan	
Site	**Wentworth Park Estate**
Client	**Barmston Developments Ltd**
Job Number	**4776**
Scale	**NTS**

Figure 2 – Aerial Photograph	
Site	**Wentworth Park Estate**
Client	**Barmston Developments Ltd**
Job Number	**4776**
Scale	**NTS**

KPP ARCHITECTS
KILMARTIN PLOWMAN & PARTNERS LIMITED



UNIT 4
- 85,000 ft² FOOTPRINT G.I.A
- 4,000 ft² OFFICE (FIRST FLOOR)

TOTAL 89,000 ft² GIA

UNIT 3
- 38,750 ft² FOOTPRINT G.I.A
- 2,750 ft² OFFICE (FIRST FLOOR*)

TOTAL 41,500 ft² G.I.A.

(*APPROVAL SHOWS TOTAL OF 8,235 ft² OFFICE OVER 3 FLOORS)

UNIT 2
- 64,500 ft² FOOTPRINT G.I.A
- 3,500 ft² OFFICE (FIRST FLOOR)

TOTAL 68,000 ft² G.I.A.

UNIT 1
- 94,000ft² WAREHOUSE
- 9,750ft² 3 STOREY OFFICE

TOATAL 103,750ft² G.I.A

REV	DRAWN	DATE	DESCRIPTION
P4	TS	JAN 16	GROUND FLOOR OFFICE AREAS REMOVED
P3	AB	DEC'15	UPDATED FOLLOWING AGENTS COMMENTS
P2	JW	DEC'15	GENERAL UPDATES FOLLOWING CLIENT MEETING

KPP ARCHITECTS
KILMARTIN PLOWMAN & PARTNERS LIMITED

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W : www.kpp-leeds.co.uk

PROJECT TITLE: TANKERSLEY PARK BARNSLEY

TITLE: SITE PLAN

STATUS	PLANNING	SCALE	1:1250 @A2
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FILE	P:\PROJECTS2\ -	DATE	NOV'15
PROJECT	1979	DRAWING	201
REVISION	P6		

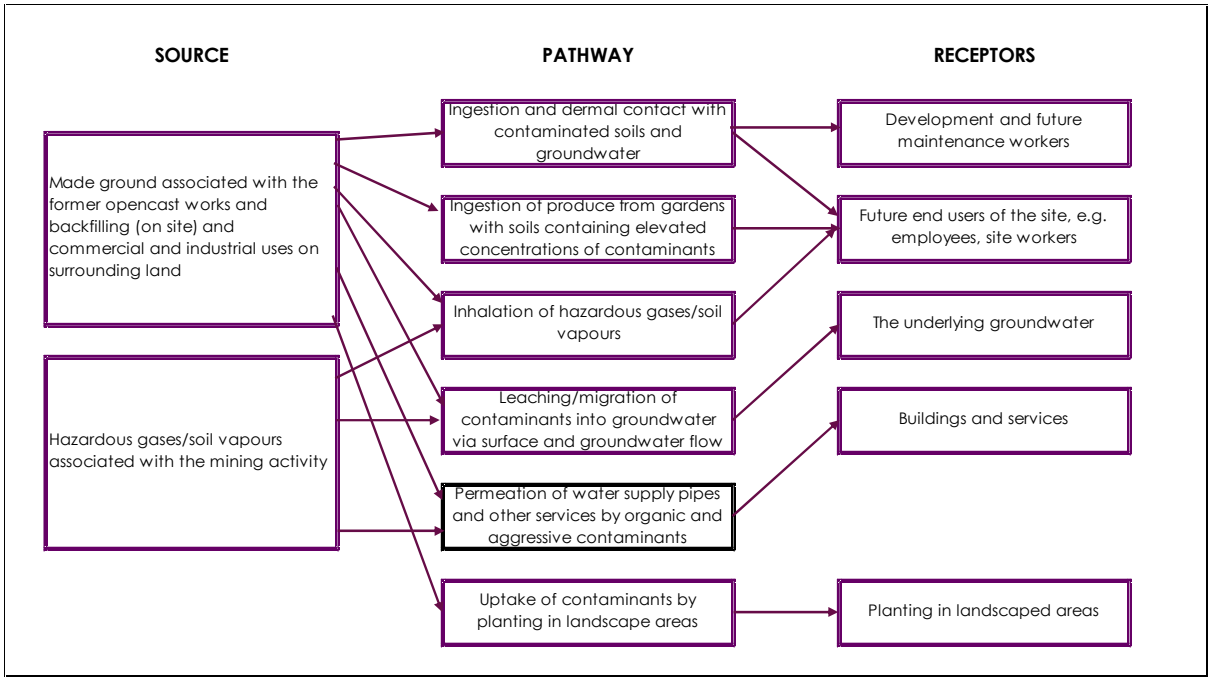

Figure 3 – Conceptual Site Model	
Site	**Wentworth Park Estate**
Client	**Barmston Developments Ltd**
Job Number	**4776**
Scale	**NTS**

Appendix B Site Photographs

Photograph 1: View looking west across the entrance road through the site

Photograph 2: View looking north west from the east part of the site

Photograph 3: View looking to the north east across the eastern part of the site

Photograph 4: View to the west from the central area of the site

Photograph 5: View towards the north west boundary from the central area of the site

Photograph 6 View to the north from the central area of the site

Photograph 7 View to the east from the central area of the site