GROUNDTECH
CONSULTING

ALDI MAFON ROAD, TREHARRIS

GEO-ENVIRONMENTAL APPRAISAL

ALDI STORES LTD

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SUMMARY

Site Details		
Site Location	The site is located circa 5.75 miles north west of Caerphilly on the southern edge of the small town of Treharris and is approximately centred on National Grid Reference 310783, 195038.	
Site Area	The site is circa 1.1 hectares in area, is irregular in shape and is generally topographically level with a gentle slope from north to south. The site is predominantly formed by the existing Coop store building which is present in the north of site. There is associated tarmac surfaced car parking directly south and west of the store. The building is single storey of brick construction, the roof construction is a combination of pitched and flat roofing. A service yard is present to the east of the Coop building. The north eastern area of the site is formed by a roughly triangular shaped area of woodland with bushes, shrubs, semi-mature and mature trees. A watercourse (Nant Mafon) is present in this area which flows from east to west and is culverted beneath the site in a brick lined culvert.	
Preliminary Risk Assessment		
History	Earliest historical records from 1874/75 indicate that the site was undeveloped and formed by fields with a watercourse running through the site flowing from east to west. A roadway/track is also present along the sites northern edge. A garage is shown in the north of the site from 1970. The watercourse is also indicated to be culverted beneath the development. Maps from 1981/84 show the garage building to be extended south. In 1990/93 the layout of the building in the north of site is shown to change and is in its current format. Recent maps show no significant change to the site.	
Geology/Hydrogeology	The site is indicated to be underlain by Glacial Till, the northernmost third of the site is indicated to be underlain by Glaciofluvial Deposits with Glacial Till beneath. The superficial Glaciofluvial Deposits underlying the northern most third of site are classified as a Secondary A Aquifer. The superficial Glacial Till deposits beneath the site are classified as a Secondary Undifferentiated Aquifer. The solid geology underlying the site consists of the Hughes Member which comprises green grey sandstones with thin mudstone/siltstone and is classified as a Secondary A Aquifer.	
Environmental Setting	The site is not within an area requiring radon protective measures. There is a record of two pollution incidents within 500m of the site, the nearest being 406m south relating to smoke which had a minor impact to air. Historic Landfill site located 314m north of the site at Berth Gron Quarry No 2, Nelson.	
Pollution Linkage (PL) Assessment	Human Health	Moderate due to potential for contaminated Made Ground beneath the site.
	Controlled Waters	Moderate due to sites previous use as a garage and possibility of USTs causing pollution and proximity to water features including Nant Mofant culverted beneath the site.
	Permanent Ground Gas	Moderate to high due to possibility for organic material associated with watercourse and sources from the surrounding area.

Ground Model	
Made Ground Soils	Made Ground was encountered beneath the site to a maximum depth of 2.0m bgl and generally comprised brown grey sandy gravel with minor constituents of brick, concrete and sandstone.
Natural Soils	Natural strata was encountered from minimum depths of between 0.4m and 1.5m bgl and generally comprised soft to stiff sandy gravelly Clay and sandy angular to subangular Gravel.
Bedrock	Weak residually weathered Sandstone bedrock recovered as sandy gravel was encountered in BH01 to BH04 f depths rom between depths of 3.2m and 5.0m bgl.
Groundwater	Groundwater was encountered across the site between 1.5m and 5.0m bgl within the natural cohesive and granular deposits.
Ground Engineering Assessment	
Foundations	Traditional strip trench and pad foundations may be adopted for the proposed development, deepening locally to account for the deeper Made Ground and soft Clay deposits. Alternatively, vibro stone columns or mini driven piles may be able to be utilised.
Highways	CBR values ranged from 1% to 7% in both natural and Made Ground. Some reengineering of the subgrade may be required prior to highway construction to achieve the required design CBR value.
SuDS	The use of SuDS drainage within the natural ground at the proposed locations is not feasible at the site due to the presence of cohesive soils which are capable of low soil infiltration rates.
Constraints	The main limitation of the site is the Nant Mafon which is culverted beneath the north of the site. Consideration will have to be given to the position of the culvert beneath the site for the building foundations. It is proposed to divert the watercourse through an open channel. Another limitation of the site is the localised areas of deeper Made Ground. The depth of the Made Ground in the area of the proposed Aldi store will require consideration when choosing an appropriate foundation design. An existing water main is located immediately to the south of the site. It should be ensured that the water main is not damaged during the development of the new Aldi store. The location of store is to take into account the 12m easement centred on 600mm trunk water main.
GQRA and Revised (PL) Assessment	
Human Health	Visual and olfactory evidence of hydrocarbon contamination was identified in WS02, WS3 and WS10. Asbestos fibres were identified in one of the sixteen samples screened through laboratory testing at trace concentrations of <0.001 mass%. The risk to human health is considered to be Low. A clean cover system comprising 450mm of topsoil/subsoil with a demarcation membrane is required in areas of soft landscaping to mitigate against the asbestos identified.
Controlled Waters	Visual and olfactory evidence of contamination was noted in WS02, WS03 and WS10. Laboratory testing of both the impacted soils indicate that it is not impacting controlled waters. The risk to controlled waters is considered to be Moderate to Low and further investigation is required.

Permanent Ground Gas	Ground gas monitoring results indicate the site lies within CS1 and gas protection measures will not be required in the proposed development. The site is not in an area requiring radon protective measures.

Final Appraisal

The following further work is required to commence the project to the construction phase:

- Detailed Foundation design
- Further investigation in inaccessible areas post demolition to assess the risk from contamination
- Further investigation in inaccessible areas post demolition to confirm depth to suitable bearing strata beneath north eastern corner of proposed Aldi store footprint
- Further investigation to assess risk to controlled waters in the vicinity of former garage and culvert
- Confirmation of recommendations made in this appraisal with regulators

TABLE OF CONTENTS

Plans		
Plan Reference	Revision	Title
GRO-20287-P01	-	Project Location Plan
GRO-20287-P02	-	Preliminary Constraints Plan
GRO-20287-P04	-	Exploratory Hole Location Plan
GRO-20287-P05	-	Ground Engineering Model
GRO-20287-P06	-	Geotechnical Constraints Plan
GRO-20287-P07	-	Revised Illustrative Conceptual Site Model (CSM)

1.0 INTRODUCTION

1.1 Project Objectives

Groundtech Consulting Limited have been instructed by Craddys on behalf of Aldi Stores Limited to undertake a Ground Investigation for a site at Mafon Road in Treharris.

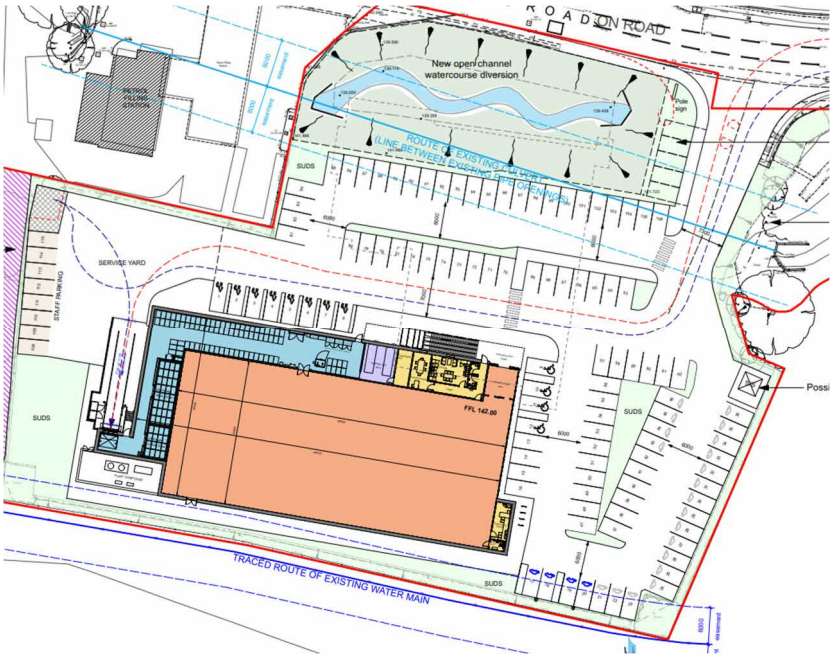
A main investigation was undertaken in accordance with BS 5930:2020, BS 10175:2017, BS 8576:2013 and Eurocode 7 to revise the CSM and quantify the level of risk identified in the PRA. The Appraisal has been prepared in accordance with current UK Legislation and to discharge Land Quality pre-commencement planning conditions.

The report has been undertaken to fulfil the requirements of a preliminary risk assessment in accordance with current LCRM risk assessment guidance. The following reports have previously been prepared for the site and are summarised within this report:

- Groundtech Consulting Preliminary Risk Assessment referenced GRO-20287-1868, dated 22nd October 2020.

1.2 Proposed Development

The proposed development is commercial end use comprising the construction of a new Aldi store on the site of an existing Coop Food store. A culverted stream runs through the north of the site which is proposed to be diverted during the development.



Proposed Development Layout

1.3 Limitations

Other conditions may exist on the site that have not been taken into account in this assessment as they are outside the scope of works. Groundtech Consulting are not responsible for these circumstances that are not outlined in the report.

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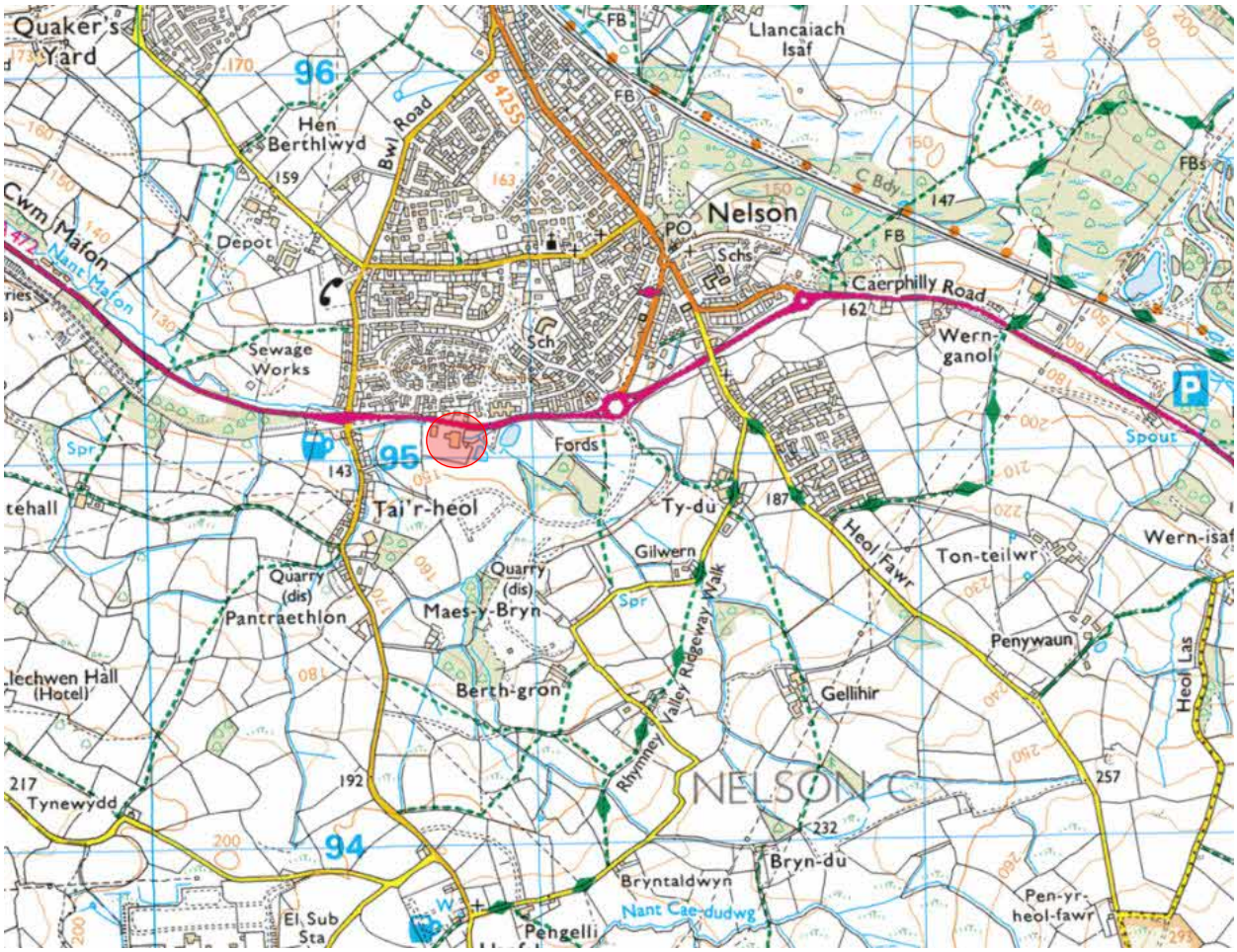
2.0 SITE SETTING

2.1 Location

The site is located circa 5.75 miles north west of Caerphilly on the southern edge of the small town of Treharris, as shown on the Project Location Plan GRO-20287-P01. The site is approximately centred on National Grid Reference 310790, 195055.



Project Location

Access to the site is gained off Mafon Road to the north of the site.

2.2 Site Description

The site is circa 1.1 hectares in area, is irregular in shape and is generally topographically level with a gentle slope from north to south.

The site is predominantly formed by the existing Coop store building which is present in the north of site. There is associated tarmac surfaced car parking directly south and west of the store. The building is single storey of brick construction, the roof construction is a combination of pitched and flat roofing.

Further car parking spaces and a tarmac surfaced access road are present directly north of the building. The access road runs down the western and eastern extents of the existing building. A service yard is present to the east of the Coop building. The road acts as a one way system around the site.

The north eastern area of the site is formed by a roughly triangular shaped area of woodland with bushes, shrubs, semi-mature and mature trees. A watercourse (Nant Mafon) is present in this area which flows from east to west and is culverted beneath the site in a brick lined culvert.

Site Boundaries and Surrounding Area

The site boundaries in the southern area of the site are generally defined by palisade fencing surrounding the car park. The northern boundary is formed by low wooden fencing where access points are not present, and the boundary in the wooded area to the north east is not clearly defined. The west of the site is unbounded, boardered by a narrow footpath and access road to the adjacent petrol filling station.

The site is surrounded by following features/land uses:

- North - Mafon Road and commercial premises followed by commercial units and then residential housing
- East - Open grassed fields with some wooded areas
- South - Fields delineated by hedgerows
- West - Texaco Petrol Filling Station, Open grassed fields and wooded areas

Site photographs are presented in Appendix 2 and relevant features are recorded on the Preliminary Development Constraints Plan GRO-20287-P02.

3.0 SUMMARY OF PRELIMINARY RISK ASSESSMENT

3.1 Introduction

A Preliminary Risk Assessment was previously completed by Groundtech Consulting Limited dated 22nd October 2020, referenced GRO-20287-1868. The pertinent information is summarised in the following sections.

3.2 Site History and Consultations

Site History

Earliest historical records from 1874/75 indicate that the site was undeveloped and formed by fields with a watercourse running through the site flowing from east to west. A roadway/track is also present along the sites northern edge. A small unspecified building is present in the north of the site on maps between 1877 and 1900 when it is assumed to have been demolished. Maps from 1959/60 show a small building in the north of the site. A garage is shown in the north of the site from 1970. The watercourse is also indicated to be culverted beneath the development. Maps from 1981/84 show the garage building to be extended south. In 1990/93 the layout of the building in the north of site is shown to change and is in its current format. Recent maps show no significant change to the site.

Consultations

The following environmental information was identified:

- The site is not within an area requiring radon protective measures
- There is a record of two pollution incidents within 500m of the site, the nearest being 406m south relating to smoke which had a minor impact to air
- Historic Landfill located 314m north of the site at Berth Gron Quarry No 2, Nelson
- Waste exemption located 43m north of the site relating to the sorting and de-naturing of controlled drugs for disposal
- Four authorised processes within 500m of the site, the closest is 14m north west relating to unloading petrol into storage tanks
- Licenced waste site recorded 472m south east of the site at Berth Gron Quarry
- Texaco Petrol Filling Station 9m north west of the site

3.3 Geology and Hydrogeology

Made Ground is not indicated to underlie the site, however due to previous developments Made Ground is likely to be present beneath the site.

The site is indicated to be underlain by Glacial Till, the northernmost third of the site is indicated to be underlain by Glaciofluvial Deposits characteristically comprising sand and gravel with Glacial Till beneath. The superficial Glaciofluvial Deposits underlying the northernmost third of site are classified as a Secondary A Aquifer. The superficial Glacial Till deposits beneath the site are classified by the Environment Agency as a Secondary Undifferentiated Aquifer.

The solid geology underlying the site consists of the Hughes Member which comprises green grey sandstones with thin mudstone/siltstone and is classified as a Secondary A Aquifer.

There are no faults within influencing distance of site.

The site does not lie within 500m of a Source Protection Zone, the nearest recorded groundwater abstraction is historical located 818m south of the site relating to a well a Penbeili Farm used for general farming and domestic use.

There are no recorded potable water abstractions within 2000m of site.

3.4 Hydrology

The nearest named watercourse is the Nant Mafon, an inland River which flows through a culvert beneath the site flowing east to west.

The Risk of Flooding from Rivers and Sea (RoFRaS) is very low, and the risk from groundwater flooding on site is low.

3.5 Preliminary Conceptual Site Model

The following risks were determined by Groundtech Consulting Limited:

Human Health

Receptor	Level of Risk	Comments
Site End Users from Contaminated Soils	Moderate	Made Ground anticipated to be present beneath the site associated with previous and current developments. USTs could also be present beneath the site associated with the former garage and USTs directly next to the site could be a source of mobile contamination. Areas of soft landscaping are to be including in the proposed development.
Site End Users from Inhalation of Vapours	Moderate to High	There is the potential for hydrocarbon contamination associated with the adjacent petrol filling station and the historic garage that was previously onsite.
Potable Water Supply Pipe	Moderate	Made Ground is likely to be present on site and there is the potential for organic contamination to be present. Water supply pipes will be included as part of the development and a pollution linkage is considered to exist.
Site End Users from Inhalation of Gas	Moderate to High	Organic materials associated with the watercourse passing through site may be present locally which could be a source of ground gas. A quarry was present c.300m north of the site which has been used as a landfill which has the potential for landfill waste to be generating ground gases which may migrate to the site.
Controlled Waters	Moderate	Made Ground is likely to be present across the site which may be contaminated with a range of contaminants. A pollution linkage is considered to exist between the potentially contaminated Made Ground and the Secondary A Aquifers. The sites previous use as a garage and the possibility for USTs could be a source of contamination, Nant Mafon is culverted beneath the site and a plausible pollution linkage is considered to exist.

3.6 Ground Engineering

Traditional shallow trench fill or strip foundations are likely to be suitable for the masonry walls and pads for the framed superstructure of the proposed development.

A SuDS drainage solution may be a viable option where the Glaciofluvial Sand and Gravel deposits are encountered.

The site is not indicated to be affected by a legacy of historic shallow coal mine workings.

3.7 Additional Considerations

The Nant Mafon is culverted beneath the site running from east to west and this should be considered in the development layout.

The location of the store is to take into account the 12m easement centred on a 600mm trunk water main on southern boundary of the site.

4.0 SCOPE OF INVESTIGATION AND RATIONALE

4.1 Project Objectives

The aim of the fieldwork was to:

Determine the stratification beneath the site
Maintain watching brief for visual and olfactory evidence of contamination
Obtain samples using methodology in current guidance for contamination testing
Identify realistic pollution linkages to groundwater
Obtain relevant geotechnical parameters for preliminary foundation design to address both ULS and SLS conditions
Determine if targeted supplementary investigation in areas of concern is required and for remedial design
Install monitoring standpipes for gas and groundwater monitoring
Assess the identified pollution linkages in the CSM
Determine the soil infiltration rates of the soils

4.2 Scope of Works

The following scope of works was completed between the dates of 7th November and 10th November 2023:

- 2 No. Soil Percolation Tests (SuDS1 to SuDS2) were undertaken between 1.2m bgl and 2.1m bgl
- 6 No. Plate Load Tests (PL01 to PL06) were undertaken between 0.3m bgl and 0.5m bgl
- 4 No. Cable Percussive boreholes (CP01 to CP04) were drilled to a maximum depth of 5.3m bgl
- 14 No. Windowless sample boreholes (WS01 to WS14) were drilled to a maximum depth of 3.0m bgl

The exploratory hole locations are presented on Groundtech Plan GRO-20287-P04 and the exploratory hole logs are in Appendix 4.

The exploratory holes were positioned to establish the stratification beneath the site and target any areas of concern as summarised in the table below:

Location	Target Rationale
PL01 to PL06	Proposed car parking areas and service yard
SuDS1 to SuDS2	Proposed SuDS locations
WS02, WS03	Adjacent Offsite Petrol Filling Station (PFS)
WS10, WS12	Area of former track and garage on site
WS13, WS14	Delineation of impacted soils from Petrol Filling Station (PFS)
CP02, WS07 to WS09	General Coverage
CP01, CP03, CP04, WS01, WS04 to WS06	Proposed building footprint
WS09, WS10, WS12	Nant Mafon
CP01 – CP04	Groundwater

The exploratory holes were logged by a suitably experienced geo-environmental engineer in general accordance with the following current guidance:

- BS 5930 'Code of Practice for Site Investigations' 2020
- BS EN 14688-1:2002 'Geotechnical Investigation and Testing – Identification and classification of soil'
- BS EN ISO 14689:2002 "Geotechnical investigation and testing – Identification and classification of rock"

4.3 Soil Sampling

During the intrusive investigation, representative samples were taken at regular intervals, changes of strata and where evidence of contamination existed. Laboratory analysis was scheduled on the samples obtained.

The samples obtained are summarised in the table below:

Soil Sample	Number
Environmental Sample	43
Disturbed Sample	34
Bulk Sample	18
Undisturbed U100 Sample	4

The samples have been obtained in accordance with current environmental and geotechnical guidance. The sampling plan has been designed obtain samples from all required strata using the correct methodology.

Disturbed samples of soil for geo-environmental testing were placed in the correct sampling containers as required by the laboratory in accordance with their MCERTS and UKAS Accreditation. Transportation was arranged in a timely manner and the samples were at the correct temperature.

The sample locations and depths are recorded on the exploratory logs.

4.4 Geo-Environmental Testing

To inform the Generic Quantitative Risk Assessment, the following geo-environmental testing was scheduled to assess the risk from contamination on the site. The testing is based on the potential sources identified in the previous PRA and observations during the Ground Investigation.

Contaminant of Concern (CoC)	Matrix	Number
Arsenic, cadmium, chromium (total and hexavalent), copper, lead, mercury, nickel, selenium, zinc and pH.	Soil	16
Speciated Petroleum Hydrocarbons (PAHs)	Soil	16
Asbestos Screening	Soil	16
Total Petroleum Hydrocarbons (TPH CWG)	Soil	8
Volatile Organic Compounds (VOCs)	Soil	4
Waste Acceptance Criteria (WAC)	Soil	4
Arsenic, Cadmium, Chromium, Copper, Nickel, Mercury, Lead, Zinc, Selenium, Water Soluble Boron total and free cyanide, total sulphate, sulphide, sulphur, pH, speciated PAH (16), phenols, thiocyanate	Groundwater	4
Hexavalent Chromium	Groundwater	4
Total Petroleum Hydrocarbons CWG and interpretation	Groundwater	4
Volatile Organic compounds (Target List + TICs)	Groundwater	4

DOC	Groundwater	4
Hardness	Groundwater	4
Arsenic, Cadmium, Chromium, Copper, Nickel, Mercury, Lead, Zinc, Selenium, Water Soluble Boron total and free cyanide, total sulphate, sulphide, sulphur, pH, speciated PAH (16), phenols, thiocyanate	Surface Water	2
Hexavalent Chromium	Surface Water	2
Total Petroleum Hydrocarbons CWG and interpretation	Surface Water	2
Volatile Organic compounds (Target List + TICs)	Surface Water	2
DOC	Surface Water	2
Hardness	Surface Water	2

The Geo-Environmental Laboratory Testing Results are presented in Appendix 5. The Groundwater and Surface Water Testing Results are presented in Appendix 6.

Representative disturbed samples were obtained for all soil types encountered. Selected samples were scheduled for testing at an approved laboratory in accordance with BS 1377 'Method of Test for Soils for Civil Engineering Purposes' 1990. The following tests were scheduled:

British Standard	Test Method	Number
Part 2	Water Content	6
Part 2	Plasticity Index Analysis	6
Part 3	pH Value	6
Part 3	Water Soluble Sulphate Content	6
Part 7	Determination of Undrained Shear Strength in Triaxial Compression	4
Part 5	One-Dimensional Consolidation Test	2

The Geotechnical Laboratory Testing Results are presented in Appendix 7.

4.5 Gas and Groundwater Monitoring/Sampling

Gas and groundwater monitoring installations were constructed in the boreholes. The standpipes consisted of both polyvinyl chloride (PVC) and high-density polyethylene (HDPE) pipe - a bentonite seal was placed around the plain pipe and a clean gravel pack was placed around the slotted pipe. A summary of the installation construction is presented in the table below:

Location	Depth	Response Zone (m bgl)	Targeted Strata	Reason
WS02	3.00	1.00 – 3.00	Natural cohesive	Ground Gas
WS03	1.50	1.00 – 1.50	Made Ground	Ground Gas
WS10	2.00	1.00 – 2.00	Natural cohesive	Ground Gas
WS12	2.00	1.00 – 2.00	Made Ground/natural cohesive strata	Ground Gas
CP01	3.40	2.40 – 3.40	Natural granular strata	Ground Gas/Groundwater
CP02	3.20	2.20 – 3.20	Natural cohesive strata	Ground Gas/Groundwater
CP03	5.30	4.00 – 5.30	Natural granular/cohesive strata	Ground Gas/Groundwater
CP04	4.30	3.00 – 4.30	Natural granular strata	Ground Gas/Groundwater

Permanent gas and flow rate monitoring was carried out using GFM 436 infrared gas monitor with integral electronic flow analyser. The measurements taken are listed below:

- Oxygen (O_2), carbon dioxide (CO_2) and methane (CH_4) as the percentage volume in air (%v/v)
- Hydrogen sulphide (H_2S) and carbon monoxide (CO) as the percentage volume in air (%v/v)
- Lower Explosive Limit (%LEL) of methane
- Atmospheric and borehole pressure, including pressure trend
- Flow measurements (l/hr)
- Weather and ground surface conditions

Both peak and steady state conditions were monitored to understand the behaviour of the permanent ground gas, the steady state conditions were recorded by allowing the gas monitor to run for a minimum of 3 minutes or steady state has been reached.

Permanent gas and groundwater monitoring results are presented in Appendix 8.

4.6 Groundwater Sampling

Well development was carried out to ensure no cross contamination from the drilling activities remained in the water column in the well. During the return visit, the installations were purged to a minimum three times the volume of the water column in the borehole prior to sampling, samples were taken between 7 and 17 days after installation.

Purging was undertaken at a slower rate than the well development, and the sampling at a slower rate again.

The method of sampling selected was using disposable low flow pump due to the contamination identified during the PRA and Ground Investigation.

Where possible a water meter was used to test the pH, temperature and conductivity before sampling until equilibrium conditions were met in accordance with BS 10175 guidelines.

Samples were sent to the UKAS Accredited laboratory the same day, sampling was carried out in general accordance with BS 5930 and BS 5667.

4.7 Vapour Survey - Photo Ionisation Detector

Standard sampling protocol and preservation of samples was undertaken as described in the EA guidance on site investigation. Soil was collected for onsite testing, a plastic bag was half filled with soil allowing a suitably sized headspace. The bag was sealed and stored for at least 20 minutes before being tested for Total Volatile Organic Compounds (TVOCs) using a Photo Ionisation Detector (PID).

Results of the PID readings are presented on the exploratory hole logs. The on-site monitoring was carried out in line CIRIA C665 to aid targeting samples for VOC laboratory analysis.

5.0 GROUND MODEL

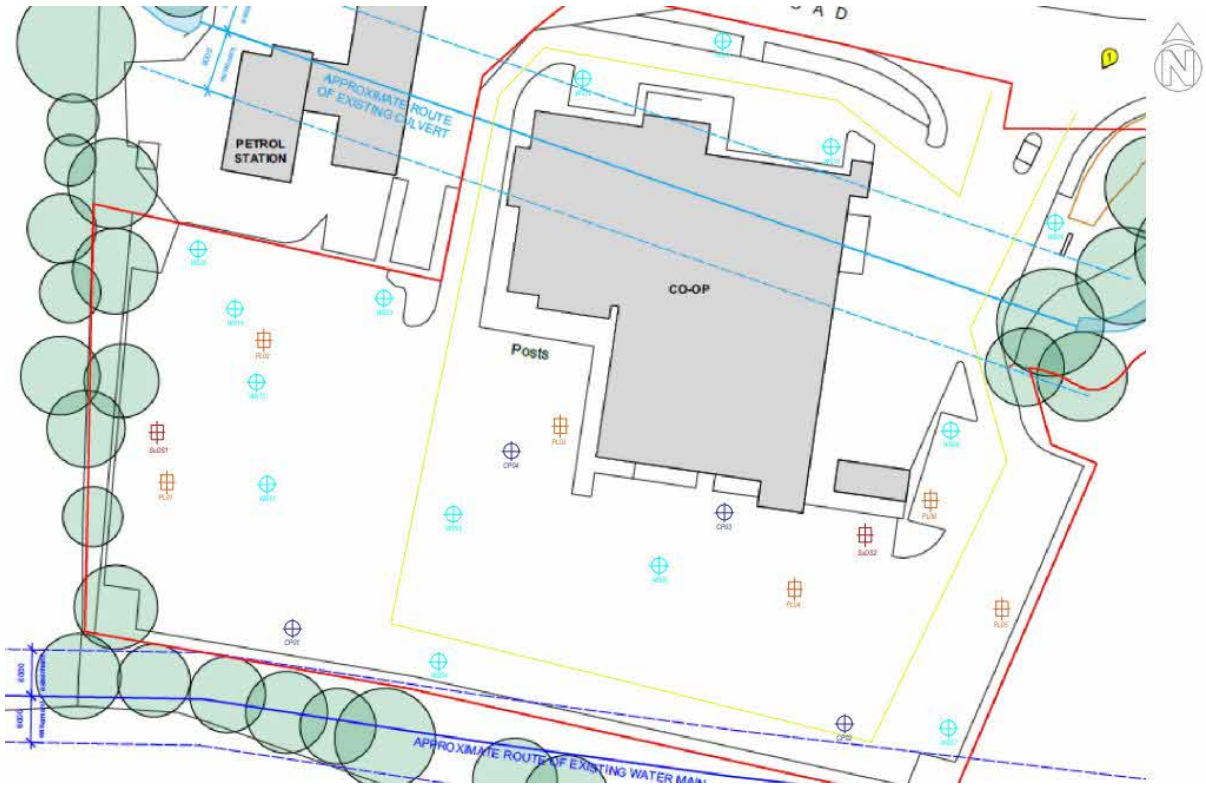
5.1 Made Ground

Made Ground was encountered across the site to a maximum depth of 2.0m bgl. The surfacing of the site largely comprised tarmac to a maximum depth of 0.2m bgl. A small area in the north east of the site is surfaced with grass.

Two main Made Ground populations were encountered during the investigation and are described below:

1. Grey slightly sandy angular to subangular fine to coarse gravel was encountered within WS01 to WS06, WS08 to WS10, WS12 to WS14, CP01, CP03, CP04, SuDS1, SuDS2 and PL01 to PL06 from 0.04m bgl to a maximum depth of 2.0m bgl.

2. Red brown sandy angular fine to coarse gravel was encountered within WS01, WS03 to WS08, SuDS1 and SuDS2 from 0.2m bgl to a maximum depth of 1.3m bgl.



Exploratory Hole Locations

5.2 Natural Ground

The natural strata encountered generally confirmed the published geological records. Two main natural stratification encountered during the investigation and are described below:

1. Soft to stiff grey brown sandy gravelly Clay was encountered within WS01 to WS08, WS10, WS12 to WS14, CP02 to CP04 and PL01 from 0.4m bgl to a maximum depth of 5.0m bgl.

2. Grey brown sandy subangular to subrounded fine to coarse Gravel was encountered within WS02, CP01, CP03 and CP04 in the south west of the site from 0.5m bgl to a maximum depth of 5.3m bgl.

5.3 Bedrock

Weak, residually weathered Sandstone bedrock recovered as sandy gravel was encountered in BH01 to BH04 at minimum depths of 3.2m to 5.0m bgl.

5.4 Groundwater

Groundwater strikes were observed across the site in CP01 to CP04, WS01 to WS04 and WS07 to WS10 from 1.7m bgl to a maximum depth of 5.0m bgl as outlined in the table below.

Location	Depth of Groundwater	Type of Strike	Stratum
CP0.1	2.60	Water strike	Sandy Gravel
CP02	2.70	Water strike	Sandy gravelly Clay
CP03	5.00	Water strike	Extremely weak Sandstone
CP04	3.70	Water strike	Sandy Gravel
WS01	1.70	Water strike	Sandy gravelly Clay
WS02	2.00	Water strike	Sandy gravelly Clay
WS03	2.00	Water strike	Sandy gravelly Clay
WS04	1.70	Water strike	Sandy gravelly Clay
WS07	2.00	Water strike	Sandy Clay
WS08	2.00	Water strike	Sandy gravelly Clay
WS09	2.00	Perched	Granular Made Ground
WS10	2.00	Water strike	Sandy gravelly Clay

5.5 Watching Brief

A watching brief was maintained during the Ground Investigation for visual and olfactory evidence of contamination.

Visual evidence of contamination was noted in WS02, WS03 and WS10 at depths between 0.5m bgl and 1.8m bgl in the granular Made Ground and natural cohesive deposits in the form of a black coating. A moderate hydrocarbon odour was also noted at this depth.

Clinker was noted as a minor constituent of the Made Ground in CP03 and CP04 at 0.5m bgl.

5.6 Excavation Stability

Collapse of the Made Ground was noted during excavation of both soil Percolation test locations (SuDS1 to SuDS2).

5.7 Excavation Progress

Slow progress while excavating the trial pits was not experienced.

6.0 GROUND ENGINEERING

6.1 Geotechnical Testing Results

Comparison of water content and the value of 0.4 times the Liquid Limit in accordance with BRE Digest 412 'Desiccation in Clay Soils' suggests significant desiccation has taken place when 0.4 times the Liquid Limit is greater than the actual water measured water content. This is a rudimentary method but also a good guide.

Results of the plasticity testing and the volume change potential of the Clay is summarised in the table below:

Reference	Depth	Modified PI	Volume Change Potential	Desiccated
WS05	1.5	11.52	Low	No
WS12	2.0	NP	NP	n/a
CP03	1.7	8.36	Low	No
WS01	1.5	NP	NP	n/a
WS06	1.6	10.44	Low	No
CP02	1.7	10.89	Low	No

Results of the Quick Undrained Triaxial test are summarised below:

Reference	Depth (m)	Shear Strength (kPa)	Strength Classification
CP02	1.20	56	Medium
CP03	1.20	37	Low
WS08	1.50	33	Low

Two consolidation tests were undertaken on the natural Clay and the results are summarised below:

Reference	Depth (m bgl)	Range of Coefficient of Compressibility (Mv) m^2/MN
CP04	1.20	0.062 – 2.084
WS08	1.50	0.035 – 0.939

6.2 Assessment Background

The ground engineering investigation has been undertaken to formulate an accurate ground model in order to undertake preliminary foundation design. The ground model has been constructed with a moderate to high level of confidence, the ground model has evolved from the information obtained by the PRA.

The site is currently occupied with an active coop store. Associated car parking, loading bays and access roads surround the store. The proposed development is to construct an Aldi store in the south of the site with associated hardstanding. The north east corner of the proposed development will encroach into the footprint of the existing Coop store.

Ground Conditions

Made Ground was encountered across the site to a maximum depth of 2.0m bgl and generally comprised grey slightly sandy angular to subangular fine to coarse gravel and red brown sandy angular fine to coarse gravel with minor constituents of tarmac, brick, concrete and sandstone.

Natural strata generally comprised soft to stiff grey brown sandy gravelly Clay to a maximum depth of 5.0m bgl and grey brown sandy subangular to subrounded fine to coarse Gravel to a maximum depth of 5.3m bgl.

Weak residually weathered Sandstone bedrock recovered as sandy gravel was encountered in BH01 to BH04 from between 3.2m to 5.3m bgl.

Groundwater strikes were observed across the site from 1.7m bgl to a maximum depth of 5.0m bgl. Groundwater strikes were observed in both the natural granular and cohesive deposits. Perched water was encountered in WS09 at 2.0m bgl within the Made Ground.

Limitations

The main limitation of the site is the Nant Mafon which is culverted beneath the north of the site. It is proposed to divert the watercourse through an open channel. It should be ensured that the integrity of the culvert is not impacted. An existing water main is located directly next to the south of the site. It should be ensured that the water main is not damaged during the development of the new Aldi store. The location of store is to take into account the 12m easement centred on 600mm trunk water main.

Groundwater was encountered between the depths of 1.7m and 5.0m bgl in the area of the proposed Aldi store. Foundations may require dewatering locally if groundwater is encountered during excavations.

Localised evidence of hydrocarbon contamination was noted in WS02 and WS03 in the north west of the site directly next to the Petrol Filling Station and WS10 in the north of the site in the area of the former garage. Visual evidence was noted at depths between 0.5m bgl and 1.8m bgl within both the Made Ground and natural deposits in the form of a black coating within the soils. A moderate hydrocarbon odour was also noted at this depth. The hydrocarbon impacted area is located away from the proposed building footprint and is underneath the proposed service yard.

Furthermore, the existing building is to be demolished, all below ground substructure and hard surfacing will require grubbing up as part of the enabling works. A watching brief should be maintained during the demolition of the existing Coop for any evidence of USTs or other evidence of contamination not identified during the ground investigation. There is also potential for deeper Made Ground to be present in the north eastern corner of the proposed Aldi store where the Coop is present.

6.3 Geotechnical Parameters

The geotechnical test results have been evaluated to derive geotechnical parameters for the soils underlying the site. A 'depth to SPT N value' graph is presented on Groundtech Plan GRO-20287-P05 to provide a generalised ground model for the site.

Characterization of the geotechnical parameters above has been undertaken to select a characteristic value, which is a cautious estimate of the value affecting the occurrence of the limit state.

- Soft to firm Clay - undrained shear strength (C_u) characteristic value of 20kPa has been selected to satisfy ULS conditions based on correlation with an SPT 'N' value of 4
- Firm medium strength Clay - undrained shear strength (C_u) characteristic value of 40kPa has been selected to satisfy ULS conditions based on laboratory testing results.

- Very dense Gravel - SPT 'N' value of 50 has been recorded and by correlation a ϕ' of 41° has been selected for ULS conditions.

6.4 Preliminary Foundation Design

The below foundation recommendations are based on the information from the boreholes in the area of the proposed Aldi store in the south of the site.

Shallow Foundations

The most suitable foundations for the proposed Aldi development are considered to be pads to support the steel frame with strip footings utilised to support the masonry walls. Pad and strip footings should be founded within the firm to stiff natural Clay deposits or very dense natural Gravel deposits at between 0.75m and 2.0m begl. All foundations should be deepened through Made Ground and soft Clay deposits. Alternatively, the masonry walls could be constructed off a ring beam supported by the pads.

Foundations will be deeper beneath the northern and north western extent of the proposed Aldi store as shown on plan GRO-20287-P06, very dense Gravel bearing strata was encountered at 3.0m bgl in CP04. Firm Clay was encountered at 0.7m begl in CP03 and became stiff by 3.8m begl, suitable bearing strata will be encountered between these depths at circa 2.0m bgl. The corner of the building is also currently occupied by part of the Coop building and further investigation is required, the depth to suitable bearing strata in the vicinity of CP03 can also be confirmed at the same time.

Preliminary foundation design has been undertaken by calculation, a safe allowable bearing pressure of 125kN/m^2 is provided for ultimate limit state design based on a 1.5m square pad or 0.6m wide strip trench foundation constructed within the firm to stiff Clay or very dense Gravel deposits.

It is recommended that foundations are kept above the water table. Groundwater was encountered between 1.7m and 5.0m bgl in the area of the proposed Aldi store therefore it is unlikely that foundation excavations will encounter groundwater however groundwater is anticipated to be encountered shallow beneath foundation excavations. If groundwater is encountered in foundation excavations, dewatering will be required.

The settlement of the very dense Gravel will be immediate and will predominantly occur during the construction phase. Settlement will be negligible and Serviceability Limit State conditions will be satisfied. Using the above pressures, settlement criteria of 25mm will not be exceeded for the Clay and Serviceability Limit State conditions will be satisfied. Due to the potential for shallow foundations to be constructed within both granular and cohesive deposits, there is potential for differential settlement to occur between the foundations constructed within the Gravel and Clay deposits. Foundations are recommended to be reinforced to mitigate the risk for differential settlement and the angle of distortion assessed when the prosed foundation layout is available.

Construction Recommendations

The recommendations in this appraisal are preliminary and the detailed design should be developed in advance and during the construction phase. If the ground conditions or groundwater regime encountered during the construction phase differ significantly to the conditions encountered during the Ground Investigation, work should cease and Groundtech Consulting contacted for further advice.

During the construction phase, supervision by a suitably qualified geotechnical engineer should be on a continuous basis to check the design assumptions are correct and construction conforms to design in accordance with EC7. Supervision should include inspections, Control Ground Investigations and monitoring by a suitably qualified geotechnical engineer.

Vibro Stone Columns (VSCs)

If traditional foundations are not considered suitable, Vibro Stone Columns (VSCs) are considered to be a suitable foundation option. The vibro contractor should be consulted to determine whether additional works are required such as pre-augering due to the ground conditions encountered. Vibro treatment depths are likely to vary.

A preliminary design resistance for ultimate limit state and serviceability limit state conditions will be the provided by the specialist vibro contractor in their detailed design. The specialist contractor should provide fitness for purpose cover for the treated zones and depth of treatment.

The depth of foundations is to be a minimum of 0.35m below the surface of the vibro treated ground as the integrity of the columns is not validated to this depth. The reinforced concrete foundation should be designed to span between the centres of adjacent stone columns.

Construction Recommendations

The recommendations in this appraisal are preliminary and the detailed design should be developed in advance and during the construction phase. If the ground conditions or groundwater regime encountered during the construction phase differ significantly to the conditions encountered during the Ground Investigation, work should cease and Groundtech Consulting contacted for further advice.

During the construction phase, supervision by a suitably qualified geotechnical engineer should be on a continuous basis to check the design assumptions are correct and construction conforms to design in accordance with EC7. Supervision should include inspections, Control Ground Investigations and monitoring by a suitably qualified geotechnical engineer.

Mini Pile Foundations

If the above foundation solutions are not considered cost beneficial, an alternative foundation solution is considered to be mini piles. Piles should be a minimum of 4.2m in length and therefore should be driven into the residually weathered Sandstone bedrock deposits to achieve this length. The pile type should be suitable to allow hard driving.

The driven piles will transfer loads through the locally deep soft Clay to the underlying residually weathered Sandstone. At this stage the loadings are not available, pile caps and reinforced ring beam should be constructed to span between piles and support loadings from walls.

Design by Calculation

Preliminary design by calculation has been carried out using due skill and care using the global factor of safety method.

The preliminary design by calculation is based on the following ground model:

- Made Ground to 1.1m bgl
- Soft Clay to 3.0m bgl

- Very dense Gravel to 4.2m bgl.
- Residually weathered Sandstone to 4.3m bgl.

For a single driven concrete pile 225mm in diameter and 4.5m in length end bearing in the Sandstone, an allowable load of 100kN has been calculated. If greater loads are associated with the proposed development, consideration should be given to pile groups. This design should be confirmed with the preferred piling contractor.

An appropriate working platform should be constructed in accordance with BR470 guidance.

Construction Recommendations

The recommendations in this appraisal are preliminary and the detailed design should be developed in advance and during the construction phase. If the ground conditions or groundwater regime encountered during the construction phase differ significantly to the conditions encountered during the Ground Investigation, work should cease and Groundtech Consulting contacted for further advice.

During the construction phase, supervision by a suitably qualified geotechnical engineer should be on a continuous basis to check the design assumptions are correct and construction conforms to design in accordance with EC7. Supervision should include inspections, Control Ground Investigations and monitoring by a suitably qualified geotechnical engineer.

6.5 Building Near Trees

If foundation excavations encounter cohesive strata in the vicinity of existing, proposed or recently removed trees, foundations should be adjusted in full accordance with NHBC Standards Chapter 4.2. Existing trees are present along the southern and western boundary of the site which are to be removed prior to the development commencing. The new Aldi store is proposed to be constructed along the southern boundary of the site.

All foundations should be deepened below roots of greater than 5mm diameter during excavations for footings. The clay is of a low volume change potential. Foundations should be constructed at a minimum depth of 0.75m begl.

A survey of all trees and hedges on the site and within 30m of the site boundary should be undertaken to identify tree species, locations and heights. This information will be required in order to assess the effects of trees on the cohesive strata and inform a foundation schedule.

Where foundation depths due to trees already present or recently removed exceeds 1.5m there is a possibility for heave to occur on removal of the tree. NHBC Guidance states that no heave precautions are required in foundations for Low volume change potential Clay.

6.6 Floor Slabs

Made Ground in excess of 600mm has been encountered beneath the north eastern extent of the proposed building footprint. If traditional shallow foundations are to be adopted for the proposed development, a suspended floor slab should be utilised.

A ground bearing floor slab is potentially an option subject to suitable earthworks design and validation testing, this would include a drainage strategy to prevent inundation settlement.

As the Clay beneath the site is of low volume change potential, NHBC guidance states that suspended in-situ concrete ground floors with a minimum void of 50mm in thickness or 200mm is recommended beneath suspended precast concrete should be utilised.

6.7 Construction

The trial pits indicate that instability of excavations is not anticipated provided they are not exposed to adverse weather conditions for any substantial period of time. Instability of the Made Ground is a possibility and should be considered in the groundworks method statements.

Tracked high specification plant is recommended to maintain the build programme. Breaking equipment may also be required to break out the substructure associated with the existing Coop building.

Groundwater has been encountered at depths between 1.7m and 5.0m bgl and is unlikely to be encountered in excavations, unless extended to this depth. If groundwater is encountered during foundation excavations, they will require to be dewatered.

6.8 Concrete Classification

Made Ground

Water soluble sulphate testing was undertaken on 16 samples of the Made Ground. The range of soluble sulphate (SO_4) recorded is 0.0080g/l to 0.0537g/l. Associated pH values ranged between 7.89 and 9.59 indicating slightly alkaline conditions.

For a dataset containing more than 9 results, the mean of the highest 20% of soluble sulphate values and the mean of the lowest 20% of pH values should be taken as the characteristic values. For the Made Ground, the characteristic soluble sulphate value is 0.0467g/l and the associated pH value is 8.1.

Natural Strata

Water soluble sulphate testing was undertaken on 6 samples of the natural ground. The range of soluble sulphate (SO_4) recorded is 10mg/l to 24mg/l. Associated pH values ranged between 4.6 and 7.4 indicating slightly acidic to neutral conditions.

For a dataset containing 5 to 9 results, the mean of the highest two soluble sulphate values and the mean of the lowest two pH values are taken as the characteristic values. For the natural strata, the characteristic soluble sulphate value is 17.5mg/l and the associated pH value is 4.7.

Due to the granular deposits present locally beneath the site, the groundwater is considered to be mobile.

The results of laboratory pH and sulphate content indicate that ACEC Class AC-1 and sulphate class DS-1 conditions prevail in accordance with BRE Special Digest 1 "Concrete in aggressive ground" 2005. The specific concrete mixes (the Design Concrete Class) to be used on site will be determined by the site specific concrete requirements in terms of the durability and structural performance. These are assessed in terms of the Structural Performance Level (SPL) and any need for Additional Protective Measures (APM) detailed in Part D of BRE Special Digest 1 with further guidance in Pt E and F.

Potentially Pyritic Ground

Six BRE SD1 Made Ground Pyrite Suites were caried out and a summary of the testing results is present below:

Stratum	Number of Samples	Contaminants of Concern	Range of Results
Natural Strata	4	Acid Soluble Sulphate (% SO_4) Soluble Sulphate (mg/l SO_4) Total Sulphur (%) Magnesium (g/l) pH	0.01 10.0 – 24.0 0.01 – 0.02 <1.5 – 5.9 4.6 – 7.4

The amount of oxidisable sulphites (OS % SO_4) in the suspected pyritic ground is determined by subtracting the acid soluble sulphates (AS % SO_4) from the total potential sulphate content:

$$OS\ \%\ SO_4 = TPS\ \%\ SO_4 - AS\ \%\ SO_4$$

The amount of oxidisable sulphates was less than 0.3% SO_4 in the natural samples tested and so these soils are not considered to be pyritic ground conditions.

6.9 Highway Design

Granular Made Ground has been encountered at formation level across the majority of the site. At one location, PL01, natural Clay was encountered at formation level.

Six plate load tests were undertaken in the vicinity of the proposed service yard and car park areas in the south of the site. The results are summarised in the table below and the full results are presented in Appendix 9.

Reference	Depth (m bgl)	Strata	CBR Value (%)
PL01	0.50	Sandy gravelly Clay	1.0
PL02	0.30	MG: Granular	6.0
PL03	0.30	MG: Granular	6.0
PL04	0.30	MG: Granular	7.0
PL05	0.30	MG: Granular	4.0
PL06	0.40	MG: Granular	6.0

CBR values of 4.0% to 7.0% were achieved in the granular Made Ground soils for pavement design purposes in the area of the existing car park. Within the natural Clay, a CBR value of 1% was recorded. Some reengineering of the subgrade will be required prior to highway construction to achieve the required design CBR value.

The car park for the proposed Aldi store will be located in the north of the site in the area of the existing Coop store and where the Nant Mafon is currently culverted beneath the site. Post demolition and backfill, earthworks to a required specification will be required to produce a suitable formation level.

The soils are considered to frost susceptible due to the fines content, highway construction should be a minimum thickness of 450mm to mitigate against the risk.

6.10 Sustainable Urban Drainage System (SuDS)

Soil infiltration testing was undertaken at two locations across the site in locations where SuDS drainage is proposed in accordance with BRE Digest 365 'Soakaways' (2016). A summary of the soil percolation test results is given below, and the full results are presented in Appendix 10.

Location	Depth (m bgl)	Test No.	Soil Infiltration Rate (m/sec)
SuDS1	2.1	1	3.18×10^{-7}
SuDS1	2.1	2	9.70×10^{-7}
SuDS1	2.1	3	4.95×10^{-7}
SuDS2	2.1	1	0.00
SuDS2	2.1	2	0.00
SuDS2	2.1	3	0.00

The use of SuDS drainage within the natural ground at the proposed locations is not feasible at the site due to the presence of cohesive soils which are capable of low soil infiltration rates.

There is potential for SuDS drainage to be suitable in the natural granular deposits, depending on the groundwater level. This should be confirmed through completing soil infiltration tests in accordance with BRE Digest 365. Any proposed SuDS drainage should be located away from any contaminated ground.

If drainage of the highway to soakaways is to be considered it is suggested that this is discussed with the Local Authority at the earliest opportunity, to confirm the adequacy of proposed testing and to allow their inspection of any testing.

7.0 LAND QUALITY

7.1 Geo-Environmental Testing Results - Soils

Samples of Made Ground have been tested for a range of relevant Contaminants of Concern. In accordance with LCRM, a Generic Quantitative Risk Assessment (GQRA) has been undertaken to determine the significance of the concentrations as derived through Geo-Environmental testing.

The GQRA process comprises the comparison of the actual concentrations measured on site with Generic Assessment Criteria (GACs) for the protection of human health.

The GACs used for the assessment of soil concentrations have been derived using the CLEA model. The GACs used are listed below:

- Soil Guideline Values (SGVs) which demonstrate minimal risk.
- LQM/CIEH S4ULs which use the same toxicological data as the SGVs but different exposure criteria.
- C4SLs which demonstrate low risk.

In deriving the GACs for use on Brownfield sites we have assumed a 1% Soil Organic Matter, unless the results indicate otherwise.

The proposed end-use for the site is a commercial development comprising the construction of a new Aldi store. We have therefore undertaken the GQRA on the basis that the proposed development site falls under the commercial land-use scenario as defined in SR3 (EA, 2009b).

The strata or sources of contamination targeted by the laboratory testing scheduled is summarised in the table below:

Strata	Number Tested	Locations
Granular Made Ground (Population 1)	8	CP01, CP03, CP04, WS02, WS10, WS12 to WS14
Granular Made Ground (Population 2)	6	WS01 and WS03 to WS07
Cohesive Made Ground	1	CP02
Topsoil	1	WS11

A summary of the Geo-Environmental Testing results is presented below and the GQRA screening values are presented in Appendix 10:

Metals				
Contaminant	Range (mg/kg)	Screening value (mg/kg)	Exceedances	Locations
Arsenic	1.00 – 8.70	640	-	-
Cadmium	<0.10 – 60.90	230	-	-
Chromium	7.20 – 34.30	8600	-	-
Hexavalent Chromium	<0.3	49	-	-
Copper	2.00 – 48.00	68000	-	-
Lead	<5.00 – 56.00	2300	-	-
Mercury	<0.1	26	-	-
Nickel	3.10 – 43.7	980	-	-
Selenium	<1.00 – 2.00	13000	-	-

Zinc	13.00 – 1253	730000	-	-
Polycyclic Aromatic Hydrocarbons (PAHs)				
Contaminant	Range (mg/kg)	Screening value (mg/kg)	Exceedances	Locations
Naphthalene	<0.04 – 0.40	190	-	-
Acenaphthylene	<0.03 – 0.50	83000	-	-
Acenaphthene	<0.05 – 0.66	84000	-	-
Fluorene	<0.04 – 0.96	63000	-	-
Phenanthrene	<0.03 – 3.75	22000	-	-
Anthracene	<0.04 – 1.17	520000	-	-
Fluoranthene	<0.03 – 10.63	23000	-	-
Pyrene	<0.03 – 9.16	54000	-	-
Benzo(a)anthracene	<0.06 – 6.97	170	-	-
Chrysene	<0.02 – 7.97	350	-	-
Benzo(b)fluoranthene	<0.05 – 10.40	44	-	-
Benzo(k)fluoranthene	<0.02 – 4.04	1200	-	
Benzo(a)pyrene	<0.04 – 7.70	35	-	-
Indeno(123cd)pyrene	<0.04 – 5.37	500	-	-
Dibenzo(ah)anthracene	<0.04 – 1.43	3.5	-	-
Benzo(ghi)perylene	<0.04 – 5.21	3900	-	-
TPH CWG – Aliphatics				
Contaminant	Range (mg/kg)	Screening value (mg/kg)	Exceedances	Locations
>C5-C6	<0.10	3200	-	-
>C6-C8	<0.10	7800	-	-
>C8-C10	<0.10 – 0.40	2000	-	-
>C10-C12	<0.20 – 1.40	9700	-	-
>C12-C16	<4.00 – 5.00	59000	-	-
>C16-C21	<7.00 – 15.00	1600000	-	-
>C21-C35	<7.00 – 118	1600000	-	-
Total aliphatics C5-35	<19.00 – 118		-	-
TPH CWG – Aromatics				
Contaminant	Range (mg/)	Screening value (mg/kg)	Exceedances	Locations
>C5-EC7	<0.10	26000	-	-
>EC7-EC8	<0.10	56000	-	-
>EC8-EC10	<0.10	3500	-	-
>EC10-EC12	<0.20	16000	-	-
>EC12-EC16	<4.00	36000	-	-
>EC16-EC21	<7.00 – 27	28000	-	-
>EC21-EC35	<7.00 – 567	28000	-	-
Total aromatics C5-35	<19.00 – 591		-	-
Total aliphatics and aromatics(C5-35)	<38.00 - 709		-	-
MTBE	<5.00 ug/kg	7900	-	-
Benzene	31.00 – 199.00 ug/kg	95	-	-

Toluene	15.00 – 272.00 ug/kg	4400	-	-
Ethylbenzene	<5.00 – 18.00 ug/kg	2800	-	-
m/p-Xylene	<5.00 – 371.00 ug/kg	3200	-	-
o-Xylene	<5.00 – 26.00 ug/kg	2600	-	-
Others				
Organic Matter	<0.2 – 18.3%			
		Asbestos Screen		
Position	Depth (m bgl)	Result	Quantification (mass%)	
WS13	0.40	Free Fibres	<0.001	
CP01	0.35	None Detected	n/a	
CP02	0.10	None Detected	n/a	
CP03	0.40	None Detected	n/a	
CP04	0.60	None Detected	n/a	
WS01	0.35	None Detected	n/a	
WS02	0.30	None Detected	n/a	
WS03	0.30	None Detected	n/a	
WS04	0.40	None Detected	n/a	
WS05	0.30	None Detected	n/a	
WS06	0.60	None Detected	n/a	
WS07	0.30	None Detected	n/a	
WS10	0.50	None Detected	n/a	
WS11	0.30	None Detected	n/a	
WS12	0.40	None Detected	n/a	
WS14	0.40	None Detected	n/a	

7.2 Generic Quantitative Risk Assessment - Soils

Made Ground was encountered across the site to a maximum depth of 2.0m bgl in the extreme north eastern area in WS09. Generally the Made Ground was encountered between 0.4m and 1.5m bgl and comprised grey brown sandy gravel with minor constituents of brick, concrete and sandstone. The full depth of Made Ground was not determined in WS09 and WS11 due to obstructions within the Made Ground.

Visual evidence of contamination was noted as a black sheen, along with a moderate diesel hydrocarbon odour in WS02, WS03 and WS10 at depths between 0.5m bgl and 1.8m bgl in both the Made Ground and natural cohesive strata.

Metals

No elevated concentrations of metals have been recorded above commercial screening values for the samples tested across the site.

Speciated Polycyclic Aromatic Hydrocarbons (PAHs)

There were no elevated levels of speciated PAHs above commercial screening values within any of the samples tested.

Total Petroleum Hydrocarbons (TPH CWG)

Visual and olfactory evidence of hydrocarbon contamination was noted in WS02 and WS03 in the west of the site directly next to the Petrol Filling Station and in WS10 in the north of the site in the area of the former garage.

No elevated concentrations of hydrocarbons have been detected based on the site having a commercial end use, with the majority of hydrocarbons being recorded below the laboratory limit of detection. Only heavy range aromatic and aliphatic hydrocarbons were identified above the laboratory detection limit, indicating no volatile hydrocarbons are present in the soils. Interpretation indicates that the source of contamination includes traces of tarmac/bitumen, PAHs and lubricating oil. A trace of possible degraded diesel was identified in WS10 at 0.5m bgl in the area of the former garage on site.

No elevated levels of MTBE and BTEX have been recorded above commercial screening values. All MTBE and BTEX were recorded under laboratory limits of detection in all samples other than WS10 at 0.5m bgl.

In order to delineate the extent of hydrocarbon contamination identified in WS02 and WS03, two further boreholes were drilled (WS13 and WS14) to the south. No evidence of hydrocarbon contamination was noted in either boreholes and all TPH in both WS13 and WS14 were recorded at levels under the laboratory limit of detection indicating that the extent of impacted soils is confined to a small area directly adjacent to the PFS.

Furthermore, results of the PID were recorded at low levels of between 0 and 1ppm across the site which indicates that the contamination is associated with heavy range organics. The vapour saturation limit was also not exceeded in any of the samples tested indicating that no volatile contamination is present on site.

Volatile Organic Compounds (VOCs)

All VOCs were recorded under the laboratory limit of detection apart from the BTEX compounds in WS10 at 0.5m bgl tested for separately. No elevated VOCs were recorded including within WS10.

Asbestos

Asbestos was detected in WS13 at 0.4m bgl with a mass concentration of <0.001%. No asbestos fibres were detected in any of the other samples screened through laboratory testing.

7.3 Geo-Environmental Testing Results - Groundwater

Four samples of groundwater were taken from WS02, CP01, CP03 and CP04 and were tested for the same suite of Contaminants of Concern (CoC) as the soils and the results compared with reference to a selection of guidance documents as detailed at the rear of this report. Samples were also taken from both upstream and downstream of the Nant Mafon which is culverted beneath the site to determine if the site is impacting the quality of the culvert.

The implementation of the Water Framework Directive (WFD) is to protect and enhance the quality of groundwater and groundwater-dependent ecosystems. The objective of the WFD requires all groundwater bodies (GWBs) are of 'good' status in terms of water quality. This status is based on thresholds for the chemical constituents of groundwater and their impact on ecosystems. Preventing pollution is by far the most sustainable and cost-effective way of maintaining good groundwater quality. NRW are committed to the 'prevent or limit' approach reflected in EU and domestic legislation.

Priority is under the Water Framework Directive to protect water supplies intended for human consumption and ensure protection of groundwater quality that supplies dependent ecosystems. After first guidance in 1992 the following significant guidance has been introduced:

- Water Framework Directive (2000/60/EC) and the Water Act 2003.
- The State of Groundwater in England and Wales 2006.
- Second phase of the environmental permitting regime in 2010 replacing the Groundwater Regulations (1999, 2009).
- Groundwater Daughter Directive.

Pollutants can be divided into those that break down easily (degradable pollutants) and those that do not (non-degradable pollutants). The Water Framework Directive introduced the concept of 'hazardous substances' and 'non-hazardous pollutants', which replaced the previous List I and List II of substances considered to pose the greatest threat to the environment.

- Hazardous substances are the most toxic and must be prevented from entering groundwater. Substances in this list may be disposed of to the ground, under a permit, but must not reach groundwater. They include pesticides, sheep dip, solvents, hydrocarbons, mercury, cadmium and cyanide.
- Non-hazardous pollutants are less dangerous and can be discharged to groundwater under a permit but must not cause pollution. Examples include sewage, trade effluent and most wastes. Non-hazardous pollutants include any substance capable of causing pollution and the list is much wider than the previous List II of substances. For example, nitrate is now a non-hazardous pollutant whereas before it was not a List II substance.

Polluting substances in groundwater can occur as a gas (gaseous phase) or dissolved in water (aqueous phase), or as a non-aqueous phase liquid (NAPL). Some pollutants include substances that dissolve readily in water. These are said to have high solubility; an example is MTBE. Substances that have low solubility (such as oil) are referred to as non-aqueous phase liquids (NAPLs). NAPLs behave differently in groundwater depending on whether they are lighter or heavier than water. Light non-aqueous phase liquids (LNAPLs) may float on the water table whereas dense non-aqueous phase liquids (DNAPLs) may sink through the aquifer until they reach an impermeable layer. They may then generate plumes of contamination. In both cases, the slowly dissolving pollutant may form a plume of dissolved contamination which moves with the groundwater flow.

A table summarising the groundwater and surface water testing results is presented below:

Metals				
Contaminant	Range (ug/l)	EQS (ug/l)	Exceedances	Locations
Arsenic	<2.5 – 2.5	50	0	-
Boron	<12.0	1000	0	-
Cadmium	<0.5	5	0	-
Chromium	<1.5	50	0	-
Hexavalent Chromium	<0.006	12	0	-
Copper	<7	20	0	-
Cyanide	<0.01 – <0.05	1	0	-
Lead	<5	50	0	-
Mercury	<1	1	0	-

Nickel	<2.0 – 9.0	50	0	-
Selenium	<3.0	10	0	-
Zinc	<3.0 – 6.0	3000	0	-
Polycyclic Aromatic Hydrocarbons (PAHs)				
Contaminant	Range (ug/l)	EQS (ug/l)	Exceedances	Locations
Naphthalene	<0.1	1.2	0	-
Benzo(a)pyrene	<0.005 – 0.036	0.00017	4	DS1, US1, WS02, CP04
Indeno(123cd)pyrene	<0.005 – 0.030	0.00017	4	DS1, US1, WS02, CP04
Benzo(ghi)perylene	<0.005 – 0.027	0.00017	3	US1, WS02, CP04
Benzo(b)fluoranthene	<0.008 – 0.060	0.00017	2	WS02, CP04
Benzo(k)fluoranthene	<0.008 – 0.024	0.00017	2	WS02, CP04
Fluoranthene	<0.005 – 0.089	0.0063	2	WS02, CP04
TPH CWG – Aliphatics				
Contaminant	Range (ug/l)	EQS (ug/l)	Exceedances	Locations
>C5-C6	<10	15,000	0	-
>C6-C8	<10	15,000	0	-
>C8-C10	<10	300	0	-
>C10-C12	<5	300	0	-
>C12-C16	<10	300	0	-
>C16-C35	<10	-	0	-
Total aliphatics C5-35	<10	-	0	-
TPH CWG - Aromatics				
Contaminant	Range (ug/l)	EQS (ug/l)	Exceedances	Locations
>C5-EC7	<10	-	0	-
>EC7-EC8	<10	-	0	-
>EC8-EC10	<10	-	0	-
>EC10-EC12	<5	90	0	-
>EC12-EC16	<10	90	0	-
>EC16-EC21	<10	90	0	-
>EC21-EC35	<10	90	0	-
Total aromatics C5-35	<10	-	0	-
Total aliphatics and aromatics(C5-35)	<10	-	0	-
MTBE	<0.1	15	0	-
Benzene	<0.5	10	0	-
Toluene	<5	74	0	-
Ethylbenzene	<1	300	0	-
m/p-Xylene	<2	30	0	-
o-Xylene	<1	30	0	-
Others				
Total Hardness		100 – 184mg/l		

All of the VOCs tested for were recorded at concentrations below the laboratory limits of detection.

7.4 Generic Quantitative Risk Assessment - Groundwater

Controlled Waters Setting

Strata underlying the site consists of Made Ground over soft to firm grey brown sandy gravelly Clay and grey sandy Gravel encountered to a maximum depth of 5.0m bgl. Residually weathered Sandstone bedrock was encountered in CP01 to CP04 from between 3.2m and 5.0m bgl.

Groundwater was encountered within the natural cohesive and granular deposits across the site at depths of between 1.7m and 5.0m bgl. Perched groundwater was encountered in the Made Ground of WS09 at 2.0m bgl.

The superficial deposits are classified as both Secondary A and Secondary Undifferentiated Aquifers. The bedrock deposits are classified as a Secondary A Aquifer. The site does not lie within 500m of a Source Protection Zone, the nearest recorded groundwater abstraction is historical located 818m south of the site relating to a well a Penbeili Farm used for general farming and domestic use.

The nearest watercourse is the Nant Mofat which is culverted beneath the site and the contaminants tested for have been compared to EQS screening levels as the watercourse is the nearest compliance point/receptor.

Heavy Metals

No elevated concentrations of heavy metals have been recorded when compared to the EQS screening values.

Speciated Polycyclic Aromatic Hydrocarbons (PAHs)

Within WS02 and CP04, slightly elevated concentrations of speciated PAHs were recorded. As benzo-PAHs are classed as hazardous priority substances, they should be prevented from entering groundwater and surface waters. These concentrations are considered to be associated with the proximity of WS02 to the adjacent petrol filling station and associated USTs. Evidence of hydrocarbon contamination was also noted in the soils of WS02. Both WS02 and CP04 contained Glaciofluvial deposits. The elevations in CP04 indicate that there is a pathway within the locally encountered permeable granular deposits.

The surface water samples from both upstream and downstream of the culvert showed slight PAH elevations in indeno(123cd)pyrene and benzo(ghi)perylene. Higher concentrations were recorded in the upstream samples in both cases indicating that the site is not impacting the quality of the surface waters.

Total Petroleum Hydrocarbons (TPH CWG)

All TPH CWG, MTBE and BTEX were recorded under laboratory limits of detection, no elevations have been identified.

In addition, no free phase contamination was noted in any of the locations.

The results of testing indicate that the former uses of the site has not impacted the groundwater significantly. The assessment is based on Level 2 Remedial Target Values where the compliance point is beneath the site (using EQS/DWS screening levels). A Hydrogeological Detailed Quantitative Risk Assessment (DQRA) is not considered to be required.

The groundwater levels recorded during the Ground Investigation and the monitoring indicate the groundwater flow direction is to the west away from surface water features. The petrol fueling station and

USTs are positioned to the west, downgradient of site. Clay has also been encountered in the superficial deposits which is impermeable and will limit infiltration into the bedrock deposits.

No groundwater was encountered in the north of the site and in the area surrounding the culvert at the time of sampling. Prior to development, it is recommended that, if available, groundwater testing is conducted on the groundwater in the north of the site.

Further investigation is also required following the demolition of the existing Coop store for any visual or olfactory evidence of contamination associated with the historic garage in the north of the site. Evidence of hydrocarbon contamination in the form of black staining and moderate odour, was noted in WS10 at 0.5m bgl beneath the area of the historic garage.

The surface water samples were taken from upstream and downstream of the Nant Mafon culverted beneath the site. However, the culvert was inaccessible from onsite are not considered to be from onsite.

7.5 Permanent Ground Gases

Four monitoring visits have been undertaken at the site between 15th November 2023 and 4th January 2024.

No concentrations of methane (CH_4) have been recorded in the boreholes, levels of carbon dioxide (CO_2) were recorded up to a maximum level of 1.9%v/v and the associated oxygen concentrations were recorded at a minimum level of 15.8%v/v.

In addition, no positive gas flow rates have been detected during the monitoring visits.

The atmospheric pressure ranged between 979mb to 1001mb and the monitoring visits have been undertaken during periods of steady, falling and rising barometric pressure.

Characterisation of the Gas Screening Value (GSV)

Based upon the results recorded, in accordance with CIRIA Report C665, the risk to the site from ground gases has been assessed by converting the results to get gas screen values (GSVs), calculated by multiplying the typical maximum gas concentrations with the recorded maximum positive gas flow rates. In addition, individual "hazardous gas flow rates" (Qhg) have been derived for each monitoring point. As no levels of methane have been recorded, a GSV for carbon dioxide only has been calculated.

GSV (l/hr) = max borehole flow rate (l/hr) x max gas concentration (%)

For this assessment, the maximum recorded concentration of carbon dioxide of 1.9%v/v has been used No positive gas flow rates have been detected therefore, the limit of detection of the gas analyser of 0.1l/hr has been used to calculate the GSV – this is worst case scenario.

Carbon Dioxide GSV = 0.019 (1.9%) x 0.1 = 0.0019 l/hr

In order to assess the ground gas regime beneath the site and the need to incorporate ground gas precautions, guidance was taken from CIRIA C665 'Assessing risks posed by hazardous ground gases to buildings'. Based on the site being developed for a commercial end use, the Wilson and Card method has been used to carry out the assessment.

When considering the results in accordance with CIRIA C665 (Section A Development and Table 8.5 – Modified Wilson and Card Classification) it can be seen that the GSV values for carbon dioxide are below the assessment GSV of 0.07l/hr and falls within Characteristic Situation 1 therefore, gas protection measures are not required.

Characteristic Situation 1

The proposed development is classified as Building Type C in accordance with BS 8485:2019 and the site falls in CS1 in accordance with Table 2 of the above guidance and no gas protection measures are required.

All detectable hydrocarbons were heavy range, with all low range hydrocarbons being recorded below laboratory limits of detection. All VOCs were recorded below the laboratory limit of detection apart from BTEX compounds tested for separately. All TPH and BTEX were recorded below the laboratory limit of detection for groundwater. Furthermore, the vapour saturation limit was not exceeded for any of the samples tested and PID readings were recorded between 0ppm and 1ppm indicating that volatile hydrocarbons are not present on site. The risk from vapours is considered to be Low.

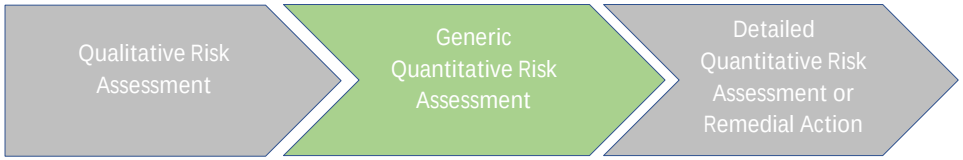
Further investigation is required post demolition of the existing Coop store for any contamination not previously identified.

The site is not located in an area where Radon Protection Measures are required.

7.6 Revised Pollution Linkage Assessment

The CSM has been revised based on the Ground Investigation and testing using Source-Pathway-Receptor assessment criteria that is applicable in the UK, a risk assessment has been completed to determine if a plausible pollution linkage exists between the identified contaminants and receptors. The risk classification has been estimated in accordance with the CIRIA C552 assessment criteria outlined in Appendix 12.

Human Health Pollution Linkage Assessment



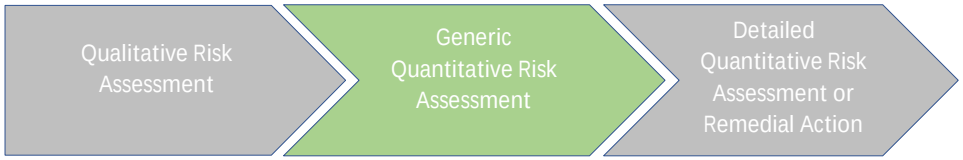
- The table below represents the second stage in the land quality risk assessment process - the Generic Quantitative Risk Assessment.
- In order for a development site to be deemed 'suitable for use' the level of risk needs to be reduced to an acceptable level - low to negligible risk. The purpose of each stage of risk assessment is to establish if there is a requirement for additional stages of assessment in order to have sufficient confidence to support a risk characterisation or remedial action.

Conceptual Site Model					Generic Quantitative Risk Assessment	
PL	Potential Source	Pollution Linkage	Likelihood	Consequence/ Severity	Risk Rating	Rationale and Action
PL1	Contaminated Soils	Ingestion of soil and dust. Dermal contact with soil.	Unlikely	Medium	Moderate to Low	Pollution Linkage 1 refers to proposed site users coming into contact with contaminated soils on the site. Made Ground was encountered beneath the site to a maximum depth of 2.0m bgl. Evidence of hydrocarbon contamination was encountered in WS02 and WS03 adjacent to the petrol filling station and in WS10 in the area of the former garage. No elevated CoC were recorded against commercial screening values. A single asbestos identification was recorded in the Made Ground of WS13 at 0.4m bgl at trace concentrations of <0.001 mass%. The JIWG receptor tool indicated there is very low risk present. Further investigation is required post demolition of the Coop in the area of the historic garage.

Conceptual Site Model					Generic Quantitative Risk Assessment	
PL	Potential Source	Pollution Linkage	Likelihood	Consequence/ Severity	Risk Rating	Rationale and Action
						The proposed development is for a new Aldi store which will cover the majority of the site with hardsurfacing. Where soft landscaping areas are present, a pollution linkage is considered to exist between the contaminated Made Ground and site end users.
PL2	Contaminated Soils	Inhalation of vapour.	Low likelihood	Medium to Severe	Low	Pollution linkage 2 refers to vapours migrating into confined spaces within the proposed development. Visual and olfactory evidence of hydrocarbon contamination was noted in WS02, WS03 and WS10 during the Ground Investigation. However, no hydrocarbons within the volatile range were recorded through the geo-environmental testing. All PID readings were also recorded between 0ppm and 1ppm indicating that no volatile hydrocarbons are present on site. Therefore, as a significant source of volatiles has not been identified a realistic pollution linkage does not exist. Further investigation is required however post demolition of the Coop in the area of the historic garage.
PL3	Contaminated Soils	Inhalation of soil dust by adjacent site users.	Unlikely	Medium	Low	Pollution Linkage 3 relates to contamination on the subject site affecting adjacent site users. Natural cohesive deposits were encountered beneath the site which will significantly reduce the lateral migration of contamination. Although visual and

Conceptual Site Model						Generic Quantitative Risk Assessment
PL	Potential Source	Pollution Linkage	Likelihood	Consequence/ Severity	Risk Rating	Rationale and Action
						olfactory evidence of contamination was noted, no elevated CoC were identified during geo-environmental testing. Therefore, a plausible pollution linkage is not considered to exist.
PL4	Contaminated Soils	Attacking potable water supply pipe.	Likely	Medium	Moderate	Pollution Linkage 4 refers to the possible contaminants permeating potable water pipes and consumption by the future site end users of the tainted water supply. Made Ground was encountered across the site to a maximum depth of 2.0m bgl. The proposed development will contain new potable water supply pipes which may be installed in Made Ground therefore a pollution linkage is considered to exist and a water company risk assessment is required.
PL5	Ground Gas	Migration and accumulation of ground gas in internal spaces.	Likely	Medium to Severe	Low	Made Ground is present beneath the site to a maximum depth of 2.0m bgl. Several industrial site uses surround the site which may be a potential source of ground gasses. The ground gas results indicate that the site lies within CS1 and gas protection measures will not be required in the proposed development. The site is not within an area requiring radon precautions within foundations.

Controlled Waters Pollution Linkage Assessment



- The table below represents the second stage in the land quality risk assessment process – Generic Quantitative Risk Assessment.
- In order for a development site to be deemed 'suitable for use' the level of risk needs to be reduced to an acceptable level - low to negligible risk. The purpose of each stage of risk assessment is to establish if there is a requirement for additional stages of assessment in order to have sufficient confidence to support a risk characterisation or remedial action.

Conceptual Site Model					Generic Quantitative Risk Assessment	
PL	Potential source	Pollution linkage	Likelihood	Severity	Level of risk	Rationale
PL6	Contaminated Soils	Impaction of groundwater from soil contamination (diffuse and point). Impaction of groundwater from groundwater plume.	Unlikely	Medium	Moderate to Low	Made Ground was encountered across the site to a maximum depth of 2.0m bgl associated with the previous developments on the site. The superficial deposits underlying the site are classified as both an Undifferentiated Aquifer and Secondary A Aquifer (northern most third). The bedrock deposits are classified as a Secondary A Aquifer. The site is not located within 500m of a Source Protection Zone and the groundwater is not considered to be a sensitive resource. Visual and olfactory evidence of hydrocarbon contamination was noted in WS02, WS03 and WS10 during the Ground Investigation, all groundwater testing recorded TPH concentrations below laboratory detection limits. A viable pollution linkage is not considered to exist. However, further investigation is required around the former garage and culvert.

Conceptual Site Model						Generic Quantitative Risk Assessment
PL	Potential source	Pollution linkage	Likelihood	Severity	Level of risk	Rationale
PL7	Contaminated Soils	Migration of soil and groundwater contamination impacting surface waters.	Likely	Medium	Moderate to Low	Surface water features have been identified within the vicinity of site and the nearest named watercourse is the Nant Mafon which is culverted beneath the site. Visual and olfactory evidence of hydrocarbon contamination was noted in WS02, WS03 and WS10 during the Ground Investigation. Groundwater testing recorded TPH levels below laboratory detection limits. Surface water testing was undertaken both upstream and downstream of the culvert beneath the site. A pollution linkage is not considered to exist. However, further investigation is required around the former garage and culvert.

7.7 Outline Remedial Strategy

Soils

The geo-environmental testing has not highlighted any elevated concentrations of CoC in the Made Ground beneath the site. Asbestos fibres were detected in one sample of the Made Ground in WS13 at 0.4m bgl and have been quantified at trace concentrations of <0.001mass%.

The majority of the site is to be underlain with hardstanding associated with the new Aldi store, car parking and loading bays which will effectively act as a cover system and no remedial action will be required.

Where minimal areas of soft landscaping are present within the final development, a cover system will be required comprising 450mm of clean topsoil/subsoil underlain by a contamination demarcation barrier.

Any imported soils will need to be tested to ensure they are suitably clean for the proposed commercial end use and the thickness of the cover system should be validated.

Further investigation is required in the area of the Coop store post demolition in order to identify and contamination under areas that were inaccessible during the ground investigation.

Controlled waters

Visual and olfactory evidence of hydrocarbon contamination has been encountered in WS02, WS03 and WS10 during the Ground Investigation. Groundwater and surface water testing results also recorded all TPH, BTEX, and MTBE below laboratory detection limits. Remediation in relation to controlled waters is not required.

Following demolition of the existing Coop store, further investigation is required in the north of the site in the area of the former garage and culvert.

Ground Gases

Ground gas monitoring indicates that the site is within CS1 and gas protection measures will not be necessary. The site is not in an area requiring Radon protection measures.

Watching Brief and Regulatory Compliance

A watching brief should be in place during ground works and construction. If previously unidentified contamination is encountered, work should cease in that area and Groundtech Consulting contacted for advice.

Regulatory compliance should be obtained pre-commencement to avoid delays during the construction phase which will have cost implications.

7.8 Asbestos in Soils

Asbestos fibres were detected in one out of the sixteen samples of Made Ground that were screened at trace concentrations of <0.001 mass%.

Where possible, it is advised that any Made Ground soils containing asbestos are left in the ground undisturbed.

Where soils will be disturbed as part of the ground works, in accordance with the Joint Industry Working Group (JIWG) decision support tool for CAR2012 work categories, the combined hazard and exposure ranking is Very Low for the asbestos detected. The work is classified as non-licenced, and CAR does not apply.

The JIWG tables are presented in Appendix 13. This should be used as an aid to classify risk and recommend the level of protection required, the final decision on how asbestos within the soils should be managed should be made by the contractor.

The presence of asbestos within the ground will require, a safe system of work to be set up on site to deal with the asbestos risk from the Made Ground. This may include but be not limited to:

- The use of qualified personnel where required.
- Careful segregation of stockpiles on site.
- Defining transport routes.
- Cleaning down of machinery in designated areas.
- Decontamination unit for ground workers.
- Damping down of soils to prevent dust migration.

All such works will need to be agreed with the regulatory bodies (HSE, LA).

7.9 Health and Safety - Construction and Ground Workers

During the reclamation and construction phases of the site development it will be necessary to protect the health and safety of site personnel. The risk to construction and ground workers is assessed in the table below:

PL Ref	Potential Source	Pollution Linkage	Likelihood	Severity	Level of Risk
PL8	Made Ground	Ingestion, direct contact, inhalation of dusts.	Likely	Medium	Low
PL8	Asbestos	Ingestion, direct contact, inhalation of dusts.	Likely	Medium	Low

General guidance on these matters is given in the Health and Safety Executive (HSE) document "Protection of Workers and the General Public during the Redevelopment of Contaminated Land". In summary, the following measures are suggested to provide a minimum level of protection:

- All ground workers should be issued with the relevant protective clothing, footwear and gloves. These protective items should not be removed from the site and personnel should be instructed as to why and how they are to be used.
- Hand-washing and boot-washing facilities should be provided.
- Care should be taken to minimise the potential for off-site migration of contamination by the provision of dust suppression control and wheel cleaning equipment during the construction works.
- Good practices relating to personal hygiene should be adopted on the site.
- The contractor shall satisfy the Health and Safety Executive with regard to any other matters concerning the health, safety and welfare of persons on the site.

7.10 Waste Classification by Assessment

We have reviewed the testing results and inputted them into the HazWasteOnline model which allows users to code and classify waste as defined in the EWC (European Waste Catalogue 2002) based on EC Regulation 1272/2008 on the Classification, labelling and packaging of substances and mixtures (CLP) and latest Environment Agency guidance (WM3 "Guidance on the classification and assessment of waste (1st edition 2015)-Technical Guidance").

This is a useful tool as waste producers have the legal responsibility to classify any waste they produce.

Sixteen samples were tested to assess whether they contained any contaminants in the hazardous range when screened against assessment criteria within WM3. The results are in the Waste Classification Report presented in Appendix 14.

Location	Depth (m bgl)	Material	Classification	Hazardous Properties
CP01	0.35	MG: Grey brown sandy gravel	Non-Hazardous	-
CP02	0.60	MG: Grey brown slightly sandy slightly gravelly clay	Non-Hazardous	-
CP03	0.40	MG: Grey brown sandy gravel	Non-Hazardous	-
CP04	0.60	MG: Grey brown sandy gravel	Non-Hazardous	-
WS01	0.35	MG: Red brown sandy gravel	Non-Hazardous	-
WS02	0.30	MG: Grey brown sandy gravel	Non-Hazardous	-
WS03	0.30	MG: Red brown sandy gravel	Non-Hazardous	-
WS04	0.40	MG: Red brown sandy gravel	Non-Hazardous	-
WS05	0.30	MG: Red brown sandy gravel	Non-Hazardous	-
WS06	0.60	MG: Red brown sandy gravel	Non-Hazardous	-
WS07	0.30	MG: Red brown sandy gravel	Non-Hazardous	-
WS10	0.50	MG: Grey brown sandy gravel	Non-Hazardous	-
WS11	0.30	MG: Brown sandy gravelly topsoil	Non-Hazardous	-
WS12	0.40	MG: Grey brown sandy gravel	Non-Hazardous	-
WS13	0.40	MG: Grey brown sandy gravel	Non-Hazardous	-
WS14	0.40	MG: Grey brown sandy gravel	Non-Hazardous	-

Based on the assessment tool the Made Ground has been classified as Non-Hazardous. Total testing was not undertaken on the natural soils and are assumed to also be Non-Hazardous.

Asbestos fibres were detected at trace concentrations of <0.001 mass% in one of the samples screened therefore does not affect the classification.

7.11 Waste Acceptance Criteria (WAC) Results

The Landfill Directive (Directive 1999/31/EC on the landfilling of waste) led to the establishment of a methodology for classifying wastes. Wastes can only be accepted at a landfill if they meet the relevant Waste Acceptance Criteria (WAC) for that type of landfill. There are three different WAC, these are for:

- Inert waste
- Non-Hazardous waste

- Hazardous waste

Wastes should first be classified based on their total concentrations as detailed in the previous section. WAC testing is then required if the end disposal route is a landfill.

Solid and eluate WAC analysis was undertaken on six samples, the findings of which are presented in the table below.

Reference	Depth (m)	Strata Type	Classification by Assessment	WAC Analysis	Landfill Disposal
CP01	0.35	Granular Made Ground	Non-Hazardous	Inert	Inert
CP02	0.60	Cohesive Made Ground	Non-Hazardous	Inert	Inert
WS02	0.30	Granular Made Ground	Non-Hazardous	Inert	Inert
WS10	0.50	Granular Made Ground	Non-Hazardous	Inert	Inert

The WAC testing has revealed that if the end disposal route of the Made Ground is landfill the material would be accepted at an Inert Landfill.

The possibility of automatic inert classification of the natural soils should be explored in accordance with Section 4.3 of the EA guidance document. The Council Decision includes a list of wastes in Section 2.1.1 of the document that are assumed to be inert and therefore acceptable at a landfill for inert waste without testing, this is the case if:

- They are single stream waste of a single waste type (although different waste types from the list may be accepted together if they are from a single source)
  and
- There is no suspicion of material or substances such as metals, asbestos, plastics, chemicals, etc to an extent which increases the risk associated with the waste sufficiently to justify contamination and they do not contain other their disposal in other classes of landfill.

If any organic contaminated material is encountered during the construction phase, it is possible that this may be classified as hazardous and testing should be undertaken at that time.

Materials should segregated and where necessary sufficient time is allowed to further classify the material properly, including discussion with landfill sites and waste transfer stations to find the best disposal route. It is recommended that where possible that the soils could be recycled at a suitable local waste treatment plant or transfer station rather than a landfill disposal route.

The reuse of soils on the site this should be done in accordance with the CL:AIRE "Development Industry Code of Practice for the Definition of Waste" (CL:AIRE CoP). Any re-use scheme should be designed to minimise disposal costs.

After a cut and fill balance plan/volume calculation has been carried out, a U1 and T5 exemption could be registered. This will allow the use of the following soils without a waste permit or under Dow CoP MMP:

- 1,000 tonnes (c. 600m^3) of non-hazardous soil
- 5,000 tonnes (c. 3,000m^3) of natural sand and gravels.

- 50,000 tonnes (c. 25,000m^3) of bituminous material to be used in roadways.
- 5,000 tonnes (c. 3,000m^3) of crushed concrete/stone.

8.0 FINAL APPRAISAL

8.1 Land Quality

Made Ground was encountered across the site to a maximum depth of 2.0m bgl. Visual and olfactory evidence of diesel hydrocarbon contamination was noted in WS02, WS03 and WS10 associated with the adjacent petrol filling station and former garage.

No elevated levels of Contaminants of Concern (CoC) were recorded above commercial screening values. Asbestos fibres were identified within one of the samples screened through laboratory testing at trace concentrations of <0.001 mass%.

The risk from contaminated soils is considered to be Low. The majority of the redevelopment will be covered by hardsurfacing which will act as a cover system, in areas of soft landscaping a 450mm of suitably clean subsoil/topsoil and warning membrane should be placed to mitigate the risk.

Further investigation is required post demolition in the areas previously inaccessible for any evidence of contamination.

Visual evidence of hydrocarbon contamination was noted in WS02, WS03 and WS10 in the form of a black coating. A moderate hydrocarbon odour was also noted. No elevated TPH, MTBE and BTEX were recorded above commercial screening values and the majority were recorded below laboratory limits of detection. All PID readings were recorded between 0 and 1ppm. The risk from vapours is considered to be Low.

Gas monitoring visits classify the site as CS1 as no methane has been recorded in any of the boreholes and carbon dioxide levels did not exceed 1.9%v/v. The risk from ground gasses is considered to be Low.

The risk to controlled waters has been assessed as Low. Further investigation is required following the demolition of the existing Coop store in the area of the historic garage and culvert.

The soils underlying the site have been classified as Non-Hazardous for waste disposal purposes.

8.2 Ground Engineering

The most suitable foundations for the proposed Aldi development are considered to be pads to support the steel frame with strip footings utilised to support the masonry walls. Pad and strip footings should be founded within the firm to stiff natural Clay deposits or very dense natural Gravel deposits at between 0.75m and 2.0m begl.

If traditional foundations are not considered suitable, Vibro Stone Columns (VSCs) are considered to be a suitable foundation option.

A final alternative foundation solution is considered to be mini piles. Piles should be a minimum of 4.2m in length and therefore should be driven into the residually weathered Sandstone bedrock deposits.

SuDS drainage is not considered to be feasible for the proposed development due to poor infiltration rates observed.

8.3 Required Further Work

The following further work is considered necessary to progress the site to construction phase:

- Detailed Foundation design
- Further investigation in inaccessible areas post demolition to assess the risk from contamination
- Further investigation in inaccessible areas post demolition to confirm depth to suitable bearing strata beneath north eastern corner of proposed Aldi store footprint
- Further investigation to assess risk to controlled waters in the vicinity of former garage and culvert
- Confirmation of recommendations made in this appraisal with regulators

9.0 RELEVANT INDUSTRY REFERENCES

British Standards Institution. Investigation of Potentially Contaminated sites - code of practice. BS 10175:2017.

British Standards Institution 'Code of Practice for Site Investigations' BS 5930:2015

British Standards Institution "Geotechnical investigation and testing – Identification and classification of soil" BS EN ISO 14688:2002.

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CIRIA 552 "Contaminated Land Risk Assessment – A guide to good practice" 2001.

CIRIA C665 "Assessing Risks Posed by Hazardous Ground Gases to Buildings" 2007.

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BS 8576:2013 'Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs)'

BS 8485:2015 'Code of practise for the design of protective measures for methane and carbon dioxide ground gases for new buildings'

The Hazardous Waste (England) Regulations 2005.

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Environment Agency & NHBC, 2000. R&D Publication 66. Guidance for the Safe Development of Housing on Land Affected by Contamination.

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NHBC Standards 2024

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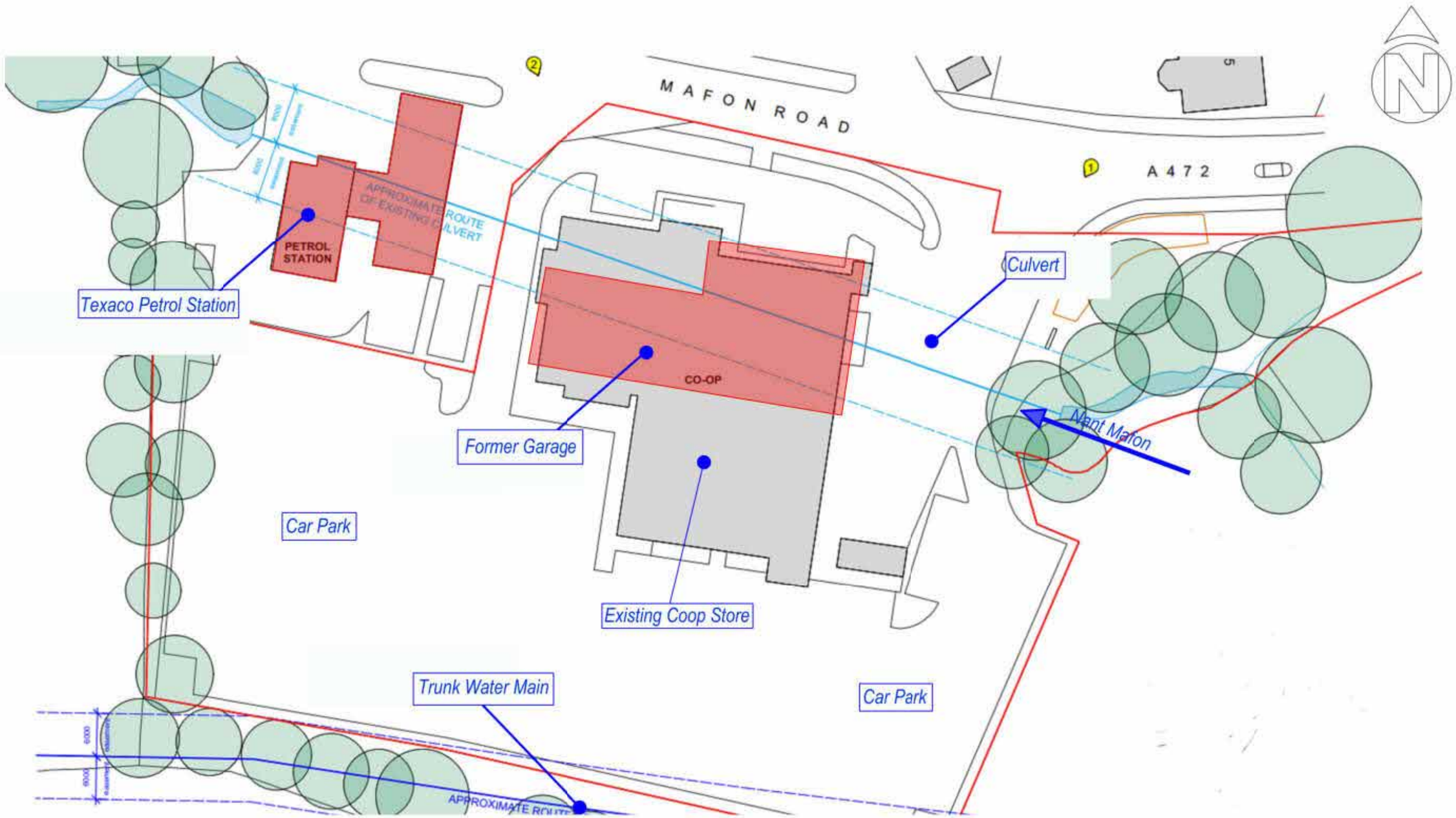
APPENDIX 1 - Plans

GROUNDTECH CONSULTING	CLIENT	DATE				Status		Notes
	ALDI STORES LIMITED	OCTOBER 2020				Preliminary		Location of Site
	PROJECT TITLE	SCALE				Draft		
	ALDI MAFON ROAD, TREHARRIS	NTS				Issued	●	
	PLAN TITLE	PLAN NUMBER				For Comment		
	PROJECT LOCATION PLAN	GRO-20287-P01	Rev.	Details	Date	Approved		



GROUNDTECH CONSULTING

CLIENT	ALDI STORES LIMITED
PROJECT TITLE	ALDI MAFON ROAD, TREHARRIS
PLAN TITLE	PRELIMINARY DEVELOPMENT CONSTRAINTS PLAN
DATE	OCTOBER 2020
SCALE	NTS
PLAN NUMBER	GRO-20287-P02

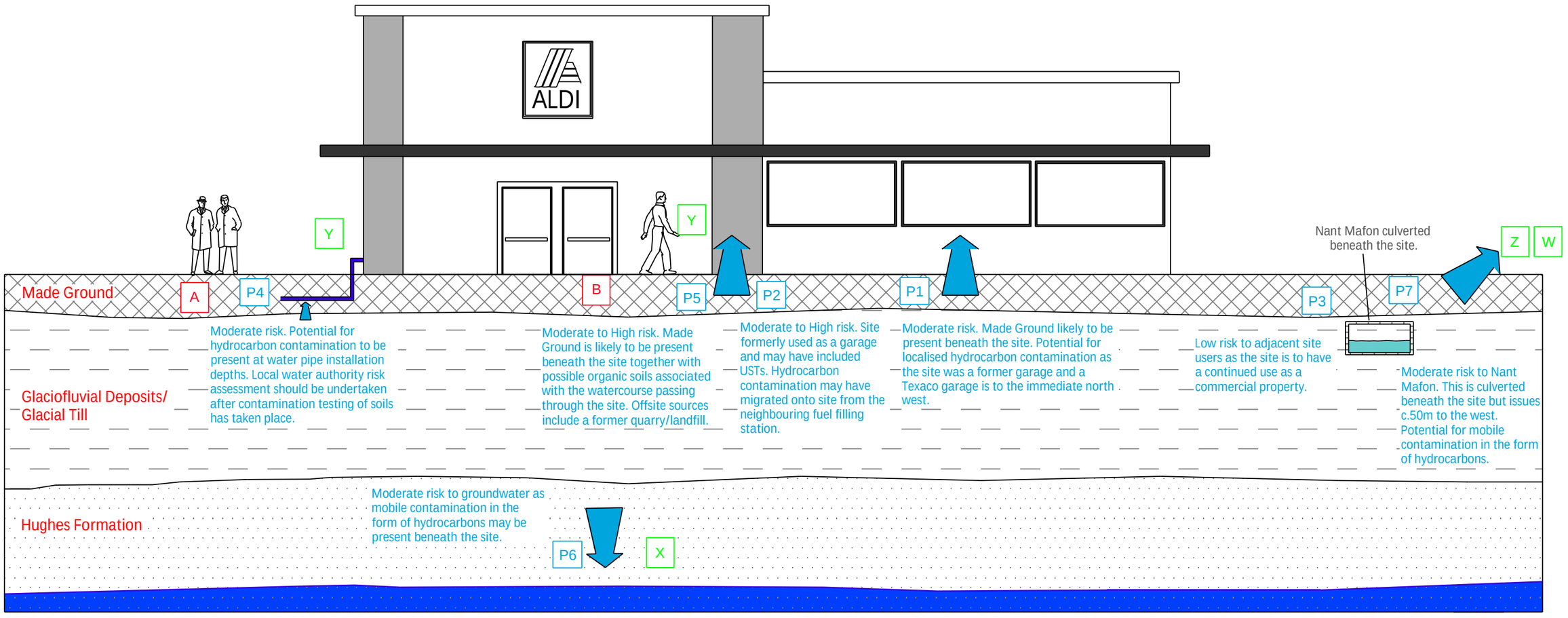
Rev.	Details	Date

Status	
Preliminary	
Draft	
Issued	●
For Comment	
Approved	

Notes

Approximate site boundary

SOURCES	POLLUTION LINKAGES	RECEPTORS
A. Contaminated soils / Made ground. B. Ground gas.	P1. Ingestion of soil and dust. P2. Inhalation of vapour. P3. Inhalation of soil dust by adjacent site users. P4. Attacking of potable water supply pipe. P5. Migration and accumulation of ground gas in internal places. P6. Impaction of groundwater from soil contamination. P7. Migration of soil and groundwater contamination impacting surface waters.	W. Nant Mafon culverted beneath the site and issues c.50m west. X. Groundwater within the Secondary A Aquifers. Y. Site end users. Z. Adjacent site users.



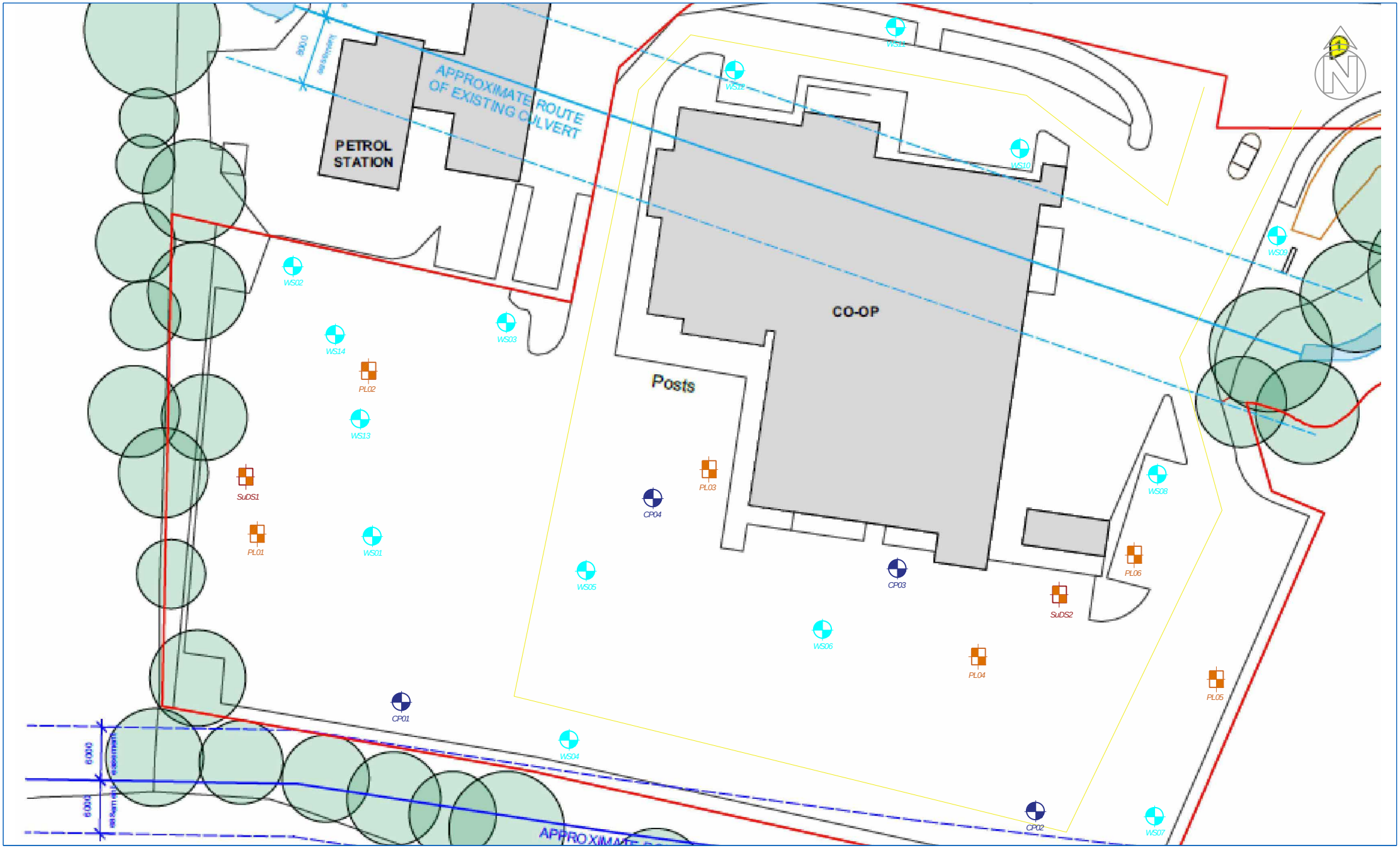
GROUNDTECH CONSULTING

CLIENT	ALDI STORES LIMITED
PROJECT TITLE	ALDI MAFON ROAD, TREHARRIS
PLAN TITLE	ILLUSTRATIVE PRELIMINARY CSM
DATE	OCTOBER 2020
SCALE	NTS
PLAN NUMBER	GRO-20287-P03

Rev.	Details	Date

Status	
Preliminary	
Draft	
Issued	●
For Comment	
Approved	

Notes



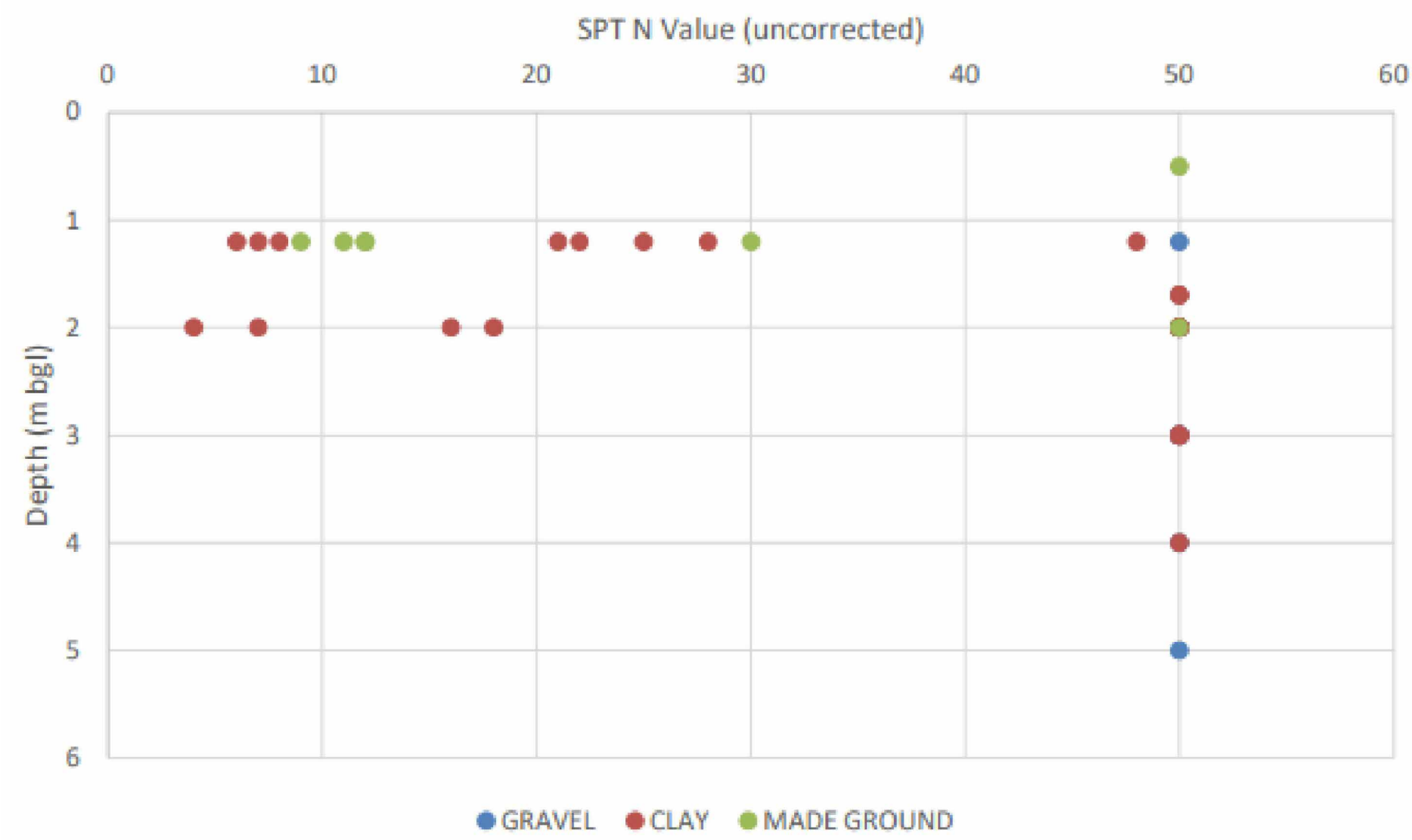
GROUNDTECH CONSULTING

CLIENT	ALDI STORES LIMITED
PROJECT TITLE	ALDI MAFON ROAD, TREHARRIS
PLAN TITLE	EXPLORATORY HOLE LOCATION PLAN
DATE	NOVEMBER 2023
SCALE	NTS
PLAN NUMBER	GRO-20287-P04

Rev.	Details	Date

Status	
Preliminary	
Draft	
Issued	●
For Comment	
Approved	

Notes
- CABLE PERCUSSIVE BOREHOLE LOCATIONS
- WINDOWLESS SAMPLE BOREHOLE LOCATIONS
- PLATE LOAD TEST LOCATIONS
- SOIL PERCOLATION TEST LOCATIONS



GROUNDTECH CONSULTING

CLIENT	ALDI STORES LTD
PROJECT TITLE	ALDI MAFON ROAD, TREHARRIS
PLAN TITLE	SPT VS DEPTH PLAN
DATE	NOVEMBER 2023
SCALE	NTS
PLAN NUMBER	GRO-20287-P05

Rev.	Details	Date

Status	
Preliminary	
Draft	
Issued	●
For Comment	
Approved	

Notes