

THE IRON LINE, MILLOM (ZONES 3-10) PHASE 2 GROUND INVESTIGATION REPORT

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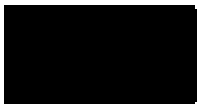
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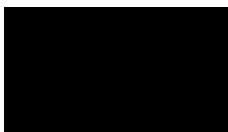
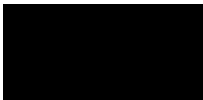
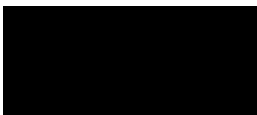
Site Address: The Iron Line, Millom, Cumbria, LA18 4LB

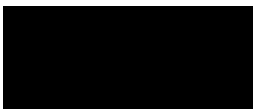
Curtins
Merchant Exchange
17-19 Whitworth Street West
Manchester, M1 5WG
Tel: 0161 236 2394
www.curtins.com

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Author	Signature	Date
Lucy Woods BSc (Hons), MSc Geo-Environmental Engineer		08 April 2025

Reviewed	Signature	Date
Jonathan Lord BSc (Hons), MCIWEM Senior Geo-Environmental Engineer		11 November 2024
Rachel Mayne BSc (Hons), CGeol, EurGeol, FGS Principal Geotechnical Engineer		11 November 2024
Niall Farnworth BSc (Hons), MCIWEM Principal Geo-Environmental Engineer		08 April 2025

Authorised	Signature	Date
Niall Farnworth BSc (Hons), MCIWEM Principal Geo-Environmental Engineer		08 April 2025

EXECUTIVE SUMMARY

Appointment	Curtins were instructed by Cumberland Council to undertake an intrusive site investigation at the proposed development site known as The Iron Line, located in Millom, Cumbria, LA18 4LB. Part of the site is a Site of Special Scientific Interest (SSSI), a Ramsar Site, a Special Protection area and a Special Area of Conservation which comprises RSPB Hodbarrow and the southern side of the Redhills Quarry (owned by Cumbria County Council). The site is centred on SD 17877 79009 and covers an area of approximately 58 Ha. The aim of the ground investigation is to characterise the shallow geo-environmental and geotechnical conditions prior to the development of the site comprising consolidation, repair and installation of interpretive sculpture to Towsey Hole Windmill; refurbishment of the existing Tern Island hide; new bird hides, pathways, gateway features and street furniture; enhancement of wildlife habitats; associated landscaping and drainage infrastructure; and maintenance of byway with restricted vehicular access. The site itself has been split into distinct sections, with the majority of works being undertaken within the northeast of the site in the proposed Visitors Centre, identified as Zone 1, in support of design and construction of the new visitor centre, with Ground Investigation undertaken earlier this year and presented within a separate report. Ground Investigation in Zones 3 – 10 has now been undertaken and is described within this report.
Current Site Status	The site comprises RSPB Hodbarrow which covers the majority of the site, and land to the southern side of the Redhills Quarry (owned by Cumbria County Council). A sea wall is present bounding the south of the site, extending from east to west. Heritage and historic structures are present such as the Hodbarrow lighthouse and Hodbarrow Beacon. There is a large lagoon located within the southeastern portion of the site, with the majority of the site is covered by grassland and tree cover. A footpath extending the entire length of the outer seawall is present, with several footpaths extending into the RSPB Hodbarrow site to the east. The site is a Site of Special Scientific Interest (SSSI), Ramsar Site, Special Protection Area and Special Area of Conservation. The site itself has been split into distinct sections: • Zone 1: Visitors Centre ◦ Proposed New Visitors Centre building, car parking, roads and infrastructure. • Zone 3: Towsey Hole Windmill ◦ Improvement of existing paths and construction of new paths. • Zone 4: Haverigg Lighthouse & Tern Island Hide ◦ Improvement to paths/roads • Zone 5: Annie Lowther Hide ◦ Improvement of existing paths and construction of new paths. • Zone 7: Quarry Hides ◦ Improvement to paths/roads • Zone 8: Iron Line Railway ◦ Improvement to paths/roads • Zone 9: Iron Line Entrance ◦ Improvement to paths/roads • Zone 10: Mainsgate Road Entrance & Hodbarrow Car Park ◦ Improvement to paths/roads The main development is proposed in Development Zone 1, where a Visitors Centre building will be constructed. The remainder of the Development Zones will receive some development comprising consolidation, repair and installation of interpretive sculpture to Towsey Hole Windmill; refurbishment of the existing Tern Island hide; new bird hides, pathways, gateway features and street furniture; enhancement of wildlife habitats; associated landscaping and drainage infrastructure; and maintenance of byway with restricted vehicular access.
Summary of Existing Information	The earliest available mapping (1867) shows the site as largely undeveloped comprising predominantly marshland and part of the estuary, with some evidence of mineral extraction. The industrial premises of Redhills Quarry (to the north-east) and the Hodbarrow Iron Mine / Hodbarrow Quarries (south-east of the site) can be seen in mapping from 1867, including the 'Hodbarrow Scar', an engine house, the Old Wind Mill and shafts in the south-east of the site. By 1898, Redhill Quarry and the Hodbarrow Iron Mine had undergone significant expansion, with various pits noted across the east of the site, and the addition of a major rail network, the construction of reservoirs and several spoil pits across the east of the site. The Hodbarrow Lighthouse was constructed in the south-east of the site, along with the Hodbarrow Sea Wall which extended across to Steel Green in the west. By 1924, the 'Outer Barrier' Sea Wall was constructed at the south of the site, a large sea wall extending further out into the Duddon Channel, along with the construction of a lighthouse within the centre of the barrier. During this time, the spoil pit areas on site had been increased, and the reservoir previously present to the south-east had been infilled. The Hodbarrow Iron Mine closed in 1968, anecdotal evidence suggests that subsistence of the Inner Sea Wall caused the collapse and subsequent flooding of the Hodbarrow Mine. The rail network within the site had been dismantled and buildings disused. Disused spoil pits remained during this time, with a slag heap noted in the east of the site. Buildings surrounding the Arnold and Annie Lowther Pits had been dismantled. The area behind the outer sea wall barrier became gravelled with the lighthouse becoming disused. During 1986, most of the site was converted into a Nature Reserve. The remaining buildings associated with the mine and quarry workings were dismantled, with the majority of spoil and slag pits removed. The reservoirs once throughout the site had been infilled. One shaft remained on mapping within the northern area of the site. Heritage buildings such as the Old Wind Mill, Hodbarrow Beacon and

	Hodbarrow Lighthouse remain on site. The Hodbarrow Sea Wall had been reduced in size to allow the connection between lakes forming the Hodbarrow Lagoon. BGS mapping indicates the site is heavily worked with numerous areas of infilled and worked ground, with Made Ground indicated across the site on mapping. Superficial deposits are not noted to be present across much of the site on BGS records. Bedrock geology comprises multiple lithologies across the site, recorded as the Red Hill Limestone, Martin Limestone Formation, Low Furness Basal Formation and the Dalton Formation. A BGS radon report indicates full radon protection measures are required for the new Visitors Centre building. The site is underlain by a Secondary A Aquifer within the bedrock formation. The nearest surface water feature is the RSPG Hodbarrow nature reserve lakes, a River feature in the southwest and the Tidal Duddon River approximately 16m south of the site.
Fieldworks Undertaken (Zones 3 – 10)	Site investigation works were undertaken between the 2nd and 4th of September 2024, once bird nesting season had come to an end. The Zones 3 – 10 ground investigation comprised of 5 No. Window Sample Boreholes, 2 No. Foundation Hand Pits, 2 No. Hand Pits, 2 No. Soakaway Trial Pits and 14 No. CBR tests undertaken using a DCP.
Encountered Ground Conditions	Topsoil was encountered in 13 No. locations from ground level to a maximum depth of 1.35m bgl, comprising grass or vegetation over dark brown gravelly sand or reddish brown/dark brown slightly sandy slightly gravelly to gravelly clay with occasional cobbles. Gravels comprised mudstone, limestone, sandstone, quartzite, coal, slate, brick, twigs and occasional clinker. Occasional cobbles of limestone. Made Ground was encountered in 16 No. locations from ground level – 0.22m bgl, to a maximum (unproven) thickness of 1.20m bgl. Made Ground surface covering comprising tarmac was encountered within 6 No. locations. Cohesive Made Ground comprised reddish brown gravelly clay with occasional cobbles gravels comprised grey and greenish blue slag and clinker, with occasional cobbles of slag; yellowish brown and brown mottled slightly sandy slightly gravelly clay with frequent rootlets and gravel of broken glass, brick and limestone; and as dark brown slightly sandy gravelly clay with occasional cobbles, gravel of brick, concrete, limestone and slag and cobbles of brick and slag. Granular Made Ground comprised dark brown and black cobbly gravelly fine to coarse ashly sand with gravel of brick, limestone and tarmac, with cobbles of brick. Cohesive superficial deposits indicative of Glacial Till was encountered within 9 No. locations from 0.05m to 1.68m bgl, with a maximum (unproven) thickness of 4.86m, comprising firm to stiff, reddish brown/yellowish brown/brownish grey/brown slightly sandy slightly gravelly to very gravelly clay with occasional cobbles with gravel of limestone, mudstone and siltstone, cobbles of limestone. Granular superficial deposits indicative of Glacial Till was encountered within 5 No. locations from 0.07m to 1.35m bgl, with a maximum (unproven) thickness of 2.00m, comprising medium dense light orangish/pinkish brown/reddish brown/cream/yellow slightly gravelly fine to coarse sand with gravel of limestone and mudstone. Bedrock deposits indicative of the Martin Limestone Formation/Red Hill Limestone Formation were encountered within 2 No. locations. Weathered bedrock deposits comprised firm reddish brown slightly sandy gravelly to very gravelly clay with cobbles of limestone; and as reddish brown clayey gravelly cobbly boulders of limestone, with gravel and cobbles of limestone. Competent bedrock deposits comprised light grey and reddish brown limestone. Perched water may be present within Made Ground.
Environmental Laboratory Testing	Asbestos was identified within 1 No. sample, present as textile of chrysotile, asbestos quantification of 1.158% at 0.20m bgl below an existing tarmac road. 1 No. exceedance was identified within the soil, from a Made Ground sample from HP4-01 at 0.40m bgl, which provided a result of 10,600mg/kg of Lead, exceeding <i>Commercial</i> GAC. This was likely associated with slag deposits.
Ground Contamination	A Low-risk rating is identified to proposed site end-users from direct contact, inhalation, and ingestion of contaminants within Made Ground soils accounting for the development proposals, and the presence of proposed hardstanding in areas where elevated lead or asbestos has been identified. A Moderate/Low-risk rating is identified to proposed site end-users and maintenance workers from direct contact, inhalation, and ingestion of contaminants within Made Ground soils accounting for appropriate PPE and sanitary facilities are utilised during groundworks and construction works. A Low risk rating is currently identified to controlled waters in relation to groundwater and surface water receptors accounting for the lack of shallow groundwater within the Made Ground soils, and no evidence of gross contamination found during the ground investigation in Zones 3 – 10. A Low risk is identified to the end users of site from ground gas accounting for the development proposals.
Geotechnical Assessment	The location of the proposed bird hides has been reviewed with consideration of the existing steeply sloping ground and accessibility of construction plant, within Zone 5 the proposed bird hide has been moved away from a steep slope adjacent to the inner sea wall and has been moved to a flatter area approximately 50m south-east of the originally proposed location. Due to the ground instability from recorded or unrecorded mine shafts it is recommended that a watching brief is adopted during all groundworks onsite, together with the other recommendations detailed in Section 2.4. Following Curtins ground investigation, development plans were updated including relocation of bird hides. One of the potential shaft locations identified from 'archive' records is in close proximity to the bird hide relocated to the south of Zone 7. Further assessment is recommended, or consideration should be made to relocating the bird hide away from this shaft, outside of its departure zone and zone of influence.

	The cohesive Superficial Deposits (Glacial Till) with an undrained shear strength in excess of 40kPa are estimated to have a net safe bearing capacity in the region of 70kN/m². Assuming a concrete plinth type structure will be used for the base of the bird hides, it is recommended that all Topsoil, Made Ground or other soft / loose or deleterious material is removed, and the construction is wholly in one material type i.e. wholly cohesive Glacial Till. A medium volume change potential should be assumed, and heave precautions included, if necessary. Further information on the hide locations and type of construction are required to be able to refine the foundations advice. A preliminary CBR of 5% can be assumed based on the results of the TRL DCP test results. It is recommended that additional Plate CBR Tests are undertaken at proposed formation levels to verify the design CBR assumed. A buried concrete classification of DS-1 has been determined from the available pH and water-soluble sulphate results.
Recommendations	Based on the findings of the ground investigation, the following recommendations are made for Zones 3 – 10: 1) Carry out expansivity testing on slag deposits. 2) Installation of a geogrid beneath new paths and roadways to protect against potential subsidence relating to historical mining activity. 3) The bird hide foundation design should consider the risk of ground instability associated with unrecorded mine shaft collapse through appropriate design mitigation. 4) Following the relocation of the bird hide within Zone 5, and relocation of 1 No. bird hide within Zone 7, additional ground investigation is required to confirm the ground conditions beneath these locations. 5) Watching brief to be carried out during groundworks by geotechnical engineer to monitor for evidence of shafts. If any are recorded construction works should be stopped, and further risk assessment carried out. It's further recommended that a geotechnical engineer should inspect foundation formations prior to construction. 6) The engineering recommendations contained within the report should be reviewed once the final development proposals and site levels are confirmed. 7) It is recommended that additional Plate CBR Tests are undertaken at proposed formation levels to verify the design CBR assumed. 8) Asbestos management plan during construction works due to presence of asbestos fibres in shallow Made Ground. 9) Construction and maintenance workers should be provided with suitable PPE with respect to environmental chemical results presented herein. 10) Should unexpected contamination be observed during construction advice should be obtained from a Geo-environmental Engineer.

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1. INTRODUCTION

1.1 Project Background

Curtins were instructed by Cumberland Council to undertake an intrusive site investigation at the proposed development site known as The Iron Line, located in Millom, Cumbria, LA18 4LB. Part of the site is a Site of Special Scientific Interest (SSSI), a Ramsar Site, a Special Protection area and a Special Area of Conservation which comprises RSPB Hodbarrow and the southern side of the Redhills Quarry (owned by Cumbria County Council). The site is centred on SD 17877 79009 and covers an area of approximately 58 Ha.

The location and extent of the site is shown in *Figure 1* overleaf. The overall project comprises consolidation, repair and installation of interpretive sculpture to Towsey Hole Windmill; refurbishment of the existing Tern Island hide; new bird hides, pathways, gateway features and street furniture; enhancement of wildlife habitats; associated landscaping and drainage infrastructure; and maintenance of byway with restricted vehicular access.

This report relates specifically to the RSPB site, specifically development areas identified herein as Zones 3-10.

A separate ground investigation report has been produced for the Cumbria County Council site where the Visitors Centre is proposed, identified herein as Zone 1.

A proposed site plan is included in *Appendix A*.

1.2 Project Aim

This aim of the investigation is to characterise the geo-environmental and geotechnical conditions for the proposed construction works.

Curtins have undertaken the following relevant geo-environmental reports previously for the wider site:

- Phase 1 Preliminary Risk Assessment (Ref. 080874-CUR-00-XX-RP-GE-001-V03, 2025) (Ref. 1)
 - included recommendations for intrusive ground investigation works to further characterise the site.
- Mining Risk Assessment (Ref. 080874-CUR-XX-XX-T-GE-00005-P02, 2025) (Ref. 2)
 - included recommendations for intrusive ground investigation works to further characterise the site.

Ground investigation was undertaken earlier in 2024 on Zone 1, the proposed Visitors Centre Site, in support of design and construction of the new visitor centre. This investigation was reported in Phase 2 Ground Investigation Report for Zone 1 (080874-CUR-XX-XX-RP-GE-00006-P03) (Ref. 3)

Ground Investigation has now also been undertaken on other development Zones (3-10) outside of bird nesting season, the findings of which will be discussed within this report.

1.3 Scope of Services

In order to achieve the project aim, the Phase 2 report is intended to assess:

- a) If there is a risk of the proposed end user being adversely impacted upon by potential contamination in shallow site soils that may be present on the site due to its known current, recent and historical use;
- b) If there is a risk of groundwater and/or surface water being adversely impacted upon by potential contamination that may be present on the site due to its known current, recent and historical use;
- c) If there is a risk to the end user from soil gases including methane, carbon dioxide, carbon monoxide and hydrogen sulphide;
- d) Likelihood of the proposed works being adversely impacted by potential geo-hazards across the site; and
- e) If there is a risk to the proposed works from historic mining activities.

In addition, recommendations on foundation solutions for the proposed structures are provided.

Detailed flood risk assessment, ecology and archaeological studies are outside of the scope of this report.

2. PHASE 1 PRELIMINARY SITE ASSESSMENT SUMMARY

This section presents a summary of the Phase 1 Preliminary Risk Assessment (PRA) that has been completed for the subject site. This incorporates a summary of site setting, history and geology as presented in the Curtins PRA and Curtins MRA (Ref. 1 & 2). For further detail Curtins previous reports should be consulted.

2.1 Site Location and Current Details

Site use, location and description are shown below in *Table 1* and *Figure 1*.

Table 1 – Site Details

Site Address	The Iron Line, Millom, Cumbria, LA18 4LB
NGR	SD 17877 79009
Area of Site	Approximately 58 Ha.
Current Site Use and Description	The site comprises RSPB Hodbarrow which covers the majority of the site, and land to the southern side of the Redhills Quarry (owned by Cumbria County Council). A sea wall is present bounding the south of the site, extending from east to west. Heritage and historic structures are present such as the Hodbarrow Lighthouse and Hodbarrow Beacon. There is a large lagoon located within the southeastern portion of the site, with the majority of the site is covered by grassland and tree cover. A footpath extending the entire length of the outer seawall is present, with several footpaths extending into the RSPB Hodbarrow site to the east. The site is a Site of Special Scientific Interest (SSSI), Ramsar Site, Special Protection Area and Special Area of Conservation. Due to the size of the site, it has been split into Development Zones. The site itself has been split into distinct sections, with the majority of works being undertaken within the north of the site in the proposed Visitors Centre: • Zone 1: Visitors Centre ○ Proposed New Visitors Centre Building, car parking, roads and infrastructure. • Zone 3: Towsey Hole Windmill ○ Improvement of existing paths and construction of new paths. • Zone 4: Haverigg Lighthouse & Tern Island Hide ○ Improvement to paths/roads • Zone 5: Annie Lowther Hide ○ Improvement of existing paths and construction of new paths. • Zone 7: Quarry Hides ○ Improvement to paths/roads • Zone 8: Iron Line Railway ○ Improvement to paths/roads • Zone 9: Iron Line Entrance ○ Improvement to paths/roads • Zone 10: Mainsgate Road Entrance & Hodbarrow Car Park ○ Improvement to paths/roads The main development is proposed in Development Zone 1, where a Visitors Centre building will be constructed. The remainder of the Development Zones will receive limited development such as new and improved roads, paths and hides.



Figure 1 – Site Location Plan with Development Zones, site boundary shown in red.

2.2 Historical Mapping Records

The site has an extensive mining history with Hodbarrow Iron Mine in operation between 1850 and 1968. Ore was removed by a form of pillar-and-stall working known as “top slicing”. Levels, some of which were accompanied by short rises, were driven from the shafts into the heart of the ore body, each level being separated from the one beneath by unrobbed ground known as ‘middling’s’.

A review of the available historical mapping information for the site has been undertaken as part of the Curtins Phase 1 Preliminary Risk Assessment (Ref. 1) with specific reference to potential historic mining.

Earliest mapping records show the site to have been largely undeveloped comprising predominantly marshland and part of the estuary, with some evidence of mineral extraction. The industrial premises of Redhills Quarry (to the north-east) and the Hodbarrow Iron Mine / Hodbarrow Quarries (south-east of the site) can be seen in mapping from 1867, including the ‘Hodbarrow Scar’, an engine house, the Old Wind Mill and shafts in the south-east of the site. By 1898, Redhill Quarry and the Hodbarrow Iron Mine had undergone significant expansion, with various pits noted across the east of the site, and the addition of a major rail network, the construction of reservoirs and a number of spoil pits across the east of the site. The Hodbarrow Lighthouse was constructed in the south-east of the site, along with the Hodbarrow Sea Wall which extended across to Steel Green in the west.

By 1924, the ‘Outer Barrier’ Sea Wall was constructed at the south of the site, a large sea wall extending further out into the Duddon Channel, along with the construction of a lighthouse within the centre of the barrier. During this time, the spoil pit areas on site had been increased, and the reservoir previously present to the south-east had been infilled.

The Hodbarrow Iron Mine closed in 1968, anecdotal evidence suggests that subsidence of the Inner Sea Wall caused the collapse and subsequent flooding of the Hodbarrow Mine. The rail network within the site had been dismantled and buildings disused. Disused spoil pits remained during this time, with a slag heap noted in the east of the site. Buildings surrounding the Arnold and Annie Lowther Pits had been dismantled. The area behind the outer sea wall barrier became gravelled with the lighthouse becoming disused. During 1986, the majority of the site was converted into a

Nature Reserve. The remaining buildings associated with the mine and quarry workings were dismantled, with the majority of spoil and slag pits removed. The reservoirs once throughout the site had been infilled. One shaft remained on mapping within the northern area of the site. Heritage buildings such as the Old Wind Mill, Hodbarrow Beacon and Hodbarrow Lighthouse remain on site. The Hodbarrow Sea Wall had been reduced in size to allow the connection between lakes forming the Hodbarrow Lagoon.

Redhills Quarry to the north of the site is noted as disused in 1973, with the active workings to the west noted as disused in 1993. 'Millom Raceway' was opened in 1995 on the former pit slag heap, the track was formally known as the Redhills Raceway until 2003 when it fell into disuse. A Household Waste Recycling Centre is now located at Redhills Quarry immediately northeast of site (Zone 1).

Further review of Cumbria mining archive maps is included in Curtins Mining Risk Assessment Report (Ref. 2)

2.3 Geology, Hydrogeology and Hydrology

A study of the BGS mapping records (Sheet 048 for Ulverston), along with the Envirocheck Report (Ref. 4), indicates the following geological succession underlying the site:

2.3.1 Made Ground

Geological Maps indicate the site is heavily worked with numerous areas of infilled ground, worked ground (undivided) and Made Ground (undivided) indicated on mapping, comprising voids and artificial deposits.

It is likely that the Made Ground will comprise the iron works process arisings.

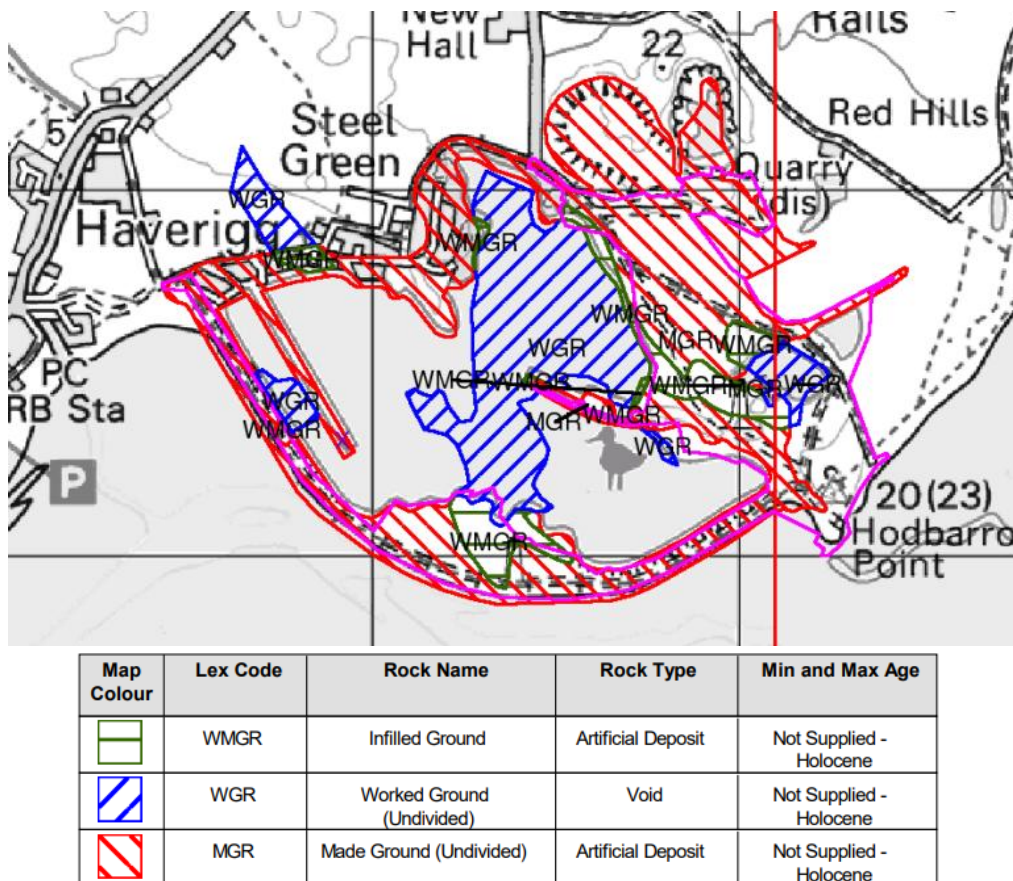
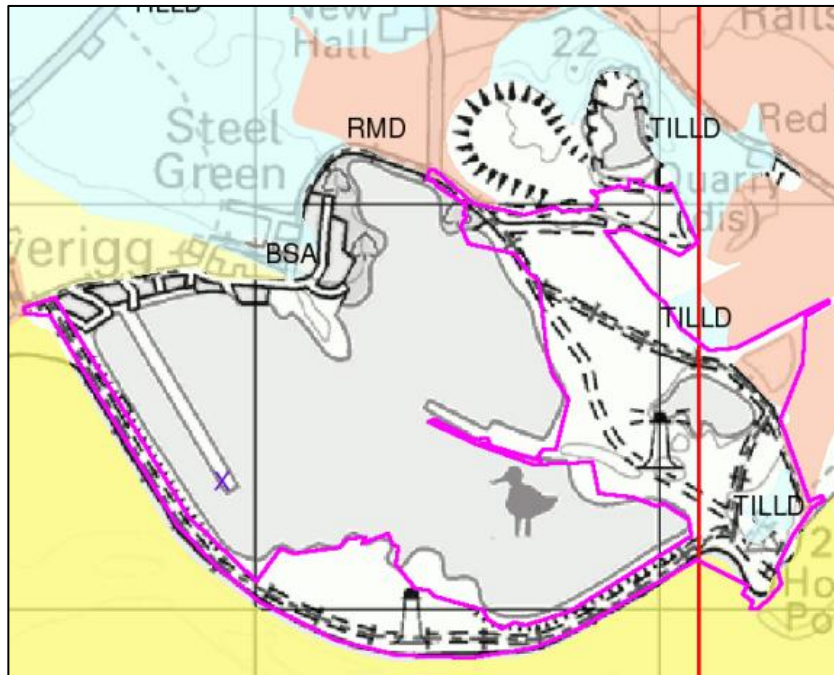


Figure 2 – Extract from BGS 1:50,000 mapping (Artificial Ground)

2.3.2 Superficial Deposits

Superficial deposits are not recorded to be present on the majority of the site.

A limited area of Raised Marine Deposits are noted to be present in the far east of the site, with a limited area of Glacial Till recorded in the south-eastern corner of the site.



Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
Yellow	TFD	Tidal Flat Deposits	Clay and Silt	Not Supplied - Holocene
Yellow	ALV	Alluvium	Clay, Silt, Sand and Gravel	Not Supplied - Holocene
Yellow	SAMD	Saltmarsh Deposits	Clay and Silt	Not Supplied - Holocene
Light Blue	TILLD	Till, Devensian	Diamicton	Not Supplied - Devensian
Pink	GFDUD	Glaciofluvial Deposits, Devensian	Sand and Gravel	Not Supplied - Devensian
Light Yellow	BSA	Blown Sand	Sand	Not Supplied - Quaternary
Orange	STOB	Storm Beach Deposits	Gravel	Not Supplied - Quaternary
Light Orange	RMD	Raised Marine Deposits	Sand and Gravel	Not Supplied - Quaternary

Figure 3 – Extract from BGS 1:50,000 mapping (Superficial Deposits)

2.3.3 Bedrock

Bedrock geology comprises multiple lithologies across the site, recorded as the Red Hill Limestone, Martin Limestone formation, Low Furness Basal Formation, and the Dalton Formation.

- The Red Hill Limestone Formation is described as a carbonate bioclastic, intraclastic and peloidid grainstones, coarse-grained and virtually structureless following bioturbation;
- The Martin Limestone formation described as mainly carbonate mudstones with significant grainstones, locally cross-bedded, and oolites in the upper part, ranging from peritidal to marine;
- The Low Furness Basal formation as conglomerate, sandstones, siltstones and mudstones with subordinate evaporites, the upper part of limestones and siltstones, mostly red with interbedded conglomerates, all presumed of marine origin; and,

- The Dalton Formation at base as a mid to dark grey, even bedded carbonate grainstone and packstone, with dark grey thinly bedded backstones and wackestones with shaly interbeds, with the upper part comprising even bedded packstones and grainstones.

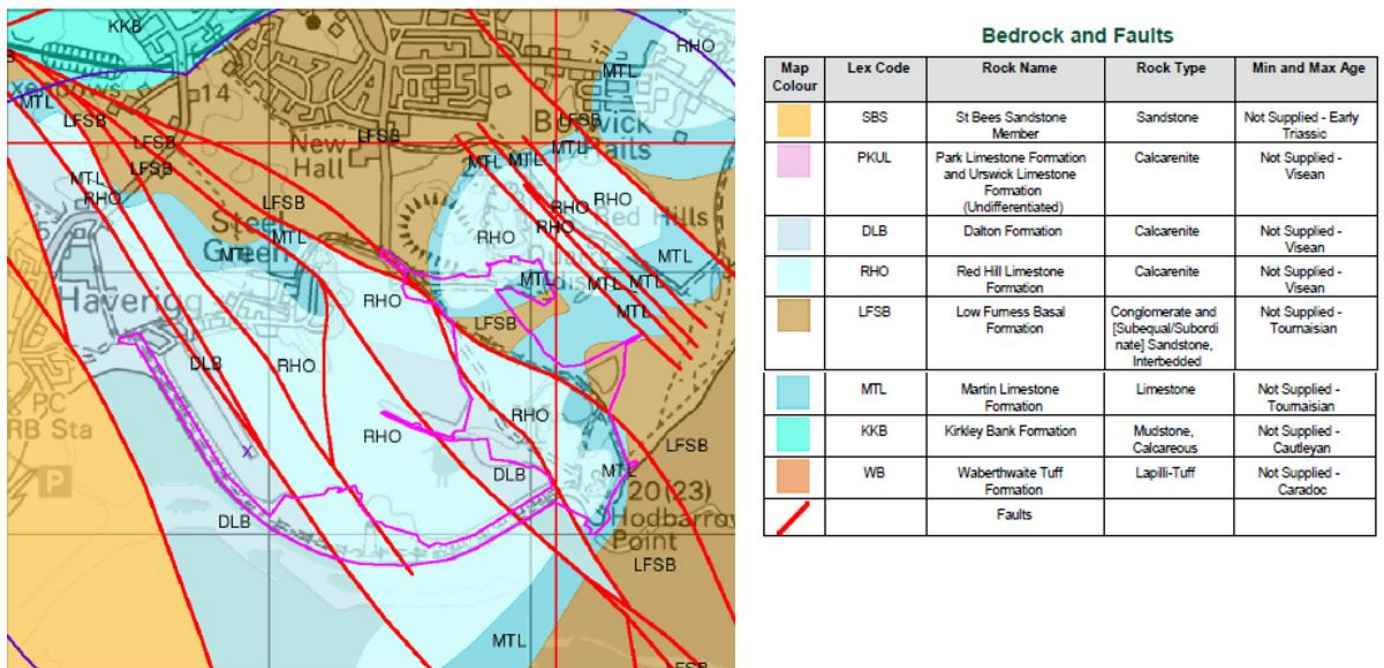


Figure 4 – Extract from BGS 1:50,000 mapping (Bedrock).
Site outlined in purple.

The site and surrounding area are heavily faulted, with shallow dipping (5-15 degrees) SW and striking NW-SE cutting across all lithology types.

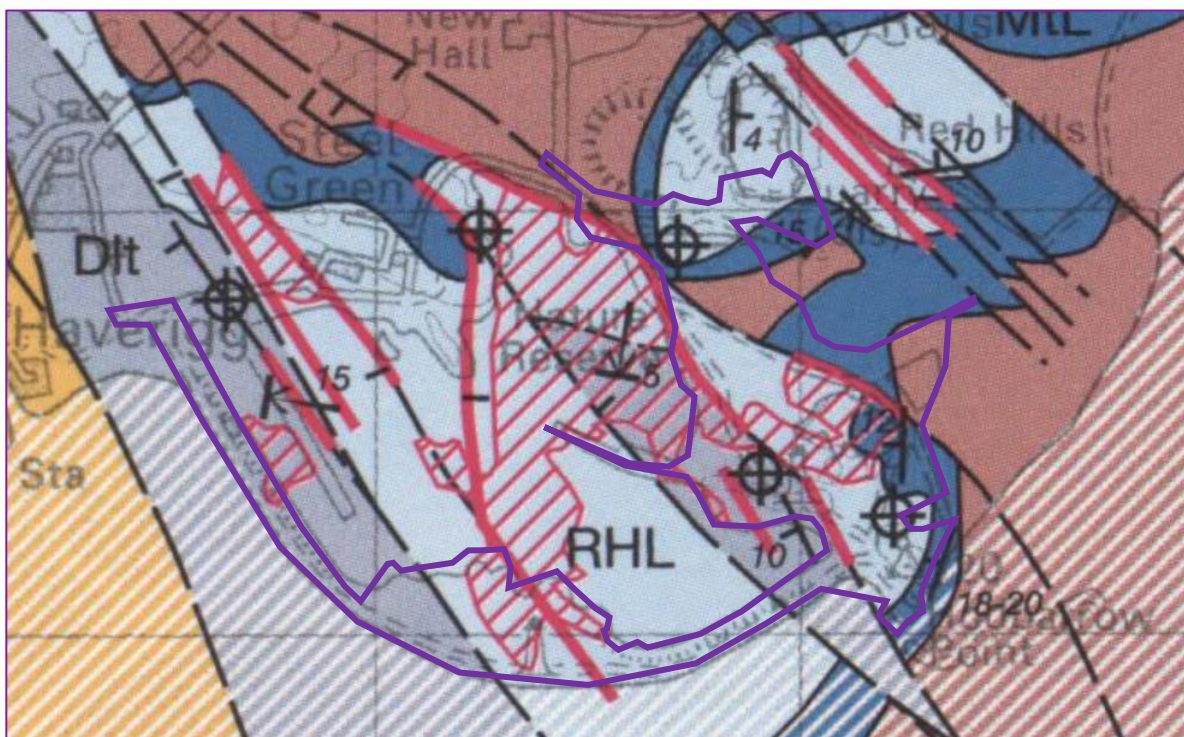


Figure 5 – Extract from BGS 1:50,000 mapping (Bedrock)
Approximate Site Boundary in Purple.
Red lines showing haematite veins
Red cross-hatched showing hematite deposits, worked at rockhead and at depth
Black lines showing faults
Black Crossed circles showing abandoned mine shafts.

2.3.4 Hydrology and Hydrogeology

The nearest surface water features are an unidentified river feature in the southwest of site, the RSPB Hodbarrow Nature Reserve lakes onsite and offsite, the Hodbarrow Lagoon, and the Tidal Duddon River approximately 16m south of site. There are 23 OS Water Network Lines within 500m of the site.

There have been 14 No. pollution incidents to controlled waters within 500m of the site boundary, all but one are classified as Category 3 (Minor) Incidents, it is unlikely that these will pose any risk to the proposed development. The Category 2 (Significant) Incident was located 330m northwest of the site at Haverigg Pool in 1993, the cause of the incident is unknown.

There have been 2 No. substantiated pollution incidences recorded approximately 700m northeast and 880m west of the site, where a Category 2 (Significant) incident to land occurred in 2010 due to construction and demolition materials and wastes; and, where a Category 2 (Significant) Incident to land and air occurred in 2001 due to natural organic material respectively.

There are seven active discharge consents issued by United Utilities within 500m of the site boundary.

Bedrock deposits on site are identified as Secondary A Aquifers. Secondary A aquifers comprise permeable layers that can support local water supplies and may form an important source of base flow to rivers.

Groundwater vulnerability has been assessed as high risk; the site is situated on a Productive Bedrock and Secondary Superficial Aquifer which has well connected fractures, contributing to a high pollutant speed and a dilution of >550mm/year. There is low soluble rock risk in relation to groundwater vulnerability.

No groundwater abstractions are listed within 1km of the site.

2.3.5 BGS Borehole Records

There are 160 noted boreholes located within 500m of the site. 23 No. boreholes are recorded within the site boundary, 21 No. of which are deep boreholes (greater than 30m), 1 No. is moderately deep (between 10 – 30m) and 1 No. is shallow (between 0 – 10m). The boreholes on and around the site were undertaken between 1882 and 1971, with depths between 5.00m and 222.99m bgl, all of which progressed into the bedrock strata.

Selected borehole records are further reviewed in Curtins Phase 1 PRA (Ref. 1).

2.3.6 BGS Mineral Sites

The site is not situated within a coal mining reporting area, and as such risks associated with coal mining are considered Very Low.

Iron mining was undertaken at Hodbarrow Iron Mine on site. The mine opened ~1850 and was in operation until 1968, surface extraction and underground mining was undertaken. The large iron ore mine which had twice extended its capacity. Firstly, by building the inner sea barrier, and then again through construction of the outer sea barrier to allow them to mine ore which was previously beneath the sea/estuary. This area has since been flooded and is known as the Hodbarrow Lagoon. Curtins mining risk assessment is further summarised in Section 2.4.

Table 2 below provides a summary of the minerals that are recorded or likely to have been worked beneath the footprint of the site.

Table 2 – Past Underground Mining

Mine	Geology	Mineral	Depth (m)	Direction to Working	Extraction Thickness (cm)
Hodbarrow Iron Mine	Red Hill Limestone Formation Martin Limestone Formation Low Furness Basal Formation Dalton Formation	Iron Ore	Unknown	Beneath Site	Unknown

The Iron Ore containing Red Hill Limestone Formation along with the Dalton Formation are present beneath the site, and further dip towards the south-west.

There are 5 No. opencast workings recorded within 500m of the surrounding area, detailed in Table 3 below:

Table 3 – BGS Recorded Mineral Sites within 500m of the Development Area.

Site Name	Operator	Distance from Site (m)	Commodity	Status
Red Hills Quarry	Unknown	1	Limestone	Ceased
Red Hills Slag Bank	Millom Aggregates	119	Slag	Ceased
Red Hills Quarry	Unknown	188	Limestone	Ceased
Whitriggs Close Clay Pits	Unknown	300	Common Clay and Shale	Ceased
Whitriggs Close Clay Pits	Unknown	411	Common Clay and Shale	Ceased

2.3.7 Other Ground Stability Issues

The Envirocheck Report confirms the following in relation to potential geotechnical hazards highlighted in Table 4 below:

Table 4 – Ground Stability Hazards for the Site and Surrounding Area.

Ground Stability Hazard	Hazard Potential On-site	Hazard Potential Off-site
Collapsible Ground	No Hazard	No Hazard
Compressible Ground	Very Low - Moderate	Moderate
Ground Dissolution (Soluble Rocks)	No Hazard - Low	Low
Landslide	Very Low – Low	Very Low - Moderate
Running Sand	No Hazard - Moderate	Low
Shrinking or Swelling Clay	No Hazard - Low	Very Low

Given the information above there is unlikely to be a need to address any of the ground stability hazards mentioned above. However, slope stability should be considered for Zone 1 due to the steep slope down to Redhills Quarry at the north. Intrusive ground investigation works will confirm the nature of the ground conditions at the subject site.

2.3.8 Ground Gas

Radon

The Envirocheck Report (Ref. 4), Radon Mapping (Ref. 5) confirm that the site is within a radon affected area where 10 – 30% of homes are to be at or above the action level.

A BGS radon report (Ref. 24) has been procured for the Zone 1 Visitors Centre site which indicates that full radon protective measures are required in the construction of the new building.

Landfill

The Envirocheck Report (Ref. 4) show that there are seven recorded Landfill sites within the site and 250m of the site boundary, shown in Table 5 below.

Table 5 - Recorded Landfill Sites Within the Site Boundary.

Site Name	Distance from Site/ Location	Operator / Licence Holder	Site Category & Dates Deposited	Licence Number / Provider Reference	Input Rate	Status
Red Hill	On site (north east)	BGS Recorded	N/A	N/A	N/A	N/A
Redhills Quarry	On site (north east)	Cumbria County Council	Special waste and liquid sludge, 1969-1993	EAHLD07713	N/A	N/A
Millom Civic Amenity Site, Redhills Quarry (Licenced)	On Site (north east)	Cumbria Waste Management Ltd	Household waste amenity sites	57294	Unknown	Transferred
Redhills Quarry	139m	Cumbria County Contracting	Special waste and liquid sludge including: Inert, Industrial, Commercial and Household	R20/M4	Medium (Equal to or greater than 25,000 and less than 75,000 tonnes per year)	Licence lapsed (1st June 1991)
Redhills Quarry	139m	Cumbria County Contracting	Special waste and liquid sludge including: Inert, Industrial, Commercial and Household	R20/M4	Medium (Equal to or greater than 25,000 and less than 75,000 tonnes per year)	Record Superseded (1st October 1990)

Site Name	Distance from Site/ Location	Operator / Licence Holder	Site Category & Dates Deposited	Licence Number / Provider Reference	Input Rate	Status
Redhills Quarry	139m	Cumbria County Contracting	Landfill	R20	Undefined	Record Superseded (1st June 1977)
Millom C.A. Site (Waste Transfer Site)	On site	L&W Wilson (Endmoor) Ltd	Civic Amenity	294/M1	Very Small (Less than 10,000 tonnes per year)	Operational as far as is known (1st August 1995)

Review of the Envirocheck Report (Ref. 4) identified 7 No. areas of potentially infilled land with 500m of the site boundary. 5 No. of these potentially infilled land areas are within the site boundary, all of unknown filled ground (Pit, Quarry etc). The proposed Visitors Centre is situated on or very close to an infilled reservoir associated with Hodbarrow Mine. The reservoir first appears on the historical maps in 1900 and was infilled around 1986 when the site was acquired by the RSPB.

2.4 Curtins Mining Risk Assessment Summary

Risk assessment has been undertaken for each of the development 'Zones' as identified in Section 2.1 using the pertinent mining records and information discussed in previous sections. Curtins drawing titled 'Summary of Historical Iron Mining and Associated Features' is enclosed in *Appendix A* with extracts used within the assessment below.

Development Zone 1 was assessed independently due to the development including new structures. Development Zones 3 – 10 are assessed collectively due to the proposed developments including bird hide structures and improvements to paths and roadways only. Summary of Mining risk established through Curtins Mining Risk Assessment are outlined in Table 6 & 7 below. For further detail the Mining Risk Assessment report should be consulted (Ref. 2).

Development Zones 3 – 10 have been assessed separately but the conclusions summarised collectively due to the proposed developments including improvements to paths and roadways.

Table 6 – Summary of Mining Risks and Proposed Actions associated with Development Zone 1

Scenario	Consequence	Likelihood	Risk in Development Zone 1 (Visitors Centre)	Proposed Action
Underground Mining (probable at deeper depths) >30m below rockhead	Medium	Unlikely	Low	No action required.
Underground Mining (probable at shallow depths) <30m below rockhead	Medium	Low Likelihood	Moderate/Low	An initial ground investigation for initial planning submissions and design purposes, complete rotary open boreholes to determine to determine the presence of voids, broken ground which may be indicative of shallow workings within influencing depths of the proposed structure, boreholes to be

Scenario	Consequence	Likelihood	Risk in Development Zone 1 (Visitors Centre)	Proposed Action
				advanced to circa 40m bgl. Ground gases should be monitored during borehole advancement due to potential for mine gases. - Dependent on the findings of the ground investigation determine and produce a treatment specification from the ground investigation information. - Dependent on the findings of the ground investigation complete proof drilling and grouting of the proposed development area, relevant to the building footprints and a suitable distance surrounding any building footprints.
Mine entries (shafts and adits)	Medium	Low Likelihood	Moderate - Low	- Identify location of the ventilation borehole and decommission in accordance with EA guidance. - A watching brief should be carried out by a geotechnical engineer during groundworks to monitor for evidence of any unrecorded mine entries. Where mine entries are recorded during construction works should be stopped and further risk assessment carried out. A remedial specification and capping measures may then need to be provided.
Mining Geology	Medium	Unlikely	Low	Complete the initial ground investigation to determine the thickness of any Made Ground or superficial deposits, and depth to bedrock across the site area.
Mine gas emissions	Medium	Low	Moderate / Low	Complete the initial ground investigation and install ground gas monitoring wells in selected exploratory borehole locations to enable a monitoring programme and gas risk assessment for the site.
Recorded Mining Surface Hazard	Medium	Low Likelihood	Moderate – Low	Complete the initial ground investigation to determine the thickness of any Made Ground or superficial deposits, and depth to bedrock across the site area.

Table 7 – Summary of Mining Risks and Proposed Actions associated with Development Zone 3 - 10

Scenario	Consequence	Likelihood	Risk in Development Zone 3 – 10	Proposed Action
Underground Mining (probable at deeper depths) >30m below rockhead	Medium	Unlikely	Zone 3,4 ,5, 7, 8, 9 & 10 Low	No specific action required.

Scenario	Consequence	Likelihood	Risk in Development Zone 3 – 10	Proposed Action
Underground Mining (probable at shallow depths) <i><30m below rockhead</i>	Medium	Low Likelihood	Zone 3, 4, 5, 7, 8, 9 & 10 Low	No specific action required.
Mine entries (shafts and adits)	Medium	Low Likelihood	Zone 3, 4, 5, 7, 8, 9 & 10 Moderate – Low	- Watching brief to be carried out during all groundworks by geotechnical engineer to monitor for evidence of shafts. If any are recorded during construction works should be stopped and further risk assessment carried out. A remedial specification and capping measures may then need to be provided. - All new or upgraded roads, paths and features on Zones 3, 4, 5, 7, 8, 9 & 10 to be underlain with geogrid to provide some mitigation against any shaft collapse.
Mining Geology	Medium	Unlikely	Zone 3, 4, 5, 7, 8, 9 & 10 Low	No specific action required.
Mine gas emissions	Medium	Low	Zone 3, 4, 5, 7, 8, 9 & 10 Low	No specific action required.
Recorded Mining Surface Hazard	Medium	Low Likelihood	Zone 3, 4, 5, 7, 8, 9 & 10 Moderate – Low	Complete the initial ground investigation to determine the presence of any Made Ground aggressive ground and expansivity to be considered.
Surface Mining (open cast workings)	Medium	Unlikely	Zone 3, 4, 5, 7, 8, 9 & 10 Low	Complete the initial ground investigation to determine the type of Made Ground along with taking environmental samples.

3. ZONES 3 – 10: PHASE 2 GROUND INVESTIGATION SCOPE OF WORKS

Ground investigation works across Zones 3 – 10 were completed between the 2nd and 4th of September 2024, once bird nesting season had come to an end.

The scope of the ground investigation was designed in general accordance with current UK guidance including LCRM (Ref. 6), BS10175 (Ref. 7), BS5930:2015+A1:2020 (Ref. 8) and BSEN1997-2:2007 Eurocode 7 (Ref. 9).

The scope and rationale are summarised in *Table 8*.

Table 8 - Scope of Works

Exploratory Hole Type	Exploratory Hole Reference	Exploratory Hole Depth (m bgl)	Rationale
Window Sample Boreholes	DSBH3-01	4.45	To characterise shallow ground and groundwater conditions; To collect soil samples for chemical analysis; and, To collect samples for geotechnical soil testing.
	DSBH5-01	1.20	
	DSBH5-02	5.45	
	DSBH7-01	5.45	
	DSBH7-01	5.45	
Foundation Hand Pits	HP3-01	1.00	To characterise existing foundations below heritage buildings; To characterise shallow ground and groundwater conditions; and, To collect soil samples for chemical analysis.
	HP4-01	0.65	
Hand Pits	HP3-02	1.20	To characterise shallow ground and groundwater conditions; and, To collect soil samples for chemical analysis.
	HP3-03	1.20	
Soakaway Trial Pits	SA3-01	0.32	To characterise shallow ground and groundwater conditions; To collect soil samples for chemical analysis; and, for BRE SD1 soakaway testing.
	SA3-02	1.50	
CBR Tests	CBR3-01	0.25	To confirm shallow ground conditions for roads and hardstanding design.
	CBR3-02	0.22	
	CBR3-03	0.29	
	CBR4-01	0.15	
	CBR5-01	0.22	
	CBR7-01	0.20	
	CBR7-02	0.20	
	CBR8-01	0.25	
	CBR8-02	0.23	
	CBR9-01	0.25	
	CBR9-02	0.25	
	CBR9-03	0.22	
	CBR10-01	0.26	
	CBR10-02	0.28	

For information regarding the location of the exploratory hole locations, refer to Curtins drawings within *Appendix A*.

3.1 Soil Logging and Sampling

Exploratory hole arisings were logged onsite by a qualified engineer in general accordance with the requirements of BS5930:2015+A1:2020 (Ref. 8), including recording observed visual and olfactory indicators of contamination.

Exploratory hole logs are provided in *Appendix B*.

3.2 Ecological Considerations

The site is located within areas of protected land, including Priority Lowland Meadow habitats, and is located immediately within the RSPB and SSSI, RSPB Hodbarrow.

Before Curtins first attended site an Ecological Impact Assessment was undertaken by Greengage (Ref. 25) which provided recommendations and mitigation measures for the works and during construction.

On arrival, site staff were inducted and given a toolbox talk by Greengage ecologists to inform about the ecological considerations on site. This included the protected Priority Lowland Meadow areas, which could not be tracked across by vehicles, the flora and fauna of interest and measures to reduce the impact of works on the environment.

Vehicles tracking onto site entered from an approved specified location and where possible used the same tracks while moving across site to reduce the impact of vehicles on the environment. While tracking to the positions the route was observed by an ecologist to watch for any sign of animals of interest, such as the Natterjack Toad.

A hand pump pressure washer was used to wash down the boots of personnel onsite each time they walked off areas affected by invasive plant species, to reduce the potential spread of the nuisance species. A pressure washer was used to wash the track mats, the rig and vehicle tacks at the end of the job to remove potential nuisance species and reduce the chance to potentially spread the species.

During the Zone 3 – 10 ground investigation, 2 No. positions (HP3-02 and HP3-03) were relocated due to the presence of invasive species, with their new positions approved by the ecologist on site from Greengage.

4. LABORATORY ANALYSIS

Representative soil samples were selected for laboratory geotechnical and chemical testing, based on field observations, to inform the proposed works.

Selected environmental soil samples were placed in laboratory provided containers and stored in cool boxes prior to being transported to the nominated laboratory under the laboratory's chain of custody documentation. The laboratory selected by Curtins for chemical was Envirolab (UKAS and MCERTS accredited), with the laboratory for geotechnical samples was i2 Analytical (UKAS and MCERTS accredited).

Sampling positions were generally located in a non-targeted, systematic array to give adequate and representative coverage of the site's proposed end use and the immediate environmental setting, concentrating in the Made Ground.

4.1 Environmental Chemical Analysis

The contaminants of concern potentially present on the site were considered to include, amongst others; organic matter, fill, hydrocarbons (e.g. fuel/oils) the extent of which is captured by the broad environmental testing suite listed in Table 9.

Table 9 - Environmental Chemistry Analysis Suite: Soils

Suite Ref	Analyte	LOD
Curtins Soil Suite A	Asbestos Screen, pH and Soil Organic Matter (SOM)	0.1%
	Arsenic, Chromium, Chromium VI, Copper, Lead, Selenium, Zinc, Nickel	5 mg/kg
	Boron (water soluble)	1 mg/kg
	Cadmium	0.5 mg/kg
	Mercury	0.1 mg/kg
	Cyanide (total)	10 mg/kg
	Sulphate (total)	200 mg/kg
	Sulphide	2 mg/kg
	Sulphur (elemental)	20 mg/kg
	Phenols (screen)	1 mg/kg
	PAHs (USEPA 16)	0.1 mg/kg
	TPH (Aro/Alk Split)	0.01 to 0.1 mg/kg

During the ground investigation, 3 No. samples were taken from Made Ground soils, 3 No. samples from Topsoil and 1 No. sample from natural soils. All soil samples were tested for Curtins Soil Suite A, as detailed in Table 9.

Asbestos quantification was undertaken on 1 No. samples where asbestos was identified in a soil sample where woven chrysotile was identified.

Copies of the environmental chemistry testing certificates are presented in *Appendix D*.

4.2 Geotechnical Analysis

Soil samples for testing were prepared in accordance with BS1377: Part 1:2016 (Ref. 10). The geotechnical testing undertaken is listed in Table 10.

Table 10 – Geotechnical Laboratory Testing

Test Type	Quantity	Standard
Moisture Content	6	BS1377 1990, Part 2 (clause 3.2)
pH	6	BS1377 1990, Part 3 (clause 9.4 & 9.5)
Soluble Sulphate in 2:1 water/soil extract SO ₄	6	BS1377 1990, Part 3 (clause 5.3 & 5.5)
Atterberg Limits (4 Point)	5	BS1377 1990 (clause 4.3 and clause 5)
Particle Size Distribution (wet sieve)	1	BS1377-2:2022 (clause 10)

The results of the geotechnical testing are summarised in *Section 7.0* of this report. Copies of the geotechnical testing certificates are presented in *Appendix E*.

4.3 Quality Assurance and Quality Control

Soil chemical analysis and soil geotechnical testing was conducted by Envirolab and i2 Analytical, UKAS and MCERTS accredited laboratories. All samples were delivered in appropriate containers for the suites tested and analysed within the recommended holding times. No deviations were recorded at the time of analysis.

5. ZONE 3 – 10: GROUND CONDITIONS

The ground conditions encountered during the ground investigation works generally comprised Topsoil and/or Made Ground overlying cohesive and granular superficial deposits, with bedrock deposits encountered within 2 No. locations only.

5.1 General

A summary of the ground conditions encountered during the site investigation works is presented in Table 11, with detailed information presented in the exploratory hole logs included in *Appendix B*.

Table 11 - Summary of Ground Conditions Encountered

Strata	Depth to Top of Strata m bgl	Recorded Thickness (m)		Description
		Min	Max	
Topsoil	0.00	0.21	1.35	Grass over reddish brown/dark brown slightly sandy slightly gravelly to gravelly clay with frequent rootlets and occasional cobbles. Gravel of mudstone, limestone, quartzite, coal, slate, brick, twigs and occasional clinker. Occasional cobbles of limestone. Vegetation over dark brown gravelly sand. Gravel of sandstone and limestone.
Made Ground ¹	0.00 – 0.22	0.05	0.98 ²	Surface Covering: Tarmac. Sub-base: Dark brown and black cobbly gravelly fine to coarse sand. Gravel of brick, limestone and tarmac. Cobbles of brick. Black ashy gravelly fine to coarse sand. Gravel of brick and coal. Reddish brown/dark brown gravelly clay with occasional cobbles. Gravel of slag, clinker, brick, concrete and limestone. Cobbles of brick, slag and clinker. Yellowish brown/brown slightly sandy slightly gravelly clay with frequent rootlets. Gravel of broken glass, brick and limestone.
Cohesive Superficial Deposits	0.05 – 1.68	0.90	4.86 ²	Firm to stiff, reddish brown/yellowish brown/brownish grey/brown slightly sandy slightly gravelly to very gravelly clay with occasional cobbles. Gravel of limestone, mudstone and siltstone. Cobbles of limestone. Firm dark purplish brown sandy gravelly clay with rare cobbles. Gravel of limestone, coal. Cobbles of limestone.
Granular Superficial Deposits	0.07 – 1.35	0.20	2.00 ²	Medium dense light orangish/pinkish brown/reddish brown/cream/yellow slightly gravelly fine to medium sand. Gravel of limestone and mudstone.
Bedrock	0.13 – 0.14	1.37 ²		Weathered: Reddish brown clayey gravelly cobbly boulders of limestone. Light grey and reddish brown limestone.

1 – Made Ground depth not proven in all positions.

2 – Thickness not proven. Greater thicknesses may be present.

These descriptions are further detailed in the below sections.

5.2 Topsoil

Topsoil was encountered in 4 No. window sample borehole locations (DSBH3-01, DSBH5-01, DSBH5-02 and DSBH7-02), 3 No. hand pit locations (HP3-01, HP3-03 and HP4-01), 2 No. soakaway trial pit locations (SA3-01 and SA3-02), and 4 No. CBR locations from ground level to a maximum depth of 1.35m bgl.

Topsoil encountered generally comprised of grass or vegetation over dark brown gravelly sand, or reddish brown/dark brown, slightly sandy, slightly gravelly to gravelly clay with occasional cobbles. Gravel comprised of mudstone, limestone, sandstone, quartzite, coal, slate, brick, twigs and occasional clinker. Occasional cobbles of limestone. Not all gravel constituents were encountered in each location.

5.3 Made Ground

Made Ground was encountered in 2 No. window sample borehole locations (DSBH5-01 and DSBH7-01), 2 No. hand pit locations (HP3-02 and HP4-01) and 11 No. CBR locations from between ground level and 0.22m bgl, with a maximum thickness of 0.98m (unproven thickness).

5.3.1 Surface Covering

A surface covering of tarmac was encountered within DSBH7-01, CBR7-01, CBR7-02, CBR8-01, CBR8-02 and CBR10-01 from ground level to depths between 0.05m to 0.06m bgl.

5.3.2 Made Ground

Cohesive Made Ground was encountered within HP3-02 and HP4-01 with thicknesses ranging between 0.05m and 0.35m, described as reddish-brown gravelly clay with occasional cobbles; yellowish brown and brown mottled slightly sandy slightly gravelly clay; and as dark brown slightly sandy gravelly clay with occasional cobbles. Gravel comprised slag, clinker, broken glass, brick, concrete and limestone, cobbles comprised slag and brick. Not all gravel constituents were encountered in each location.

Granular Made Ground was encountered in DSBH5-02 beneath topsoil comprising light orangish/pinkish brown sand and dark purplish brown clayey gravelly sand with rare cobbles, gravel comprised limestone, coal and clinker with a thickness of 0.70m; and in DSBH7-01 immediately underlying a tarmac surface covering, described as dark brown and black cobbly gravelly fine to coarse ashy sand, with gravel of brick, limestone and tarmac with cobbles of brick; and as black ashy gravelly fine to coarse sand with gravel of brick and coal, with a thickness of 0.90m.

5.4 Superficial Deposits

5.4.1 Cohesive

Cohesive deposits probably indicative of Glacial Till were encountered from depths of between 0.05m to 1.68m bgl in DSBH5-02, DSBH7-01, DSBH7-02, HP3-01, HP3-02, HP3-03, CBR10-01 and CBR10-02, with thicknesses of 0.90m (proven thickness) to 4.86m (unproven final thickness).

The cohesive deposits generally comprised firm to stiff, reddish brown/yellowish brown/brownish grey/brown slightly sandy slightly gravelly to very gravelly clay with occasional cobbles. Gravel of limestone, mudstone and siltstone. Cobbles of limestone.

5.4.2 Granular

Granular deposits probably indicative of Glacial Till was encountered from depths of between 0.07m to 1.35m bgl in DSBH5-02, DSBH7-01, HP3-03, CBR5-01 and CBR9-02 with thicknesses of 0.20m (proven thickness) to 2.00m (unproven final thickness).

The granular deposits comprised medium dense light orangish/pinkish brown/reddish brown/cream/yellow slightly gravelly fine to coarse sand. Gravel of limestone and mudstone. Not all gravel constituents were encountered in each location.

5.5 Possible Bedrock 'Residual Soil' - Martin Limestone/Red Hill Limestone Formation

Bedrock weathered to a 'Residual Soil' probably indicative of the Martin Limestone Formation/Red Hill Limestone Formation was encountered within DSBH3-01, SA3-01 and SA3-02 only.

It was encountered in DSBH3-01 and SA3-02 from a depth of 0.13m to 0.21m bgl, comprising firm reddish brown slightly sandy gravelly to very gravelly clay with cobbles of limestone; and as reddish brown clayey gravelly cobbly boulders of limestone, with gravel and cobbles of limestone.

Slightly more competent bedrock was encountered within SA3-01 from a depth of 0.14m bgl, comprising light grey and reddish-brown limestone.

5.6 Existing Foundations

Two foundation hand pits were undertaken to understand the foundations of existing structures on site, in Zone 3 (Towsey Hole Windmill) and Zone 4 (Haverigg Lighthouse).

The foundation hand pit undertaken in Zone 3 (HP3-01) encountered the foundation of the Towsey Hole Windmill, comprising larger bricks at the base of the brick structure at 0.39m below ground level, formed on firm orangish brown clay.

The foundation hand pit undertaken in Zone 4 (HP4-01) encountered what is assumed to be the foundation of the Haverigg Lighthouse, comprising a metal base which projected 0.70m from the metal structure at 0.51m below ground level. The base of foundation was not encountered due to groundwater ingress.

The foundation hand pit drawings can be referred to in *Appendix A*.

5.7 Obstructions Encountered

Obstructions were recorded within DSBH5-01 at 1.20m bgl as hard compacted ground comprising of gravel and cobbles of slag and clinker.

5.8 Groundwater

Groundwater was encountered within this ground investigation within HP4-01 only, at 0.15m bgl. Groundwater encountered likely represents perched groundwater.

5.9 Observed Potential Contamination

Varied anthropogenic constituents were also noted throughout Made Ground soils as detailed in Section 5.3.

No further visual or olfactory contamination was observed during the ground investigation within Zones 3 – 10.

6. GROUND MODEL

6.1 Topsoil

Topsoil was encountered in 13 No. locations from ground level to a maximum depth of 1.35m bgl. The Topsoil encountered within this ground investigation is described in Section 5.2.

Limited geotechnical testing was undertaken in the Topsoil due to it being considered an unsuitable material for use in geotechnical designs. As a result no geotechnical parameters have been derived. The geotechnical test results recorded within the Topsoil are summarised in Table 12.

Table 12 – Summary of Geotechnical Test Results – Made Ground

Parameter	No. of Tests	Results	
		Min	Max
Laboratory Tests – General ¹			
pH	3	7.68	8.04
Water Soluble Sulphate (mg/l)	3	<10	20
Water Content (% w/w)	3	19.2	22.7

1 - Includes pH and water-soluble sulphate values derived from environmental testing.

6.2 Made Ground

Made Ground was encountered in 15 No. locations from between ground level and 0.22m bgl, with a maximum thickness of 0.98m (unproven thickness). The Made Ground encountered within this ground investigation is described in Section 5.3.

Due to the variable nature of Made Ground in terms of strength and composition, this layer is not deemed to be a suitable founding stratum. As such, limited geotechnical testing was undertaken on this stratum and geotechnical design parameters have not been derived for the Made Ground.

The geotechnical test results recorded within the Made Ground are summarised in Table 13.

Table 13 – Summary of Geotechnical Test Results – Made Ground

Parameter	No. of Tests	Results	
		Min	Max
In Situ Tests			
SPT 'N' Value (uncorrected)	1	44	
Laboratory Tests – General ¹			
pH	3	7.91	8.22
Water Soluble Sulphate (mg/l)	3	20	30
Water Content (% w/w)	3	13.7	31.1

(1) Includes pH and water-soluble sulphate values derived from environmental testing.

The SPT terminated in Made Ground comprising gravelly clay with occasional cobbles of slag. It is not possible to use this data to determine the strength of the Made Ground, as the high N value may be indicative of cobbles. More data would be required to enable this.

6.3 Superficial Deposits

Cohesive deposits probably indicative of Glacial Till were encountered from depths of between 0.05m to 1.68m bgl in 9 No. locations. Granular deposits probably indicative of Glacial Till were encountered from depths of between 0.07m to 1.35m bgl in 5 No. locations.

The geotechnical test results recorded within the cohesive and granular Superficial Deposits are summarised in Table 14.

Table 14 - Summary of Geotechnical Test Results – Superficial Deposits

Parameter		No. of Tests	Results	
			Min	Max
In Situ Tests				
SPT 'N' Value (uncorrected)		14	1	26
Laboratory Tests – General				
Atterberg Tests	Liquid Limit (%)	4	30	50
	Plastic Limit (%)	4	14	20
	Plasticity Index (%)	4	16	30
	Modified Plasticity Index (%) ¹	4	14	29
Moisture Content (% w/w) ²		4	15	20
pH ²		5	7.7	8.5
Water Soluble Sulphate (mg/l) ²		5	6.39	37.4

(1) Modified plasticity index in accordance with NHBC Chapter 4.2.

(2) Includes pH and water soluble sulphate values derived from environmental testing.

10 No. SPT 'N' Values (uncorrected) were recorded in cohesive Superficial Deposits, with results ranging between 1 and 26. 4 No. SPT 'N' Values (uncorrected) were recorded in granular superficial deposits, with results ranging between 3 and 10, indicating loose/medium dense material (BS5930:2015+A1:2020). The SPT 'N' Values (uncorrected) are plotted against depth and presented on Figure 7.

A total of four Atterberg Tests were undertaken within the cohesive Superficial Deposits and the results suggest that the clay is of low to intermediate plasticity. Modified Plasticity Index results >10% suggest that the soil is 'shrinkable' in accordance with the NHBC Technical Standards, Chapter 4.2, 2024. Four of the five results classify the soil as having a low volume change potential in accordance with BRE Digest 240 (1993); Low Rise Buildings on Shrinkable Clay Soils; Part 1 (Ref. 11), except for one sample taken from DSBH7-02 at 1.20m bgl which classifies as medium volume change potential. The results of the Atterberg Limits are presented on Figure 6. In the absence of more data a medium volume change potential should be assumed for the cohesive Superficial Deposits to be conservative.

An estimate of Undrained Shear Strength (c_u), of cohesive soils can be derived from the correlation between Plasticity Indices (PI) and SPT N values (Ref. 12) using **Equation 1**:

$$c_u = f_1 N \quad \text{Equation 1}$$

Where:

c_u = Undrained Shear Strength

$$f_1 = \text{Stroud Factor determined from Figure 1.5 (Ref. 12)}$$

$$N = \text{SPT } N_{60} \text{ Value}$$

SPT N_{60} (corrected) values use the energy certificate from the SPT hammer from the drillers; however in the absence of this, SPT N values (uncorrected) have been used in Equation 1.

Using Equation 1, and an f_1 factor of 5.1 for an average modified plasticity index of 20%, estimated undrained shear strengths of 5kPa to 133kPa may be determined, indicating the clays to be of extremely low to high strength. The results are presented on Figure 8. Some degree of increasing undrained shear strength with depth can be seen on Figure 8 within the cohesive Superficial Deposits and a conservative design line has been plotted so that an estimated c_u can be calculated for a specific depth. The line equation is as follows:

$$c_u = 5.1 + 25.5z$$

Where z is depth from 1.20m.

1 No. Particle Size Distribution Test (wet sieve) was undertaken on a sample from DSBH5-02 at 4.00m bgl, with a result of 99% sand and 1% silt/clay particles, analogous with the field description.

Characteristic weight densities can be estimated from BS8004:2015 + A1:2020 for granular and cohesive soils above and below the groundwater table, based on their density (granular) or strength (cohesive).

Assuming a loose / medium dense sand, a weight density of 16kN/m³ is recommended above the groundwater table and 17kN/m³ below the groundwater table is recommended.

A conservative angle of shearing resistance of 28° is recommended for the granular Superficial Deposits, after Peck, Hanson and Thornburn (1965) and a SPT N value of 3.

Depending on the strength of the cohesive Superficial Deposits the following weight densities are recommended.

	Above and Below the Groundwater Table:
Low	16kN/m ³
Medium	17kN/m ³
High	18kN/m ³

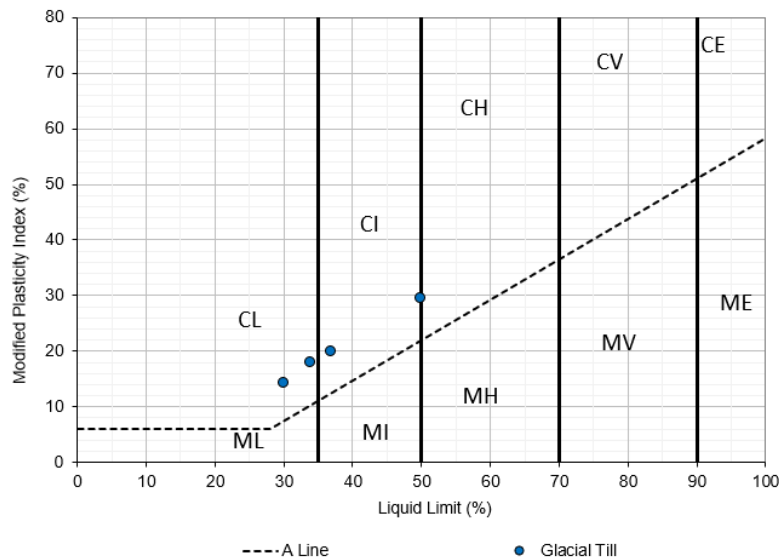


Figure 6 – Casagrande Chart

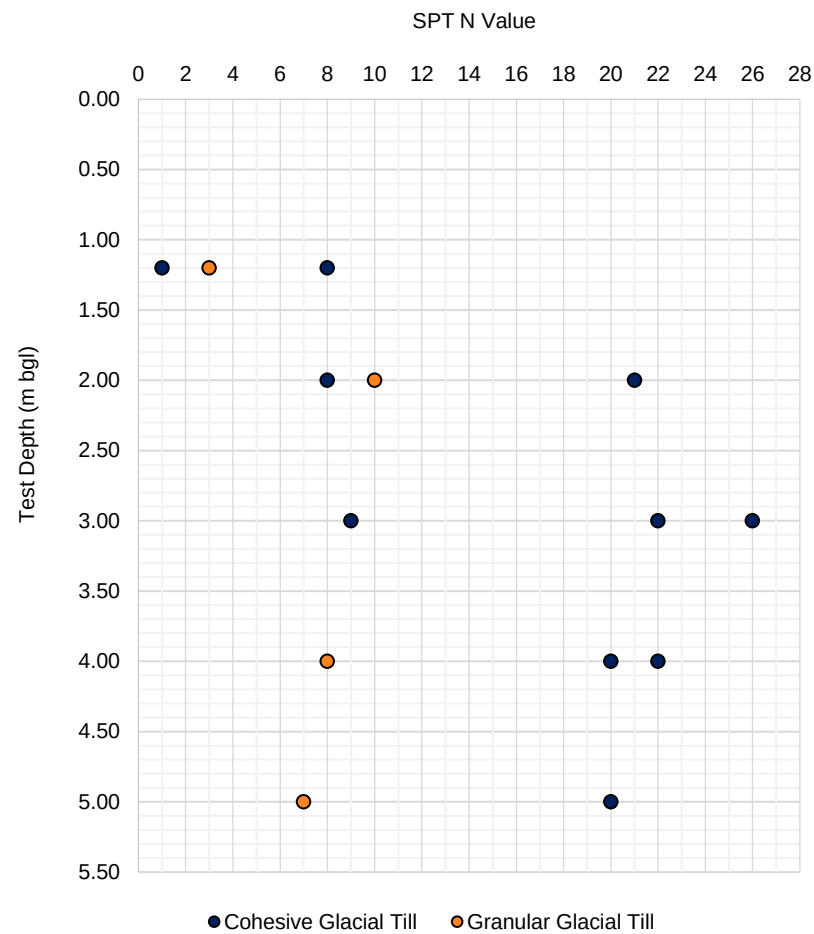


Figure 7 - SPT 'N' Value vs. Depth (m bgl) for Cohesive and Granular Glacial Till

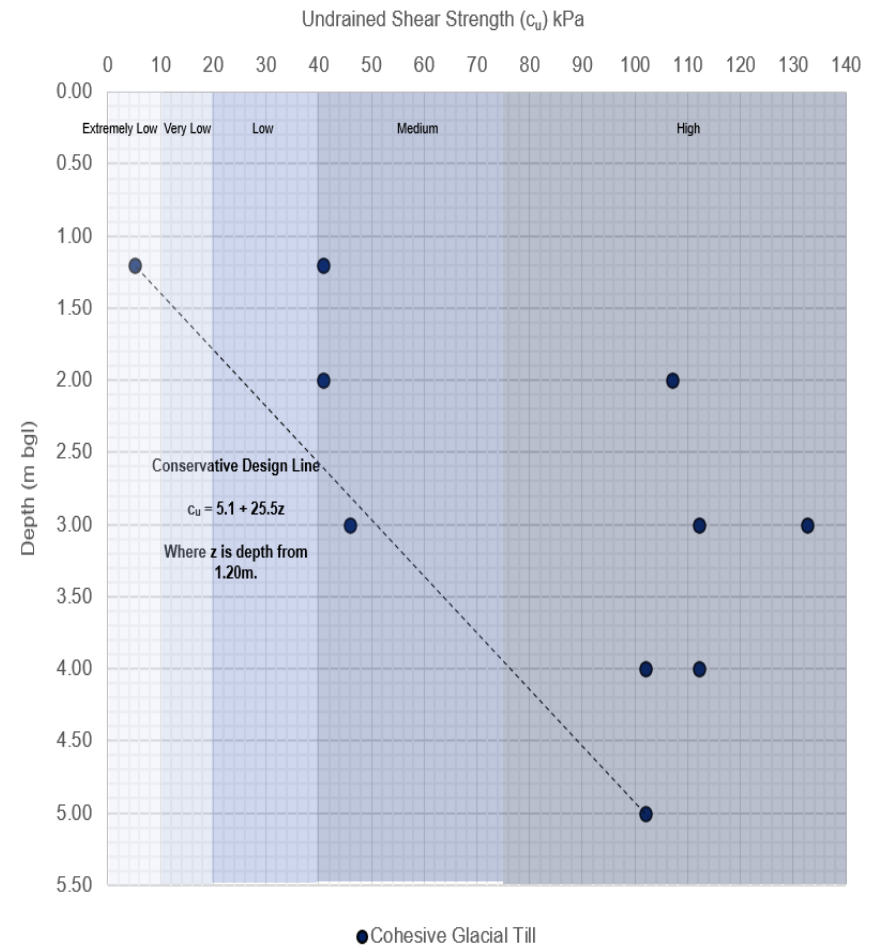


Figure 8 – Relationship between Undrained Shear Strength vs. Depth (m bgl)

6.4 Possible Bedrock 'Residual Soil'

Weathered bedrock indicative of Residual Soil was only encountered in DSBH3-01, SA3-01 and SA3-02. The geotechnical test results recorded within the bedrock are summarised in Table 15.

Table 15 - Summary of Geotechnical Test Results – Possible Bedrock 'Residual Soil'

Parameter		No. of Tests	Results
		Min	Max
In Situ Tests			
SPT 'N' Value (uncorrected)		4	5
Laboratory Tests – General			
Atterberg Tests	Liquid Limit (%)	1	42
	Plastic Limit (%)	1	19
	Plasticity Index (%)	1	23
	Modified Plasticity Index (%) ¹	1	18
Moisture Content (% w/w)		2	11.7
pH		2	8.3
Water Soluble Sulphate (mg/l)		2	2.66
			<10

(1) Modified plasticity index in accordance with NHBC Chapter 4.2.

Given the nature of the bedrock recovered from the borehole and trial pits and without further site investigation it is recommended that this is treated as a cohesive soil in geotechnical design.

4 No. SPT 'N' Values (uncorrected) were taken in weathered bedrock, recovered as sandy gravelly clay with cobbles, with results ranging from 5 to 9. The SPT 'N' Values (uncorrected) are presented on Figure 13.

1 No. Atterberg Test was undertaken within the weathered bedrock deposits recovered as sandy gravelly clay. It is not possible to determine a volume change potential with such a limited dataset.

A moderately conservative Undrained Shear Strength, c_u , of cohesive Residual Soil can be estimated from the correlation between Plasticity Indices (PI) and SPT N values (Ref. 12) using **Equation 1**.

Using this correlation, and a conservative f_1 factor of 4.5, in the absence of more plasticity index results, estimated undrained shear strengths of 23kPa to 41kPa are determined, suggesting cohesive soil of low to medium strength.

The following weight densities are recommended based on a low to medium strength cohesive soil above and below the groundwater table:

	Above and Below the Groundwater Table:
Low	16kN/m ³
Medium	17kN/m ³

6.5 Aggressive Ground Conditions

The classification of the site in terms of concrete in aggressive ground is based on the guidance provided in Table C2 of the Building Research Establishment (BRE) Special Digest 1, Concrete in aggressive ground, 3rd edition of 2005 (Ref. 13).

In total there are 13 No. pH and water-soluble sulphate results for the site of which there are 3 No. within the Topsoil, 3 No. within the Made Ground, 5 No. within the Superficial Deposits and 2 No. in the Possible Bedrock 'Residual Soils'. More data is recommended to confirm the concrete classification for specific stratum however a preliminary concrete classification of DS-1 can be assumed based on the dataset available, assuming non-pyritic ground and no groundwater results available.

7. GROUND AND GROUNDWATER CONTAMINATION ASSESSMENT

This section of the report includes the assessment of the potential contamination, solid, liquid and gas, identified on the subject site which may present a risk to the proposed end users, associated utilities, and the wider environment.

In LCRM guidance published by the Environment Agency (Ref. 6), the risk to human health or controlled waters is determined through an assessment of pollutant linkages between a source of contamination (within the ground or groundwater either on or off site) and a sensitive receptor such as end users of the site, building materials, edible plants grown in gardens or groundwater abstracted for drinking. This is termed a source-pathway-receptor relationship.

These models have a common approach, which is one of a tiered assessment. At each stage of the assessment further detail can be applied to the conceptual site model to provide a detailed interpretation on a site by site basis. As part of the planning process this approach is adopted to establish either if the site is 'suitable for use' or whether additional work or else remedial work is required for the site to be deemed so.

The sub-sections hereafter therefore incorporate the second Tier (Tier 2) of the approach described in EA guidance, otherwise referred to as the Generic Quantitative Risk Assessment (GQRA). The GQRA builds on the qualitative risk assessment (Tier 1) presented in the Phase 1 Desk Study (Ref. 1), in conjunction with observations made during the ground investigation and is based solely on the results of the chemical and other testing data obtained as part of Curtins ground investigation. The GQRA is used to build/refine the Conceptual Site Model (CSM) for the site as detailed and presented in Section 8.0 of this report.

More detail on Curtins risk assessment methodology, rationale and hierarchy for human health risk assessment is enclosed in Appendix G.

7.1 Human Health GQRA

7.1.1 Adopted Soil Human Health GACs Screening Methodology

The proposed development in Zones 3 – 10 comprises improved accessibility, new footpaths, construction of new bird hides, and repairs to existing structures is most analogous with a '*Commercial*' end-use scenario.

The soil organic matter (SOM) content has an influence on the volatilisation of organic contaminants (i.e., the higher the SOM, the lower the volatilisation rate and therefore inhalation exposure risk). Soil organic matter (SOM) values for the site soils ranged from 2% to 33.2%. Consideration of the geometric mean results in a calculated value of 4.00% for weathered bedrock deposits, 6.71% for Made Ground soils and 8.84% for Topsoil.

A comparison against Tier 1 thresholds for a SOM of 6% for Made Ground and Topsoil soils, and a SOM 2.5% for weathered bedrock deposits has been adopted for '*Commercial*' end-use. The adopted GAC's are listed in *Appendix F*.

7.1.2 Generic Assessment Criteria Screening of Soil Chemical Laboratory Results

The results of the environmental testing can be referred to in *Appendix D*, with testing undertaken on a total of 7 No. soil samples across the site.

With respect to the proposed '*Commercial*' end use, soil chemical analysis results recorded 1 No. exceedance:

- HP4-01 at 0.40m bgl (Made Ground) – 10,600mg/kg of Lead, (screening value of 2,300mg/kg).

The exploratory hole log for HP4-01 (*Appendix B*) describes the Made Ground as containing gravel and cobbles of slag material (waste byproduct from smelting process), which may explain the high exceedance of lead. The Development Plan (*Appendix A*) for Zone 4 where the anomalous lead exceedance was recorded is shown to comprise hardstanding surface changes and improvements, which would break the pathway between the source (Made Ground) and the receptor (visitors to the site).

Environmental testing results are provided within *Appendix D*.

All soil samples were screened for asbestos, with 1 No. positive identifications obtained, the results of which are summarised in Table 18.

Table 16 - Positive Asbestos Identification

Location	Depth (m bgl)	Stratum	Type	Matrix	Asbestos in soil Quantification (%)
DSBH7-01	0.20	Made Ground: dark brown and black cobbly, gravelly sand.	Chrysotile	Textile	1.158

This ACM was identified below the existing tarmac within a granular made ground stratum. The Development Plan (*Appendix A*) for Zone 7 where the positive asbestos identification was encountered shows that future development comprises hardstanding surface changes and improvements only, breaking the pathway between the source (Made Ground) and the receptors (visitors to the site). No soft landscaping changes are proposed.

8. REVISED CONCEPTUAL SITE MODEL

The Preliminary Conceptual Site Model (PCSM) presented and discussed in the Phase 1 Preliminary Risk Assessment (Ref. 1) has been revised following the GQRA in Section 7.0 above. The Revised Conceptual Site Model (CSM) is summarised in the table overleaf.

The CSM details the source-pathway-receptor linkages or potential pollutant linkages (PPL) that have been identified as relevant for the site. The GQRA details the associated level of risk relating to these potential pollutant linkages.

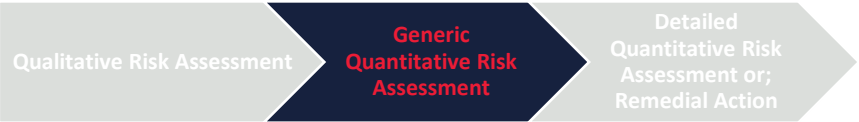
The CSM follows the framework outlined within CIRIA C552 (Ref. 22) which is summarised within *Appendix G*.

The 'risk rating' within the CSM refers to the risk that the source, pathway, receptor linkage or PPL is complete. Unless specifically stated it does not necessarily refer to an immediate risk and is intended to be used as a tool to assess the necessity for further assessment/investigation.

Risks presented by Mining are discussed and assessed within Section 2.4 and the Curtins Mining Risk Assessment (Ref. 2).

Under current health and safety legislation, employers are required to carry out their own appropriate risk assessments and mitigation to protect themselves and their employees, other human receptors, and the environment from potential contamination. Such risks must be adequately mitigated by law, specifically the Construction Design Management (CDM) Regulations, 2015 (Ref. 23) which require that potential risks to human health and the environment from construction activities are appropriately identified and all necessary steps taken to eliminate / manage that risk. It has been assumed that any future construction works on site will be undertaken in compliance with these requirements.

Reference should be given to the environmental testing results discussed within Section 7.0 and presented within *Appendix D*.



- The table below represents the Second stage in the land quality risk assessment process; the Revised Conceptual Site Model following the Quantitative Risk Assessment.
- For a development site to be deemed ‘suitable for use’ the level of risk needs to be brought down to acceptable levels, i.e. low to very low risk. The purpose of each stage of risk assessment is ultimately to establish if there is a requirement for additional levels of assessment to be made to have sufficient confidence to support a risk characterisation or management decision, e.g., remedial action.

Conceptual Site Model			Qualitative Risk Assessment			Comments	Actions
Source	Pathway(s)	Receptor(s)	Consequence	Likelihood of Occurrence	Risk Rating		
Significant sources of on-site contamination: • Made Ground of unknown composition from uncontrolled deposition of materials on site during the infilling of land. • Uncontrolled deposition of Made Ground during the construction and demolition previously undertaken on site. • Uncontrolled deposition of spoil associated with mining and mineral extraction. • Unknown contamination associated with the sites former industrial use, may include leakages and spillages from plant and machinery. Significant sources of off-site contamination: • Various landfills off-site • Uncontrolled deposition of Made Ground during the construction and demolition previously undertaken on site • Uncontrolled deposition of spoil associated with mining and mineral extraction. • Unknown contamination associated with the sites former industrial use, may include leakages and spillages from plant and machinery.	Direct contact and dermal uptake, soil and dust ingestion, dust and migration inhalation.	Site end-users (Site staff and visitors)	Medium Chronic health risk.	Unlikely	Low	Environmental chemical analysis recorded 1 No. exceedance of lead within Zone 4 during the investigation when compared against ‘Commercial’ end use scenario GACs One positive identifications of asbestos containing materials have been identified in this investigation within Zone 7. Both Zone 4 and Zone 7 development to comprise hardstanding surfacing changes and improvements, breaking the pathways between the source and the receptor.	Further ground investigation in uncharacterised areas, where bird hides have been relocated to. Should unexpected contamination be observed during demolition/construction, works should be stopped with advice obtained from an appropriate specialist.
		Construction and Maintenance workers	Medium Chronic health risk.	Low	Moderate/Low	Environmental chemical analysis recorded 1 No. exceedance of lead within Zone 4 during the investigation when compared against ‘Commercial’ end use scenario GACs One positive identifications of asbestos containing materials have been identified in this investigation within Zone 7.	Asbestos management plan during construction works due to presence of asbestos fibres in shallow Made Ground. Health & Safety precautions to be used by workers. Construction and maintenance workers should be provided with suitable PPE with respect to environmental chemical results presented herein. Should unexpected contamination be observed during demolition/construction, works should be stopped with advice obtained from an appropriate specialist.
	Vertical and horizontal migration through weathered bedrock (soils).	Controlled Waters (Surface Water) Nearest surface water feature is the RSPB Hodbarrow nature reserve lakes, a River feature in the southwest and the tidal Duddon river approximately 16m south of the site.	Medium Pollution of sensitive water resources.	Unlikely	Low	No evidence of gross contamination found in ground investigation. No groundwater was encountered during the ground investigation within Zones 3 – 10, excepting perched water within HP4-01. Cohesive deposits present overlying and interbedded with the granular deposits acting as a potential barrier to vertical migration.	No further action required unless evidence of gross contamination identified during construction.
		Controlled Waters (Groundwater) Secondary A Aquifer within bedrock deposits underlying the site.	Medium Pollution of sensitive water resources.	Unlikely	Low	Groundwater in area likely to be of reduced quality and sensitivity due to mining legacy.	
	Vertical and horizontal migration through the Made Ground and superficial deposits.	End users of site (Site staff and visitors)	Medium Chronic health risk.	Unlikely	Low	With consideration for the proposed development in these areas (improved accessibility, footpaths, bird hides with no enclosed airspaces), the risk posed by ground gas is considered to be Low.	The potential risks from ground gases to the excavations are to be dealt with by the Contractor, in accordance with the Confined Space Regulations, during construction.
		Maintenance workers					

9. ENGINEERING ASSESSMENT AND RECOMMENDATIONS

9.1 Introduction

This section will assess the relevant geotechnical issues for the current development proposals, these comprise access improvements, new footpaths, construction of new bird hides, and repairs to existing structures.

It should be noted that detail may change in the development of designs beyond the issue of this Phase 2 Report and the Construction Designer should satisfy themselves regarding the adequacy of their design and proposed approach to construction by reference to the on-going project design proposals, the ground investigation information, and their own examination of the site.

The concept of the new bird hides is to be developed, but at this stage is understood to comprise lightweight timber or similar structures. In addition, at the time of writing, information on proposed levels and structural loads was not available. Therefore, this report should be reviewed once this information is provided.

9.2 Geotechnical Considerations and Constraints

9.2.1 Topography

In older development plans, bird hides were proposed on existing steeply sloping ground. It was recommended that their location was reviewed with the consideration of the constructability. 1 No. bird hide within Zone 5 (Annie Lowther Hide) has since been relocated away from the steep slope up to the inner sea wall and instead appears on a flatter area approximately 50m to the south-east.

9.2.2 Mining Risk

The intrusive investigation works did not identify any evidence of shallow mine workings or mining related features, such as voids or broken ground. No mine entries or potential mine shafts were identified during the investigation.

Curtins drawing titled 'Summary of Historical Iron Mining and Associated Features' (*Appendix A*) shows numerous mine entries on the site within each Zone. Installation of a Geogrid beneath new paths, roadways and bird hides should be considered to reduce the impact and protect against potential subsidence relating to the sites historical mining activity.

Slag mining waste was identified within the Made Ground deposits in several Zones of the site. It's recommended that this material is not re-used and instead is removed from site by appropriate waste disposal practices.

The recommendations from the mining risk assessment should be adhered to which include:

- A watching brief is recommended to be carried out during all groundworks by a geotechnical engineer to monitor for evidence of shafts. If any are recorded during construction works should be stopped and further risk assessment carried out. A remedial specification and capping measures may then need to be provided.
- All new or upgraded roads, paths and features outlined in Curtins drawing titled 'Shafts and Relic Mining Features – Areas of Highest Risk' (*Appendix A*) to be underlain with high-strength geogrid reinforcement to provide some mitigation against any shaft collapse.

Following Curtins ground investigation, development plans were updated including relocation of bird hides. One of the potential shaft locations identified from 'archive' records is in close proximity to the bird hide relocated to the south of Zone 7. Further assessment is recommended, or consideration should be made to relocating the bird hide away from this shaft, outside of its departure zone and zone of influence.

9.2.3 Slope Stability

Steep slopes are identified in several areas of the site (Zones 3, 5, 7, and 8) along with several areas close to the Hodbarrow Lagoon or large ponds on site (Zones 5, 7, 8 and 9) which could potentially have unstable banks. The presence of dense woodland restricted the feasibility of a topographical survey. As a result, slope heights and gradients

are currently unknown. Due to the proposed access roads, the stability of the slopes should be considered further and if deemed necessary, a slope stability assessment undertaken.

9.2.4 Excavations

Local instability should be expected due to the presence of sand and gravel, along with granular Made Ground. Where batters are not feasible it is anticipated that some form of temporary earth retaining works would be required. Excavations shallower than 1.20m deep, requiring personnel access, will require closed side support. The chosen contractor should provide details on how they intend to ensure the safety and stability of proposed excavations.

Perched water may be encountered as seepages in shallow excavations for foundations or services. Where encountered, standing water within the excavations could result in weakening of the founding soils, as such, the water should be removed facilitating suitable methods. Where dewatering is deemed to be required, general advice on dewatering in accordance with CIRIA Report C750: Groundwater control (CIRIA, 2016) should be taken into consideration.

Excavation through layers of Made Ground encountered across the site should be feasible using conventional site plant.

9.2.5 Presence of Existing / Relic Structures

No relic structures were encountered during ground investigation within Zones 3 – 10, however the presence of unidentified relic structures cannot be discounted, and caution should be undertaken during phases of construction.

Should buried structures be encountered, it is recommended that they are fully grubbed out to prevent differential settlement where new structures are proposed or delays during construction.

9.2.6 Volume Change Potential

Volume Change Potential should be considered when there are shrinkable soils and proposed structures in the vicinity of retained, removed or proposed trees/hedgerows.

Should cohesive Superficial Deposits be present at formation level it should be assumed that this has a medium volume change potential, unless further testing can be undertaken to enable a reassessment. Minimum foundation depths and heave precautions may need to be considered as per the guidance contained in the NHBC Technical Standards, Chapter 4.2 'Building near trees', 2024, for which the tree species would be required.

9.2.7 Slag Expansivity Potential

Slag deposits have the potential to expand volumetrically which could affect proposed paths, roads or structures. It would be prudent to check the expansivity potential of the slag deposits on site.

9.3 Other Considerations and Constraints

9.3.1 Presence of Existing Services / Utilities

The presence of existing services / utilities may require capping and/or diversion associated with the development, which should be managed through the appropriate utility suppliers during the construction phase. The Principal Contractor should ensure that appropriate mitigation measures are put in place during the construction phase (i.e. during excavation of the Made Ground).

9.3.2 Obstructions

Given the site history, further obstructions within the Made Ground cannot be discounted in un-investigated areas.

It is recommended that all obstructions are removed during the enabling works, or their location accurately recorded, to avoid delays during construction.

9.3.3 Waterlogged Ground

Areas of land where 'marsh/swamp' environments are present may need to undergo dewatering and drainage put in place to mitigate further flooding.

9.3.4 Ecological Constraints

Zones 3 – 10 are located within areas of protected land, including Priority Lowland Meadow habitats, and is located within the RSPB and SSSI, RSPB Hodbarrow. Rare species such as Natterjack Toad are known to present along with and nuisance plant species such as Mares Tail observed on site.

Greengage's Ecological Impact Assessment (Ref. 25) should be consulted for ecological constraints and construction mitigation measures. Specialist ecologist advice should be sought for all construction works.

9.3.5 Drainage

To assess feasibility for soakaway drainage in Zone 3, 2 No. machine excavated trial pits were undertaken for soakaway testing.

1 No. successful soakaway test in accordance with BRE365 'Soakaway design' was undertaken within the weathered bedrock 'Residual Soil' in SA3-02. A second location, SA3-01, was also undertaken in an area of shallow bedrock (from 0.14m bgl) and this test failed to soakaway after 3 hours of testing.

Table 17 – Summary of Positive Soakaway Test Results

Position ID	Test Number	Time, T_{p75-25} (seconds)	Infiltration Rate
SA3-02	Test 1	15.0	1.47×10^{-3}
	Test 2	15.0	1.47×10^{-3}
	Test 3	15.0	1.47×10^{-3}

* Unable to calculate infiltration rate due to insufficient drop in water level.

At the location of soakaway SA3-02 an infiltration rate of 1.47×10^{-3} has been calculated suggesting soakaways may be suitable in this specific location.

Elsewhere, soakaway drainage maybe unfeasible in some areas of the site due the depth of Made Ground or presence of variable cohesive and granular Superficial Deposits. Drainage systems or further soakaway testing for feasibility may be required in other areas.

9.4 Foundations

The concept of the new bird hides is to be developed, but at this stage is understood to comprise lightweight timber or similar structures. Loadings are unknown at present however they are anticipated to be low.

The Topsoil and Made Ground are not considered to be suitable bearing stratum due to their low strength and variability.

It is recommended that foundations are within the natural Superficial Deposits or 'Residual Soil' and wholly within one material type, e.g. granular or cohesive, to prevent differential settlement. Over excavation may be required to achieve this.

For the purpose of this preliminary assessment a light timber frame structure ≤ 6 m in length on an unreinforced raft has been assumed founded on either cohesive Superficial Deposits, granular Superficial Deposits or weathered bedrock 'Residual Soil'. Assuming that the Superficial Deposits at formation level are cohesive with an undrained shear strength in excess of 40kPa, and assuming a bulk unit weight of 16kN/m³, a net safe bearing capacity of 75kPa is suggested.

The foundation advice should be revisited once the locations and proposed construction of the bird hides are finalised and the constraints identified above appropriately considered through further foundations options appraisal.

The bird hide foundation design should also consider the risk of ground instability associated with unrecorded mine shaft collapse through appropriate design mitigation. In addition, as mentioned a watching brief is recommended during all groundworks and a geotechnical engineer should inspect formations prior to construction.

Updated development plans have been issued following Curtins Ground Investigation. Ground characterisation in areas not yet characterised is recommended prior to construction, due to the relocation of bird hides.

9.5 Road and Hardstanding Assessment

14 No. TRL Dynamic Cone Penetrometer (DCP) tests (CBR3-01 – 3-03, CBR 5-01 – 5-02, CBR7-01 – 7-02, CBR8-02, CBR9-01 – 9-03, CBR10-01 – 10-02), were undertaken to estimate CBR values in the shallow soils, mainly within existing roads and pathways. The tests began below existing tarmac hardstanding and sub-base at depths ranging between 0.00m (ground level) and 0.29m bgl on Superficial Deposits or Made Ground. The TRL DCP results are included within *Appendix C* and a summary provided in Table 18.

Table 18 – Summary of TRL DCP Test Results

Test Reference	CBR Comments
CBR3-01	CBR >5% from 0.60m bgl.
CBR3-02	CBR >5% from 0.45m bgl.
CBR3-03	CBR >5% from 0.59m bgl.
CBR5-01	CBR >5% from 0.55m bgl.
CBR5-02	CBR >5% from 0.14m bgl.
CBR7-01	CBR >5% from 0.21m bgl.
CBR7-02	CBR >5% from 0.21m bgl.
CBR8-01	CBRs typically >5% from 0.17m bgl.
CBR8-02	CBR >5% from 0.23m bgl.
CBR9-01	CBR >5% from 0.40m bgl.
CBR9-02	CBR >5% from 0.54m bgl.
CBR9-03	CBR >5% from 0.50m bgl.
CBR10-01	CBR >5% from 0.54m bgl.
CBR10-02	CBR typically >5% from 0.49m bgl.

The TRL results are highly variable, and it is considered likely that cobbles and boulders identified within the granular Made Ground and Superficial Deposits encountered elsewhere onsite have influenced the estimated CBR results, evidenced by unusually high CBR values (>20%).

As the Made Ground is variable, it is suggested that the formation is thoroughly proof rolled to identify any areas of soft or deleterious material with a CBR <5%. If present, these should be excavated and replaced with a thoroughly compacted granular fill.

For the purpose of preliminary design, a CBR value of 5% is suggested. It is recommended that additional CBR tests are undertaken at proposed formation levels to verify that the design CBR has been achieved. Given the high gravel content, Plate CBR Tests may be more appropriate.

9.6 Chemical Attack on Buried Concrete

The results of the buried concrete assessment suggest Design Sulphate Class DS-1, for the Topsoil, Made Ground, Superficial Deposits and Bedrock 'Residual Soil'.

10. CONCLUSIONS & RECOMMENDATIONS

10.1 Conclusions

A revised tabulated revised Conceptual Site Model has been derived following the findings on the Generic Quantitative Risk Assessment risk assessment and is presented in *Section 8.0*.

10.1.1 Ground and Groundwater Contamination

With respect to the proposed Commercial end-use of the site, 1 No. exceedance of lead was encountered within HP4-01 in Zone 4. Asbestos was present in 1 No. soil samples taken from Zone 7 at 0.20m, below existing tarmac, recorded as textile of chrysotile (1.158 % w/w).

Varied anthropogenic constituents were also noted throughout Made Ground soils. No further visual or olfactory contamination was observed during the ground investigation within Zones 3 – 10.

A **Low**-risk rating is identified to proposed site end-users from direct contact, inhalation, and ingestion of contaminants within Made Ground soils accounting for the development proposals, and the presence of proposed hardstanding in areas where elevated lead or asbestos has been identified.

A **Moderate/Low**-risk rating is identified to proposed site end-users and maintenance workers from direct contact, inhalation, and ingestion of contaminants.

The following is recommended to mitigate against future human health risks:

- Asbestos management plan during construction works due to presence of asbestos fibres in shallow Made Ground in Zone 7.
- Construction and maintenance workers should be provided with suitable PPE with respect to environmental chemical results presented herein.
- Should unexpected contamination be observed during demolition/construction, works should be stopped with advice obtained from an appropriate specialist. This will include if asbestos is encountered in any proposed soft landscaped areas.

A **Low** risk rating is currently identified to controlled waters in relation to groundwater and surface water receptors accounting for the lack of shallow groundwater within the Made Ground soils, and no evidence of gross contamination found during the ground investigation in Zones 3 – 10.

A **Low** risk rating is currently identified to site end users and maintenance workers from vertical and horizontal migration of ground gases through the Made Ground and superficial deposits with consideration for the proposed developments in Zones 3 – 10 (improved accessibility, footpaths and bird hides with no enclosed airspaces).

10.2 Geotechnical Conclusions and Recommendations

The location of the proposed bird hides should be reviewed with consideration of the existing steeply sloping ground and accessibility of construction plant. Earthworks and Slope Stability will otherwise need to be considered further. A site visit with a Geotechnical Engineer is suggested to discuss the proposed locations and geotechnical implications.

Due to the ground instability from recorded or unrecorded mine shafts it is recommended that a watching brief is adopted during all groundworks onsite, together with the other recommendations detailed in Section 2.4.

The cohesive Superficial Deposits (Glacial Till) with an undrained shear strength in excess of 40kPa are estimated to have a net safe bearing capacity in the region of 70kN/m². Assuming a concrete plinth type structure will be used for the base of the bird hides, it is recommended that all Topsoil, Made Ground or other soft / loose or deleterious material is removed, and the construction is wholly in one material type i.e. wholly cohesive Glacial Till. A medium volume change potential should be assumed, and heave precautions included, if necessary. Further information on the hide locations and type of construction are required to be able to refine the foundations advice.

A preliminary CBR of 5% can be assumed based on the results of the TRL DCP test results. It is recommended that additional Plate CBR Tests are undertaken at proposed formation levels to verify the design CBR assumed.

A buried concrete classification of DS-1 has been determined from the available pH and water-soluble sulphate results.

10.3 Recommendations

Based on the findings of the ground investigation, the following recommendations are made in relation to Zones 3 – 10:

- 1) Carry out expansivity testing on slag deposits.
- 2) Installation of a geogrid beneath new paths and roadways to protect against potential subsidence relating to historical mining activity.
- 3) The bird hide foundation design should consider the risk of ground instability associated with unrecorded mine shaft collapse through appropriate design mitigation.
- 4) Following the relocation of the bird hide within Zone 5, and relocation of 1 No. bird hide within Zone 7, additional ground investigation is required to confirm the ground conditions beneath these locations.
- 5) Watching brief to be carried out during groundworks by geotechnical engineer to monitor for evidence of shafts. If any are recorded construction works should be stopped, and further risk assessment carried out. It's further recommended that a geotechnical engineer should inspect foundation formations prior to construction.
- 6) The engineering recommendations contained within the report should be reviewed once the final development proposals and site levels are confirmed.
- 7) It is recommended that additional Plate CBR Tests are undertaken at proposed formation levels to verify the design CBR assumed.
- 8) Asbestos management plan during construction works due to presence of asbestos fibres in shallow Made Ground.
- 9) Construction and maintenance workers should be provided with suitable PPE with respect to environmental chemical results presented herein.
- 10) Should unexpected contamination be observed during construction advice should be obtained from a Geo-environmental Engineer.

11. REFERENCES

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26. NHBC Standards (2021) Chapter 5.1.8. Infill up to 600mm deep.

12. APPENDICES

Appendix A – Drawings

Appendix B – Exploratory Hole Logs

Appendix C – TRL DCP and Soakaway Results

Appendix D – Chemical Laboratory Test Results

Appendix E – Geotechnical Laboratory Test Results

Appendix F – GAC Screening Thresholds

Appendix G – Risk Assessment Methodology

Appendix A – Drawings

FURNITURE / BOUNDARIES

- F1.0 - PICNIC TABLE**
Location: Site wide
Material: Corten Steel / Timber / Concrete
- F2.0 - BENCH**
Location: Site wide
Material: Corten Steel / Timber / Concrete
- F2.1 - BENCH (EXISTING)**
Location: Site wide
Material: Timber
- F3.0 - WAYFINDING - SITE NAVIGATION**
Location: Site wide
Material: Corten Steel w/ laser cuttings
- F4.0 - WAYFINDING - ARRIVAL**
Location: Site wide
Material: Corten Steel w/ laser cuttings
- F5.0 - INFO BOARD: ECOLOGY**
Location: Site wide
Material: Corten Steel w/ laser cuttings
- F5.1 - INFO BOARD: MAP LOCATION**
Location: Site wide
Material: Corten Steel w/ laser cuttings
- F5.2 - INFO BOARD: HERITAGE**
Location: Site wide
Material: Corten Steel w/ laser cuttings
- F6.0 - VIEWING SCREEN**
Location: To Hidden Lagoon
Material: Timber
- F7.0 - DOUBLE LEAF GATE**
Location: Road to Welcome Building / HWRC
Material: Subject to future detail
- F7.1 - SINGLE LEAF GATE**
Location: To RSPB BOAT boundary
Material: Subject to future detail
- F8.0 - FEATURE FENCE**
Location: Site wide
Material: Timber
- F8.1 - EXISTING FENCE**
Location: Site wide
Material: Timber

- F9.0 - FEATURE ARTWORK**
Location: Site wide
Refer to Design & Access Statement Chapter 7
- F10.0 - CAR PARK PAY MACHINE**
Location: To Visitor Centre car park
Material: -
- F11.0 - FEATURE CONC BENCH w/ TIMBER TOP**
Location: Site wide
Material: Concrete / Timber
- F12.0 - CYCLE PARKING**
Location: Site wide
Material: Steel
- F13.0 - TIMBER LOGS**
Location: To car parking spaces
Material: Timber
- F14.0 - EV CHARGING LOCATIONS**
Location: To welcome building car park
Material: -
- F15.0 - THRESHOLD DETAIL**
Location: To key thresholds
Material: Corten
- F16.0 - BIRD HIDE**
Location: To Hidden Lagoon / Lagoon
Material: Timber
- F17.0 - PV CANOPY**
Location: To welcome building car park
Material: Subject to future detail
- F18.0 - WASTE BIN**
Location: Site wide
Material: Subject to future detail
- F19.0 - HAND RAIL**
Location: To entrance steps
Material: Subject to future detail
- F20.0 - BOLLARD**
Location: To Byway Entrances
Material: Timber

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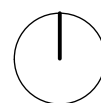
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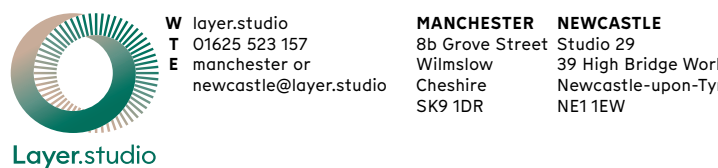
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HARDWORKS

- S1.0 - SELF BINDING GRAVEL WITHOUT EDGINGS EXCEPT ON STEEP GRADIENTS (P)**
Location: To primary pedestrian routes
Dims: 15m wide
- S2.0 - STONE TO DUST SURFACE (V)**
Assumed: Existing surface planned - pot holes filled - Type 1 dressing with Grano Dust surface finish
Location: To Byway
Dims: As existing
- S3.0 - TIMBER BOARDWALK (P)**
Location: To sand dune raised walkway
Dims: 18m wide w/ low upstand
- S4.0 - VEHICULAR MACADAM (V)**
Location: Visitor Centre car park / Access Road Trench
Dims: 15m wide trench cover w/ passing places
- S5.0 - VEHICULAR ROUTE (MACADAM) (V)**
Assumed: Some resurfacing as per S4.0 specification
Location: To access road from Mainsgate Road to visitor centre - existing surface made good
Dims: 48m wide
- S6.0 - NATURAL STONE PAVING (P)**
Location: To Towsey Hole Windmill
- S7.0 - INSITU CONCRETE w/ SMOOTH FINISH (P)**
Location: To in ground railway details / Visitor Centre / Hoadbarrow Lighthouse
- S7.1 - INSITU CONCRETE w/ EXPOSED AGGREGATE FINISH (P / V)**
Location: To Visitor Centre / Whiterock Junction
- S8.0 - REINFORCED GRAVEL (P)**
Location: To Visitor Centre car park / Annie Lowther Hide
- S9.0 - RAISED STEEL WALKWAY w TIMBER EDGE (P)**
Location: To Visitor Centre
- SE - SURFACE EXISTING**
Location: As noted



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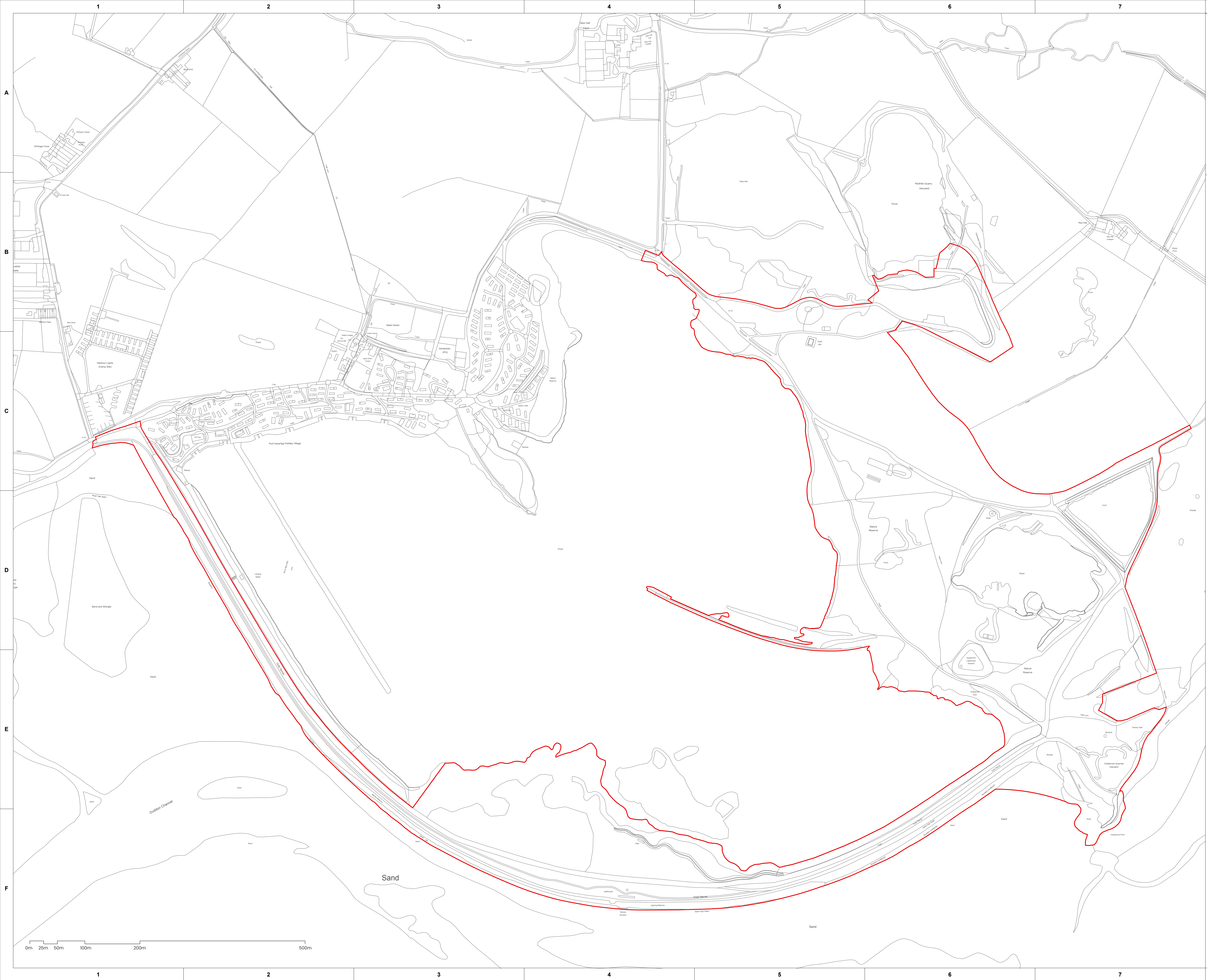
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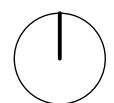
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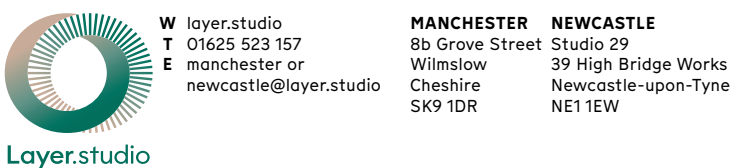
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	S4.0 - VEHICULAR MACADAM (V) Location: Visitor Centre car park / Access Road Trench Dims: 15m wide trench cover w/ passing places
	S5.0 - VEHICULAR ROUTE (MACADAM) (V) Assumed: Some resurfacing as per S4.0 specification Location: To access road from Mainsgate Road to visitor centre - existing surface made good Dims: 48m wide
	S6.0 - NATURAL STONE PAVING (P) Location: To Towsey Hole Windmill
	S7.0 - INSITU CONCRETE w/ SMOOTH FINISH (P) Location: To in ground railway details / Visitor Centre / Hoadbarrow Lighthouse
	S7.1 - INSITU CONCRETE w/ EXPOSED AGGREGATE FINISH (P / V) Location: To Visitor Centre / Whiterock Junction
	S8.0 - REINFORCED GRAVEL (P) Location: To Visitor Centre car park / Annie Lowther Hide
	S9.0 - RAISED STEEL WALKWAY w TIMBER EDGE (P) Location: To Visitor Centre
	SE - SURFACE EXISTING Location: As noted

ORIGINATOR

W
layer.studio
T
01625 523 157
E
manchester or
newcastle@layer.studio
Cheshire
SK9 1DR

MANCHESTER
80 Grove Street
Willeslow
Cheshire
SK9 1DR

NEWCASTLE
Studio 29
39 High Bridge Works
Newcastle-upon-Tyne
NE1 1EW

Client

Cumberland Council

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Millom, Cumbria

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Work Stage

Stage 3

Status

Planning

Revision

PO2



FURNITURE / BOUNDARIES	
 F1.0 - PICNIC TABLE Location: Site wide Material: Corten Steel / Timber / Concrete	 F9.0 - FEATURE ARTWORK Location: Site wide <i>Refer to Design & Access Statement Chapter 7</i>
 F2.0 - BENCH Location: Site wide Material: Corten Steel / Timber / Concrete	 F10.0 - CAR PARK PAY MACHINE Location: To Visitor Centre car park Material: -
 F2.1 - BENCH (EXISTING) Location: Site wide Material: Timber	 F11.0 - FEATURE CONC BENCH w/ TIMBER TOP Location: Site wide Material: Concrete / Timber
 F3.0 - WAYFINDING - SITE NAVIGATION Location: Site wide Material: Corten Steel w/ laser cuttings	 F12.0 - CYCLE PARKING Location: Site wide Material: Steel
 F4.0 - WAYFINDING - ARRIVAL Location: Site wide Material: Corten Steel w/ laser cuttings	 F13.0 - TIMBER LOGS Location: To car parking spaces Material: Timber
 F5.0 - INFO BOARD: ECOLOGY Location: Site wide Material: Corten Steel w/ laser cuttings	 F14.0 - EV CHARGING LOCATIONS Location: To welcome building car park Material: -
 F6.1 - INFO BOARD: MAP LOCATION Location: Site wide Material: Corten Steel w/ laser cuttings	 F15.0 - THRESHOLD DETAIL Location: To key thresholds Material: Corten
 F6.2 - INFO BOARD: HERITAGE Location: Site wide Material: Corten Steel w/ laser cuttings	 F16.0 - BIRD HIDE Location: To Hidden Lagoon / Lagoon Material: Timber
 F6.0 - VIEWING SCREEN Location: To Hidden Lagoon Material: Timber	 F17.0 - PV CANOPY Location: To welcome building car park Material: Subject to future detail
 F7.0 - DOUBLE LEAF GATE Location: Road to Welcome Building / HWRC Material: Subject to future detail	 F18.0 - WASTE BIN Location: Site wide Material: Subject to future detail
 F7.1 - SINGLE LEAF GATE Location: To RSPB BOAT boundary Material: Subject to future detail	 F19.0 - HAND RAIL Location: To entrance steps Material: Subject to future detail
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 F8.1 - EXISTING FENCE Location: Site wide Material: Timber	

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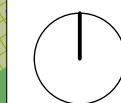
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ORIGINATOR

 W layerstudio 01625 523 157 manchester or newcastle@layerstudio	MANCHESTER 80 Grove Street Willslow Cheshire SK9 1DR	NEWCASTLE Studio 29 39 High Bridge Works Newcastle-upon-Tyne NE1 1EW
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Client

Cumberland Council

Project

**The Iron Line
Millom, Cumbria**

Drawing Title

GA | Hodbarrow Car Park

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Work Stage Stage 3	Status Planning	Revision P02	



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	F10.0 - CAR PARK PAY MACHINE Location: To Visitor Centre car park Material: -
	F11.0 - FEATURE CONC BENCH w/ TIMBER TOP Location: Site wide Material: Concrete / Timber
	F12.0 - CYCLE PARKING Location: Site wide Material: Steel
	F13.0 - TIMBER LOGS Location: To car parking spaces Material: Timber
	F14.0 - EV CHARGING LOCATIONS Location: To welcome building car park Material: -
	F15.0 - THRESHOLD DETAIL Location: To key thresholds Material: Corten
	F16.0 - BIRD HIDE Location: To Hidden Lagoon / Lagoon Material: Timber
	F17.0 - PV CANOPY Location: To welcome building car park Material: Subject to future detail
	F18.0 - WASTE BIN Location: Site wide Material: Subject to future detail
	F19.0 - HAND RAIL Location: To entrance steps Material: Subject to future detail
	F20.0 - BOLLARD Location: To Byway Entrances Material: Timber

NOTES:
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THIS DRAWING WAS PLOTTED ON:
07/04/2025

REVISION HISTORY				
DATE	REV	ZONE	DESCRIPTION	CHK
26/03/25	P01		Stage 03 draft issue - for coordination	MDM
07/04/25	P02		Issued for planning	MDM

KEY	
GENERAL INFORMATION	
	APPLICATION BOUNDARY
HARDWORKS	
	S1.0 - SELF BINDING GRAVEL WITHOUT EDGINGS EXCEPT ON STEEP GRADIENTS (P) Location: To primary pedestrian routes Dims: 15m wide
	S2.0 - STONE TO DUST SURFACE (V) Assumed: Existing surface planed - pot holes filled - Type 1 dressing with Grano Dust surface finish Location: To Byway Dims: As existing
	S3.0 - TIMBER BOARDWALK (P) Location: To stand dune raised walkway Dims: 1.8m wide w/ low upstand
	S4.0 - VEHICULAR MACADAM (V) Location: Visitor Centre car park / Access Road Trench Dims: 15m wide trench cover w/ passing places
	S5.0 - VEHICULAR ROUTE (MACADAM) (V) Assumed: Some resurfacing as per S4.0 specification Location: To access road from Mainsgate Road to visitor centre - existing surface made good Dims: 4.8m wide
	S6.0 - NATURAL STONE PAVING (P) Location: To Towsey Hole Windmill
	S7.0 - INSITU CONCRETE w/ SMOOTH FINISH (P) Location: To in ground railway details / Visitor Centre / Hoadbarrow Lighthouse
	S7.1 - INSITU CONCRETE w/ EXPOSED AGGREGATE FINISH (P / V) Location: To Visitor Centre / Whiterock Junction
	S8.0 - REINFORCED GRAVEL (P) Location: To Visitor Centre car park / Annie Lowther Hide
	S9.0 - RAISED STEEL WALKWAY w TIMBER EDGE (P) Location: To Visitor Centre
	SE - SURFACE EXISTING Location: As noted



ORIGINATOR

	W layer.studio T 01625 523 157 E manchester or newcastle@layer.studio	MANCHESTER 80 Grove Street Willslow Cheshire SK9 1DR	NEWCASTLE Studio 29 39 High Bridge Works Newcastle-upon-Tyne NE1 1EW
--	--	---	---

Client

Cumberland Council

Project

The Iron Line

Millom, Cumbria

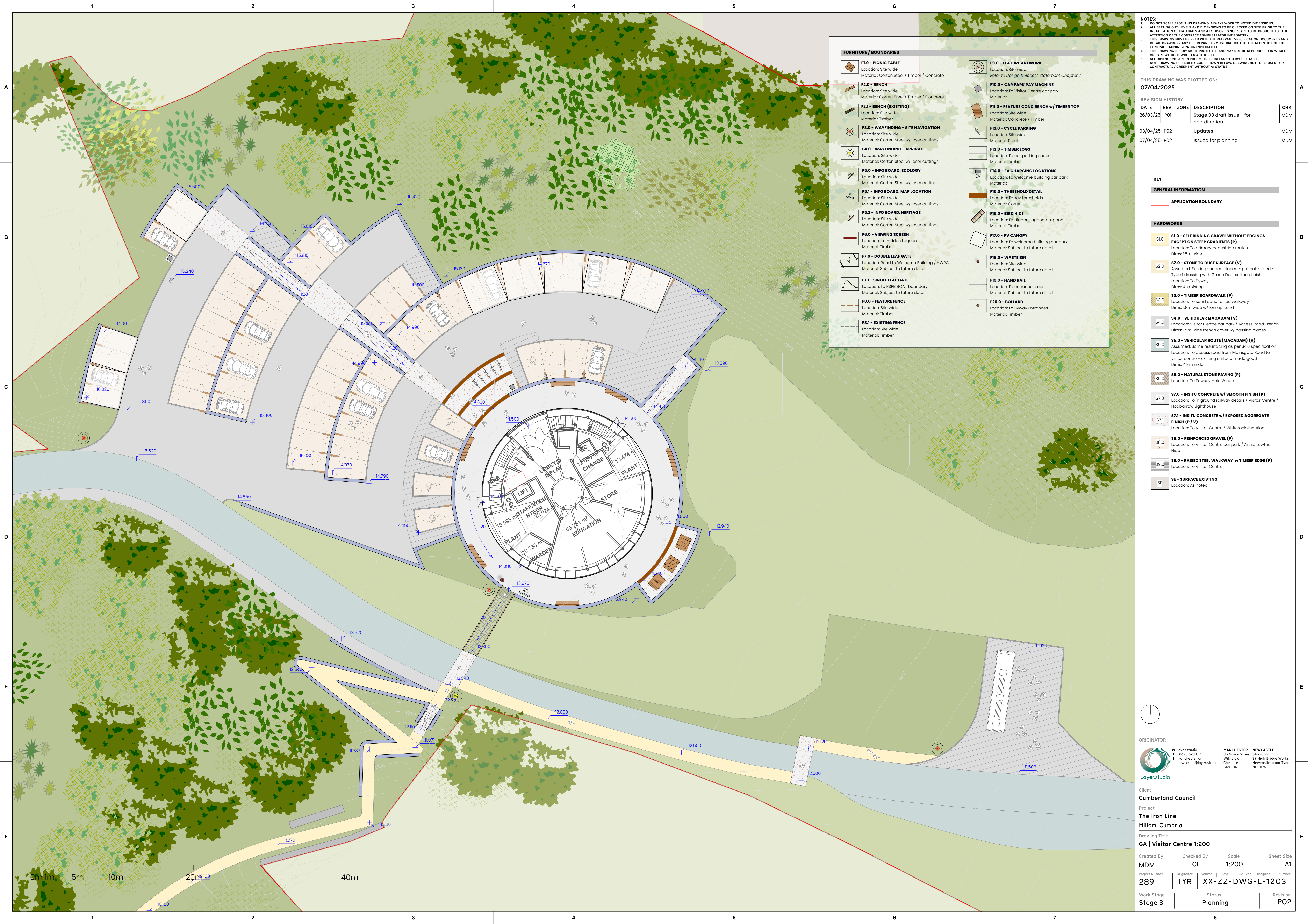
Drawing Title

GA | Visitor Centre 1:500

Created By	Checked By	Scale	Sheet Size
MDM	CL	1:500	A1

Project Number	Originator	Volume	Level	File Type	Discipline	Number
289	LYR			XX-ZZ-DWG-L-1202		

Work Stage	Status	Revision
Stage 3	Planning	P02



FURNITURE / BOUNDARIES

F1.0 - PICNIC TABLE
Location: Site wide
Material: Corten Steel / Timber / Concrete

F2.0 - BENCH
Location: Site wide
Material: Corten Steel / Timber / Concrete

F2.1 - BENCH (EXISTING)
Location: Site wide
Material: Timber

F3.0 - WAYFINDING - SITE NAVIGATION
Location: Site wide
Material: Corten Steel w/ laser cuttings

F4.0 - WAYFINDING - ARRIVAL
Location: Site wide
Material: Corten Steel w/ laser cuttings

F5.0 - INFO BOARD: ECOLOGY
Location: Site wide
Material: Corten Steel w/ laser cuttings

F5.1 - INFO BOARD: MAP LOCATION
Location: Site wide
Material: Corten Steel w/ laser cuttings

F5.2 - INFO BOARD: HERITAGE
Location: Site wide
Material: Corten Steel w/ laser cuttings

F6.0 - VIEWING SCREEN
Location: To Hidden Lagoon
Material: Timber

F7.0 - DOUBLE LEAF GATE
Location: Road to Welcome Building / HWRC
Material: Subject to future detail

F7.1 - SINGLE LEAF GATE
Location: To RSPB BOAT boundary
Material: Subject to future detail

F8.0 - FEATURE FENCE
Location: Site wide
Material: Timber

F8.1 - EXISTING FENCE
Location: Site wide
Material: Timber

F9.0 - FEATURE ARTWORK
Location: Site wide
Refer to Design & Access Statement Chapter 7

F10.0 - CAR PARK PAY MACHINE
Location: To Visitor Centre car park
Material: -

F11.0 - FEATURE CONC BENCH w/ TIMBER TOP
Location: Site wide
Material: Concrete / Timber

F12.0 - CYCLE PARKING
Location: Site wide
Material: Steel

F13.0 - TIMBER LOGS
Location: To car parking spaces
Material: Timber

F14.0 - EV CHARGING LOCATIONS
Location: To welcome building car park
Material: -

F15.0 - THRESHOLD DETAIL
Location: To key thresholds
Material: Corten

F16.0 - BIRD HIDE
Location: To Hidden Lagoon / Lagoon
Material: Timber

F17.0 - PV CANOPY
Location: To welcome building car park
Material: Subject to future detail

F18.0 - WASTE BIN
Location: Site wide
Material: Subject to future detail

F19.0 - HAND RAIL
Location: To entrance steps
Material: Subject to future detail

F20.0 - BOLLARD
Location: To Byway Entrances
Material: Timber

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THIS DRAWING WAS PLOTTED ON:

07/04/2025

REVISION HISTORY

DATE	REV	ZONE	DESCRIPTION	CHK
26/03/25	P01		Stage 03 draft issue - for coordination	MDM
03/04/25	P02		Updates	MDM
07/04/25	P02		Issued for planning	MDM

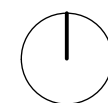
KEY

GENERAL INFORMATION

APPLICATION BOUNDARY

HARDWORKS

- S1.0 - SELF BINDING GRAVEL WITHOUT EDGINGS EXCEPT ON STEEP GRADIENTS (P)**
Location: To primary pedestrian routes
Dims: 15m wide
- S2.0 - STONE TO DUST SURFACE (V)**
Assumed: Existing surface planed - pot holes filled - Type 1 dressing with Grano Dust surface finish
Location: To Byway
Dims: As existing
- S3.0 - TIMBER BOARDWALK (P)**
Location: To sand dune raised walkway
Dims: 1.8m wide w/ low upstand
- S4.0 - VEHICULAR MACADAM (V)**
Location: Visitor Centre car park / Access Road Trench
Dims: 15m wide trench cover w/ passing places
- S5.0 - VEHICULAR ROUTE (MACADAM) (V)**
Assumed: Some resurfacing as per S4.0 specification
Location: To access road from Mainsgate Road to visitor centre - existing surface made good
Dims: 4.8m wide
- S6.0 - NATURAL STONE PAVING (P)**
Location: To Towsey Hole Windmill
- S7.0 - INSITU CONCRETE w/ SMOOTH FINISH (P)**
Location: To in ground railway details / Visitor Centre / Hoadbarrow Lighthouse
- S7.1 - INSITU CONCRETE w/ EXPOSED AGGREGATE FINISH (P / V)**
Location: To Visitor Centre / Whiterock Junction
- S8.0 - REINFORCED GRAVEL (P)**
Location: To Visitor Centre car park / Annie Lowther Hide
- S9.0 - RAISED STEEL WALKWAY w TIMBER EDGE (P)**
Location: To Visitor Centre
- SE - SURFACE EXISTING**
Location: As noted



ORIGINATOR

W layerstudio
01625 523 157
manchester or
newcastle@layerstudio

MANCHESTER
80 Grove Street
Willslow
Cheshire
SK9 1DR

NEWCASTLE
Studio 29
39 High Bridge Works
Newcastle-upon-Tyne
NE1 1EW

Client

Cumberland Council

Project

The Iron Line

Millom, Cumbria

Drawing Title

GA | Visitor Centre 1:200

Created By	Checked By	Scale	Sheet Size
MDM	CL	1:200	A1

Project Number	Originator	Volume	Level	File Type	Discipline	Number
289	LYR		XX-ZZ-DWG-L-1203			

Work Stage	Status	Revision
Stage 3	Planning	P02



FURNITURE / BOUNDARIES

- F1.0 - PICNIC TABLE**
Location: Site wide
Material: Corten Steel / Timber / Concrete
- F2.0 - BENCH**
Location: Site wide
Material: Corten Steel / Timber / Concrete
- F2.1 - BENCH (EXISTING)**
Location: Site wide
Material: Timber
- F3.0 - WAYFINDING - SITE NAVIGATION**
Location: Site wide
Material: Corten Steel w/ laser cuttings
- F4.0 - WAYFINDING - ARRIVAL**
Location: Site wide
Material: Corten Steel w/ laser cuttings
- F5.0 - INFO BOARD: ECOLOGY**
Location: Site wide
Material: Corten Steel w/ laser cuttings
- F5.1 - INFO BOARD: MAP LOCATION**
Location: Site wide
Material: Corten Steel w/ laser cuttings
- F5.2 - INFO BOARD: HERITAGE**
Location: Site wide
Material: Corten Steel w/ laser cuttings
- F6.0 - VIEWING SCREEN**
Location: To Hidden Lagoon
Material: Timber
- F7.0 - DOUBLE LEAF GATE**
Location: Road to Welcome Building / HWRC
Material: Subject to future detail
- F7.1 - SINGLE LEAF GATE**
Location: To RSPB Boat boundary
Material: Subject to future detail
- F8.0 - FEATURE FENCE**
Location: Site wide
Material: Timber
- F8.1 - EXISTING FENCE**
Location: Site wide
Material: Timber
- F9.0 - FEATURE ARTWORK**
Location: Site wide
Refer to Design & Access Statement Chapter 7
- F10.0 - CAR PARK PAY MACHINE**
Location: To Visitor Centre car park
Material: -
- F11.0 - FEATURE CONC BENCH w/ TIMBER TOP**
Location: Site wide
Material: Concrete / Timber
- F12.0 - CYCLE PARKING**
Location: Site wide
Material: Steel
- F13.0 - TIMBER LOGS**
Location: To car parking spaces
Material: Timber
- F14.0 - EV CHARGING LOCATIONS**
Location: To welcome building car park
Material: -
- F15.0 - THRESHOLD DETAIL**
Location: To key thresholds
Material: Corten
- F16.0 - BIRD HIDE**
Location: To Hidden Lagoon / Lagoon
Material: Subject to future detail
- F17.0 - PV CANOPY**
Location: To welcome building car park
Material: Subject to future detail
- F18.0 - WASTE BIN**
Location: Site wide
Material: Subject to future detail
- F19.0 - HAND RAIL**
Location: To entrance steps
Material: Subject to future detail
- F20.0 - BOLLARD**
Location: To Byway Entrances
Material: Timber

NOTES:

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THIS DRAWING WAS PLOTTED ON:

07/04/2025

REVISION HISTORY

DATE	REV	ZONE	DESCRIPTION	CHK
26/03/25	PO1		Stage 03 draft issue - for coordination	MDM
07/04/25	PO2		Issued for planning	MDM

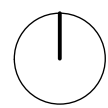
KEY

GENERAL INFORMATION

APPLICATION BOUNDARY

HARDWORKS

- S1.0 - SELF BINDING GRAVEL WITHOUT EDGINGS EXCEPT ON STEEP GRADIENTS (P)**
Location: To primary pedestrian routes
Dims: 15m wide
- S2.0 - STONE TO DUST SURFACE (V)**
Assumed: Existing surface planned - pot holes filled - Type 1 dressing with Grano Dust surface finish
Location: To Byway
Dims: As existing
- S3.0 - TIMBER BOARDWALK (P)**
Location: To stand alone raised walkway
Dims: 18m wide w/ low upstand
- S4.0 - VEHICULAR MACADAM (V)**
Location: Visitor Centre car park / Access Road Trench
Dims: 15m wide trench cover w/ passing places
- S5.0 - VEHICULAR ROUTE (MACADAM) (V)**
Assumed: Some resurfacing as per S4.0 specification
Location: To access road from Mainsgate Road to visitor centre - existing surface made good
Dims: 48m wide
- S6.0 - NATURAL STONE PAVING (P)**
Location: To Towsey Hole Windmill
- S7.0 - INSITU CONCRETE w/ SMOOTH FINISH (P)**
Location: To in ground railway details / Visitor Centre / Hoadbarrow Lighthouse
- S7.1 - INSITU CONCRETE w/ EXPOSED AGGREGATE FINISH (P / V)**
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- S8.0 - REINFORCED GRAVEL (P)**
Location: To Visitor Centre car park / Annie Lowther Hide
- S9.0 - RAISED STEEL WALKWAY w TIMBER EDGE (P)**
Location: To Visitor Centre
- SE - SURFACE EXISTING**
Location: As noted



ORIGINATOR

W layer.studio
T 01625 523 157
E manchester or newcastle@layer.studio
Cheshire
SK9 1DR

MANCHESTER
80 Grove Street
Willslow
Cheshire
SK9 1DR

NEWCASTLE
Studio 29
39 High Bridge Works
Newcastle-upon-Tyne
NE1 1EW

Client

Cumberland Council

Project

The Iron Line
Millom, Cumbria

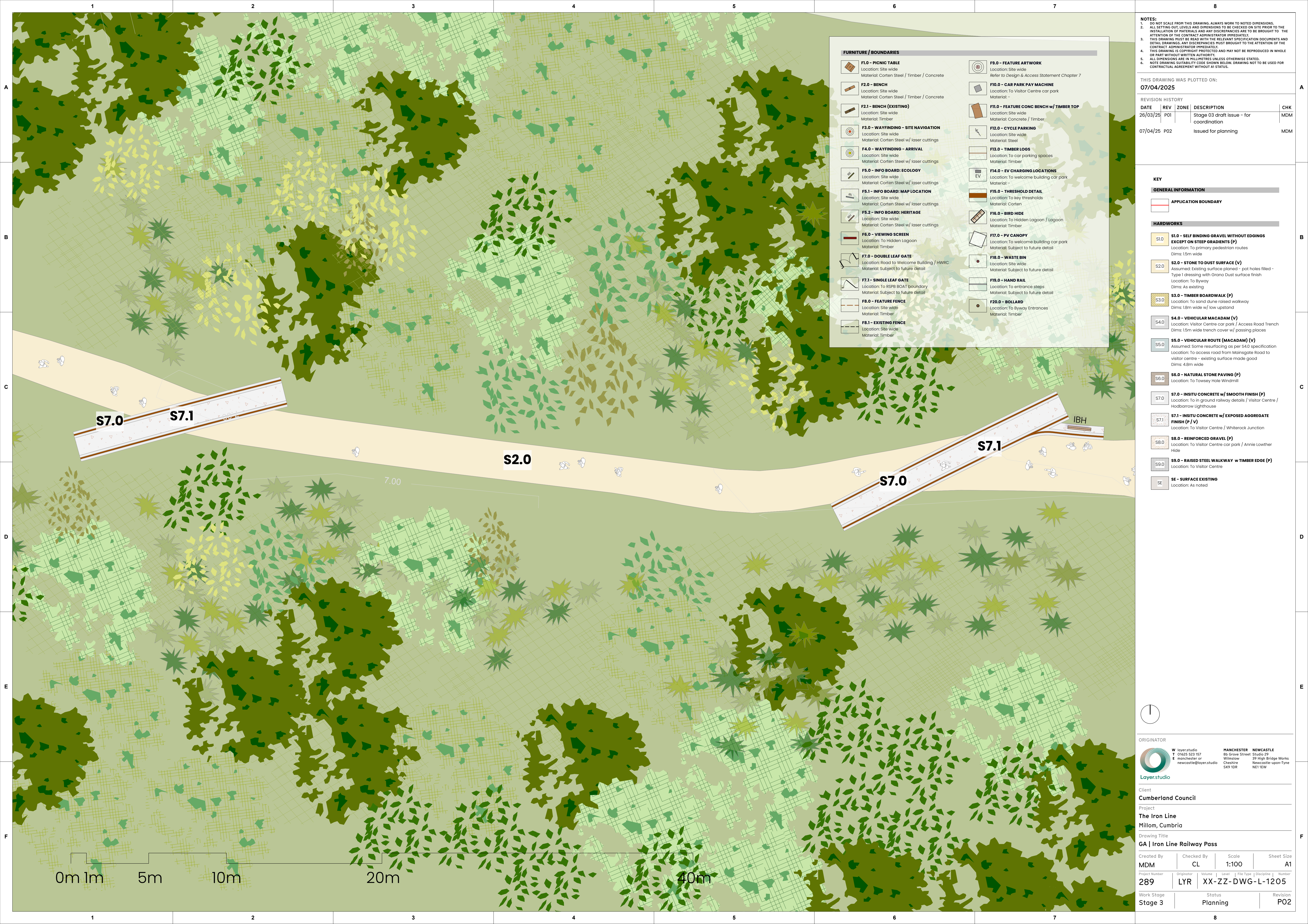
Drawing Title

GA | Iron Line Entrance

Created By	Checked By	Scale	Sheet Size
MDM	CL	1:100	A1

Project Number	Originator	Volume	Level	File Type	Discipline	Number
289	LYR	XX-ZZ-DWG-L-1204				

Work Stage	Status	Revision
Stage 3	Planning	PO2



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07/04/2025

REVISION HISTORY				
DATE	REV	ZONE	DESCRIPTION	CHK
26/03/25	P01		Stage 03 draft issue - for coordination	MDM
07/04/25	P02		Issued for planning	MDM

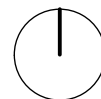
KEY

GENERAL INFORMATION

APPLICATION BOUNDARY

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Location: To in ground railway details / Visitor Centre / Hoobarrow Lighthouse
- S7.1 - INSITU CONCRETE w/ EXPOSED AGGREGATE FINISH (P / V)**
Location: To Visitor Centre / Whiterock Junction
- S8.0 - REINFORCED GRAVEL (P)**
Location: To Visitor Centre car park / Annie Lowther Hide
- S9.0 - RAISED STEEL WALKWAY w TIMBER EDGE (P)**
Location: To Visitor Centre
- SE - SURFACE EXISTING**
Location: As noted



ORIGINATOR

W
01625 523 157
E
manchester or
newcastle@layer.studio

MANCHESTER
80 Grove Street
Willeslow
Cheshire
SK9 1DR

NEWCASTLE
Studio 29
39 High Bridge Works
Newcastle-upon-Tyne
NE1 1EW

Client

Cumberland Council

Project

The Iron Line
Millom, Cumbria

Drawing Title

GA | Iron Line Railway Pass

Created By MDM	Checked By CL	Scale 1:100	Sheet Size A1
Project Number 289	Originator LYR	Volume XX-ZZ-DWG-L-1205	Number
Work Stage Stage 3	Status Planning	Revision P02	

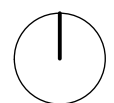


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DATE	REV	ZONE	DESCRIPTION	CHK
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07/04/25	P02		Issued for planning	MDM

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	S9.0 - RAISED STEEL WALKWAY w TIMBER EDGE (P) Location: To Visitor Centre
	SE - SURFACE EXISTING Location: As noted



ORIGINATOR			
	W layer.studio T 01625 523 157 E manchester or newcastle@layer.studio Cheshire SK9 1DR	MANCHESTER 80 Grove Street Willeslow Cheshire SK9 1DR	NEWCASTLE Studio 29 39 High Bridge Works Newcastle-upon-Tyne NE1 1EW
Client			
Cumberland Council			
Project			
The Iron Line			
Millom, Cumbria			
Drawing Title			
GA Coal Pit Hide			
Created By	Checked By	Scale	Sheet Size
MDM	CL	1:100	A1
Project Number	Originator	Volume	Level
289	LYR	XX-ZZ-DWG-L-1206	Number
Work Stage	Status	Revision	
Stage 3	Planning	P02	



FURNITURE / BOUNDARIES

- F1.0 - PICNIC TABLE**
Location: Site wide
Material: Corten Steel / Timber / Concrete
- F2.0 - BENCH**
Location: Site wide
Material: Corten Steel / Timber / Concrete
- F2.1 - BENCH (EXISTING)**
Location: Site wide
Material: Timber
- F3.0 - WAYFINDING - SITE NAVIGATION**
Location: Site wide
Material: Corten Steel w/ laser cuttings
- F4.0 - WAYFINDING - ARRIVAL**
Location: Site wide
Material: Corten Steel w/ laser cuttings
- F5.0 - INFO BOARD: ECOLOGY**
Location: Site wide
Material: Corten Steel w/ laser cuttings
- F5.1 - INFO BOARD: MAP LOCATION**
Location: Site wide
Material: Corten Steel w/ laser cuttings
- F5.2 - INFO BOARD: HERITAGE**
Location: Site wide
Material: Corten Steel w/ laser cuttings
- F6.0 - VIEWING SCREEN**
Location: To Hidden Lagoon
Material: Timber
- F7.0 - DOUBLE LEAF GATE**
Location: Road to Welcome Building / HWRC
Material: Subject to future detail
- F7.1 - SINGLE LEAF GATE**
Location: To RSPB BOAT boundary
Material: Subject to future detail
- F8.0 - FEATURE FENCE**
Location: Site wide
Material: Timber
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Location: Site wide
Material: Timber
- F9.0 - FEATURE ARTWORK**
Location: Site wide
Refer to Design & Access Statement Chapter 7
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Material: -
- F11.0 - FEATURE CONC BENCH w/ TIMBER TOP**
Location: Site wide
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Location: Site wide
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- F13.0 - TIMBER LOGS**
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THIS DRAWING WAS PLOTTED ON:
07/04/2025

REVISION HISTORY

DATE	REV	ZONE	DESCRIPTION	CHK
26/03/25	P01		Stage 03 draft issue - for coordination	MDM
07/04/25	P02		Issued for planning	MDM

KEY

GENERAL INFORMATION

APPLICATION BOUNDARY

HARDWORKS

- S1.0 - SELF BINDING GRAVEL WITHOUT EDGINGS EXCEPT ON STEEP GRADIENTS (P)**
Location: To primary pedestrian routes
Dims: 15m wide
- S2.0 - STONE TO DUST SURFACE (V)**
Assumed: Existing surface planned - pot holes filled - Type 1 dressing with Grano Dust surface finish
Location: To Byway
Dims: As existing
- S3.0 - TIMBER BOARDWALK (P)**
Location: To stand dune raised walkway
Dims: 1.8m wide w/ low upstand
- S4.0 - VEHICULAR MACADAM (V)**
Location: Visitor Centre car park / Access Road Trench
Dims: 15m wide trench cover w/ passing places
- S5.0 - VEHICULAR ROUTE (MACADAM) (V)**
Assumed: Some resurfacing as per S4.0 specification
Location: To access road from Mainsgate Road to visitor centre - existing surface made good
Dims: 4.8m wide
- S6.0 - NATURAL STONE PAVING (P)**
Location: To Towsey Hole Windmill
- S7.0 - INSITU CONCRETE w/ SMOOTH FINISH (P)**
Location: To in ground railway details / Visitor Centre / Headbarrow Lighthouse
- S7.1 - INSITU CONCRETE w/ EXPOSED AGGREGATE FINISH (P / V)**
Location: To Visitor Centre / Whiterock Junction
- S8.0 - REINFORCED GRAVEL (P)**
Location: To Visitor Centre car park / Annie Lowther Hide
- S9.0 - RAISED STEEL WALKWAY w TIMBER EDGE (P)**
Location: To Visitor Centre
- SE - SURFACE EXISTING**
Location: As noted



ORIGINATOR



W layerstudio
T 01625 523 157
E manchester or
newcastle@layerstudio

MANCHESTER NEWCASTLE
80 Grove Street Studio 29
Willeslow or
Cheshire SK9 1DR

39 High Bridge Works
Newcastle-upon-Tyne
NE1 1EW

Client

Cumberland Council

Project

The Iron Line
Millom, Cumbria

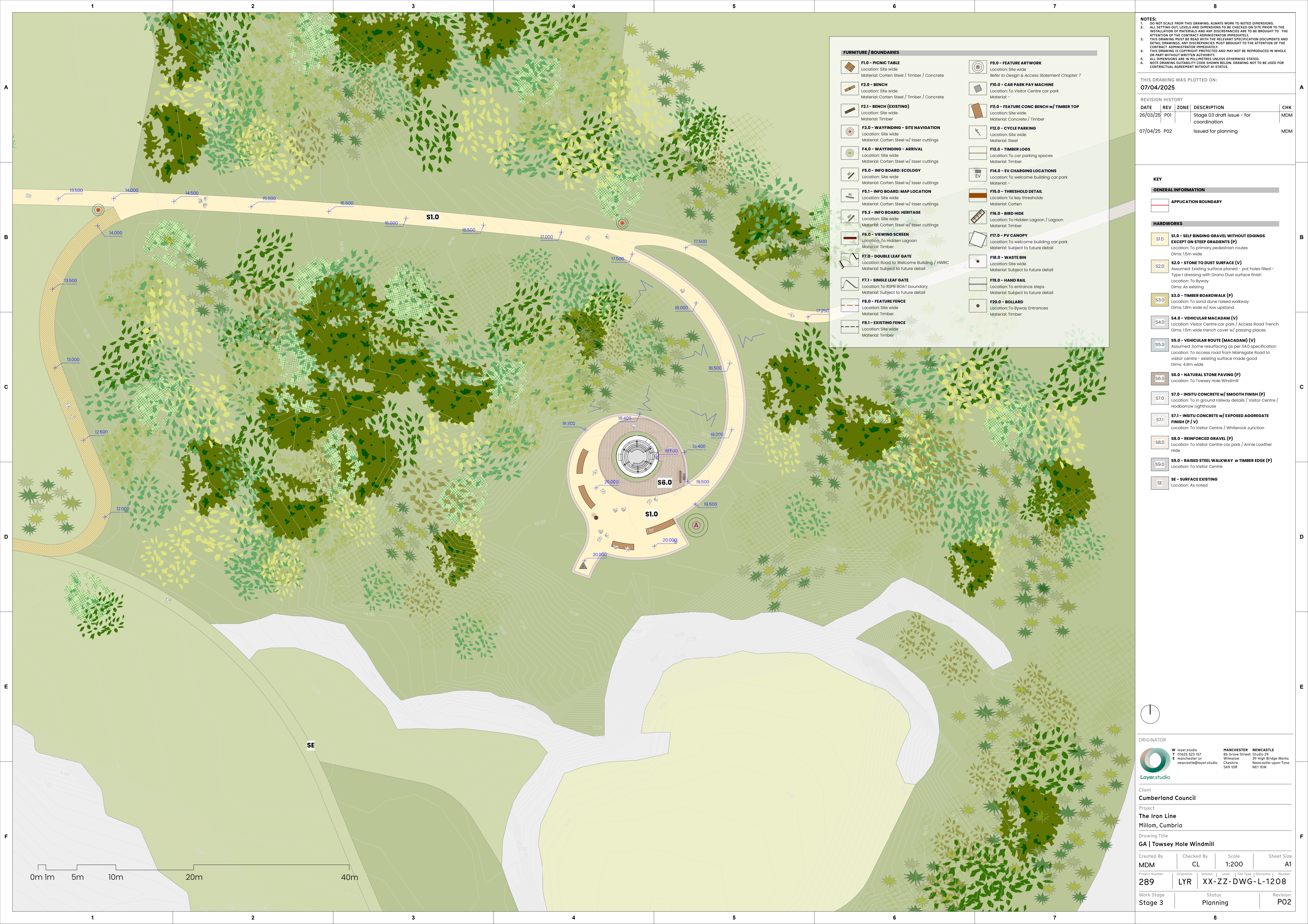
Drawing Title

GA | Whiterock Junction

Created By	Checked By	Scale	Sheet Size
MDM	CL	1:200	A1

Project Number	Originator	Volume	Level	File Type	Discipline	Number
289	LYR			XX-ZZ-DWG-L-1207		

Work Stage	Status	Revision
Stage 3	Planning	P02



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07/04/2025

REVISION HISTORY				
DATE	REV	ZONE	DESCRIPTION	CHK
26/03/25	P01		Stage 03 draft issue - for coordination	MDM
07/04/25	P02		Issued for planning	MDM

KEY

GENERAL INFORMATION

APPLICATION BOUNDARY

HARDWORKS

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Assumed: Existing surface planned - pot holes filled - Type 1 dressing with Grano Dust surface finish
Location: To Byway
Dims: As existing

S3.0 - TIMBER BOARDWALK (P)
Location: To stand dune raised walkway
Dims: 18m wide w/ low upstand

S4.0 - VEHICULAR MACADAM (V)
Location: Visitor Centre car park / Access Road Trench
Dims: 15m wide trench cover w/ passing places

S5.0 - VEHICULAR ROUTE (MACADAM) (V)
Assumed: Some resurfacing as per S4.0 specification
Location: To access road from Mainsgate Road to visitor centre - existing surface made good
Dims: 48m wide

S6.0 - NATURAL STONE PAVING (P)
Location: To Towsey Hole Windmill

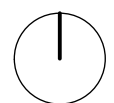
S7.0 - INSITU CONCRETE w/ SMOOTH FINISH (P)
Location: To in ground railway details / Visitor Centre / Headbarrow Lighthouse

S7.1 - INSITU CONCRETE w/ EXPOSED AGGREGATE FINISH (P / V)
Location: To Visitor Centre / Whiterock Junction

S8.0 - REINFORCED GRAVEL (P)
Location: To Visitor Centre car park / Annie Lowther Hide

S9.0 - RAISED STEEL WALKWAY w TIMBER EDGE (P)
Location: To Visitor Centre

SE - SURFACE EXISTING
Location: As noted



ORIGINATOR

W **layerstudio**
01625 523 157
manchester@layerstudio
newcastle@layerstudio

MANCHESTER **NEWCASTLE**
80 Grove Street Studio 29
Willslow 39 High Bridge Works
Cheshire Newcastle-upon-Tyne
SK9 1DR NE1 1EW

Client

Cumberland Council

Project

The Iron Line

Millom, Cumbria

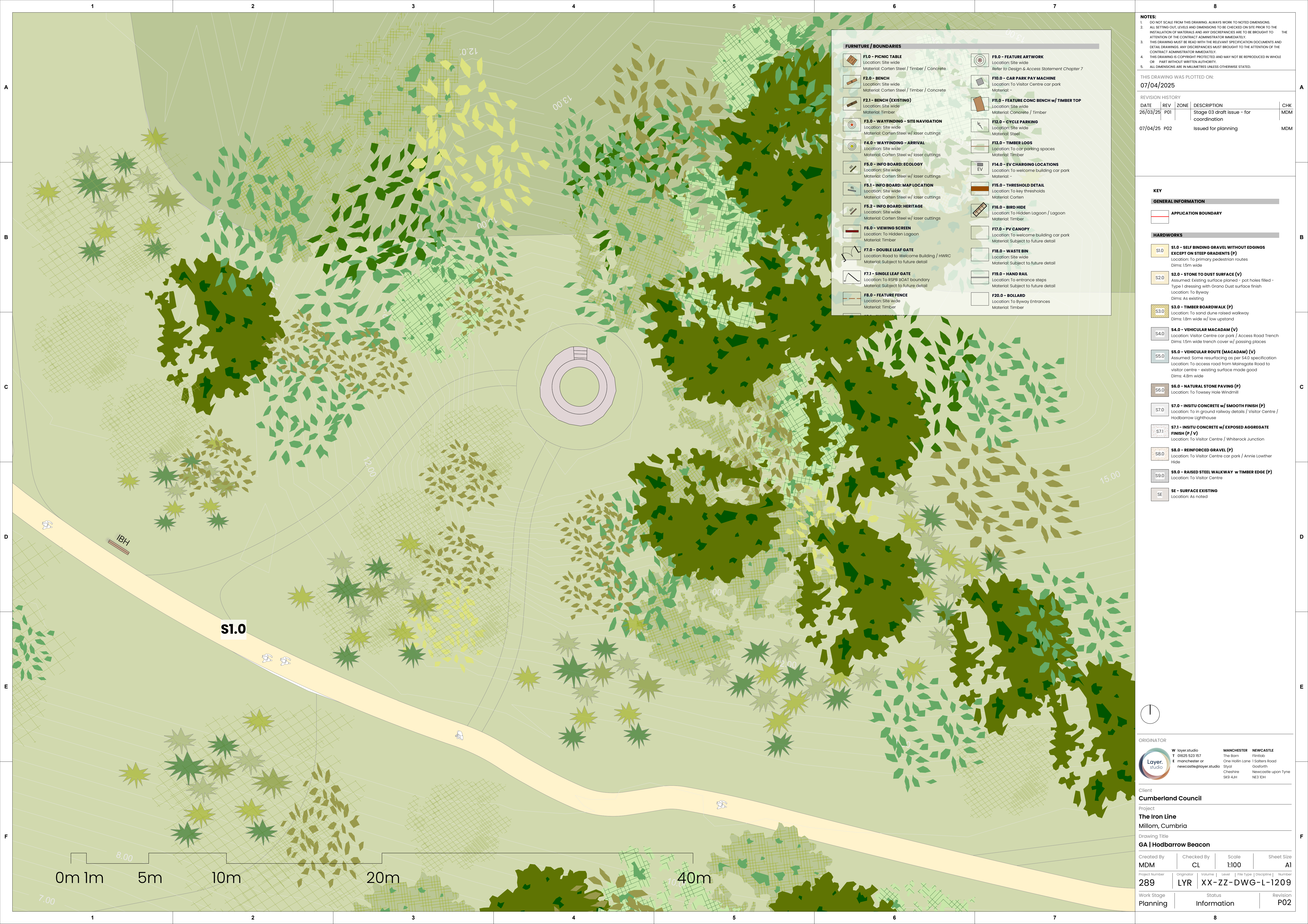
Drawing Title

GA | Towsey Hole Windmill

Created By	Checked By	Scale	Sheet Size
MDM	CL	1:200	A1

Project Number	Originator	Volume	Level	File Type	Discipline	Number
289	LYR			XX-ZZ-DWG-L-1208		

Work Stage	Status	Revision
Stage 3	Planning	P02



FURNITURE / BOUNDARIES	
 F1.0 - PICNIC TABLE Location: Site wide Material: Corten Steel / Timber / Concrete	 F8.0 - FEATURE ARTWORK Location: Site wide Refer to Design & Access Statement Chapter 7
 F2.0 - BENCH Location: Site wide Material: Corten Steel / Timber / Concrete	 F10.0 - CAR PARK PAY MACHINE Location: To Visitor Centre car park Material: -
 F2.1 - BENCH (EXISTING) Location: Site wide Material: Timber	 F11.0 - FEATURE CONC BENCH w/ TIMBER TOP Location: Site wide Material: Concrete / Timber
 F3.0 - WAYFINDING - SITE NAVIGATION Location: Site wide Material: Corten Steel w/ laser cuttings	 F12.0 - CYCLE PARKING Location: Site wide Material: Steel
 F4.0 - WAYFINDING - ARRIVAL Location: Site wide Material: Corten Steel w/ laser cuttings	 F13.0 - TIMBER LOGS Location: To car parking spaces Material: Timber
 F5.0 - INFO BOARD: ECOLOGY Location: Site wide Material: Corten Steel w/ laser cuttings	 F14.0 - EV CHARGING LOCATIONS Location: To welcome building car park Material: -
 F5.1 - INFO BOARD: MAP LOCATION Location: Site wide Material: Corten Steel w/ laser cuttings	 F15.0 - THRESHOLD DETAIL Location: To key thresholds Material: Corten
 F5.2 - INFO BOARD: HERITAGE Location: Site wide Material: Corten Steel w/ laser cuttings	 F16.0 - BIRD HIDE Location: To Hidden Lagoon / Lagoon Material: Timber
 F6.0 - VIEWING SCREEN Location: To Hidden Lagoon Material: Timber	 F17.0 - PV CANOPY Location: To welcome building car park Material: Subject to future detail
 F7.0 - DOUBLE LEAF GATE Location: Road to Welcome Building / HWRC Material: Subject to future detail	 F18.0 - WASTE BIN Location: Site wide Material: Subject to future detail
 F7.1 - SINGLE LEAF GATE Location: To RSF9 Boat boundary Material: Subject to future detail	 F19.0 - HAND RAIL Location: To entrance steps Material: Subject to future detail
 F8.0 - FEATURE FENCE Location: Site wide Material: Timber	 F20.0 - BOLLARD Location: To Byway Entrances Material: Timber

NOTES:				
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THIS DRAWING WAS PLOTTED ON:				
07/04/2025				
REVISION HISTORY				
DATE	REV	ZONE	DESCRIPTION	CHK
26/03/25	P01		Stage 03 draft issue - for coordination	MDM
07/04/25	P02		Issued for planning	MDM

KEY	
GENERAL INFORMATION	
	APPLICATION BOUNDARY
HARDWORKS	
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	S2.0 - STONE TO DUST SURFACE (V) Assumed: Existing surface planned - pot holes filled Type 1 dressing with Grano Dust surface finish Location: To Byway Dims: As existing
	S3.0 - TIMBER BOARDWALK (P) Location: To sand dune raised walkway Dims: 18m wide w/ low upstand
	S4.0 - VEHICULAR MACADAM (V) Location: Visitor Centre car park / Access Road Trench Dims: 15m wide trench cover w/ passing places
	S5.0 - VEHICULAR ROUTE (MACADAM) (V) Assumed: Some resurfacing as per S4.0 specification Location: To access road from Mainsgate Road to visitor centre - existing surface made good Dims: 4.8m wide
	S6.0 - NATURAL STONE PAVING (P) Location: To Towsey Hole Windmill
	S7.0 - INSITU CONCRETE w/ SMOOTH FINISH (P) Location: To in ground railway details / Visitor Centre / Hodbarrow Lighthouse
	S7.1 - INSITU CONCRETE w/ EXPOSED AGGREGATE FINISH (P / V) Location: To Visitor Centre / Whiterock Junction
	S8.0 - REINFORCED GRAVEL (P) Location: To Visitor Centre car park / Annie Lowther Hide
	S9.0 - RAISED STEEL WALKWAY w TIMBER EDGE (P) Location: To Visitor Centre
	SE - SURFACE EXISTING Location: As noted



ORIGINATOR



W layer.studio
T 01625 523 157
E manchester or newcastle@layer.studio

MANCHESTER
The Barn
One Hollin Lane
Styal
Cheshire
SK9 4JH

NEWCASTLE
Finlaid
1 Salters Road
Gosforth
Newcastle upon Tyne
NE3 1DH

Client:
Cumberland Council

Project:
The Iron Line
Millom, Cumbria

Drawing Title:
GA | Hodbarrow Beacon

Created By MDM	Checked By CL	Scale 1:100	Sheet Size A1
Project Number 289	Originator LYR	Volume Level File Type Discipline Number XX-ZZ-DWG-L-1209	
Work Stage Planning	Status Information	Revision P02	

F1.0 - PICNIC TABLE

Location: Site wide

Material: Corten Steel / Timber / Concrete

F2.0 - BENCH

Location: Site wide

Material: Corten Steel / Timber / Concrete

F2.1 - BENCH (EXISTING)

Location: Site wide

Material: Timber

F3.0 - WAYFINDING - SITE NAVIGATION

Location: Site wide

Material: Corten Steel w/ laser cuttings

F4.0 - WAYFINDING - ARRIVAL

Location: Site wide

Material: Corten Steel w/ laser cuttings

F5.0 - INFO BOARD: ECOLOGY

Location: Site wide

Material: Corten Steel w/ laser cuttings

F5.1 - INFO BOARD: MAP LOCATION

Location: Site wide

Material: Corten Steel w/ laser cuttings

F5.2 - INFO BOARD: HERITAGE

Location: Site wide

Material: Corten Steel w/ laser cuttings

F6.0 - VIEWING SCREEN

Location: To Hidden Lagoon

Material: Timber

F7.0 - DOUBLE LEAF GATE

Location: Road to Welcome Building / HWRC

Material: Subject to future detail

F7.1 - SINGLE LEAF GATE

Location: To RSPB BOAT boundary

Material: Subject to future detail

F8.0 - FEATURE FENCE

Location: Site wide

Material: Timber

F8.1 - EXISTING FENCE

Location: Site wide

Material: Timber

F9.0 - FEATURE ARTWORK

Location: Site wide

Refer to Design & Access Statement Chapter 7

F10.0 - CAR PARK PAY MACHINE

Location: To Visitor Centre car park

Material: -

F11.0 - FEATURE CONC BENCH w/ TIMBER TOP

Location: Site wide

Material: Concrete / Timber

F12.0 - CYCLE PARKING

Location: Site wide

Material: Steel

F13.0 - TIMBER LOGS

Location: To car parking spaces

Material: Timber

F14.0 - EV CHARGING LOCATIONS

Location: To welcome building car park

Material: -

F15.0 - THRESHOLD DETAIL

Location: To key thresholds

Material: Corten

F16.0 - BIRD HIDE

Location: To Hidden Lagoon / Lagoon

Material: Timber

F17.0 - PV CANOPY

Location: To welcome building car park

Material: Subject to future detail

F18.0 - WASTE BIN

Location: Site wide

Material: Subject to future detail

F19.0 - HAND RAIL

Location: To entrance steps

Material: Subject to future detail

F20.0 - BOLLARD

Location: To Byway Entrances

Material: Timber

0m 1m 5m 10m 20m 40m

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DATE	REV	ZONE	DESCRIPTION	CHK
26/03/25	P01		Stage 03 draft issue - for coordination	MDM
07/04/25	P02		Issued for planning	MDM

KEY	
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	S9.0 - RAISED STEEL WALKWAY w TIMBER EDGE (P) Location: To Visitor Centre
	SE - SURFACE EXISTING Location: As noted

ORIGINATOR

W

layerstudio

T

01625 523 157

manchester or newcastle@layerstudio

MANCHESTER

80 Grove Street Studio 29

Willeslow

Cheshire

SK9 1DR

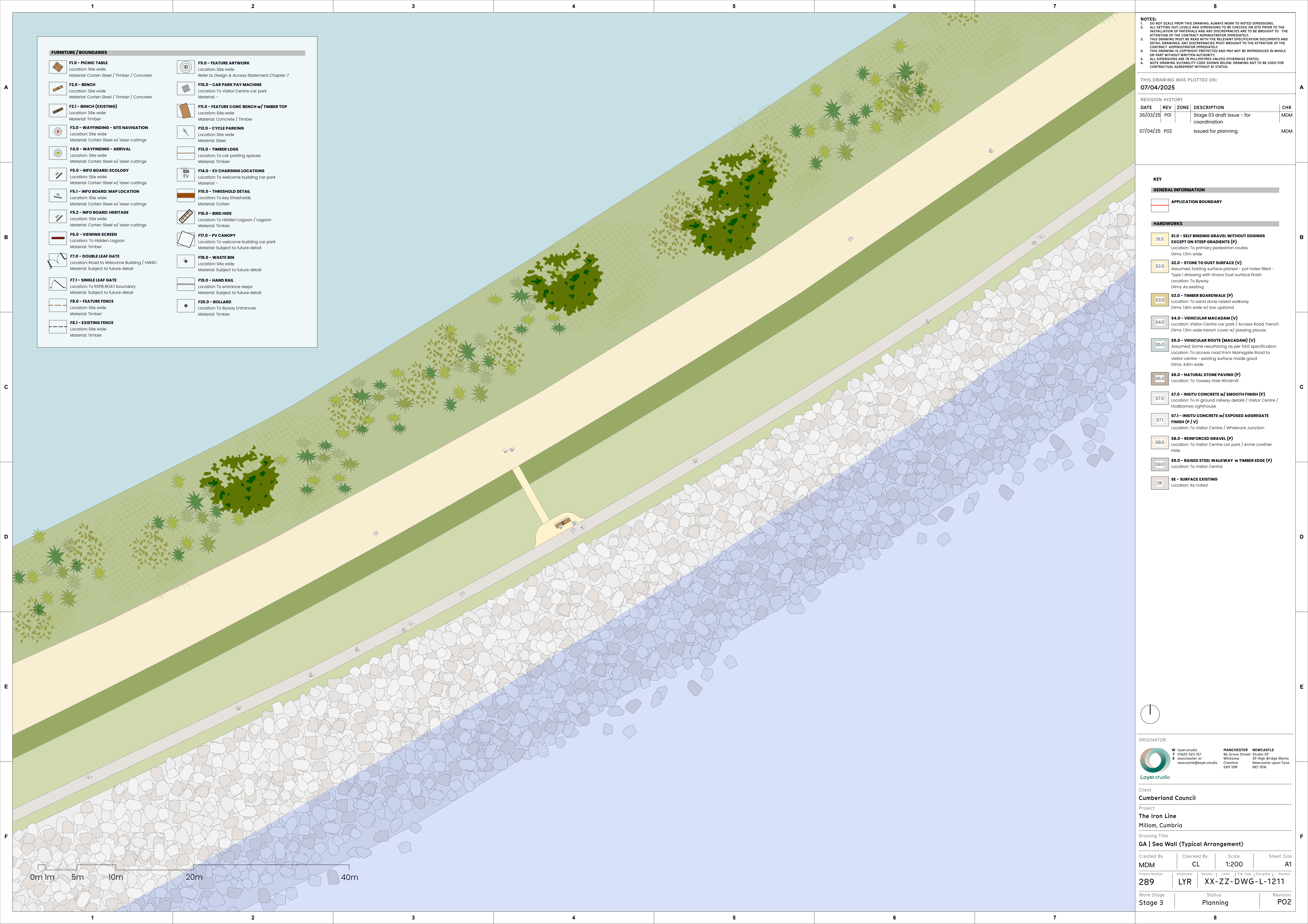
NEWCASTLE

39 High Bridge Works

Newcastle-upon-Tyne

NE1 1EW

Client			
Cumberland Council			
Project			
The Iron Line			
Millom, Cumbria			
Drawing Title			
GA Annie Lowther Hide			
Created By	Checked By	Scale	Sheet Size
MDM	CL	1:100	A1
Project Number	Originator	Volume	Level
289	LYR	XX-ZZ-DWG-L-1210	Number
Work Stage	Status	Revision	
Stage 3	Planning	P02	



FURNITURE / BOUNDARIES

- F1.0 - PICNIC TABLE**
Location: Site wide
Material: Corten Steel / Timber / Concrete
- F2.0 - BENCH**
Location: Site wide
Material: Corten Steel / Timber / Concrete
- F2.1 - BENCH (EXISTING)**
Location: Site wide
Material: Timber
- F3.0 - WAYFINDING - SITE NAVIGATION**
Location: Site wide
Material: Corten Steel w/ laser cuttings
- F4.0 - WAYFINDING - ARRIVAL**
Location: Site wide
Material: Corten Steel w/ laser cuttings
- F5.0 - INFO BOARD: ECOLOGY**
Location: Site wide
Material: Corten Steel w/ laser cuttings
- F5.1 - INFO BOARD: MAP LOCATION**
Location: Site wide
Material: Corten Steel w/ laser cuttings
- F5.2 - INFO BOARD: HERITAGE**
Location: Site wide
Material: Corten Steel w/ laser cuttings
- F6.0 - VIEWING SCREEN**
Location: To Hidden Lagoon
Material: Timber
- F7.0 - DOUBLE LEAF GATE**
Location: Road to Welcome Building / HWRC
Material: Subject to future detail
- F7.1 - SINGLE LEAF GATE**
Location: To RSPB BOAT boundary
Material: Subject to future detail
- F8.0 - FEATURE FENCE**
Location: Site wide
Material: Timber
- F8.1 - EXISTING FENCE**
Location: Site wide
Material: Timber

- F9.0 - FEATURE ARTWORK**
Location: Site wide
Refer to Design & Access Statement Chapter 7
- F10.0 - CAR PARK PAY MACHINE**
Location: To Visitor Centre car park
Material: -
- F11.0 - FEATURE CONC BENCH w/ TIMBER TOP**
Location: Site wide
Material: Concrete / Timber
- F12.0 - CYCLE PARKING**
Location: Site wide
Material: Steel
- F13.0 - TIMBER LOGS**
Location: To car parking spaces
Material: Timber
- F14.0 - EV CHARGING LOCATIONS**
Location: To welcome building car park
Material: -
- F15.0 - THRESHOLD DETAIL**
Location: To key thresholds
Material: Corten
- F16.0 - BIRD HIDE**
Location: To Hidden Lagoon / Lagoon
Material: Timber
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Material: Subject to future detail
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07/04/2025

REVISION HISTORY

DATE	REV	ZONE	DESCRIPTION	CHK
26/03/25	P01		Stage 03 draft issue - for coordination	MDM
07/04/25	P02		Issued for planning	MDM

KEY

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Location: To Byway
Dims: As existing
- S3.0 - TIMBER BOARDWALK (P)**
Location: To stand dune raised walkway
Dims: 18m wide w/ low upstand
- S4.0 - VEHICULAR MACADAM (V)**
Location: Visitor Centre car park / Access Road Trench
Dims: 15m wide trench cover w/ passing places
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- S9.0 - RAISED STEEL WALKWAY w TIMBER EDGE (P)**
Location: To Visitor Centre
- SE - SURFACE EXISTING**
Location: As noted



ORIGINATOR



Client

Cumberland Council

Project

The Iron Line
Millom, Cumbria

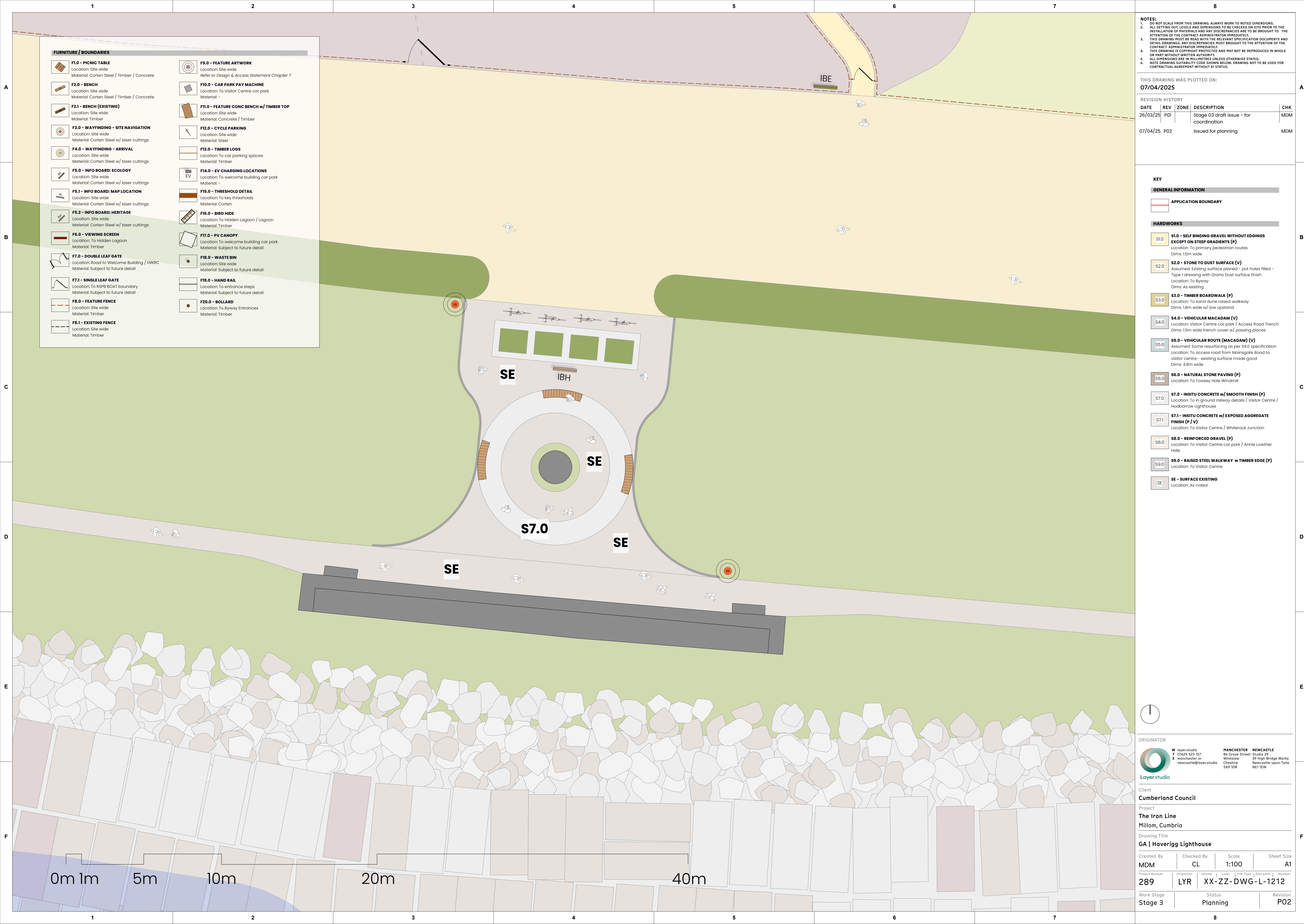
Drawing Title

GA | Sea Wall (Typical Arrangement)

Created By	Checked By	Scale	Sheet Size
MDM	CL	1:200	A1

Project Number	Originator	Volume	Level	File Type	Discipline	Number
289	LYR	XX-ZZ-DWG-L-1211				

Work Stage	Status	Revision
Stage 3	Planning	P02



FURNITURE / BOUNDARIES

 **F1.0 - PICNIC TABLE**
Location: Site wide
Material: Corten Steel / Timber / Concrete

 **F2.0 - BENCH**
Location: Site wide
Material: Corten Steel / Timber / Concrete

 **F2.1 - BENCH (EXISTING)**
Location: Site wide
Material: Timber

 **F3.0 - WAYFINDING - SITE NAVIGATION**
Location: Site wide
Material: Corten Steel w/ laser cuttings

 **F4.0 - WAYFINDING - ARRIVAL**
Location: Site wide
Material: Corten Steel w/ laser cuttings

 **F5.0 - INFO BOARD: ECOLOGY**
Location: Site wide
Material: Corten Steel w/ laser cuttings

 **F5.1 - INFO BOARD: MAP LOCATION**
Location: Site wide
Material: Corten Steel w/ laser cuttings

 **F5.2 - INFO BOARD: HERITAGE**
Location: Site wide
Material: Corten Steel w/ laser cuttings

 **F6.0 - VIEWING SCREEN**
Location: To Hidden Lagoon
Material: Timber

 **F7.0 - DOUBLE LEAF GATE**
Location: Road to Welcome Building / HWRC
Material: Subject to future detail

 **F7.1 - SINGLE LEAF GATE**
Location: To RSPB BOAT boundary
Material: Subject to future detail

 **F8.0 - FEATURE FENCE**
Location: Site wide
Material: Timber

 **F8.1 - EXISTING FENCE**
Location: Site wide
Material: Timber

 **F9.0 - FEATURE ARTWORK**
Location: Site wide
Refer to Design & Access Statement Chapter 7

 **F10.0 - CAR PARK PAY MACHINE**
Location: To Visitor Centre car park
Material: -

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Location: Site wide
Material: Concrete / Timber

 **F12.0 - CYCLE PARKING**
Location: Site wide
Material: Steel

 **F13.0 - TIMBER LOGS**
Location: To car parking spaces
Material: Timber

 **F14.0 - EV CHARGING LOCATIONS**
Location: To welcome building car park
Material: -

 **F15.0 - THRESHOLD DETAIL**
Location: To key thresholds
Material: Corten

 **F16.0 - BIRD HIDE**
Location: To Hidden Lagoon / Lagoon
Material: Timber

 **F17.0 - PV CANOPY**
Location: To welcome building car park
Material: Subject to future detail

 **F18.0 - WASTE BIN**
Location: Site wide
Material: Subject to future detail

 **F19.0 - HAND RAIL**
Location: To entrance steps
Material: Subject to future detail

 **F20.0 - BOLLARD**
Location: To Byway Entrances
Material: Timber

NOTES:
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THIS DRAWING WAS PLOTTED ON:
07/04/2025

REVISION HISTORY				
DATE	REV	ZONE	DESCRIPTION	CHK
26/03/25	P01		Stage 03 draft issue - for coordination	MDM
07/04/25	P02		Issued for planning	MDM

KEY

GENERAL INFORMATION

 APPLICATION BOUNDARY

HARDWORKS

-  **S1.0 - SELF BINDING GRAVEL WITHOUT EDGINGS EXCEPT ON STEEP GRADIENTS (P)**
Location: To primary pedestrian routes
Dims: 15m wide
-  **S2.0 - STONE TO DUST SURFACE (V)**
Assumed: Existing surface planned - pot holes filled - Type 1 dressing with Grano Dust surface finish
Location: To Byway
Dims: As existing
-  **S3.0 - TIMBER BOARDWALK (P)**
Location: To stand dune raised walkway
Dims: 18m wide w/ low upstand
-  **S4.0 - VEHICULAR MACADAM (V)**
Location: Visitor Centre car park / Access Road Trench
Dims: 15m wide trench cover w/ passing places
-  **S5.0 - VEHICULAR ROUTE (MACADAM) (V)**
Assumed: Some resurfacing as per S4.0 specification
Location: To access road from Mainsgate Road to visitor centre - existing surface made good
Dims: 48m wide
-  **S6.0 - NATURAL STONE PAVING (P)**
Location: To Towsey Hole Windmill
-  **S7.0 - INSITU CONCRETE w/ SMOOTH FINISH (P)**
Location: To in ground railway details / Visitor Centre / Hoadbarrow Lighthouse
-  **S7.1 - INSITU CONCRETE w/ EXPOSED AGGREGATE FINISH (P / V)**
Location: To Visitor Centre / Whiterock Junction
-  **S8.0 - REINFORCED GRAVEL (P)**
Location: To Visitor Centre car park / Annie Lowther Hide
-  **S9.0 - RAISED STEEL WALKWAY w TIMBER EDGE (P)**
Location: To Visitor Centre
-  **SE - SURFACE EXISTING**
Location: As noted



ORIGINATOR



W

layer.studio

01625 523 157

manchester or newcastle@layer.studio

Cheshire

MANCHESTER

80 Grove Street

Willslow

SK9 1DR

NEWCASTLE

Studio 29

39 High Bridge Works

Newcastle-upon-Tyne

NE1 1EW

Client			
Cumberland Council			
Project			
The Iron Line			
Millom, Cumbria			
Drawing Title			
GA Haverigg Lighthouse & Tern Island Hide			
Created By	Checked By	Scale	Sheet Size
MDM	CL	1:200	A1
Project Number	Originator	Volume	Level
289	LYR	XX-ZZ-DWG-L-1213	
Work Stage	Status	Revision	
Stage 3	Planning	P02	



FURNITURE / BOUNDARIES	
	F1.0 - PICNIC TABLE Location: Site wide Material: Corten Steel / Timber / Concrete
	F2.0 - BENCH Location: Site wide Material: Corten Steel / Timber / Concrete
	F2.1 - BENCH (EXISTING) Location: Site wide Material: Timber
	F3.0 - WAYFINDING - SITE NAVIGATION Location: Site wide Material: Corten Steel w/ laser cuttings
	F4.0 - WAYFINDING - ARRIVAL Location: Site wide Material: Corten Steel w/ laser cuttings
	F5.0 - INFO BOARD: ECOLOGY Location: Site wide Material: Corten Steel w/ laser cuttings
	F5.1 - INFO BOARD: MAP LOCATION Location: Site wide Material: Corten Steel w/ laser cuttings
	F5.2 - INFO BOARD: HERITAGE Location: Site wide Material: Corten Steel w/ laser cuttings
	F6.0 - VIEWING SCREEN Location: To Hidden Lagoon Material: Timber
	F7.0 - DOUBLE LEAF GATE Location: Road to Welcome Building / HWRC Material: Subject to future detail
	F7.1 - SINGLE LEAF GATE Location: To RSPB BOAT boundary Material: Subject to future detail
	F8.0 - FEATURE FENCE Location: Site wide Material: Timber
	F8.1 - EXISTING FENCE Location: Site wide Material: Timber
	F9.0 - FEATURE ARTWORK Location: Site wide <i>Refer to Design & Access Statement Chapter 7</i>
	F10.0 - CAR PARK PAY MACHINE Location: To Visitor Centre car park Material: -
	F11.0 - FEATURE CONC BENCH w/ TIMBER TOP Location: Site wide Material: Concrete / Timber
	F12.0 - CYCLE PARKING Location: Site wide Material: Steel
	F13.0 - TIMBER LOGS Location: To car parking spaces Material: Timber
	F14.0 - EV CHARGING LOCATIONS Location: To welcome building car park Material: -
	F15.0 - THRESHOLD DETAIL Location: To key thresholds Material: Corten
	F16.0 - BIRD HIDE Location: To Hidden Lagoon / Lagoon Material: Timber
	F17.0 - PV CANOPY Location: To welcome building car park Material: Subject to future detail
	F18.0 - WASTE BIN Location: Site wide Material: Subject to future detail
	F19.0 - HAND RAIL Location: To entrance steps Material: Subject to future detail
	F20.0 - BOLLARD Location: To Byway Entrances Material: Timber

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 -

THIS DRAWING WAS PLOTTED ON:
07/04/2025

REVISION HISTORY				
DATE	REV	ZONE	DESCRIPTION	CHK
03/06/24	P01		Preliminary Issue	MDM
04/04/25	P02		Revised Issue	CE
07/04/25	P03		Issued for planning	MDM

KEY	
GENERAL INFORMATION	
	APPLICATION BOUNDARY
HARDWORKS	
	S1.0 - SELF BINDING GRAVEL WITHOUT EDGINGS EXCEPT ON STEEP GRADIENTS (P) Location: To primary pedestrian routes Dims: 15m wide
	S2.0 - STONE TO DUST SURFACE (V) Assumed: Existing surface planed - pot holes filled - Type 1 dressing with Grano Dust surface finish Location: To Byway Dims: As existing
	S3.0 - TIMBER BOARDWALK (P) Location: To stand dune raised walkway Dims: 1.8m wide w/ low upstand
	S4.0 - VEHICULAR MACADAM (V) Location: Visitor Centre car park / Access Road Trench Dims: 15m wide trench cover w/ passing places
	S5.0 - VEHICULAR ROUTE (MACADAM) (V) Assumed: Some resurfacing as per S4.0 specification Location: To access road from Mainsgate Road to visitor centre - existing surface made good Dims: 4.8m wide
	S6.0 - NATURAL STONE PAVING (P) Location: To Towsey Hole Windmill
	S7.0 - INSITU CONCRETE w/ SMOOTH FINISH (P) Location: To in ground railway details / Visitor Centre / Hoadbarrow Lighthouse
	S7.1 - INSITU CONCRETE w/ EXPOSED AGGREGATE FINISH (P / V) Location: To Visitor Centre / Whiterock Junction
	S8.0 - REINFORCED GRAVEL (P) Location: To Visitor Centre car park / Annie Lowther Hide
	S9.0 - RAISED STEEL WALKWAY w TIMBER EDGE (P) Location: To Visitor Centre
	SE - SURFACE EXISTING Location: As noted

PRIORITY HABITAT TYPES	
	ANNEX 1 H6210 CALCAREOUS GRASSLAND Type: Briza-Brachypodium Status: Maintained
	ANNEX 1 H6210 CALCAREOUS GRASSLAND Type: CG1 Status: Maintained
	PRIORITY HABITAT LOWLAND MEADOWS Type: MG1e Status: Maintained
	PRIORITY HABITAT LOWLAND MEADOWS Type: MG1e Status: Maintained
	RENATURED CALCAREOUS GRASSLAND Type: Existing land Status: Re-natured to calcareous grassland
	NON PRIORITY HABITAT



ORIGINATOR	
	W layer.studio T 01625 523 157 E manchester or newcastle@layer.studio C Cheshire N SK9 1DR
MANCHESTER 80 Grove Street Willeslow Cheshire SK9 1DR	NEWCASTLE Studio 29 39 High Bridge Works Newcastle-upon-Tyne NE1 1EW
Client	
Cumberland Council	
Project	
The Iron Line	
Millom, Cumbria	
Drawing Title	
GA Visitor Centre 1:500	
Created By	Checked By
MDM	CL
Scale	Sheet Size
1:500	A1
Project Number	Originator
289	LYR
Volume	Level
File Type	Discipline
Number	
Work Stage	Status
Stage 3	Planning
Revision	P03



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Location: To Visitor Centre
- SE - SURFACE EXISTING**
Location: As noted

HABITAT TYPES

- DENSE CONTINUOUS SCRUB**
Type: A2.1
Status: Maintained
- MOSAIC: SAND DUNE GRASSLAND / SAND DUNE SCRUB**
Type: H6.5 / H6.7
Status: Maintained
- UNIMPROVED CALCAREOUS GRASSLAND**
Type: B3.1
Status: Maintained
- QUARRY**
Type: II.2
Status: Maintained
- HIGHLIGHTED SPECIES**
Type: Monticola
Status: Removed
- HIGHLIGHTED SPECIES**
Type: Sea Buckthorn
Status: Removed



ORIGINATOR

W layerstudio
01625 523 157
manchester or
newcastle@layerstudio

MANCHESTER 80 Grove Street Studio 29
Willeslow
Cheshire
SK9 1DR

NEWCASTLE 39 High Bridge Works
Newcastle-upon-Tyne
NE1 1EW

Client

Cumberland Council

Project

The Iron Line
Millom, Cumbria

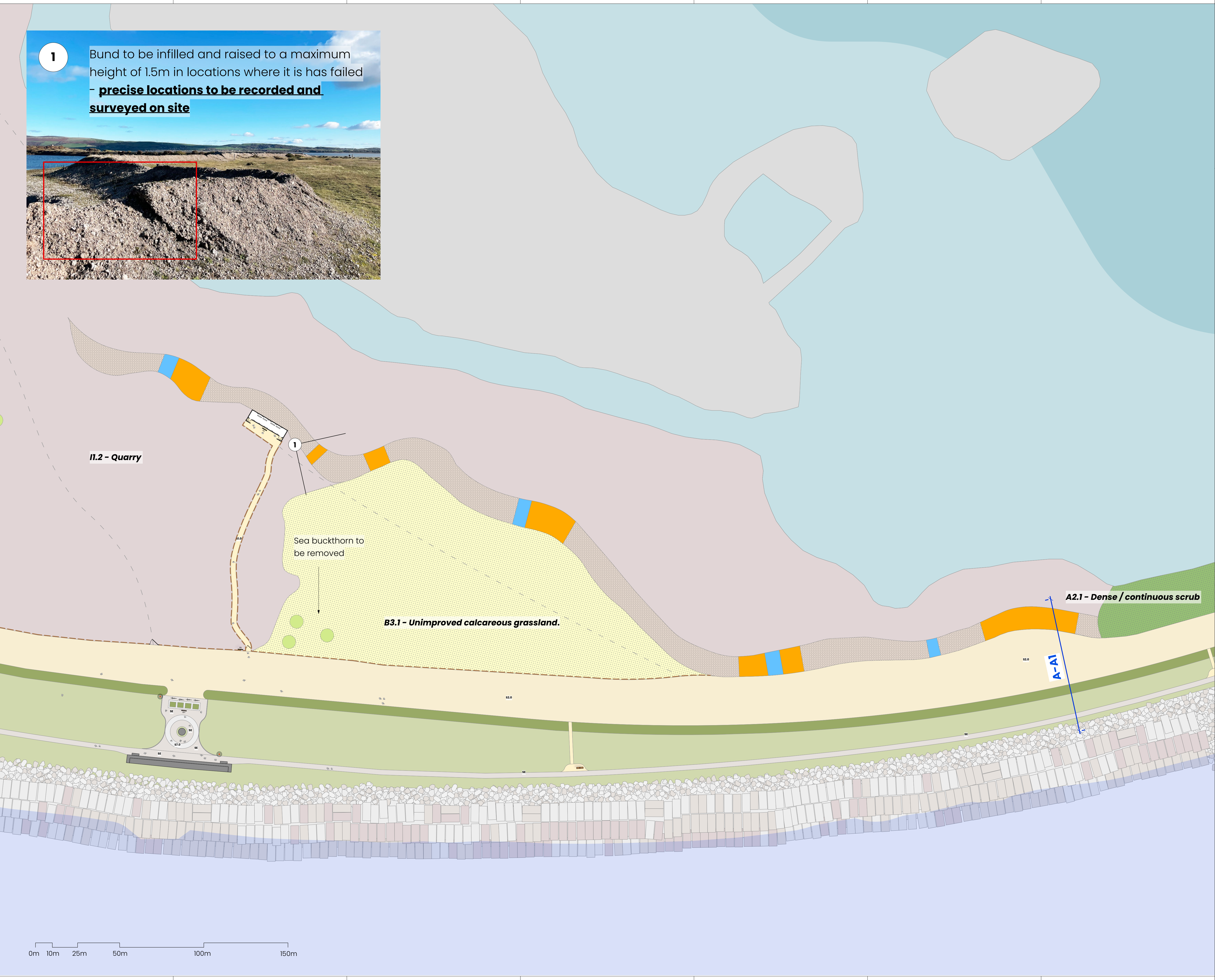
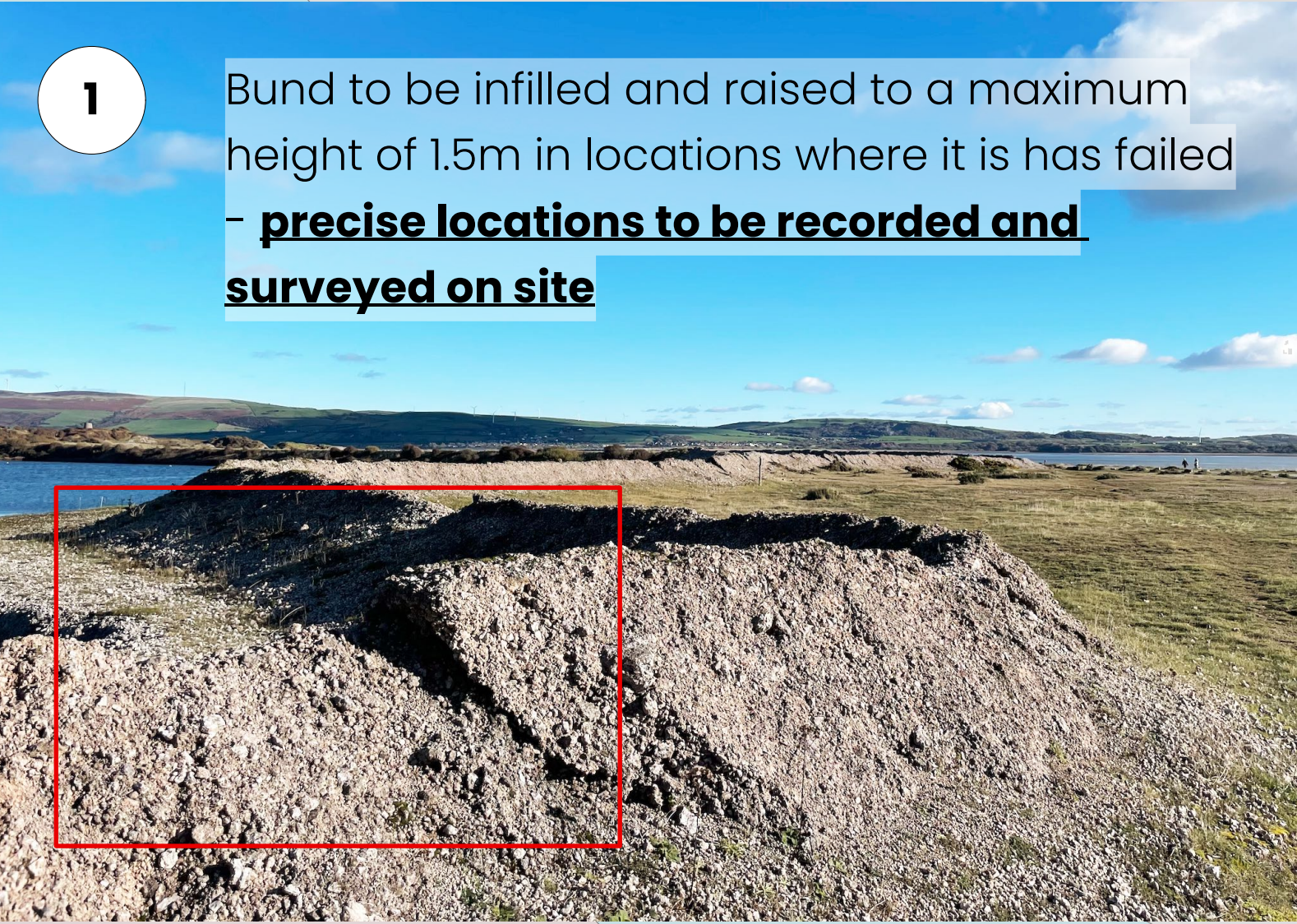
Drawing Title

GA | Lighthouse & Tern Island Hide - Overview

Created By	Checked By	Scale	Sheet Size
MDM	CL	1:500	A1

Project Number	Originator	Volume	Level	File Type	Discipline	Number
289	LYR			XX-ZZ-DWG-L-1302		

Work Stage	Status	Revision
Stage 3	Planning	P03



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07/04/2025

REVISION HISTORY				
DATE	REV	ZONE	DESCRIPTION	CHK
03/06/24	P01		Preliminary Issue	MDM
04/04/25	P02		Revised Issue	CE
07/04/25	P03		Issued for planning	MDM

KEY

GENERAL INFORMATION

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Location: To stand dune raised walkway
Dims: 18m wide w/ low upstand
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Location: To Visitor Centre car park / Annie Lowther Hide
- S9.0 - RAISED STEEL WALKWAY w TIMBER EDGE (P)**
Location: To Visitor Centre
- SE - SURFACE EXISTING**
Location: As noted

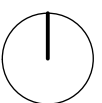
KEY

GENERAL INFORMATION

APPLICATION BOUNDARY

SLAG BUND REMEDIATION WORKS

- SLAG BUND - EXISTING
- SLAG BUND - INCREASED HEIGHT
To a maximum of 1500mm
- SLAG BUND - INFILL



ORIGINATOR



W
layer.studio
01625 523 157
E
manchester or
newcastle@layer.studio

MANCHESTER
80 Grove Street
Willeslow
Cheshire
SK9 1DR

NEWCASTLE
Studio 29
39 High Bridge Works
Newcastle-upon-Tyne
NE1 1EW

Client

Cumberland Council

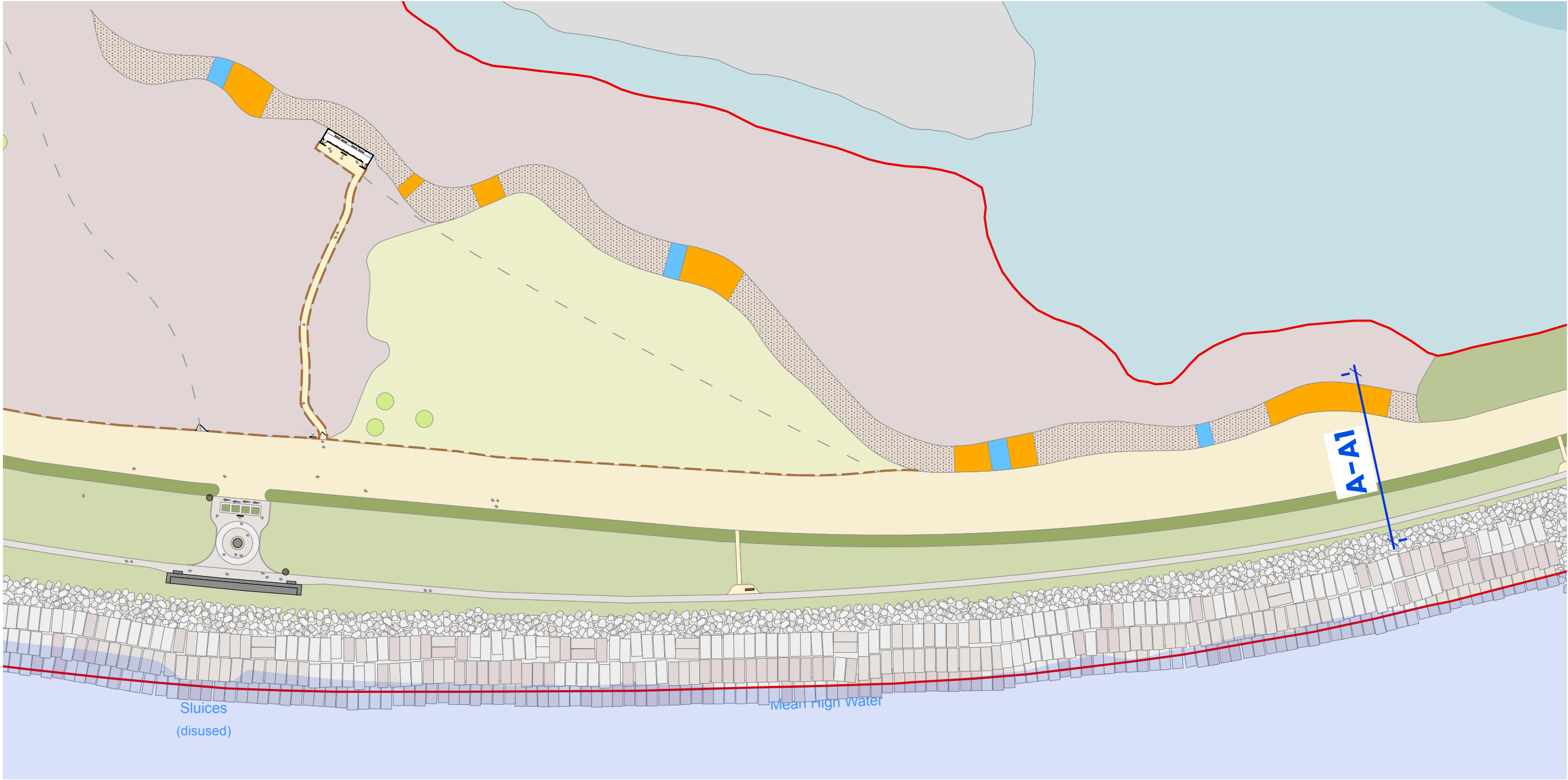
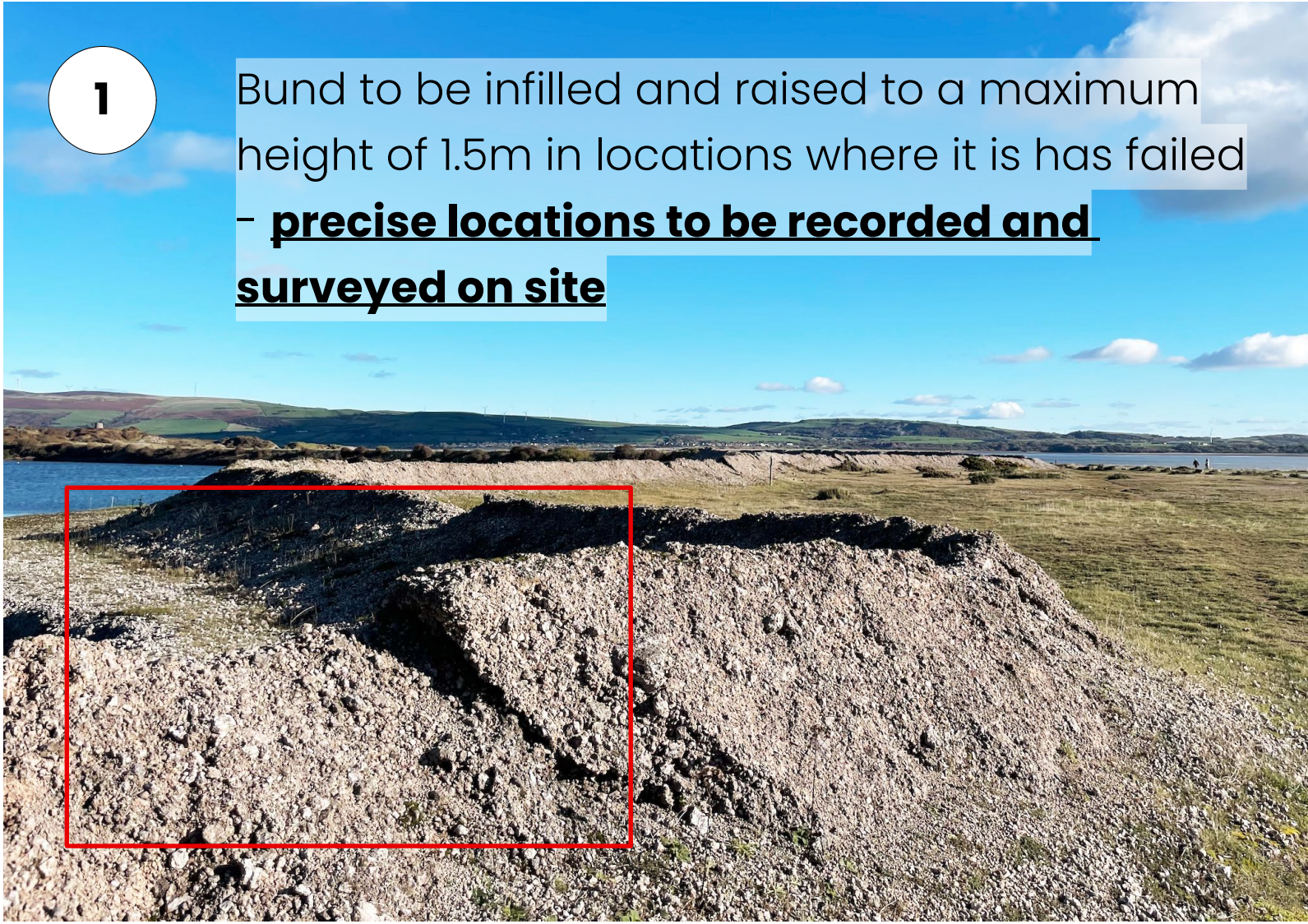
Project

The Iron Line
Millom, Cumbria

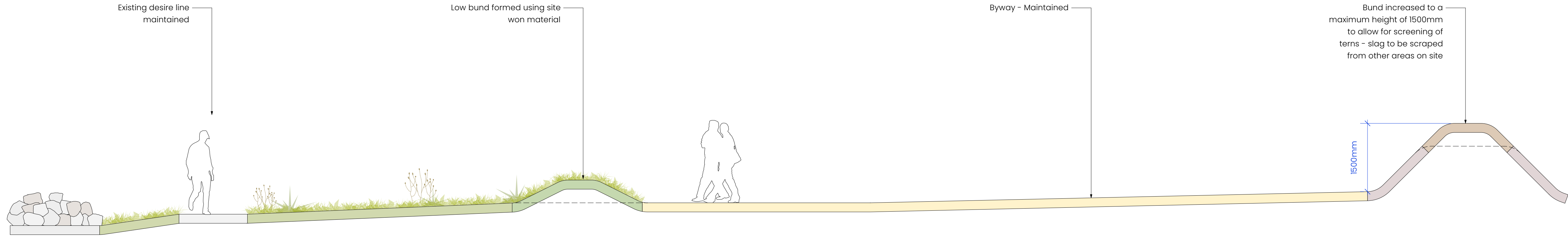
Drawing Title

GA | Lighthouse & Tern Island Hide - Slag Bund

Created By	Checked By	Scale	Sheet Size
MDM	CL	1:500	A1
Project Number	Originator	Volume	Level
289	LYR	XX-ZZ-DWG-L-1303	
Work Stage	Status	Revision	
Stage 3	Planning	P03	



D01 Location Map
Scale: 1:100



D02 Section A-A1
Scale: 1:50

NOTES:

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THIS DRAWING WAS PLOTTED ON:
07/04/2025

REVISION HISTORY				
DATE	REV	ZONE	DESCRIPTION	CHK
03/06/24	P01		Preliminary Issue	MDM
04/04/25	P02		Revised Issue	CE
07/04/25	P03		Issued for planning	MDM



ORIGINATOR

W layerstudio
01625 523 157
manchester or
newcastle@layerstudio

MANCHESTER
80 Grove Street
Wilmslow
Cheshire
SK9 1DR

NEWCASTLE
Studio 39
39 High Bridge Works
Newcastle-upon-Tyne
NE1 1EW

Client
Cumberland Council

Project
The Iron Line
Millom, Cumbria

Drawing Title
S | Sea Wall Cross Section

Created By		Checked By		Scale		Sheet Size	
MDM		CL		As Noted		A1	
Project Number		Originator	Volume	Level	File Type	Discipline	Number
289		LYR	XX-ZZ-DWG-L-1304				
Work Stage		Status				Revision	
Stage 3		Planning				P03	



Proposed BH Locations

- CBR Test Location
- Hand Pit
- Rotary Open Borehole
- Soakaway Test
- Trial Pit
- Windowless Dynamic Sample Borehole
- Trial Trench
- Site Boundary

0 5 10 15 m

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Curtins Consulting Ltd
Merchant Exchange, 17-19 Whitworth Street West,
Manchester, M1 5WG
t: 0161 236 2394
e: manchester@curtins.com
www.curtins.com

Structures - Civils - Environmental - Infrastructure - Transport Planning - Sustainability - Expert Advisory Services
Birmingham - Bristol - Cardiff - Douglas - Edinburgh - Kendal - Leeds - Liverpool - London - Manchester - Nottingham

Status INFORMATION

Project: Iron Line, Millom

Drg Title: Zone 3 - Towsey Hole Windmill
Proposed Exploratory Hole Location Plan

Scale: See scale bar above	Size: A3	Issue Date: 26/02/2024	Drawn: JL	Checked: NF
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Drg No: 080874-CUR-XX-XX-DR-GE-80002	Rev: P01
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- CBR Test Location
- Hand Pit
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- Soakaway Test
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Status INFORMATION

Project: **Iron Line, Millom**

Drg Title: **Zone 4 - Haverigg Lighthouse
Proposed Exploratory Hole Location Plan**

Scale: See scale bar above	Size: A3	Issue Date: 26/02/2024	Drawn: JL	Checked: NF
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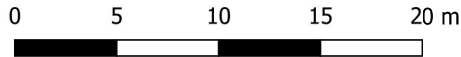
Drg No:	080874-CUR-XX-XX-DR-GE-80003	Rev:	P0
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Proposed BH Locations

-  CBR Test Location
-  Hand Pit
-  Rotary Open Borehole
-  Soakaway Test
-  Trial Pit
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Manchester, M1 5WG
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e: manchester@curtins.com
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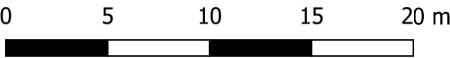
Structures - Civils - Environmental - Infrastructure - Transport Planning - Sustainability - Expert Advisory Services
Birmingham - Bristol - Cardiff - Douglas - Edinburgh - Kendal - Leeds - Liverpool - London - Manchester - Nottingham

Status INFORMATION				
Project: Iron Line, Millom				
Drg Title: Zone 5 - Annie Lowther Hide Proposed Exploratory Hole Location Plan				
Scale: See scale bar above	Size: A3	Issue Date: 26/02/2024	Drawn: JL	Checked: NF
Drg No: 080874-CUR-XX-XX-DR-GE-80004				Rev: P01
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Proposed BH Locations

- CBR Test Location
- Hand Pit
- Rotary Open Borehole
- Soakaway Test
- Trial Pit
- Windowless Dynamic Sample Borehole
- Trial Trench
- Site Boundary



Curtins

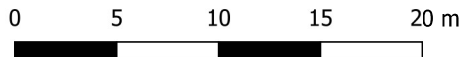
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t: 0161 236 2394
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www.curtins.com
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Birmingham - Bristol - Cardiff - Douglas - Edinburgh - Kendal - Leeds - Liverpool - London - Manchester - Nottingham

Status				
INFORMATION				
Project:				
Iron Line, Millom				
Drg Title:				
Zone 8 - Iron Line Railway Pass Proposed Exploratory Hole Location Plan				
Scale:	Size:	Issue Date:	Drawn:	Checked:
See scale bar above	A3	26/02/2024	JL	NF
Drg No:				Rev:
080874-CUR-XX-XX-DR-GE-80006				P01



Proposed BH Locations

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Curtins

Curtins Consulting Ltd
Merchant Exchange, 17-19 Whitworth Street West,
Manchester, M1 5WG
t: 0161 236 2394
e: manchester@curtins.com
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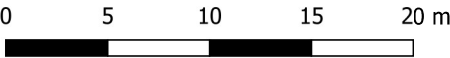
Structures - Civils - Environmental - Infrastructure - Transport Planning - Sustainability - Expert Advisory Services
Birmingham - Bristol - Cardiff - Douglas - Edinburgh - Kendal - Leeds - Liverpool - London - Manchester - Nottingham

Status				
INFORMATION				
Project:				
Iron Line, Millom				
Drg Title:				
Zone 9 - Iron Line Entrance Proposed Exploratory Hole Location Plan				
Scale:	Size:	Issue Date:	Drawn:	Checked:
See scale bar above	A3	26/02/2024	JL	NF
Drg No:				Rev:
080874-CUR-XX-XX-DR-GE-80007				P01
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Proposed BH Locations

- CBR Test Location
- Hand Pit
- Rotary Open Borehole
- Soakaway Test
- Trial Pit
- Windowless Dynamic Sample Borehole
- Trial Trench
- Site Boundary



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Curtins Consulting Ltd
Merchant Exchange, 17-19 Whitworth Street West,
Manchester, M1 5WG
t: 0161 236 2394
e: manchester@curtins.com
www.curtins.com

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Status				
INFORMATION				
Project:				
Iron Line, Millom				
Drg Title:				
Zone 10 - Main Gate & Car Park Proposed Exploratory Hole Location Plan				
Scale:	Size:	Issue Date:	Drawn:	Checked:
See scale bar above	A3	26/02/2024	JL	NF
Drg No:				Rev:
080874-CUR-XX-XX-DR-GE-80008				P01



Site Boundary

Area of Highest Risk_GeoGrid

Mining Constraints

Mine Entries

Archive

Envirocheck ECMGS

Envirocheck Maps

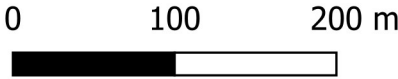
Northern Mine Research Society

Underground Working

Ore Body Working

Underground Road

Google Satellite



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Curtins Consulting Ltd
Merchant Exchange, 17-19 Whitworth Street West,
Manchester, M1 5WG
t: 0161 236 2394
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Status INFORMATION

Project: Iron Line, Millom

Drg Title: Shafts and Relic Mining Features - Area of Highest Risk'

Scale: See scale bar above	Size: A3	Issue Date: 03/03/2025	Drawn: LW	Checked: NF
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Drg No: 080874-CUR-XX-XX-DR-GE-80020	Rev: P01
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Rev:	Description:	Date:	By:	Chkd:
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Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
t: 0161 236 2394
e: manchester@curtins.com
www.curtins.com

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Status:

INFORMATION

Project:

Drg Title:

Scale:	Size:	First Issue:	Drawn:	Checked:
NTS	A3	XX/XX/XX	XX	XX

Drg No:	Rev:
XXXXXX-CUR-00-XX-DR-GE-00X	P0X

Appendix B – Exploratory Hole Logs

[illegible]

				Trial Pit Log			Trialpit No CBR4-01 Sheet 1 of 1		
Project Name: Millom Iron Line				Project No. B080874.301		Co-ords: - Level:		Date 03/09/2024	
Location: Milliom				Dimensions (m): Depth 0.15				Scale 1:20	
Client: Cumberland Council								Logged RT	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.15			MADE GROUND: Greyish brown clayey sandy fine to coarse subangular to angular gravel of concrete, tarmac and brick. Sand is fine to coarse. End of pit at 0.15 m		
								1	
								2	
								3	
								4	
Remarks: Hand excavated to 0.15m bgl.									
Stability: STABLE									



				Trial Pit Log			Trialpit No CBR8-01 Sheet 1 of 1		
Project Name: Millom Iron Line				Project No. B080874.301		Co-ords: - Level:		Date 03/09/2024	
Location: Milliom				Dimensions (m): Depth 0.25				Scale 1:20	
Client: Cumberland Council								Logged RT	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.05			MADE GROUND: Tarmac.		
				0.20			MADE GROUND: Grey sandy gravel of fine to coarse angular to subangular limestone. Sand is fine to coarse.		
				0.25			Dark brown gravelly fine to coarse sand. Gravel is fine to coarse subangular limestone, brick and concrete.		
							End of pit at 0.25 m		
									1
									2
									3
									4
Remarks: Hand excavated to 0.25m bgl.									
Stability: STABLE									

				Trial Pit Log			Trialpit No CBR8-02 Sheet 1 of 1		
Project Name: Millom Iron Line				Project No. B080874.301		Co-ords: - Level:		Date 03/09/2024	
Location: Milliom				Dimensions (m): Depth 0.23				Scale 1:20	
Client: Cumberland Council								Logged RT	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.05			MADE GROUND: Tarmac.		
				0.17			MADE GROUND: Grey sandy gravel of fine to coarse angular to subangular limestone. Sand is fine to coarse.		
				0.23			MADE GROUND: Dark brown gravelly fine to coarse sand. Gravel is fine to coarse subangular to angular brick.		
							End of pit at 0.23 m		
									1
									2
									3
									4
Remarks: Hand excavated to 0.23m bgl.									
Stability: STABLE									

				Trial Pit Log			Trialpit No CBR9-01 Sheet 1 of 1		
Project Name: Millom Iron Line				Project No. B080874.301		Co-ords: - Level:		Date 04/09/2024	
Location: Milliom				Dimensions (m): Depth 0.25				Scale 1:20	
Client: Cumberland Council								Logged RT	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.25			TOPSOIL: Vegetation overlying friable dark brown gravelly sand. Sand is fine to coarse. Gravel is fine to coarse subrounded to subangular sandstone and limestone. End of pit at 0.25 m		
								1	
								2	
								3	
								4	
Remarks: Hand excavated to 0.25m bgl.									
Stability: STABLE									



				Trial Pit Log			Trialpit No CBR9-03 Sheet 1 of 1		
Project Name: Millom Iron Line				Project No. B080874.301		Co-ords: - Level:		Date 04/09/2024	
Location: Milliom				Client: Cumberland Council		Dimensions (m): Depth 0.22		Scale 1:20 Logged RT	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.06			MADE GROUND: Reddish brown sandy gravel of fine to coarse angular to subangular limestone. Sand is fine to coarse. MADE GROUND: Black gravelly fine to coarse sand. Gravel ias fine to medium brick. End of pit at 0.22 m		
				0.22					
								1	
								2	
								3	
								4	
Remarks: Hand excavated to 0.22m bgl.									
Stability: STABLE									

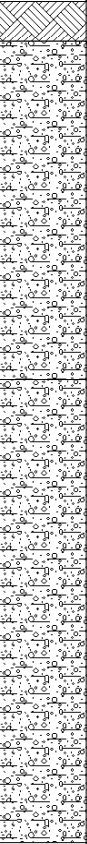
				Trial Pit Log			Trialpit No CBR10-01 Sheet 1 of 1		
Project Name: Millom Iron Line				Project No. B080874.301		Co-ords: - Level:		Date 04/09/2024	
Location: Milliom				Dimensions (m): Depth 0.26			Scale 1:20		
Client: Cumberland Council							Logged RT		
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.06			MADE GROUND: Tarmac.		
				0.16			MADE GROUND: Grey sandy gravel of fine to coarse angular to subangular limestone. Sand is fine to coarse.		
				0.26			Stiff reddish brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse subrounded to subangular limestone and sandstone.		
							End of pit at 0.26 m		
Remarks: Hand excavated to 0.20m bgl.									
Stability: STABLE									

				Trial Pit Log			Trialpit No CBR10-02 Sheet 1 of 1		
Project Name: Millom Iron Line				Project No. B080874.301		Co-ords: - Level:		Date 04/09/2024	
Location: Milliom				Dimensions (m): Depth 0.28				Scale 1:20	
Client: Cumberland Council								Logged RT	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.15			MADE GROUND: Reddish brown sandy gravel of fine to coarse angular to subangular limestone. Sand is fine to coarse. Stiff reddish brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse subrounded to subangular limestone and sandstone. End of pit at 0.28 m		
				0.28					
								1	
								2	
								3	
								4	
Remarks: Hand excavated to 0.28m bgl.									
Stability: STABLE									

				Trial Pit Log			Trialpit No HP4-01 Sheet 1 of 1		
Project Name: Millom Iron Line				Project No. B080874.301		Co-ords: - Level:		Date 02/09/2024	
Location: Milliom				Dimensions (m): Depth 0.51			Scale 1:20		
Client: Cumberland Council							Logged LW		
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.40	ES		0.15			Grass over TOPSOIL: Dark brown slightly sandy gravelly clay. Sand is fine to coarse. Gravel is fine to coarse subangular to angular of quartzite, limestone and brick. MADE GROUND: Dark brown slightly sandy gravelly clay with occasional cobbles. Sand is fine to coarse. Gravel is fine to coarse subangular to angular of brick, concrete, limestone and slag. Cobbles of brick and slag.		
				0.50 0.51					
							MADE GROUND: Metal foundation. End of pit at 0.51 m		
							1		
							2		
							3		
							4		
Remarks: Hand excavated foundation pit to 0.51m bgl. Perched water encountered at 0.15m bgl, described as a medium influx.									
Stability:									

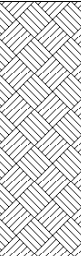
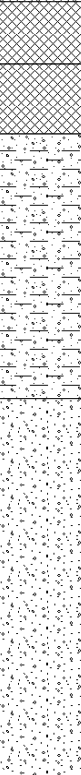


				Trial Pit Log			Trialpit No SA3-02 Sheet 1 of 1		
Project Name: Millom Iron Line				Project No. B080874.301		Co-ords: - Level:		Date 04/09/2024	
Location: Milliom				Dimensions (m): Depth 1.50			Scale 1:20		
Client: Cumberland Council							Logged LW		
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.13			Grass over TOPSOIL: Reddish brown sandy gravelly clay with frequent rootlets. Sand is fine to coarse. Gravel is fine to coarse subangular to angular of limestone. Reddish brown clayey gravelly cobbly BOULDERS. Gravel is fine to coarse, subangular to angular of limestone. Cobbles of limestone. Boulders of limestone.		
									
				1.50			End of pit at 1.50 m		
Remarks: Machine excavated trial pit to 1.50m bgl undertaken for soakaway testing. No groundwater encountered. Trial pit terminated at 1.50m bgl.									
Stability:									

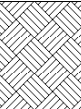
					Borehole Log			Borehole No. DSBH3-01 Sheet 1 of 1		
Project Name: Millom Iron Line					Project No. B080874.301		Co-ords: -		Hole Type WS	
Location: Milliom					Level:			Scale 1:40		
Client: Cumberland Council					Dates: 02/09/2024 - 02/09/2024			Logged By LW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					0.21			Grass over TOPSOIL: Reddish brown slightly sandy clay with frequent rootlets. Sand is fine to coarse.	1 2 3 4 5 6 7 8	
		0.50	ES					Firm light reddish brown slightly sandy very gravelly CLAY with occasional cobbles. Sand is fine to coarse. Gravel is fine to coarse subangular to angular of limestone. Cobbles of limestone.		
		1.20		N=6 (1,2/1,1,2,2)				Limited recovery due to cobble blocking the end of the sampler.		
		2.00 2.00 - 2.50	D	N=5 (1,1/1,2,1,1)	2.00			Firm reddish brown slightly sandy gravelly CLAY with cobbles. Sand is fine to coarse. Gravel is fine to coarse subangular to angular of limestone. Cobbles of limestone.		
		3.00		N=6 (1,2/1,2,2,1)				Reddish brown limestone cobble.		
		4.00		N=9 (2,3/3,2,2,2)	4.45			End of borehole at 4.45 m		
Remarks Hand excavated to 1.20m bgl. No groundwater encountered. Borehole terminated at 4.45m bgl due to multiple collapses of the borehole - undertaken in the same areas as SA3-02 which encountered cobbles and boulders of limestone, potential explanation for the collapse.										



					Borehole Log			Borehole No. DSBH5-01 Sheet 1 of 1		
Project Name: Millom Iron Line					Project No. B080874.301		Co-ords: -		Hole Type WS	
Location: Milliom					Level:			Scale 1:40		
Client: Cumberland Council					Dates: 03/09/2024 - 03/09/2024			Logged By LW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					0.22			Grass over TOPSOIL: Reddish brown slightly sandy gravelly clay with frequent rootlets and occasional cobbles. Sand is fine to coarse. Gravel is fine to coarse subangular to angular of limestone and twigs. Cobbles of limestone. MADE GROUND: Reddish brown gravelly clay with occasional cobbles. Gravel is fine to coarse subangular to angular of grey and greenish blue slag/clinker. Cobbles of subangular to angular grey and greenish blue slag. End of borehole at 1.20 m	1	
		1.20		N=50 (25 for 100mm/26,6,6,12)	1.20					
									2	
									3	
									4	
									5	
									6	
									7	
									8	
Remarks Hand excavated to 1.20m bgl. No groundwater encountered. Terminated at 1.20m bgl in hard Made Ground. Large cobbles at the base of the hand excavated pit leading to SPT refusal.										

					Borehole Log			Borehole No. DSBH5-02 Sheet 1 of 1		
Project Name: Millom Iron Line					Project No. B080874.301		Co-ords: -		Hole Type WS	
Location: Milliom					Level:			Scale 1:40		
Client: Cumberland Council					Dates: 03/09/2024 - 03/09/2024			Logged By LW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		1.20	D	N=3 (1,0/1,1,0,1)	1.35			Grass over TOPSOIL: Dark brown slightly sandy slightly gravelly clay with frequent rootlets. Sand is fine to coarse. Gravel is fine to coarse subangular to angular of limestone, brick and occasional clinker.	1	
					1.68					
		2.00		N=8 (1,2/1,2,2,3)	2.05					
		2.50								
		3.00		N=9 (3,3/2,2,2,3)	3.45					
		4.00	B	N=8 (2,2/2,2,2,2)			MADE GROUND: Light orangish/pinkish brown slightly gravelly fine to medium SAND. Gravel is fine to coarse subangular to subrounded of limestone. MADE GROUND: Dark purplish brown clayey gravelly SAND with rare cobbles. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded of limestone, coal and clinker. Cobbles of limestone. Firm to stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse subrounded of limestone and mudstone.	2		
		4.00 - 5.00								
		5.00		N=7 (2,2/1,2,2,2)						
		5.45			End of borehole at 5.45 m	3				
							4			
							5			
							6			
							7			
							8			
Remarks Hand excavated to 1.20m bgl. No groundwater encountered. Borehole complete at 5.45m bgl.										

					Borehole Log			Borehole No. DSBH7-01 Sheet 1 of 1				
Project Name: Millom Iron Line					Project No. B080874.301		Co-ords: -		Hole Type WS			
Location: Milliom					Level:			Scale 1:40				
Client: Cumberland Council					Dates: 03/09/2024 - 03/09/2024			Logged By LW				
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description				
		Depth (m)	Type	Results								
		0.20	ES	N=1 (1,0/0,0,1,0)	0.05			MADE GROUND: Tarmac.				
		1.20	D		0.20			MADE GROUND: Dark brown and black cobbly gravelly fine to coarse sand. Gravel is fine to coarse subangular to angular of brick, limestone and tarmac. Cobbles of brick.				
					0.95			MADE GROUND: Black ashy gravelly fine to coarse sand. Gravel is fine to coarse subangular to angular of brick and coal.				
					1.15			Medium dense cream and yellow slightly clayey slightly gravelly fine to medium SAND. Gravel is fine to medium of sandstone and quartz.				
					2.00			N=10 (1,1/2,2,3,3)		2.05	Firm yellowish brown and brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium subrounded of mudstone and siltstone.	
		2.33	Band of brown fine to medium SAND. Yellow and light grey from 1.64m to 2.05m bgl.									
		3.00	D	N=26 (4,4/5,6,7,8)	3.00 - 3.45					Medium dense cream, yellow and grey fine to medium SAND.		
		4.00								N=22 (5,5/5,6,6,5)		Stiff brownish grey, reddish brown and brown mottled slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse subangular of mudstone and siltstone.
												5.00
		5.45	End of borehole at 5.45 m									
Remarks Hand excavated to 1.20m bgl. No groundwater encountered. Borehole complete at 5.45m bgl.												

					Borehole Log			Borehole No. DSBH7-02 Sheet 1 of 1		
Project Name: Millom Iron Line					Project No. B080874.301		Co-ords: -		Hole Type WS	
Location: Milliom					Level:			Scale 1:40		
Client: Cumberland Council					Dates: 03/09/2024 - 03/09/2024			Logged By LW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		0.15	ES					Brambles over TOPSOIL: Dark brown slightly gravelly sandy clay. Sand is fine to coarse. Gravel is fine to coarse subangular to angular of brick and limestone.		
					0.59					
					0.92				Firm brown mottled yellowish brown sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse subangular of mudstone and limestone.	1
		1.20 1.20 - 1.50	D	N=8 (1,1/2,1,2,3)				Stiff becoming firm greyish brown mottled brown and yellowish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse subrounded to subangular of mudstone and siltstone.	2	
		2.00		N=21 (2,3/5,5,5,6)						
		3.00		N=22 (4,4/5,5,6,6)						
		4.00		N=20 (3,3/4,5,5,6)					3	
		4.45	D						4	
					5.45			<u>Firm from 4.50m to 5.45m bgl.</u>	5	
							End of borehole at 5.45 m	6		
									7	
									8	
Remarks Hand excavated to 1.20m bgl. No groundwater encountered. Borehole complete at 5.45m bgl.										

Appendix C – TRL DCP and Soakaway Results



RESULTS OF DYNAMIC CONE PENETROMETER (DCP) TESTING

Project:	Millom Iron Line				Date of Test:	03-Sep-24
Project No.	80874		Soil type:	N/A		
Test No.	CBR7-02		Soil condition:	Unsaturated		
Undertaken at 0.195M BGL.			Operator:	RT		

Undertaken at 0.195M BGL.

Blow count	Penetration (mm)	Penetration (m)	Penetration Index (DPI) mm/blow	log DPI	log CBR	Estimated CBR1 (%) ¹	log CBR	Estimated CBR2 (%) ²
0	195	0.195						
1	210	0.210	15.0	1.176	1.143	13.9	1.237	17
2	214	0.214	2.0	0.301	2.123	132.7	2.162	145
5	243	0.243	5.8	0.763	1.605	40.3	1.673	47
5	288	0.288	9.0	0.954	1.391	24.6	1.471	30
5	345	0.345	11.4	1.057	1.276	18.9	1.363	23
2	370	0.370	12.5	1.097	1.231	17.0	1.321	21
2	388	0.388	9.0	0.954	1.391	24.6	1.471	30
2	396	0.396	4.0	0.602	1.786	61.1	1.844	70
2	405	0.405	4.5	0.653	1.728	53.5	1.790	62
4	420	0.420	3.8	0.574	1.817	65.6	1.873	75
4	440	0.440	5.0	0.699	1.677	47.6	1.741	55
4	460	0.460	5.0	0.699	1.677	47.6	1.741	55
3	486	0.486	8.7	0.938	1.410	25.7	1.489	31
3	519	0.519	11.0	1.041	1.294	19.7	1.379	24
3	650	0.650	43.7	1.640	0.623	4.2	0.746	6
1	674	0.674	24.0	1.380	0.914	8.2	1.021	10
1	693	0.693	19.0	1.279	1.028	10.7	1.128	13
1	711	0.711	18.0	1.255	1.054	11.3	1.153	14
2	746	0.746	17.5	1.243	1.068	11.7	1.166	15
2	801	0.801	27.5	1.439	0.848	7.0	0.959	9
2	866	0.866	32.5	1.512	0.767	5.8	0.882	8
2	924	0.924	29.0	1.462	0.822	6.6	0.934	9

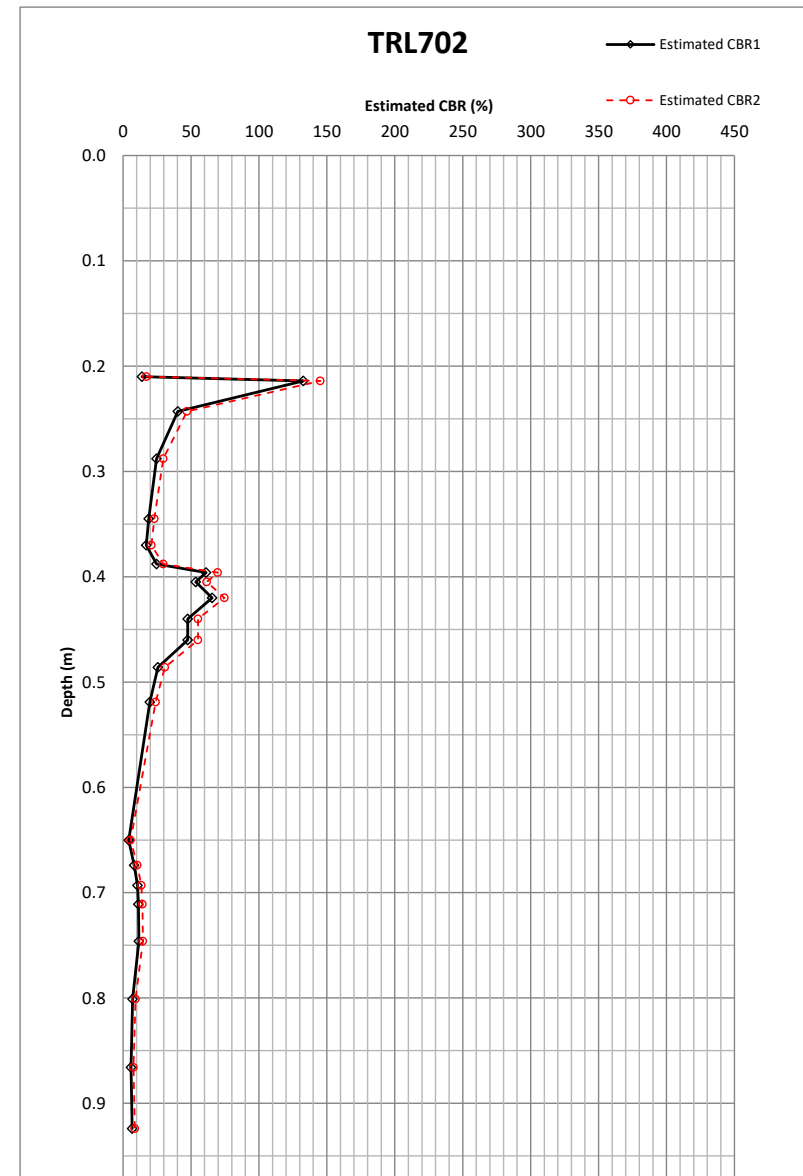
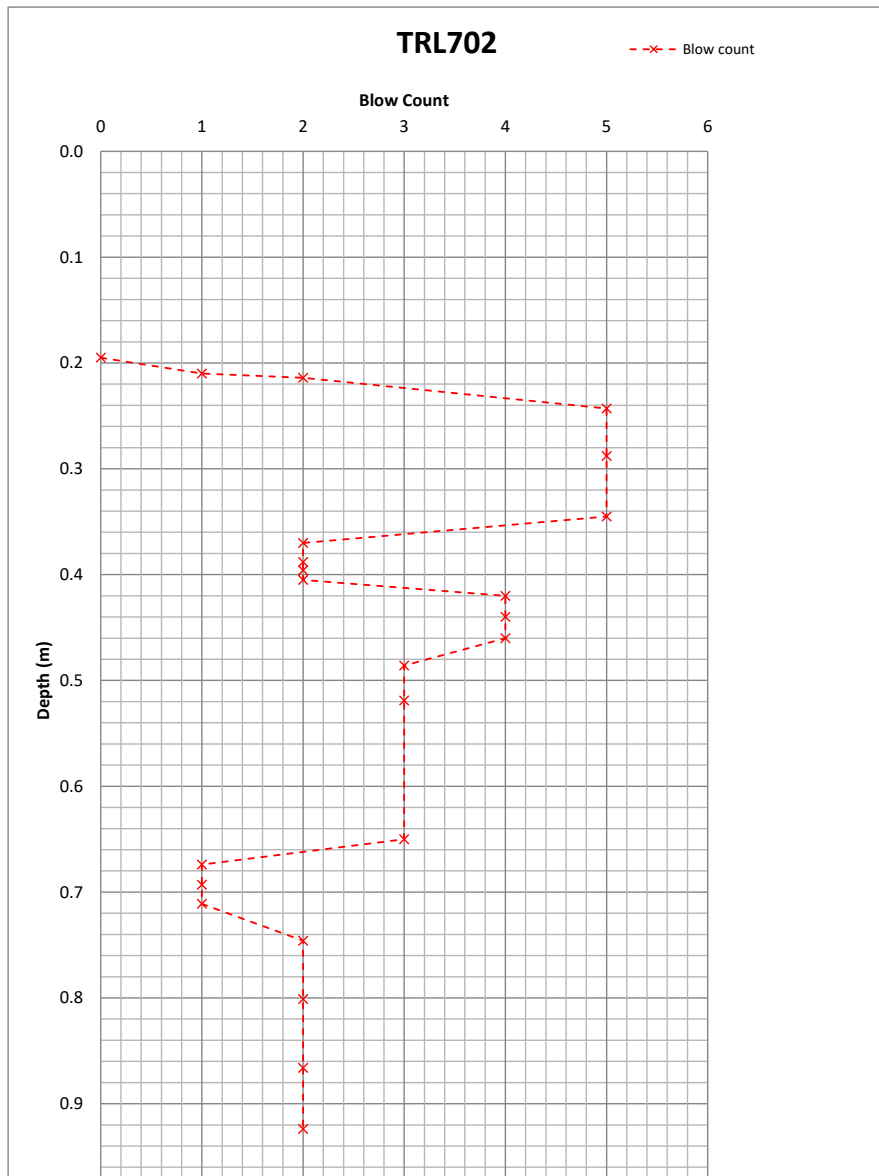
Notes:

1. CBR calculated based on Webster et al, 1992.
2. CBR calculated based on DMRB, 2008.

Reference:

- Webster S, Grau R and Williams T. 1992. Description and Application of Dual Mass Dynamic Cone Penetrometer.

Dept of Army Waterways Equipment Station, Instruction rpt GL-92-3.
- Highways Agency, 2008. Design Manual for Roads and Bridges (DMRB), Data for Pavement Assessment. HD29/08.







RESULTS OF DYNAMIC CONE PENETROMETER (DCP) TESTING

Project:	Millom Iron Line				Date of Test:	03-Sep-24	
Project No.	80874			Soil type:	N/A		
Test No.	CBR8-01			Soil condition:	Unsaturated		
Undertaken at 0.25M BGL.				Operator:	RT		

Undertaken at 0.25M BGL.

Blow count	Penetration (mm)	Penetration (m)	Penetration Index (DPI) mm/blow	log DPI	log CBR	Estimated CBR1 (%) ¹	log CBR	Estimated CBR2 (%) ²
0	160	0.160						
1	171	0.171	11.0	1.041	1.294	19.7	1.379	24
1	176	0.176	5.0	0.699	1.677	47.6	1.741	55
3	193	0.193	5.7	0.753	1.616	41.3	1.684	48
3	205	0.205	4.0	0.602	1.786	61.1	1.844	70
5	226	0.226	4.2	0.623	1.762	57.8	1.821	66
5	261	0.261	7.0	0.845	1.513	32.6	1.587	39
5	287	0.287	5.2	0.716	1.658	45.5	1.723	53
4	330	0.330	10.8	1.031	1.305	20.2	1.390	25
3	368	0.368	12.7	1.103	1.225	16.8	1.314	21
2	400	0.400	16.0	1.204	1.111	12.9	1.207	16
2	433	0.433	16.5	1.217	1.096	12.5	1.193	16
1	451	0.451	18.0	1.255	1.054	11.3	1.153	14
1	468	0.468	17.0	1.230	1.082	12.1	1.179	15
1	481	0.481	13.0	1.114	1.212	16.3	1.303	20
2	500	0.500	9.5	0.978	1.365	23.2	1.447	28
2	525	0.525	12.5	1.097	1.231	17.0	1.321	21
2	543	0.543	9.0	0.954	1.391	24.6	1.471	30
2	587	0.587	22.0	1.342	0.956	9.0	1.061	12
2	631	0.631	22.0	1.342	0.956	9.0	1.061	12
2	681	0.681	25.0	1.398	0.894	7.8	1.002	10
1	706	0.706	25.0	1.398	0.894	7.8	1.002	10
1	736	0.736	30.0	1.477	0.806	6.4	0.919	8
1	780	0.780	44.0	1.643	0.619	4.2	0.743	6
1	839	0.839	59.0	1.771	0.477	3.0	0.608	4
1	874	0.874	35.0	1.544	0.731	5.4	0.848	7
1	908	0.908	34.0	1.531	0.745	5.6	0.861	7

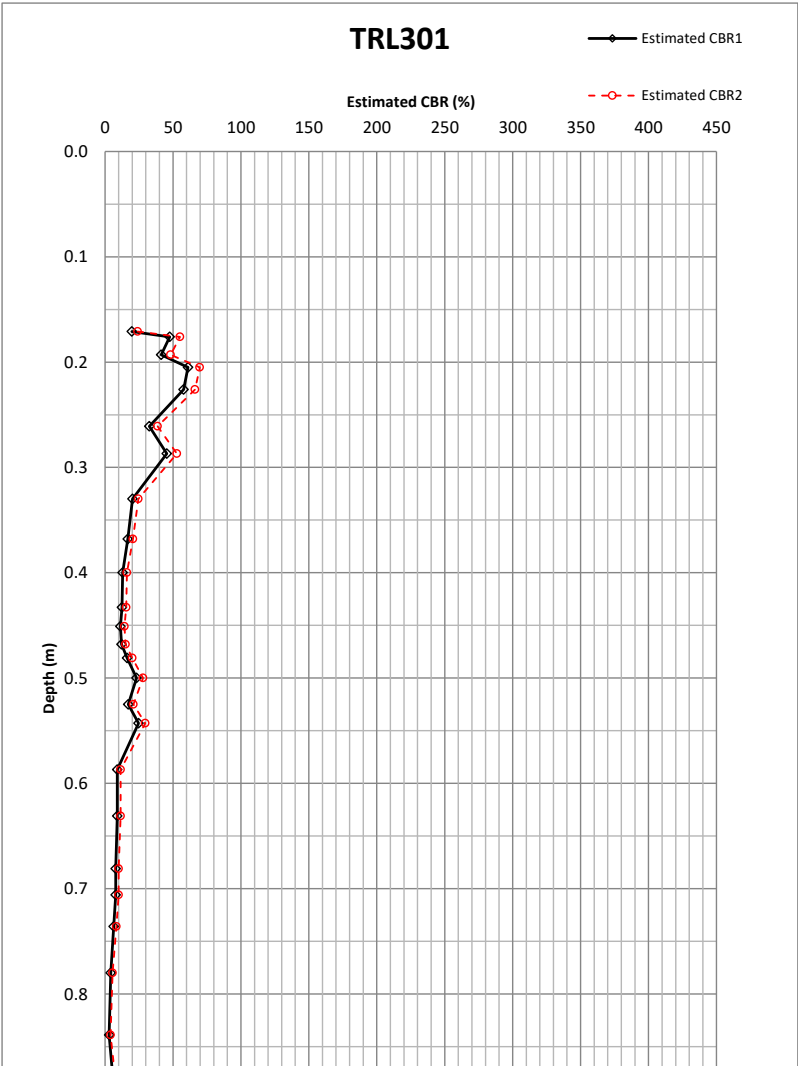
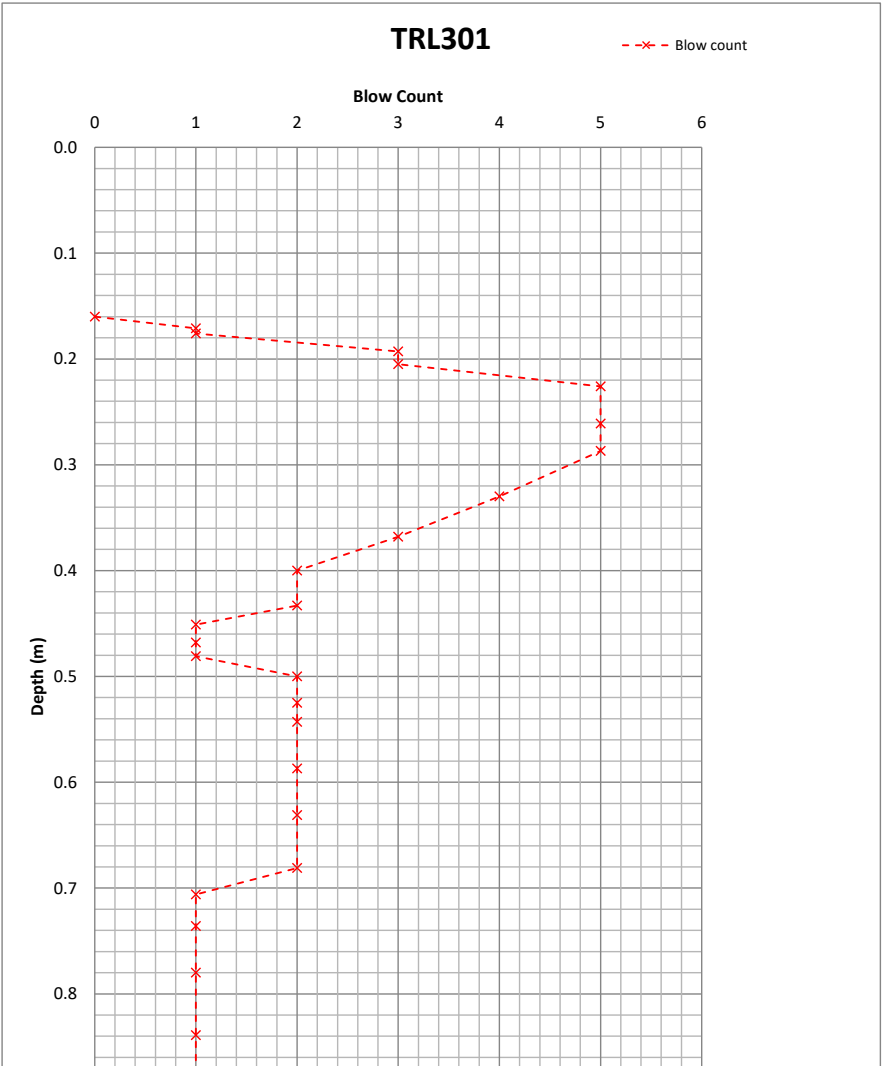
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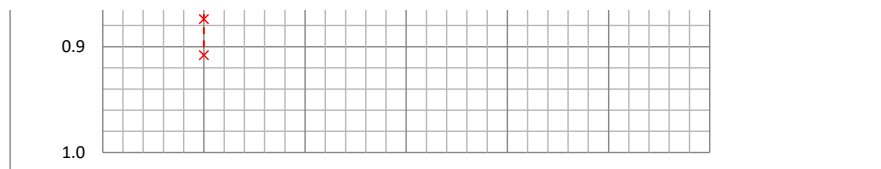
1. CBR calculated based on Webster et al, 1992.

2. CBR calculated based on DMRB, 2008.

Reference:

- Webster S, Grau R and Williams T. 1992. Description and Application of Dual Mass Dynamic Cone Penetrometer. Dept of Army Waterways Equipment Station, Instruction rpt GL-92-3.
- Highways Agency, 2008. Design Manual for Roads and Bridges (DMRB), Data for Pavement Assessment. HD29/08.







RESULTS OF DYNAMIC CONE PENETROMETER (DCP) TESTING

Project:	Millom Iron Line				Date of Test:	03-Sep-24	
Project No.	80874			Soil type:	N/A		
Test No.	CBR8-02			Soil condition:	Unsaturated		
Undertaken at 0.23M BGL.				Operator:	RT		

Undertaken at 0.23M BGL.

Blow count	Penetration (mm)	Penetration (m)	Penetration Index (DPI) mm/blow	log DPI	log CBR	Estimated CBR1 (%) ¹	log CBR	Estimated CBR2 (%) ²
0	200	0.200						
1	230	0.230	30.0	1.477	0.806	6.4	0.919	8
1	243	0.243	13.0	1.114	1.212	16.3	1.303	20
2	253	0.253	5.0	0.699	1.677	47.6	1.741	55
2	261	0.261	4.0	0.602	1.786	61.1	1.844	70
4	282	0.282	5.3	0.720	1.653	45.0	1.719	52
2	296	0.296	7.0	0.845	1.513	32.6	1.587	39
1	300	0.300	4.0	0.602	1.786	61.1	1.844	70
2	315	0.315	7.5	0.875	1.480	30.2	1.555	36
2	326	0.326	5.5	0.740	1.631	42.7	1.697	50
2	343	0.343	8.5	0.929	1.419	26.2	1.498	31
1	350	0.350	7.0	0.845	1.513	32.6	1.587	39
2	374	0.374	12.0	1.079	1.251	17.8	1.339	22
1	382	0.382	8.0	0.903	1.449	28.1	1.525	34
1	395	0.395	13.0	1.114	1.212	16.3	1.303	20
2	423	0.423	14.0	1.146	1.176	15.0	1.269	19
1	433	0.433	10.0	1.000	1.340	21.9	1.423	26
1	444	0.444	11.0	1.041	1.294	19.7	1.379	24
2	464	0.464	10.0	1.000	1.340	21.9	1.423	26
2	480	0.480	8.0	0.903	1.449	28.1	1.525	34
2	499	0.499	9.5	0.978	1.365	23.2	1.447	28
1	506	0.506	7.0	0.845	1.513	32.6	1.587	39
2	520	0.520	7.0	0.845	1.513	32.6	1.587	39
2	533	0.533	6.5	0.813	1.550	35.4	1.621	42
2	544	0.544	5.5	0.740	1.631	42.7	1.697	50
2	559	0.559	7.5	0.875	1.480	30.2	1.555	36
2	572	0.572	6.5	0.813	1.550	35.4	1.621	42
2	582	0.582	5.0	0.699	1.677	47.6	1.741	55
3	604	0.604	7.3	0.865	1.491	31.0	1.565	37

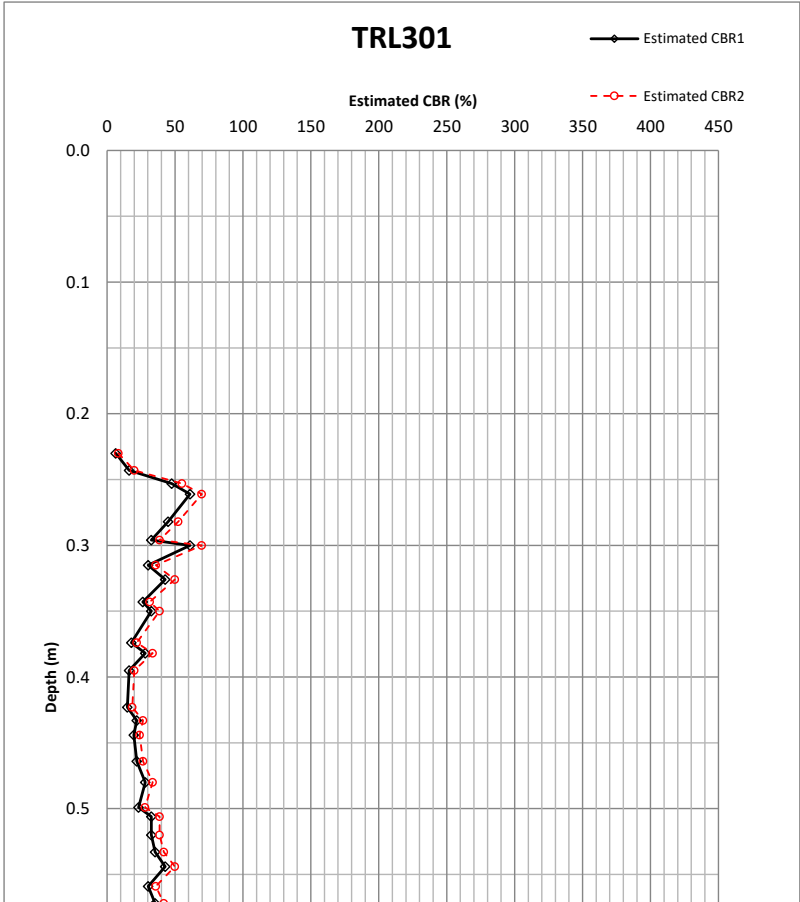
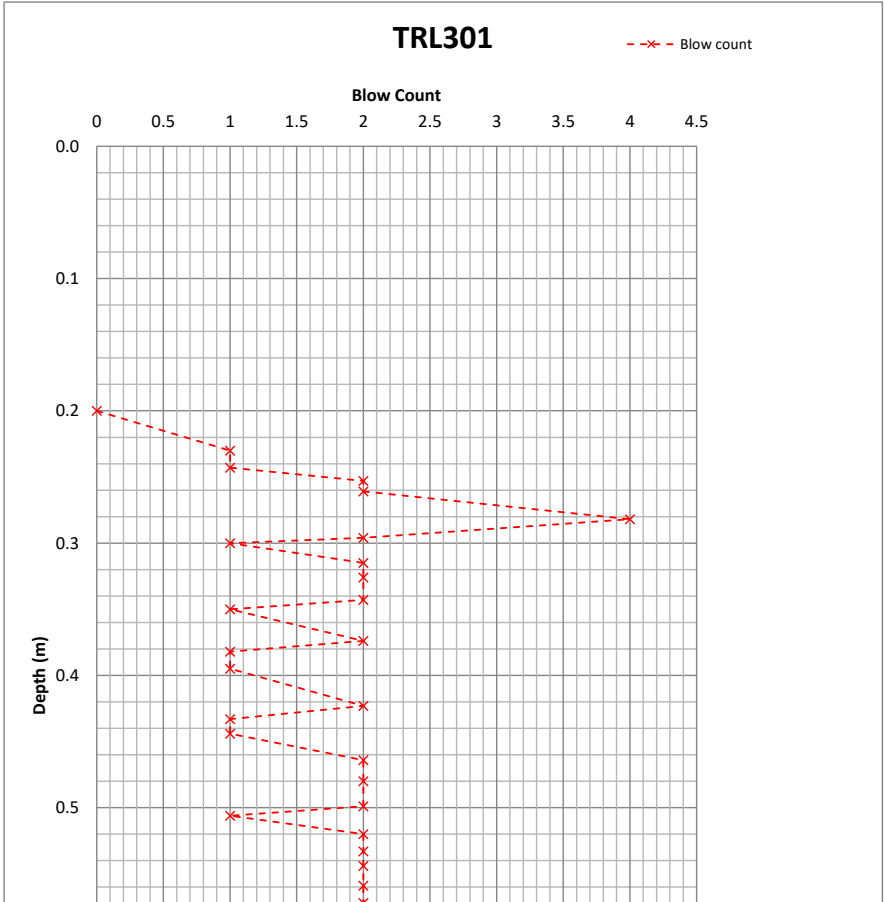
3	629	0.629	8.3	0.921	1.429	26.8	1.507	32
2	639	0.639	5.0	0.699	1.677	47.6	1.741	55
3	657	0.657	6.0	0.778	1.588	38.8	1.657	45
3	677	0.677	6.7	0.824	1.537	34.5	1.609	41

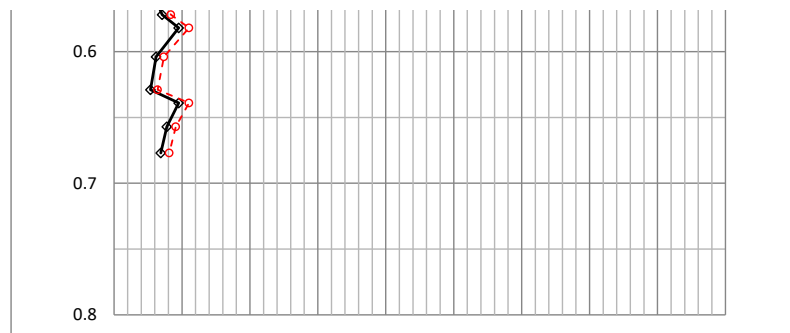
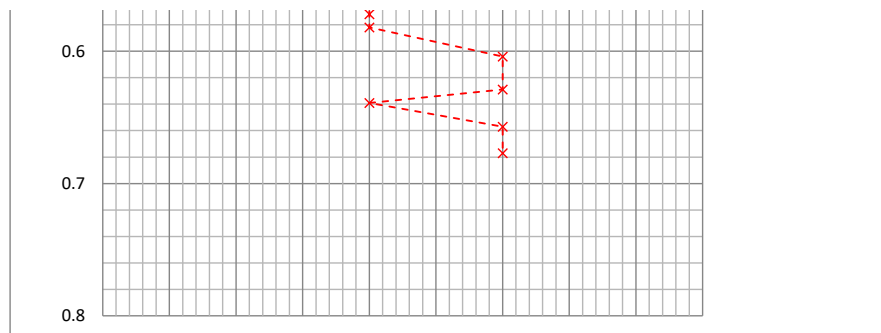
Notes:

1. CBR calculated based on Webster et al, 1992.
2. CBR calculated based on DMRB, 2008.

Reference:

- Webster S, Grau R and Williams T. 1992. Description and Application of Dual Mass Dynamic Cone Penetrometer. Dept of Army Waterways Equipment Station, Instruction rpt GL-92-3.
- Highways Agency, 2008. Design Manual for Roads and Bridges (DMRB), Data for Pavement Assessment. HD29/08.







RESULTS OF DYNAMIC CONE PENETROMETER (DCP) TESTING

Project:	Millom Iron Line				Date of Test:	04-Sep-24
Project No.	80874		Soil type:	N/A		
Test No.	CBR9-01		Soil condition:	Unsaturated		
			Operator:	RT		
Undertaken at ground level.						

Undertaken at ground level.

Blow count	Penetration (mm)	Penetration (m)	Penetration Index (DPI) mm/blow	log DPI	log CBR	Estimated CBR1 (%) ¹	log CBR	Estimated CBR2 (%) ²
0	300	0.300						
1	357	0.357	57.0	1.756	0.493	3.1	0.624	4
1	403	0.403	46.0	1.663	0.598	4.0	0.722	5
1	433	0.433	30.0	1.477	0.806	6.4	0.919	8
1	453	0.453	20.0	1.301	1.003	10.1	1.105	13
1	473	0.473	20.0	1.301	1.003	10.1	1.105	13
1	491	0.491	18.0	1.255	1.054	11.3	1.153	14
1	509	0.509	18.0	1.255	1.054	11.3	1.153	14
1	524	0.524	15.0	1.176	1.143	13.9	1.237	17
1	544	0.544	20.0	1.301	1.003	10.1	1.105	13
1	562	0.562	18.0	1.255	1.054	11.3	1.153	14
1	578	0.578	16.0	1.204	1.111	12.9	1.207	16
1	597	0.597	19.0	1.279	1.028	10.7	1.128	13
1	614	0.614	17.0	1.230	1.082	12.1	1.179	15
1	629	0.629	15.0	1.176	1.143	13.9	1.237	17
1	646	0.646	17.0	1.230	1.082	12.1	1.179	15
1	661	0.661	15.0	1.176	1.143	13.9	1.237	17
1	676	0.676	15.0	1.176	1.143	13.9	1.237	17
1	689	0.689	13.0	1.114	1.212	16.3	1.303	20
1	703	0.703	14.0	1.146	1.176	15.0	1.269	19
1	710	0.710	7.0	0.845	1.513	32.6	1.587	39
2	721	0.721	5.5	0.740	1.631	42.7	1.697	50
2	726	0.726	2.5	0.398	2.014	103.3	2.059	115
5	738	0.738	2.4	0.380	2.034	108.2	2.078	120
6	787	0.787	8.2	0.912	1.439	27.4	1.516	33
3	819	0.819	10.7	1.028	1.309	20.4	1.393	25
2	836	0.836	8.5	0.929	1.419	26.2	1.498	31
2	856	0.856	10.0	1.000	1.340	21.9	1.423	26
2	868	0.868	6.0	0.778	1.588	38.8	1.657	45

3	887	0.887	6.3	0.802	1.562	36.5	1.633	43
2	934	0.934	23.5	1.371	0.924	8.4	1.031	11
2	963	0.963	14.5	1.161	1.159	14.4	1.252	18
2	992	0.992	14.5	1.161	1.159	14.4	1.252	18
2	1023	1.023	15.5	1.190	1.127	13.4	1.222	17
1	1040	1.040	17.0	1.230	1.082	12.1	1.179	15
1	1055	1.055	15.0	1.176	1.143	13.9	1.237	17
1	1078	1.078	23.0	1.362	0.935	8.6	1.041	11

1. CBR calculated based on Webster et al, 1992.

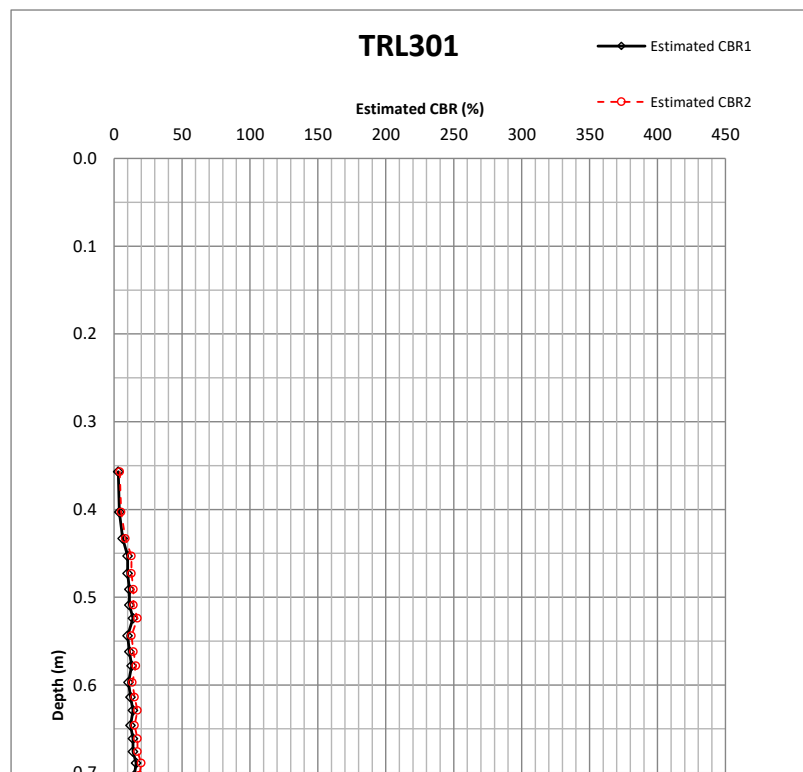
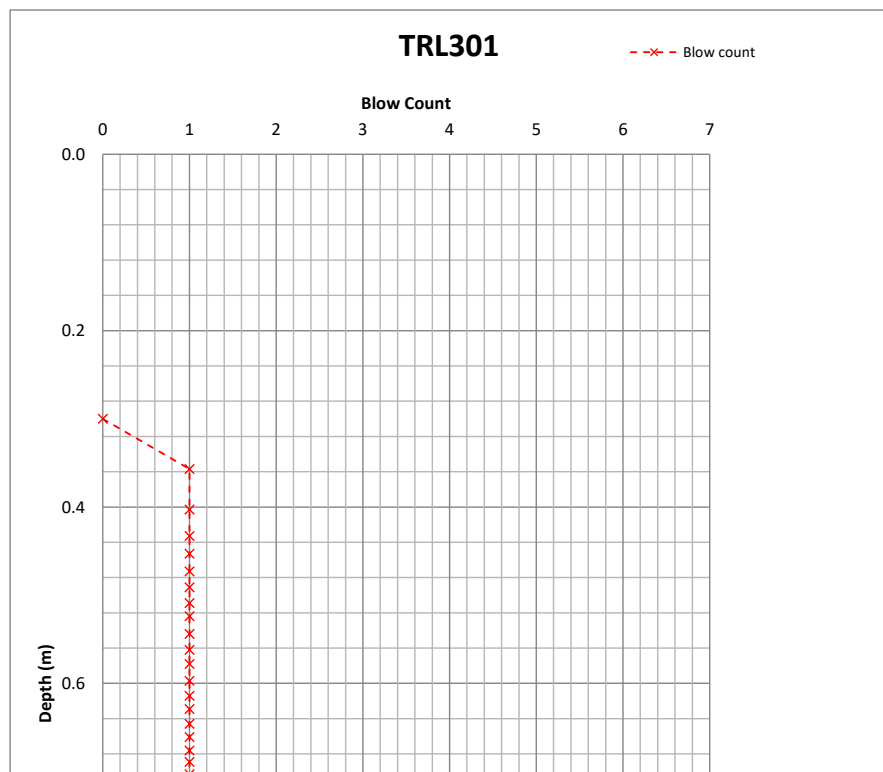
2. CBR calculated based on DMRB, 2008.

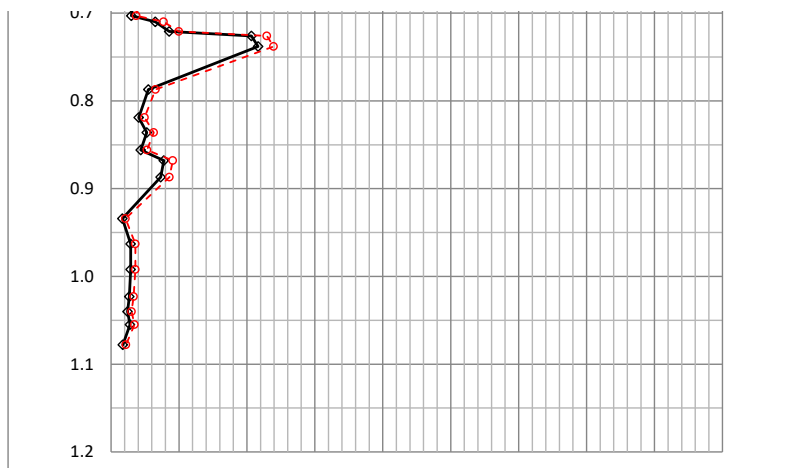
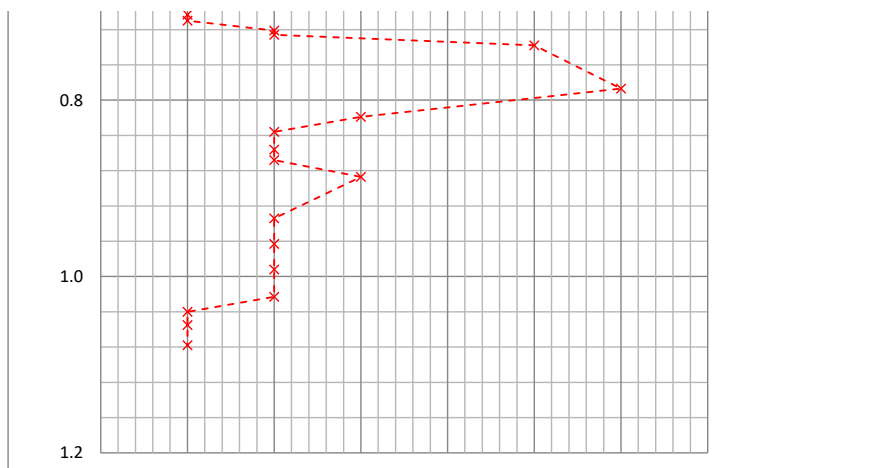
Reference:

- Webster S, Grau R and Williams T. 1992. Description and Application of Dual Mass Dynamic Cone Penetrometer.

Dept of Army Waterways Equipment Station, Instruction rpt GL-92-3.

- Highways Agency, 2008. Design Manual for Roads and Bridges (DMRB), Data for Pavement Assessment. HD29/08.







RESULTS OF DYNAMIC CONE PENETROMETER (DCP) TESTING

Project:	Millom Iron Line				Date of Test:	04-Sep-24	
Project No.	80874		Soil type:	N/A			
Test No.	CBR9-02		Soil condition:	Unsaturated			
			Operator:	RT			

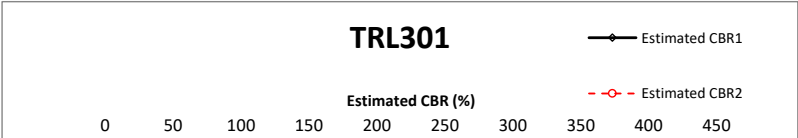
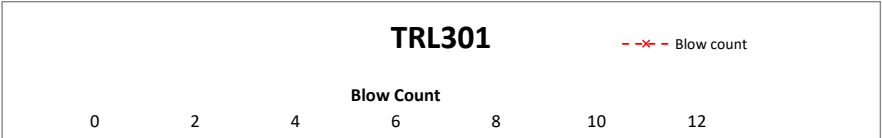
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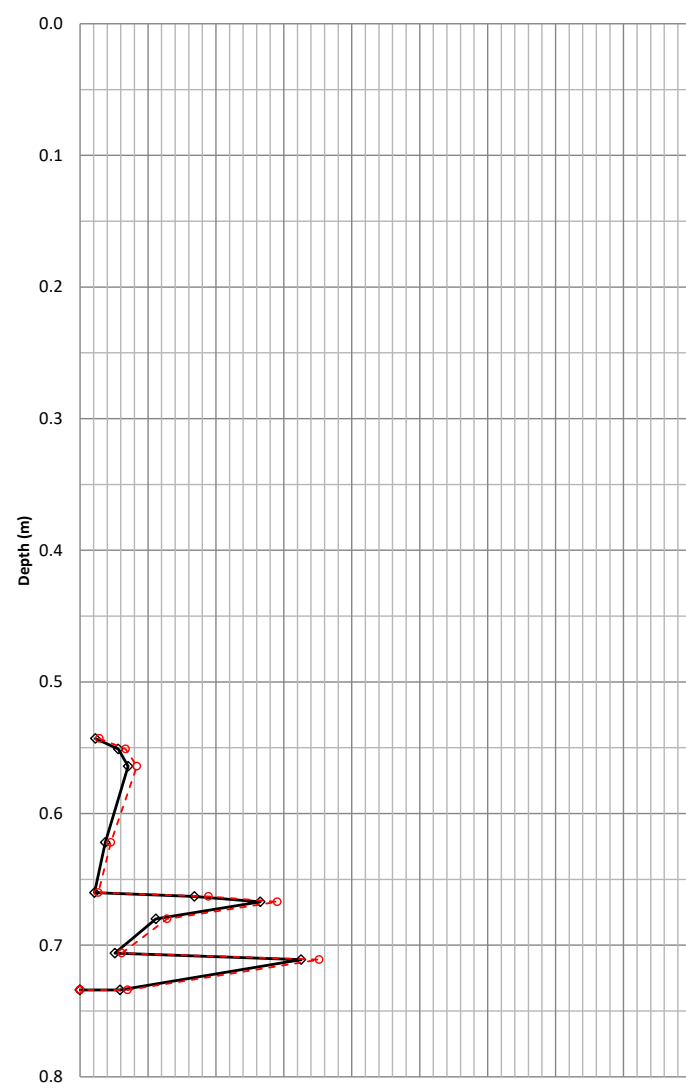
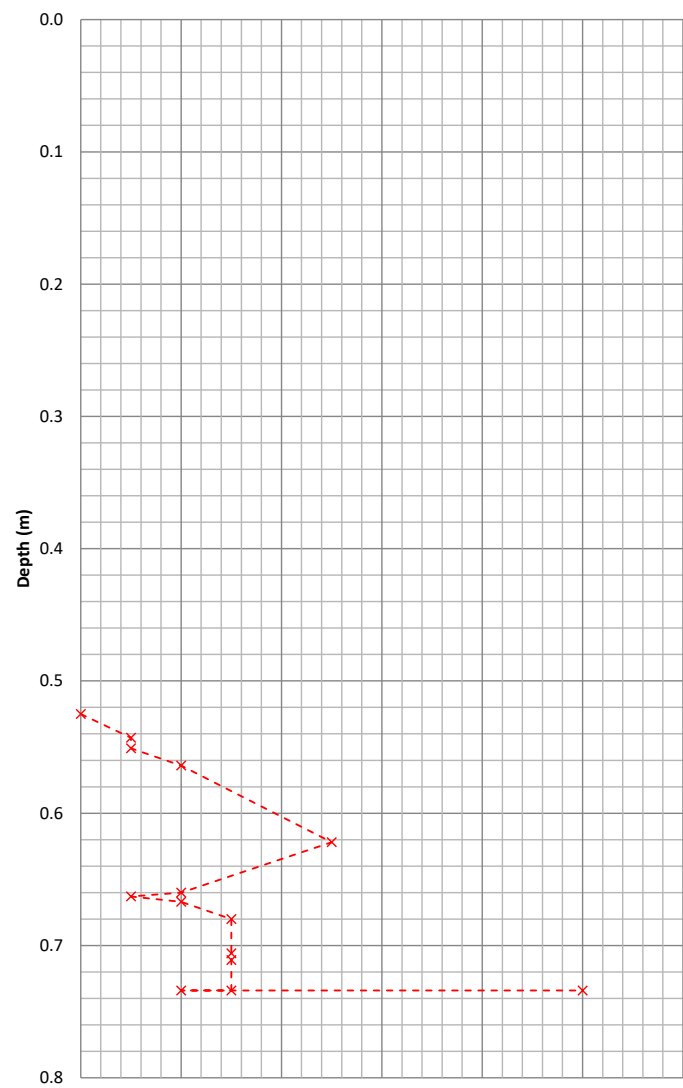
Blow count	Penetration (mm)	Penetration (m)	Penetration Index (DPI) mm/blow	log DPI	log CBR	Estimated CBR1 (%) ¹	log CBR	Estimated CBR2 (%) ²
0	525	0.525						
1	543	0.543	18.0	1.255	1.054	11.3	1.153	14
1	551	0.551	8.0	0.903	1.449	28.1	1.525	34
2	564	0.564	6.5	0.813	1.550	35.4	1.621	42
5	622	0.622	11.6	1.064	1.268	18.5	1.355	23
2	660	0.660	19.0	1.279	1.028	10.7	1.128	13
1	663	0.663	3.0	0.477	1.926	84.3	1.976	95
2	667	0.667	2.0	0.301	2.123	132.7	2.162	145
3	680	0.680	4.3	0.637	1.747	55.8	1.807	64
3	706	0.706	8.7	0.938	1.410	25.7	1.489	31
3	711	0.711	1.7	0.222	2.212	162.8	2.246	176
3	734	0.734	7.7	0.885	1.469	29.5	1.545	35
2	734	0.734	0.0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
10	734	0.734	0.0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!

1. CBR calculated based on Webster et al, 1992.
2. CBR calculated based on DMRB, 2008.

Reference:

- Webster S, Grau R and Williams T. 1992. Description and Application of Dual Mass Dynamic Cone Penetrometer. Dept of Army Waterways Equipment Station, Instruction rpt GL-92-3.
- Highways Agency, 2008. Design Manual for Roads and Bridges (DMRB), Data for Pavement Assessment. HD29/08.







RESULTS OF DYNAMIC CONE PENETROMETER (DCP) TESTING

Project:	Millom Iron Line				Date of Test:	04-Sep-24	
Project No.	80874			Soil type:	N/A		
Test No.	CBR9-03			Soil condition:	Unsaturated		
Undertaken at 0.22M BGL.				Operator:	RT		

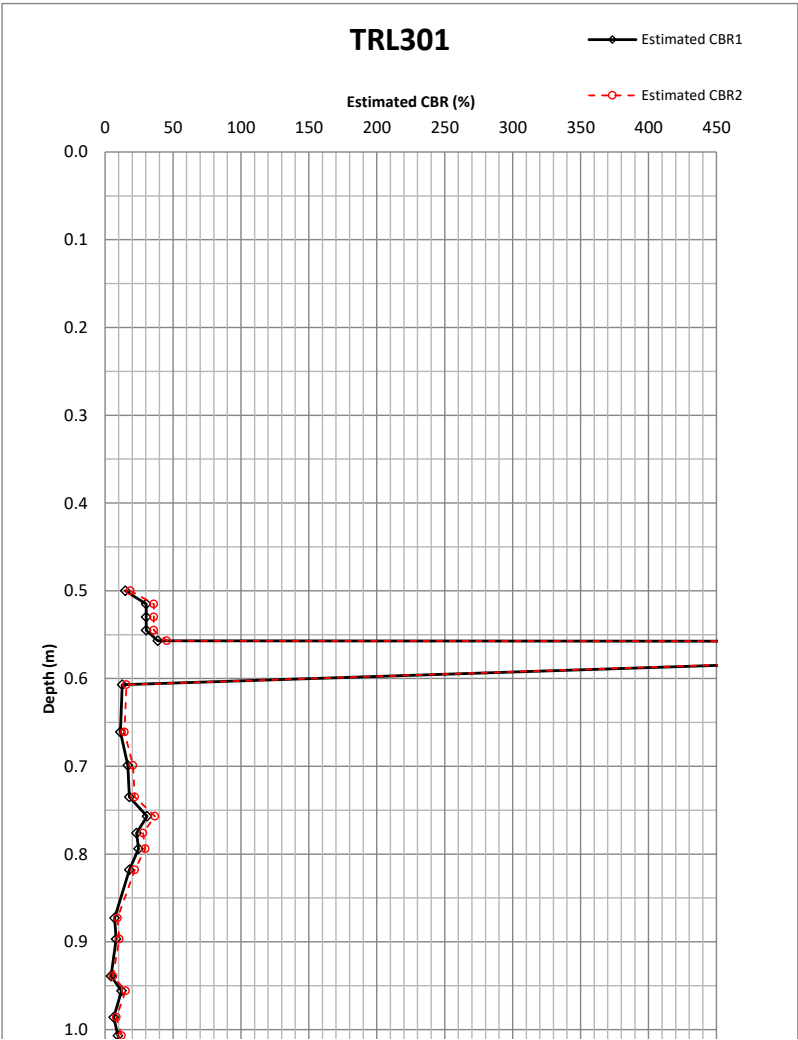
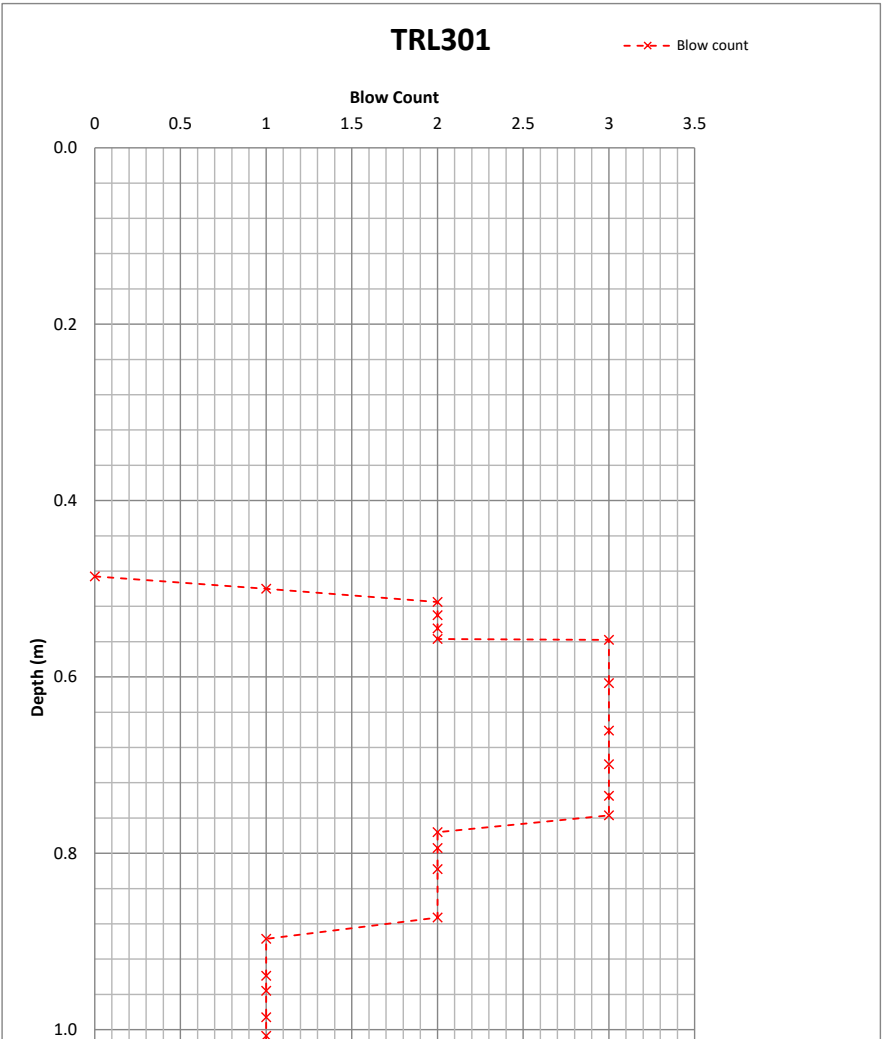
Undertaken at 0.22M BGL.

Blow count	Penetration (mm)	Penetration (m)	Penetration Index (DPI) mm/blow	log DPI	log CBR	Estimated CBR1 (%) ¹	log CBR	Estimated CBR2 (%) ²
0	486	0.486						
1	500	0.500	14.0	1.146	1.176	15.0	1.269	19
2	515	0.515	7.5	0.875	1.480	30.2	1.555	36
2	530	0.530	7.5	0.875	1.480	30.2	1.555	36
2	545	0.545	7.5	0.875	1.480	30.2	1.555	36
2	557	0.557	6.0	0.778	1.588	38.8	1.657	45
3	558	0.558	0.3	-0.477	2.994	987.1	2.984	965
3	607	0.607	16.3	1.213	1.101	12.6	1.198	16
3	661	0.661	18.0	1.255	1.054	11.3	1.153	14
3	699	0.699	12.7	1.103	1.225	16.8	1.314	21
3	735	0.735	12.0	1.079	1.251	17.8	1.339	22
3	757	0.757	7.3	0.865	1.491	31.0	1.565	37
2	776	0.776	9.5	0.978	1.365	23.2	1.447	28
2	794	0.794	9.0	0.954	1.391	24.6	1.471	30
2	818	0.818	12.0	1.079	1.251	17.8	1.339	22
2	873	0.873	27.5	1.439	0.848	7.0	0.959	9
1	897	0.897	24.0	1.380	0.914	8.2	1.021	10
1	939	0.939	42.0	1.623	0.642	4.4	0.764	6
1	956	0.956	17.0	1.230	1.082	12.1	1.179	15
1	986	0.986	30.0	1.477	0.806	6.4	0.919	8
1	1007	1.007	21.0	1.322	0.979	9.5	1.082	12
1	1025	1.025	18.0	1.255	1.054	11.3	1.153	14
1	1041	1.041	16.0	1.204	1.111	12.9	1.207	16
1	1070	1.070	29.0	1.462	0.822	6.6	0.934	9
1	1074	1.074	4.0	0.602	1.786	61.1	1.844	70
2	1083	1.083	4.5	0.653	1.728	53.5	1.790	62
2	1088	1.088	2.5	0.398	2.014	103.3	2.059	115
2	1092	1.092	2.0	0.301	2.123	132.7	2.162	145

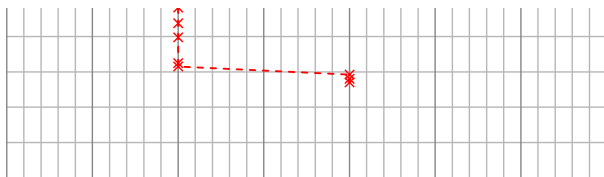
- 1. CBR calculated based on Webster et al, 1992.
- 2. CBR calculated based on DMRB, 2008.

Reference:

- Webster S, Grau R and Williams T. 1992. Description and Application of Dual Mass Dynamic Cone Penetrometer. Dept of Army Waterways Equipment Station, Instruction rpt GL-92-3.
- Highways Agency, 2008. Design Manual for Roads and Bridges (DMRB), Data for Pavement Assessment. HD29/08.

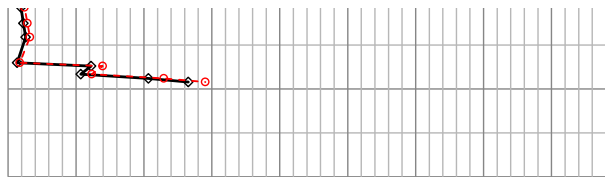


1.2



1.1

1.2





RESULTS OF DYNAMIC CONE PENETROMETER (DCP) TESTING

Project:	Millom Iron Line				Date of Test:	04-Sep-24	
Project No.	80874			Soil type:	N/A		
Test No.	CBR10-01			Soil condition:	Unsaturated		
Undertaken at 0.26M BGL.				Operator:	RT		

Undertaken at 0.26M BGL.

Blow count	Penetration (mm)	Penetration (m)	Penetration Index (DPI) mm/blow	log DPI	log CBR	Estimated CBR1 (%) ¹	log CBR	Estimated CBR2 (%) ²
0	531	0.531						
1	542	0.542	11.0	1.041	1.294	19.7	1.379	24
2	580	0.580	19.0	1.279	1.028	10.7	1.128	13
2	610	0.610	15.0	1.176	1.143	13.9	1.237	17
1	620	0.620	10.0	1.000	1.340	21.9	1.423	26
1	631	0.631	11.0	1.041	1.294	19.7	1.379	24
1	649	0.649	18.0	1.255	1.054	11.3	1.153	14
1	663	0.663	14.0	1.146	1.176	15.0	1.269	19
1	681	0.681	18.0	1.255	1.054	11.3	1.153	14
1	724	0.724	43.0	1.633	0.631	4.3	0.753	6
1	731	0.731	7.0	0.845	1.513	32.6	1.587	39
1	750	0.750	19.0	1.279	1.028	10.7	1.128	13
1	759	0.759	9.0	0.954	1.391	24.6	1.471	30
2	772	0.772	6.5	0.813	1.550	35.4	1.621	42
2	790	0.790	9.0	0.954	1.391	24.6	1.471	30
2	816	0.816	13.0	1.114	1.212	16.3	1.303	20
2	843	0.843	13.5	1.130	1.194	15.6	1.285	19
2	861	0.861	9.0	0.954	1.391	24.6	1.471	30
2	867	0.867	3.0	0.477	1.926	84.3	1.976	95
3	894	0.894	9.0	0.954	1.391	24.6	1.471	30
2	895	0.895	0.5	-0.301	2.797	626.8	2.798	628
5	944	0.944	9.8	0.991	1.350	22.4	1.432	27
3	960	0.960	5.3	0.727	1.646	44.2	1.712	51
2	990	0.990	15.0	1.176	1.143	13.9	1.237	17
2	994	0.994	2.0	0.301	2.123	132.7	2.162	145
3	999	0.999	1.7	0.222	2.212	162.8	2.246	176
5	1023	1.023	4.8	0.681	1.697	49.8	1.760	58
5	1046	1.046	4.6	0.663	1.718	52.2	1.779	60
5	1073	1.073	5.4	0.732	1.640	43.6	1.706	51

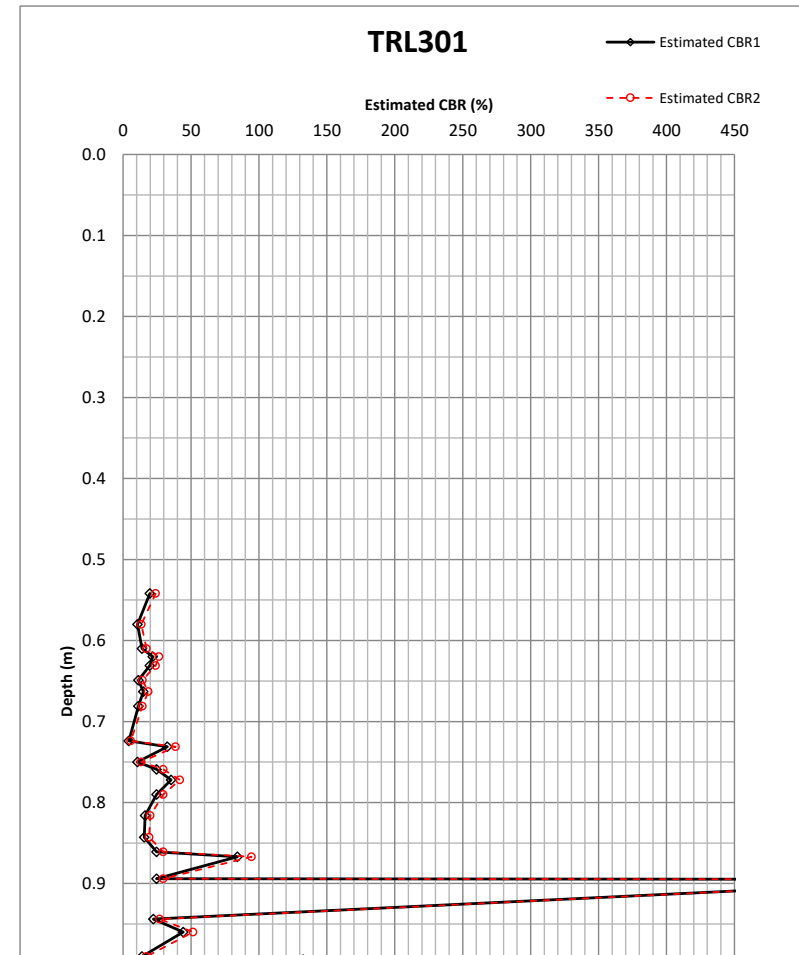
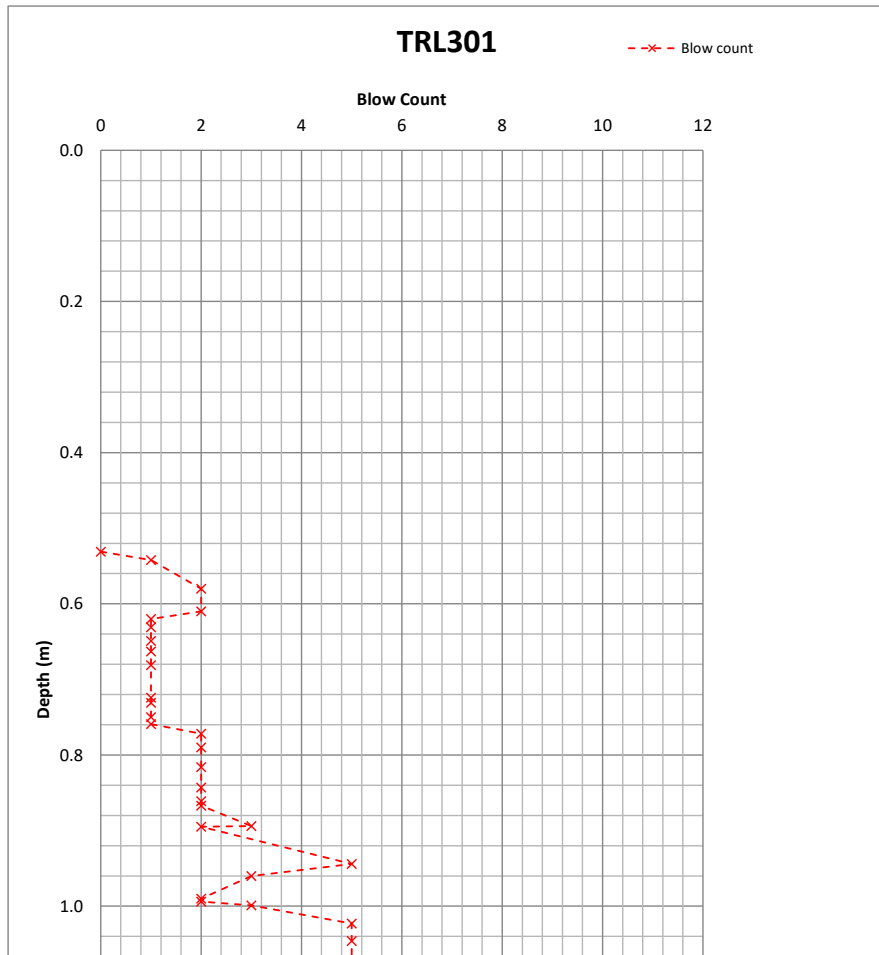
10	1124	1.124	5.1	0.708	1.668	46.5	1.732	54
10	1185	1.185	6.1	0.785	1.580	38.1	1.650	45

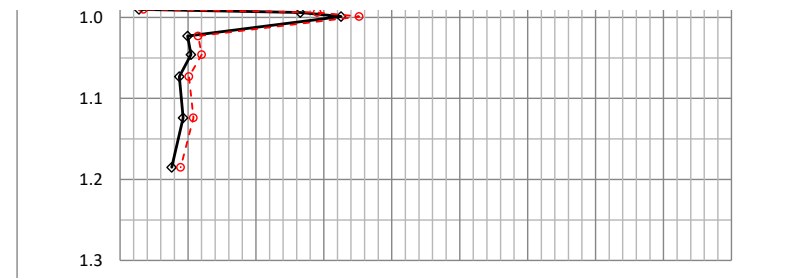
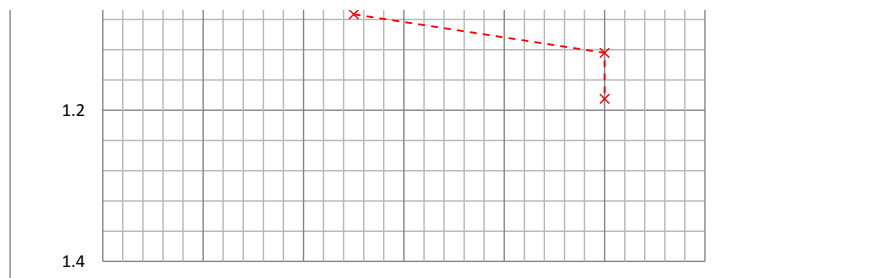
Notes:

1. CBR calculated based on Webster et al, 1992.
2. CBR calculated based on DMRB, 2008.

Reference:

- Webster S, Grau R and Williams T. 1992. Description and Application of Dual Mass Dynamic Cone Penetrometer. Dept of Army Waterways Equipment Station, Instruction rpt GL-92-3.
- Highways Agency, 2008. Design Manual for Roads and Bridges (DMRB), Data for Pavement Assessment. HD29/08.







RESULTS OF DYNAMIC CONE PENETROMETER (DCP) TESTING

Project:	Millom Iron Line				Date of Test:	04-Sep-24	
Project No.	80874			Soil type:	N/A		
Test No.	CBR10-01			Soil condition:	Unsaturated		
Undertaken at 0.28M BGL.				Operator:	RT		

Undertaken at 0.28M BGL.

Blow count	Penetration (mm)	Penetration (m)	Penetration Index (DPI) mm/blow	log DPI	log CBR	Estimated CBR1 (%) ¹	log CBR	Estimated CBR2 (%) ²
0	485	0.485						
1	491	0.491	6.0	0.778	1.588	38.8	1.657	45
2	504	0.504	6.5	0.813	1.550	35.4	1.621	42
5	531	0.531	5.4	0.732	1.640	43.6	1.706	51
2	546	0.546	7.5	0.875	1.480	30.2	1.555	36
2	560	0.560	7.0	0.845	1.513	32.6	1.587	39
2	574	0.574	7.0	0.845	1.513	32.6	1.587	39
2	588	0.588	7.0	0.845	1.513	32.6	1.587	39
3	605	0.605	5.7	0.753	1.616	41.3	1.684	48
3	625	0.625	6.7	0.824	1.537	34.5	1.609	41
2	637	0.637	6.0	0.778	1.588	38.8	1.657	45
2	651	0.651	7.0	0.845	1.513	32.6	1.587	39
2	665	0.665	7.0	0.845	1.513	32.6	1.587	39
2	673	0.673	4.0	0.602	1.786	61.1	1.844	70
2	683	0.683	5.0	0.699	1.677	47.6	1.741	55
2	696	0.696	6.5	0.813	1.550	35.4	1.621	42
2	710	0.710	7.0	0.845	1.513	32.6	1.587	39
2	720	0.720	5.0	0.699	1.677	47.6	1.741	55
2	728	0.728	4.0	0.602	1.786	61.1	1.844	70
3	740	0.740	4.0	0.602	1.786	61.1	1.844	70
3	748	0.748	2.7	0.426	1.983	96.1	2.030	107
3	756	0.756	2.7	0.426	1.983	96.1	2.030	107
3	766	0.766	3.3	0.523	1.874	74.9	1.927	85
3	776	0.776	3.3	0.523	1.874	74.9	1.927	85
3	791	0.791	5.0	0.699	1.677	47.6	1.741	55
3	804	0.804	4.3	0.637	1.747	55.8	1.807	64
3	822	0.822	6.0	0.778	1.588	38.8	1.657	45
3	834	0.834	4.0	0.602	1.786	61.1	1.844	70
3	836	0.836	0.7	-0.176	2.657	454.2	2.666	464

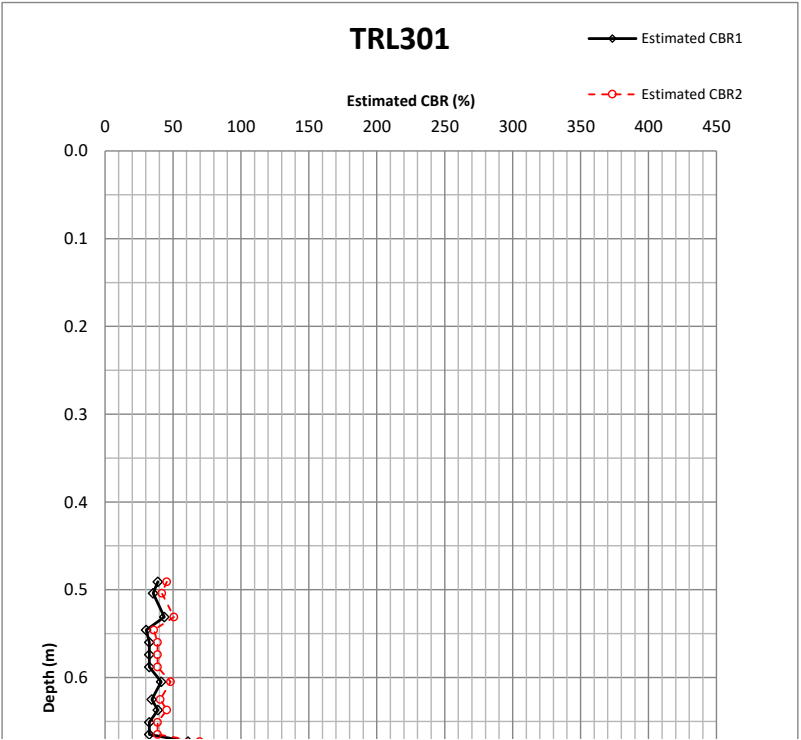
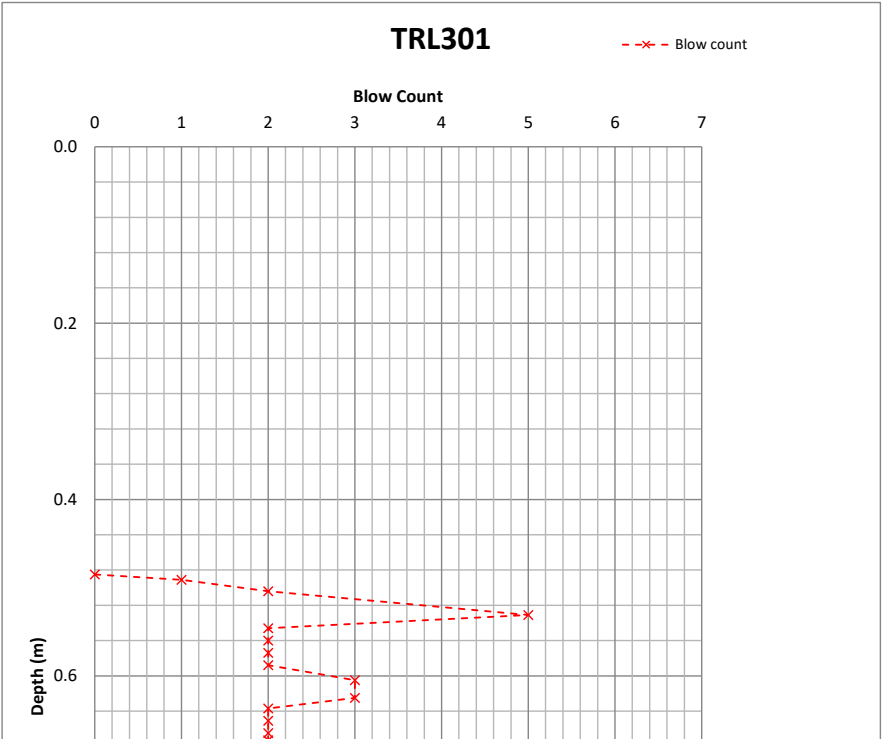
6	862	0.862	4.3	0.637	1.747	55.8	1.807	64
4	893	0.893	7.8	0.889	1.464	29.1	1.540	35
3	910	0.910	5.7	0.753	1.616	41.3	1.684	48
3	940	0.940	10.0	1.000	1.340	21.9	1.423	26
2	949	0.949	4.5	0.653	1.728	53.5	1.790	62
2	959	0.959	9.5	0.978	1.365	23.2	1.447	28
2	974	0.974	32.0	1.505	0.774	5.9	0.889	8
4	1046	1.046	26.5	1.423	0.866	7.3	0.976	9
2	1097	1.097	74.0	1.869	0.366	2.3	0.504	3

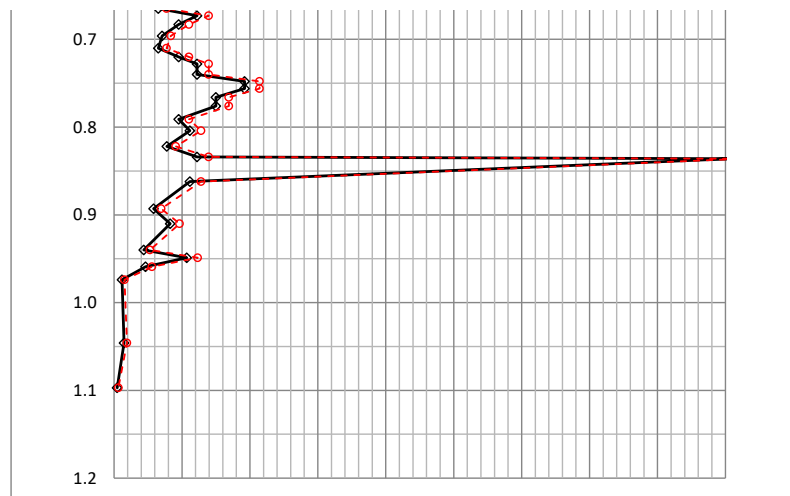
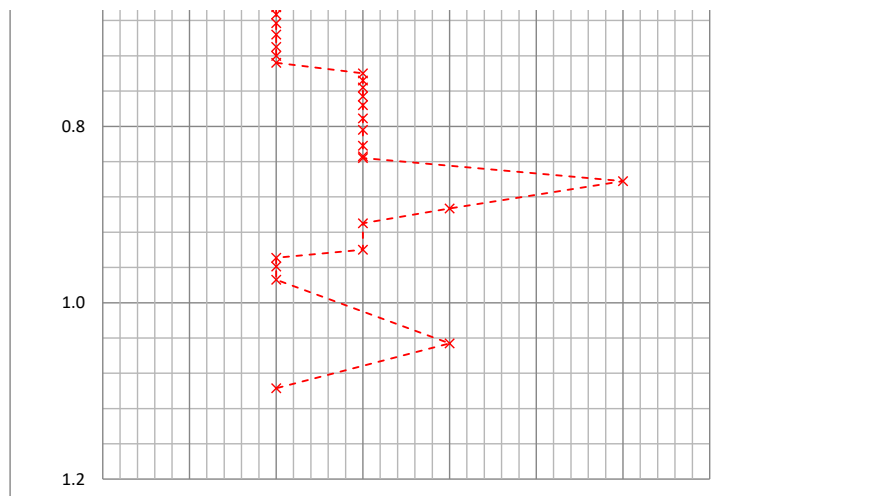
Notes:

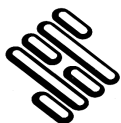
1. CBR calculated based on Webster et al, 1992.
2. CBR calculated based on DMRB, 2008.

Reference:

- Webster S, Grau R and Williams T. 1992. Description and Application of Dual Mass Dynamic Cone Penetrometer. Dept of Army Waterways Equipment Station, Instruction rpt GL-92-3.
- Highways Agency, 2008. Design Manual for Roads and Bridges (DMRB), Data for Pavement Assessment. HD29/08.







STRUCTURAL SOILS LTD
INSITU TESTING REPORT



1774

Report No. 785592R.01(00)

Date 05-September-2024 Contract The Iron Line, Millom

Client Curtins Consulting Limited
Address 51-55 TITHEBARN STREET
LIVERPOOL
L2 2SB

For the Attention of Jonathan Provis

Order received	07-March-2024	Client Reference	080874
Testing Started	20-March-2024	Client Order No.	17581
Testing Completed	04-September-2024	Instruction Type	Written

Tests marked 'Not UKAS Accredited' in this report are not included in the UKAS Accreditation Schedule for our Laboratory.

UKAS Accredited Tests

* 4 no. Plate Load Test in accordance with BS1377:Part 9:1990, Clause 4.1

Not UKAS Accredited Tests

* 5 no. Soakaway Testing to BRE Digest 365
Please note that 3 fills in each pit was not achievable due to time constraints/ground conditions

The results represent the ground conditions at the specified locations and depths at the time of testing.

Please Note: Remaining samples will be retained for a period of one month from today and will then be disposed of.

Test were undertaken on samples 'as received' unless otherwise stated.

Opinions and interpretations expressed in this report are outside the scope of accreditation for this laboratory.

Results relate only to items tested

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Structural Soils Ltd, The Potteries, Pottery Street, Castleford, WF10 1NJ Tel.01977552255. e-mail matthew.doran@soils.co.uk

TESTING VERIFICATION CERTIFICATE

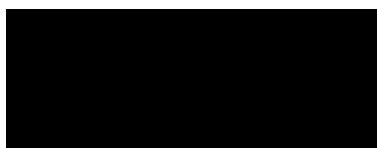
The test results included in this report are certified as:-

ISSUE STATUS: **FINAL**

In accordance with the Structural Soils Ltd Laboratory Quality Management System, results sheets and summaries of results issued by the laboratory are checked by an approved signatory. The integrity of the test data and results are ensured by control of the computer system employed by the laboratory as part of the Software Verification Program as detailed in the Laboratory Quality Manual.

This testing verification certificate covers all testing compiled on or before the following datetime: **05/09/2024 11:52:58**.

Testing reported after this date is not covered by this Verification Certificate.



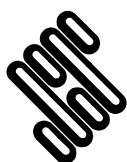
Approved Signatory
Matthew Doran (Site Testing Manager)

(Head Office)
Bristol Laboratory
Unit 1A, Princess Street
Bedminster
Bristol
BS3 4AG

Castleford Laboratory
The Potteries, Pottery Street
Castleford
West Yorkshire
WF10 1NJ

Hemel Laboratory
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Tunbridge Wells Laboratory
Bridge House, North Farm Road
Tunbridge Wells
Kent
TN2 3DR



**STRUCTURAL
SOILS LTD**

Contract:

The Iron Line, Millom

Job No:

785592

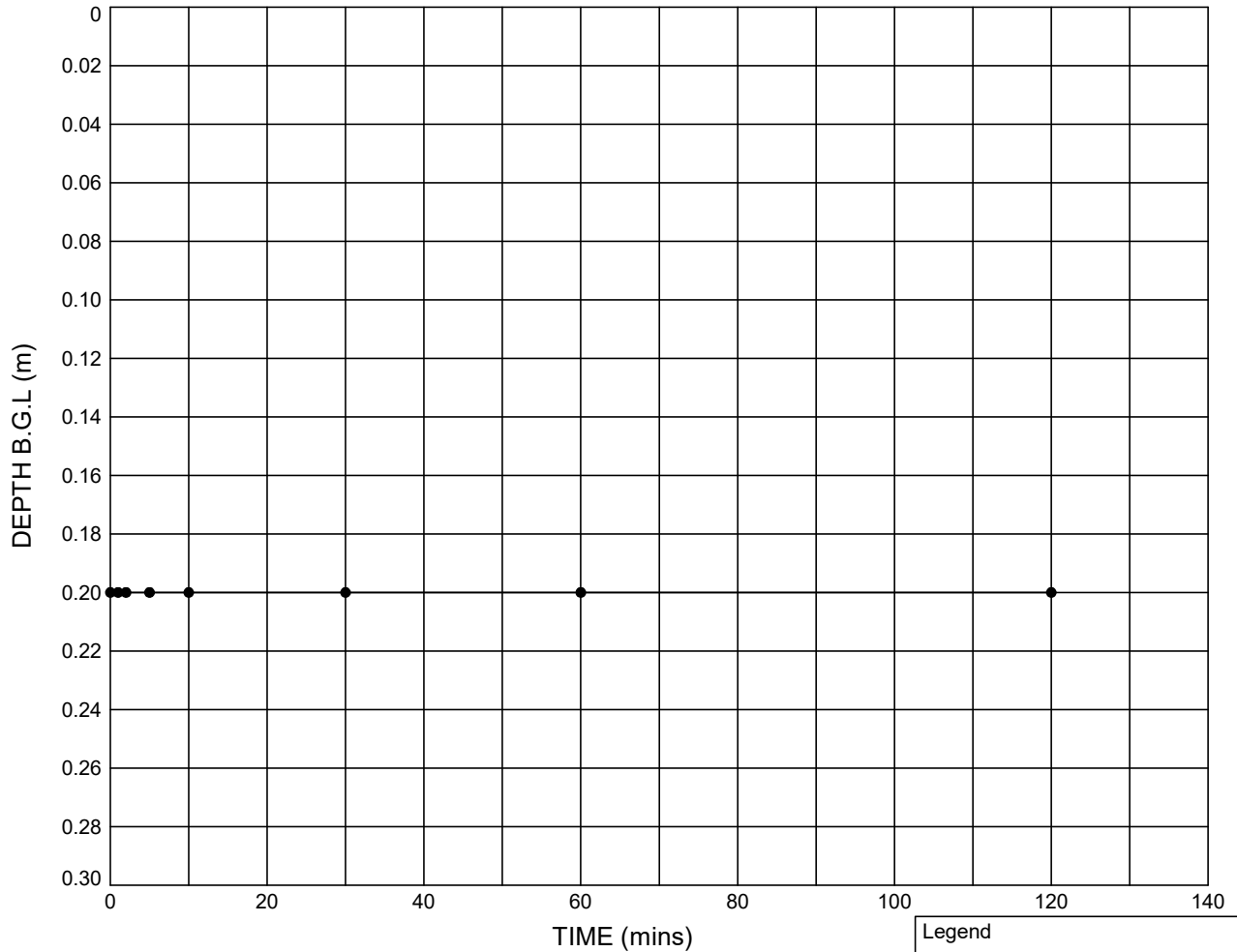


FULL SCALE SOAKAWAY TEST

Non-standard test

Soakaway Test - Position ID : **SA301**

PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME



Test 1

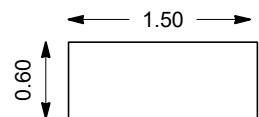
Pit start depth: = **0.30** m
Pit final depth: = **0.30** m
Effective depth, D_e = **0.10** m
Effective storage volume, V_{p75-25} = **0.0450** m³
Surface area, a_{s50} = **1.1100** m²
Time, t_{p75-25} = **N/A** secs
Infiltration rate, f = **N/A** m/s

Notes: Test 1 - Unable to calculate infiltration rate due to insufficient drop in water level

Legend

● Test 1 (04.09.24)

Plan (Not to scale)



No Bearing Taken



STRUCTURAL SOILS
The Potteries
Pottery Street
Castleford
W. Yorkshire WF10 1NJ

Compiled By

Date

Checked By

Date

05/09/24

Contract

The Iron Line, Millom

Contract Ref:

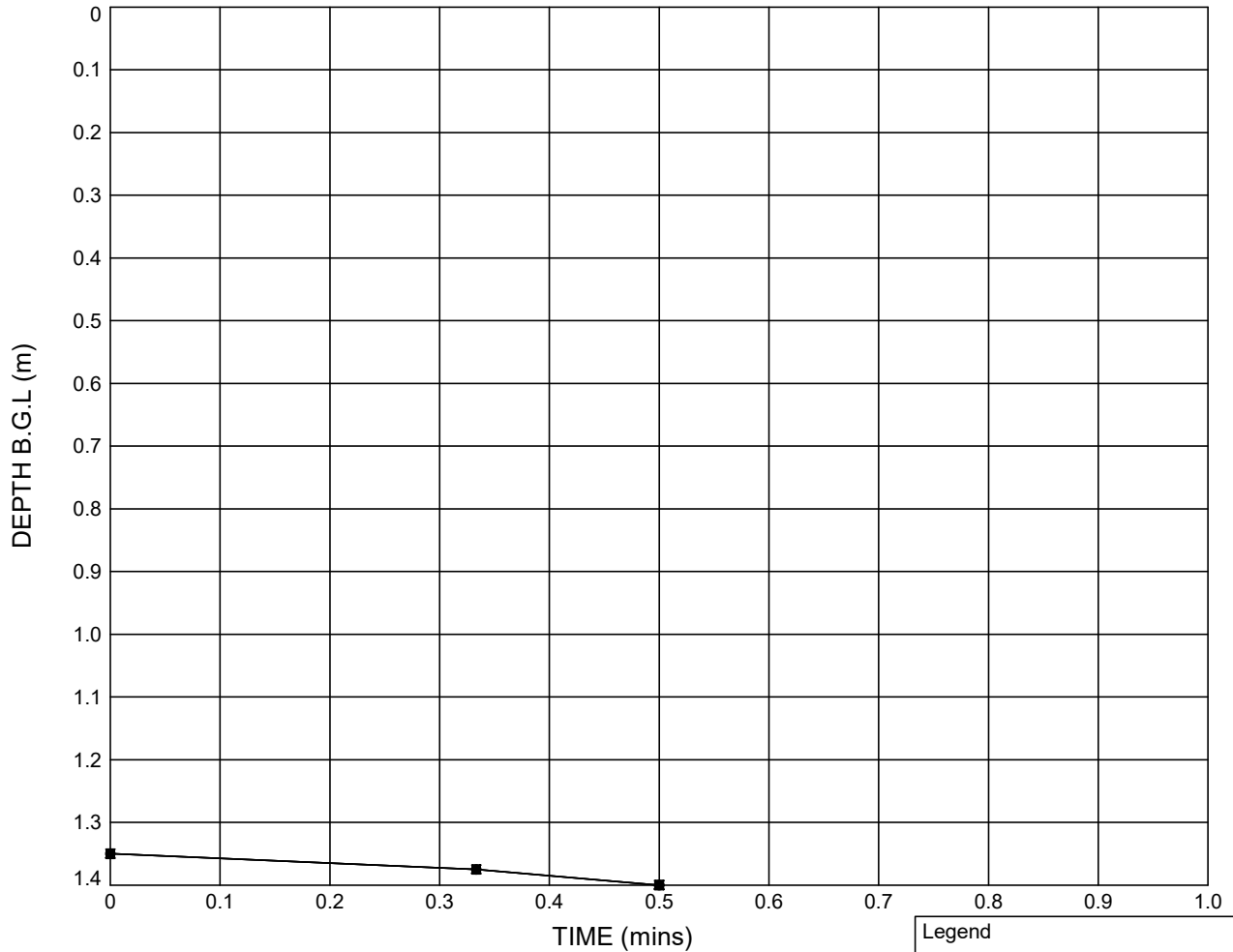
785592

FULL SCALE SOAKAWAY TEST

In accordance with BRE Digest 365

Soakaway Test - Position ID : **SA302**

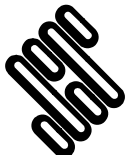
Plot of Depth of Water Below Ground Level Against Time



	Test 1	Test 2	Test 3	
Pit start depth:	= 1.40	1.40	1.40	m
Pit final depth:	= 1.40	1.40	1.40	m
Effective depth, D_e	= 0.05	0.05	0.05	m
Effective storage volume, V_{p75-25}	= 0.0188	0.0188	0.0188	m^3
Surface area, a_{s50}	= 0.8500	0.8500	0.8500	m^2
Time, t_{p75-25}	= 15.0	15.0	15.0	secs
Infiltration rate, f	= 1.47×10^{-3}	1.47×10^{-3}	1.47×10^{-3}	m/s

Legend		
●	Test 1	(04.09.24)
⊠	Test 2	(04.09.24)
▲	Test 3	(04.09.24)

Plan (Not to scale)	
← 1.50 →	
0.50 ↑	↓
No Bearing Taken	



STRUCTURAL SOILS
The Potteries
Pottery Street
Castleford
W. Yorkshire WF10 1NJ

Compiled By	Date	Checked By	Date
	05/09/24		
Contract		Contract Ref:	
The Iron Line, Millom		785592	

Appendix D – Chemical Laboratory Test Results

FINAL ANALYTICAL TEST REPORT

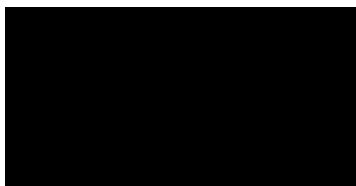
Envirolab Job Number: 24/08637
Issue Number: 1

Date: 19 September, 2024

Client: Curtins Consulting (Manchester)
Merchant Exchange
17-19 Whitworth Street
Manchester
UK
M1 5WG

Project Manager: Lucy Woods/Niall Farnworth
Project Name: Iron Line, Millom
Project Ref: 080874
Order No: 17680
Date Samples Received: 05/09/24
Date Instructions Received: 06/09/24
Date Analysis Completed: 19/09/24

Approved by:



Gemma Berrisford
Deputy Client Services Supervisor

Envirolab Job Number: 24/08637

Client Project Name: Iron Line, Millom

Client Project Ref: 080874

Lab Sample ID	24/08637/1	24/08637/2	24/08637/3	24/08637/4	24/08637/5	24/08637/6	24/08637/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	DSBH3-01	HP4-01	DSBH7-02	DSBH7-01	DSBH5-01	HP3-01	DSBH5-02			
Depth to Top	0.50	0.40	0.15	0.20	0.30	0.10	1.00			
Depth To Bottom										
Date Sampled	02-Sep-24	02-Sep-24	03-Sep-24	03-Sep-24	03-Sep-24	04-Sep-24	03-Sep-24			
Sample Type	SOIL - ES	SOIL - ES	SOIL - ES	SOIL - ES	SOIL - ES	SOIL - ES	SOIL - ES			
Sample Matrix Code	5AE	6AE	4AE	4AB	4AE	6AE	4AE			
% Moisture at <40C _A	11.7	31.1	19.2	22.7	13.7	22.7	20.3	% w/w	0.1	A-T-044
% Stones >10mm _A	17.7	<0.1	5.9	<0.1	30.3	7.1	6.8	% w/w	0.1	A-T-044
pH _D ^{M#}	8.66	8.22	7.68	7.98	7.91	8.04	7.72	pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	<0.01	0.03	<0.01	0.02	0.20	<0.01	0.02	g/l	0.01	A-T-026s
Cyanide (total) _A ^{M#}	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-042sTCN
Phenols - Total by HPLC _A	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	mg/kg	0.2	A-T-050s
Organic Matter _D ^{M#}	4.0	4.8	3.2	31.5	2.0	6.5	33.2	% w/w	0.1	A-T-032s
Arsenic _D ^{M#}	72	17	7	10	8	13	21	mg/kg	1	A-T-024s
Boron (water soluble) _D ^{M#}	<1.0	<1.0	<1.0	<1.0	1.6	<1.0	<1.0	mg/kg	1	A-T-027s
Cadmium _D ^{M#}	1.1	2.7	<0.5	0.7	<0.5	0.7	1.1	mg/kg	0.5	A-T-024s
Copper _D ^{M#}	12	171	16	114	10	30	114	mg/kg	1	A-T-024s
Chromium _D ^{M#}	17	103	19	12	7	21	18	mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-040s
Lead _D ^{M#}	14	10600	106	33	12	95	48	mg/kg	1	A-T-024s
Mercury _D	<0.17	15.3	<0.17	<0.17	<0.17	<0.17	<0.17	mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	13	34	12	70	4	19	64	mg/kg	1	A-T-024s
Selenium _D ^{M#}	2	2	<1	1	1	<1	<1	mg/kg	1	A-T-024s
Zinc _D ^{M#}	18	8170	109	169	20	185	198	mg/kg	5	A-T-024s

Envirolab Job Number: 24/08637

Client Project Name: Iron Line, Millom

Client Project Ref: 080874

Lab Sample ID	24/08637/1	24/08637/2	24/08637/3	24/08637/4	24/08637/5	24/08637/6	24/08637/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	DSBH3-01	HP4-01	DSBH7-02	DSBH7-01	DSBH5-01	HP3-01	DSBH5-02			
Depth to Top	0.50	0.40	0.15	0.20	0.30	0.10	1.00			
Depth To Bottom										
Date Sampled	02-Sep-24	02-Sep-24	03-Sep-24	03-Sep-24	03-Sep-24	04-Sep-24	03-Sep-24			
Sample Type	SOIL - ES	SOIL - ES	SOIL - ES	SOIL - ES	SOIL - ES	SOIL - ES	SOIL - ES			
Sample Matrix Code	5AE	6AE	4AE	4AB	4AE	6AE	4AE			
Asbestos in Soil (inc. matrix)										
Asbestos in soil _D [#]	NAD	NAD	NAD	Chrysotile	NAD	NAD	NAD			A-T-045
Asbestos Matrix (visual) _D	-	-	-	Woven	-	-	-			A-T-045
Asbestos Matrix (microscope) _D	-	-	-	-	-	-	-			A-T-045
Asbestos ACM - Suitable for Water Absorption Test? _D	N/A	N/A	N/A	N/A	N/A	N/A	N/A			A-T-045
Asbestos in Soil Quantification % (Hand Picking & Weighing)										
Asbestos in soil % composition (hand picking and weighing) _D	-	-	-	1.158	-	-	-	% w/w	0.001	A-T-054

Envirolab Job Number: 24/08637

Client Project Name: Iron Line, Millom

Client Project Ref: 080874

Lab Sample ID	24/08637/1	24/08637/2	24/08637/3	24/08637/4	24/08637/5	24/08637/6	24/08637/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	DSBH3-01	HP4-01	DSBH7-02	DSBH7-01	DSBH5-01	HP3-01	DSBH5-02			
Depth to Top	0.50	0.40	0.15	0.20	0.30	0.10	1.00			
Depth To Bottom										
Date Sampled	02-Sep-24	02-Sep-24	03-Sep-24	03-Sep-24	03-Sep-24	04-Sep-24	03-Sep-24			
Sample Type	SOIL - ES	SOIL - ES	SOIL - ES	SOIL - ES	SOIL - ES	SOIL - ES	SOIL - ES			
Sample Matrix Code	5AE	6AE	4AE	4AB	4AE	6AE	4AE			
PAH-16MS										
Acenaphthene _A ^{M#}	<0.01	0.04	0.06	0.03	<0.01	0.16	<0.01	mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{M#}	<0.01	0.03	0.02	0.03	<0.01	0.64	<0.01	mg/kg	0.01	A-T-019s
Anthracene _A ^{M#}	<0.02	0.46	0.16	0.12	<0.02	3.05	0.04	mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{M#}	<0.04	2.51	1.14	0.75	<0.04	14	0.09	mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{M#}	<0.04	1.83	1.11	0.91	<0.04	8.20	0.07	mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	<0.05	2.19	1.34	1.05	<0.05	8.76	0.12	mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{M#}	<0.05	1.00	0.55	0.44	<0.05	2.67	<0.05	mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07	0.89	0.55	0.44	<0.07	3.56	<0.07	mg/kg	0.07	A-T-019s
Chrysene _A ^{M#}	<0.06	2.41	1.22	0.84	<0.06	10.7	0.13	mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04	0.17	0.09	0.08	<0.04	0.82	<0.04	mg/kg	0.04	A-T-019s
Fluoranthene _A ^{M#}	<0.08	5.57	2.43	1.29	<0.08	20.3	0.21	mg/kg	0.08	A-T-019s
Fluorene _A ^{M#}	<0.01	0.06	0.05	0.01	<0.01	0.67	<0.01	mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	<0.03	0.99	0.57	0.45	<0.03	3.10	0.04	mg/kg	0.03	A-T-019s
Naphthalene _A ^{M#}	<0.03	<0.03	<0.03	<0.03	<0.03	0.07	<0.03	mg/kg	0.03	A-T-019s
Phenanthrene _A ^{M#}	<0.03	2.54	0.75	0.35	<0.03	8.76	0.12	mg/kg	0.03	A-T-019s
Pyrene _A ^{M#}	<0.07	5.04	2.01	1.19	<0.07	19.2	0.21	mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{M#}	<0.08	25.7	12.1	7.98	<0.08	105	1.03	mg/kg	0.01	A-T-019s

Envirolab Job Number: 24/08637

Client Project Name: Iron Line, Millom

Client Project Ref: 080874

Lab Sample ID	24/08637/1	24/08637/2	24/08637/3	24/08637/4	24/08637/5	24/08637/6	24/08637/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	DSBH3-01	HP4-01	DSBH7-02	DSBH7-01	DSBH5-01	HP3-01	DSBH5-02			
Depth to Top	0.50	0.40	0.15	0.20	0.30	0.10	1.00			
Depth To Bottom										
Date Sampled	02-Sep-24	02-Sep-24	03-Sep-24	03-Sep-24	03-Sep-24	04-Sep-24	03-Sep-24			
Sample Type	SOIL - ES	SOIL - ES	SOIL - ES	SOIL - ES	SOIL - ES	SOIL - ES	SOIL - ES			
Sample Matrix Code	5AE	6AE	4AE	4AB	4AE	6AE	4AE			
TPH CWG with Clean Up										
Ali >C5-C6 _A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Ali >C6-C8 _A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Ali >C8-C10 _A	<1	<1	<1	1	<1	<10	<1	mg/kg	1	A-T-055s
Ali >C10-C12 _A ^{M#}	<1	<1	<1	<1	<1	<10	<1	mg/kg	1	A-T-055s
Ali >C12-C16 _A ^{M#}	<1	<1	<1	4	<1	<10	2	mg/kg	1	A-T-055s
Ali >C16-C21 _A ^{M#}	<1	9	1	5	2	<10	4	mg/kg	1	A-T-055s
Ali >C21-C35 _A ^{M#}	<1	148	10	16	6	106	23	mg/kg	1	A-T-055s
Total Aliphatics _A	<1	157	12	26	8	106	29	mg/kg	1	Calc-As Recd
Aro >C5-C7 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Aro >C7-C8 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Aro >C8-C10 _A	<1	<1	<1	1	<1	<10	1	mg/kg	1	A-T-055s
Aro >C10-C12 _A	<1	<1	<1	1	<1	<10	1	mg/kg	1	A-T-055s
Aro >C12-C16 _A	<1	3	1	6	<1	35	5	mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	<1	46	16	23	<1	345	11	mg/kg	1	A-T-055s
Aro >C21-C35 _A ^{M#}	<1	81	91	89	<1	1660	18	mg/kg	1	A-T-055s
Total Aromatics _A	<1	131	108	122	<1	2040	35	mg/kg	1	Calc-As Recd
TPH (Ali & Aro >C5-C35) _A	<1	287	120	147	9	2140	64	mg/kg	1	Calc-As Recd
BTEX - Benzene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - Toluene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - o Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
MTBE _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s

Report Notes

General

- This report shall not be reproduced, except in full, without written approval from Envirolab.
- The client Sample No, Client Sample ID, Depth to top, Depth to Bottom and Date Sampled are all provided by the client and can affect the validity of results.
- The results reported herein relate only to the material supplied to the laboratory.
- The residue of any samples contained within this report, and any received within the same delivery, will be disposed of **four weeks** after the initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of **six months** after the initial Asbestos testing is completed.
- Analytical results reflect the quality of the sample at the time of analysis only.
- Opinions and Interpretations expressed are outside our scope of accreditation.
- A deviating sample report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.
- If a sample is outside of the calibration range or affected by interferences then it may need diluting. This will result in the limit of detection (LOD) being raised.
- Subcontracted Analysis: Please see the appended report for any deviations, current LODs and accreditation status of the test.

Key

Superscript “#”	Accredited to ISO 17025
Superscript “M”	Accredited to MCertS
Superscript “U”	Individual result not accredited
None of the above symbols	Analysis unaccredited
Subscript “A”	Analysis performed on as-received Sample
Subscript “D”	Analysis performed on the dried sample, crushed to pass 2mm sieve.
Subscript “D” on Asbestos	Analysis performed on a dried aliquot of sample provided.
Subscript “A”	Analysis has dependant options against results. Details appear in the comments of your Sample receipt
IS	Insufficient Sample for analysis
US	Unsuitable Sample for analysis
NDP	No Determination Possible
NAD	No Asbestos Detected
Trace	Asbestos found not suitable for Gravimetric Quantification – not enough to accurately weigh.
N/A	Not applicable

Asbestos

Identification: Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis

“Trace Asbestos Identified” will be reported if there is not enough present to verify the type.

Quantification: Generally a 2 stage process including visual identification, hand picking and weighing, and fibre counting. Where ACMs are found a percentage asbestos is assigned to each with reference to ‘HSG264, Asbestos: The survey guide’ and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres). “TRACE” will be reported as a quantification result.

PLEASE INFORM THE LABORATORY IF YOU WOULD LIKE THE STAGE 3 SEDIMENTATION PROCESS CARRIED OUT. Note this will be subcontracted.

Assigned Matrix Codes

1	SAND	6	CLAY/LOAM	A	Contains Stones
2	LOAM	7	OTHER	B	Contains Construction Rubble
3	CLAY	8	Asbestos Bulk (Only Asbestos ID accredited)	C	Contains visible hydrocarbons
4	LOAM/SAND	9	Incinerator Ash (some Metals accredited)	D	Contains glass / metal
5	SAND/CLAY			E	Contains roots / twigs

Note: 7,8,9 matrices are not covered by our ISO 17025 or MCertS accreditation, unless stated above.

Soil Chemical Analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as ‘% stones >10mm’.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any “A” subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any “D” subscripts.

TPH by method A-T-007:

For waters, free and visible oils are excluded from the sample used for analysis, so the reported result represents the dissolved phase only. Results “with Clean up” indicates samples cleaned up with Silica during extraction.

EPH CWG (method A-T-055) from TPH CWG:

EPH CWG results have humics mathematically subtracted through instrument calculation.

Where these humic substances have been identified in any IDs from “TPH CWG with clean up” please note that the concentration is **NOT** included in the quantified results but present in the ID for information.

Electrical Conductivity of water by method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Please contact your client manager if you require any further information.

Envirolab Deviating Samples Report

Hattersley Science & Technology Park, Stockport Road, Hattersley, SK14 3QU
Tel. 0161 368 4921 email. ask@envlab.co.uk

Client:	Curtins Consulting (Manchester), Merchant Exchange, 17-19 Whitworth Street , Manchester, UK, M1 5WG	Project No:	24/08637
Project:	Iron Line, Millom	Date Received:	06/09/2024 (am)
Clients Project No:	080874	Cool Box Temperatures (°C):	16.5, 16.1

NO DEVIATIONS IDENTIFIED

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

Envirolab Analysis Dates

Lab Sample ID	24/08637/1	24/08637/2	24/08637/3	24/08637/4	24/08637/5	24/08637/6	24/08637/7
Client Sample No							
Client Sample ID/Depth	DSBH3-01 0.50m	HP4-01 0.40m	DSBH7-02 0.15m	DSBH7-01 0.20m	DSBH5-01 0.30m	HP3-01 0.10m	DSBH5-02 1.00m
Date Sampled	02/09/24	02/09/24	03/09/24	03/09/24	03/09/24	04/09/24	03/09/24
A-T-019s	10/09/2024	10/09/2024	10/09/2024	10/09/2024	10/09/2024	10/09/2024	10/09/2024
A-T-022s	10/09/2024	10/09/2024	10/09/2024	10/09/2024	10/09/2024	10/09/2024	10/09/2024
A-T-024s	12/09/2024	12/09/2024	12/09/2024	12/09/2024	12/09/2024	12/09/2024	12/09/2024
A-T-026s	11/09/2024	11/09/2024	11/09/2024	11/09/2024	11/09/2024	11/09/2024	11/09/2024
A-T-027s	11/09/2024	11/09/2024	11/09/2024	11/09/2024	11/09/2024	11/09/2024	11/09/2024
A-T-031s	11/09/2024	11/09/2024	11/09/2024	11/09/2024	11/09/2024	11/09/2024	11/09/2024
A-T-032s	11/09/2024	11/09/2024	11/09/2024	12/09/2024	11/09/2024	11/09/2024	11/09/2024
A-T-040s	11/09/2024	11/09/2024	11/09/2024	11/09/2024	11/09/2024	11/09/2024	11/09/2024
A-T-042sTCN	10/09/2024	10/09/2024	10/09/2024	10/09/2024	10/09/2024	10/09/2024	10/09/2024
A-T-044	11/09/2024	11/09/2024	11/09/2024	11/09/2024	11/09/2024	11/09/2024	11/09/2024
A-T-045	09/09/2024	09/09/2024	09/09/2024	09/09/2024	09/09/2024	09/09/2024	09/09/2024
A-T-050s	10/09/2024	10/09/2024	10/09/2024	10/09/2024	10/09/2024	10/09/2024	10/09/2024
A-T-054				19/09/2024			
A-T-055s	11/09/2024	11/09/2024	11/09/2024	11/09/2024	11/09/2024	16/09/2024	11/09/2024
Calc-As Recd	11/09/2024	11/09/2024	11/09/2024	11/09/2024	11/09/2024	16/09/2024	11/09/2024

The above dates are the analysis completion dates, please note that these are not necessarily the date that the analysis was weighed/extracted.

End of Report

Appendix E – Geotechnical Laboratory Test Results

Curtins
Units 5/6
40 Compton Street
London

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

e: lucy.woods@curtins.com
Niall.Farnworth@curtins.com
EBMA.testing@curtins.com

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 24-040251

Project / Site name:	Iron Line, Millom	Samples received on:	05/09/2024
Your job number:	B080874	Samples instructed on/ Analysis started on:	05/09/2024
Your order number:	17683	Analysis completed by:	13/09/2024
Report Issue Number:	1	Report issued on:	18/09/2024
Samples Analysed:	6 soil samples		



Signed:

Anna Goc
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 24-040251
Project / Site name: Iron Line, Millom
Your Order No: 17683

Lab Sample Number				306794	306795	306796	306797	306798
Sample Reference				DSBH 3-01	DSBH 7-02	DSBH 7-02	DSBH 7-01	DSBH 5-02
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.00-2.50	1.20-1.50	4.00-4.45	3.00-3.45	2.50
Date Sampled				Deviating	03/09/2024	03/09/2024	03/09/2024	03/09/2024
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Test Limit of detection	Test Accreditation Status		

Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	16	14	11	12	12
Total mass of sample received	kg	0.1	NONE	0.5	0.5	0.5	0.5	0.5

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	8.3	7.7	7.9	7.7	8.5
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	5.3	44	32	41	75
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	2.66	22.2	16.1	20.6	37.4
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	2.6	18	14	3.2	7
Water Soluble Nitrate (2:1) as N	mg/kg	2	NONE	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Heavy Metals / Metalloids

Magnesium (leachate equivalent)	mg/l	2.5	NONE	3.6	4.9	7.7	7	6.5
Magnesium (water soluble)	mg/kg	5	NONE	7.1	9.8	15	14	13

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 24-040251
Project / Site name: Iron Line, Millom
Your Order No: 17683

Lab Sample Number	306799			
Sample Reference	DSBH 5-02			
Sample Number	None Supplied			
Depth (m)	4.00-5.00			
Date Sampled	03/09/2024			
Time Taken	None Supplied			
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status	

Stone Content	%	0.1	NONE	< 0.1
Moisture Content	%	0.01	NONE	5
Total mass of sample received	kg	0.1	NONE	0.5

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	7.7
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	13
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	6.39
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	3.1
Water Soluble Nitrate (2:1) as N	mg/kg	2	NONE	< 2.0
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	< 2.0

Heavy Metals / Metalloids

Magnesium (leachate equivalent)	mg/l	2.5	NONE	< 2.5
Magnesium (water soluble)	mg/kg	5	NONE	< 5.0

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number : 24-040251

Project / Site name: Iron Line, Millom

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
306794	DSBH 3-01	None Supplied	2.00-2.50	Brown clay with gravel
306795	DSBH 7-02	None Supplied	1.20-1.50	Brown clay with gravel
306796	DSBH 7-02	None Supplied	4.00-4.45	Brown clay with gravel
306797	DSBH 7-01	None Supplied	3.00-3.45	Brown clay with gravel
306798	DSBH 5-02	None Supplied	2.5	Brown clay with gravel
306799	DSBH 5-02	None Supplied	4.00-5.00	Brown sand

Analytical Report Number : 24-040251

Project / Site name: Iron Line, Millom

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight	In-house method based on British Standard Methods and MCERTS requirements.	L019B	D	NONE
Magnesium, water soluble, in soil	Determination of water soluble magnesium by extraction with water followed by ICP-OES	In-house method based on TRL 447	L038B	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Sulphate, water soluble, in soil (16hr extraction)	In-house method	L038B	D	MCERTS
Water Soluble Nitrate (2:1) as N in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08, 2:1 extraction	L078-PL	W	NONE
Chloride, water soluble, in soil	Determination of Chloride colorimetrically by discrete analyser	In-house method	L082B	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement	In-house method	L099-PL	D	MCERTS

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30°C.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Quality control parameter failure associated with individual result applies to calculated sum of individuals.

The result for sum should be interpreted with caution

Analytical Report Number : 24-040251

Project / Site name: Iron Line, Millom

This deviation report indicates the sample and test deviations that apply to the samples submitted for analysis. Please note that the associated result(s) may be unreliable and should be interpreted with care.

Key: a - No sampling date b - Incorrect container c - Holding time d - Headspace e - Temperature

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
DSBH 3-01	N/A	S	306794	a	Chloride, water soluble, in soil	L082B	a
DSBH 3-01	N/A	S	306794	a	Magnesium, water soluble, in soil	L038B	a
DSBH 3-01	N/A	S	306794	a	Sulphate, water soluble, in soil (16hr extraction)	L038B	a
DSBH 3-01	N/A	S	306794	a	Water Soluble Nitrate (2:1) as N in soil	L078-PL	a
DSBH 3-01	N/A	S	306794	a	pH in soil (automated)	L099-PL	a



TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with: BS EN ISO 17892-12:2018+A2:2022,
cl 5.3 and 5.5, Fall Cone Method, 4 Pt Test, BS 1377-2:2022,
cl 5.2 and 6

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Client: Curtins
Client Address: Units 5/6, 40 Compton Street,
London

Contact: Lucy Woods-
Site Address: Iron Line, Millom

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Client Reference: B080874
Job Number: 24-040250-1
Date Sampled: 03/09/2024
Date Received: 05/09/2024
Date Tested: 09/09/2024
Sampled By: Not Given

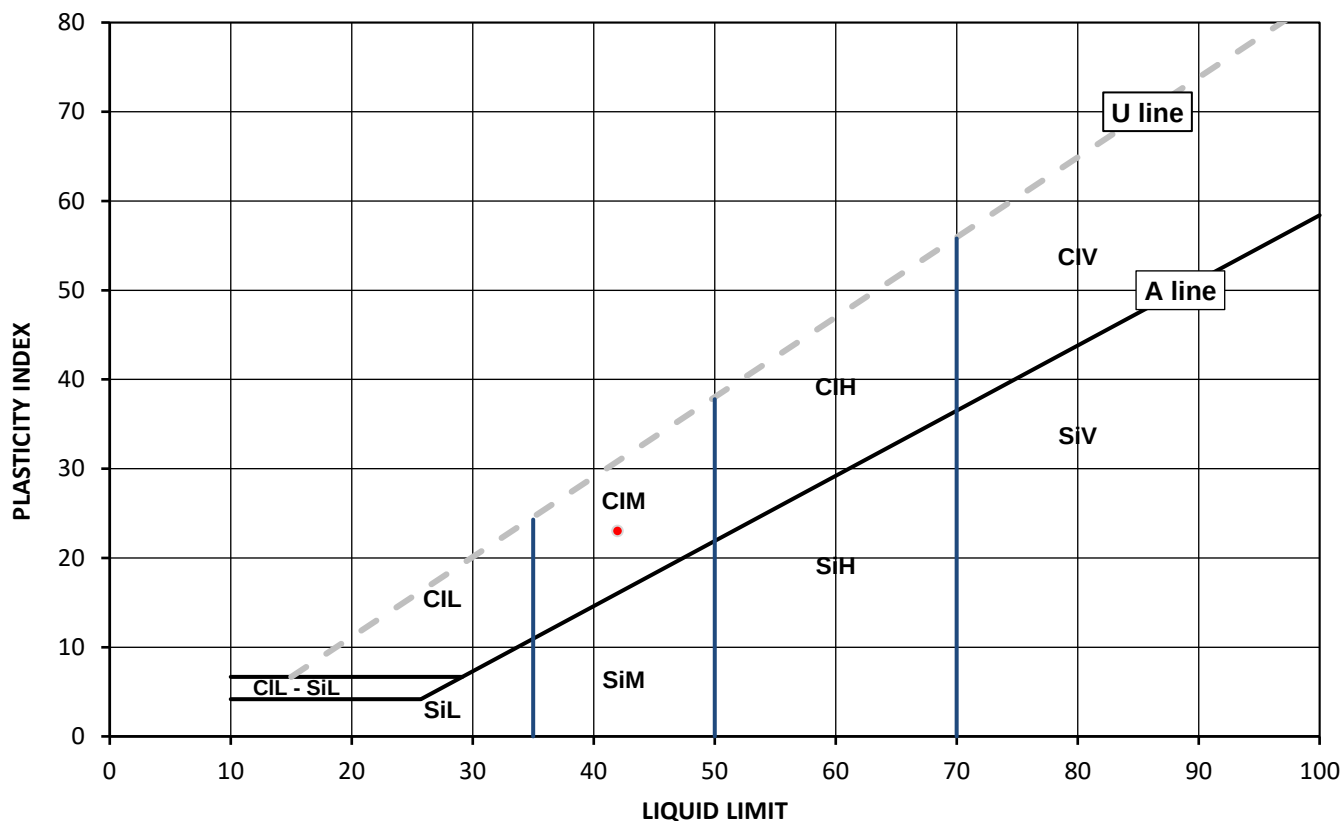
Test Results:

Laboratory Reference: 306788
Hole No.: DSBH 3-01
Sample Reference: Not Given
Sample Description: Brown slightly gravelly sandy CLAY

Depth Top [m]: 2.00
Depth Base [m]: 2.50
Sample Type: D

Sample Preparation: Tested after washing to remove >0.425mm; The water content in the sample was increased
Cone Type: 80g/30deg

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	Liquidity Index [IL] % #	Consistency Index [IC] % #	% Passing 425µm BS Test Sieve
17.8	42	19	23	-0.04	1.04	77



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
		50 to 70
		exceeding 70
		append to classification for organic material (eg ClHO)

Note: Water Content by BS EN 17892-1: 2014; # Non accredited

Remarks:

Signed:

Katarzyna Banys
Reporting Specialist
for and on behalf of i2 Analytical Ltd

Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report relate only to the sample(s) submitted for testing.



TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with: BS EN ISO 17892-12:2018+A2:2022,
cl 5.3 and 5.5, Fall Cone Method, 4 Pt Test, BS 1377-2:2022,
cl 5.2 and 6

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Client: Curtins
Client Address: Units 5/6, 40 Compton Street,
London

Contact: Lucy Woods-
Site Address: Iron Line, Millom

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Client Reference: B080874
Job Number: 24-040250-1
Date Sampled: 03/09/2024
Date Received: 05/09/2024
Date Tested: 09/09/2024
Sampled By: Not Given

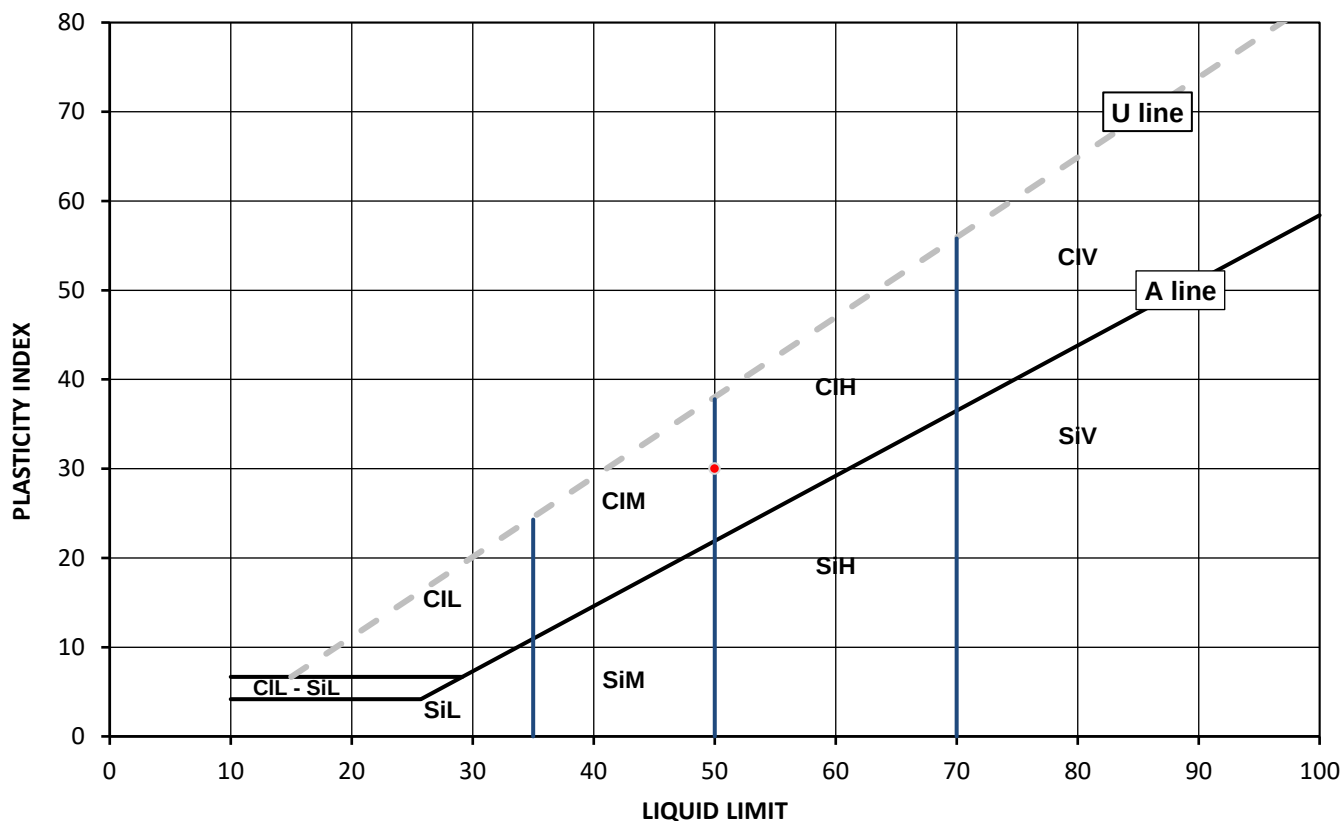
Test Results:

Laboratory Reference: 306789
Hole No.: DSBH 7-02
Sample Reference: Not Given
Sample Description: Orangish brown slightly gravelly slightly sandy CLAY

Depth Top [m]: 1.20
Depth Base [m]: 1.50
Sample Type: D

Sample Preparation: Tested after >0.425mm removed by hand; The water content in the sample was increased
Cone Type: 80g/30deg

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	Liquidity Index [IL] % #	Consistency Index [IC] % #	% Passing 425µm BS Test Sieve
19.8	50	20	30	0.00	1.00	98



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L	Low
	M	Medium
	H	High
	V	Very high
	O	Organic
		append to classification for organic material (eg ClHO)

Note: Water Content by BS EN 17892-1: 2014; # Non accredited

Remarks:

Signed:



Katarzyna Banys
Reporting Specialist
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with: BS EN ISO 17892-12:2018+A2:2022,
cl 5.3 and 5.5, Fall Cone Method, 4 Pt Test, BS 1377-2:2022,
cl 5.2 and 6

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Client: Curtins
Client Address: Units 5/6, 40 Compton Street,
London

Contact: Lucy Woods-
Site Address: Iron Line, Millom

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Client Reference: B080874
Job Number: 24-040250-1
Date Sampled: 03/09/2024
Date Received: 05/09/2024
Date Tested: 09/09/2024
Sampled By: Not Given

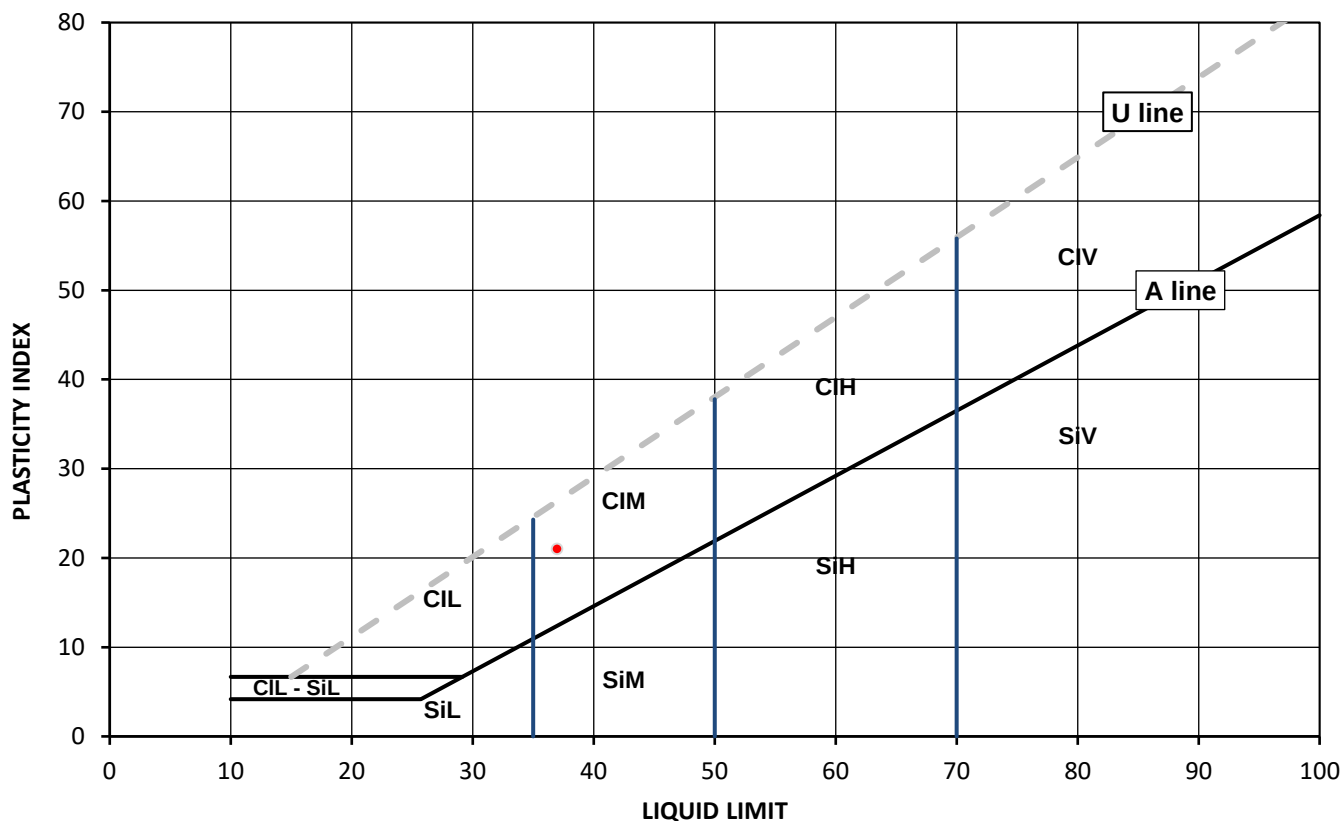
Test Results:

Laboratory Reference: 306790
Hole No.: DSBH 7-02
Sample Reference: Not Given
Sample Description: Brown slightly gravelly sandy CLAY

Depth Top [m]: 4.00
Depth Base [m]: 4.45
Sample Type: D

Sample Preparation: Tested after washing to remove >0.425mm; The water content in the sample was increased
Cone Type: 80g/30deg

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	Liquidity Index [IL] % #	Consistency Index [IC] % #	% Passing 425µm BS Test Sieve
14.8	37	16	21	-0.05	1.05	95



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

Plasticity		Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
L	Low	50 to 70
M	Medium	exceeding 70
H	High	append to classification for organic material (eg ClHO)
V	Very high	
O	Organic	

Note: Water Content by BS EN 17892-1: 2014; # Non accredited

Remarks:

Signed:

Katarzyna Banys
Reporting Specialist
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with: BS EN ISO 17892-12:2018+A2:2022,
cl 5.3 and 5.5, Fall Cone Method, 4 Pt Test, BS 1377-2:2022,
cl 5.2 and 6

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Client: Curtins
Client Address: Units 5/6, 40 Compton Street,
London

Contact: Lucy Woods-
Site Address: Iron Line, Millom

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Client Reference: B080874
Job Number: 24-040250-1
Date Sampled: 03/09/2024
Date Received: 05/09/2024
Date Tested: 09/09/2024
Sampled By: Not Given

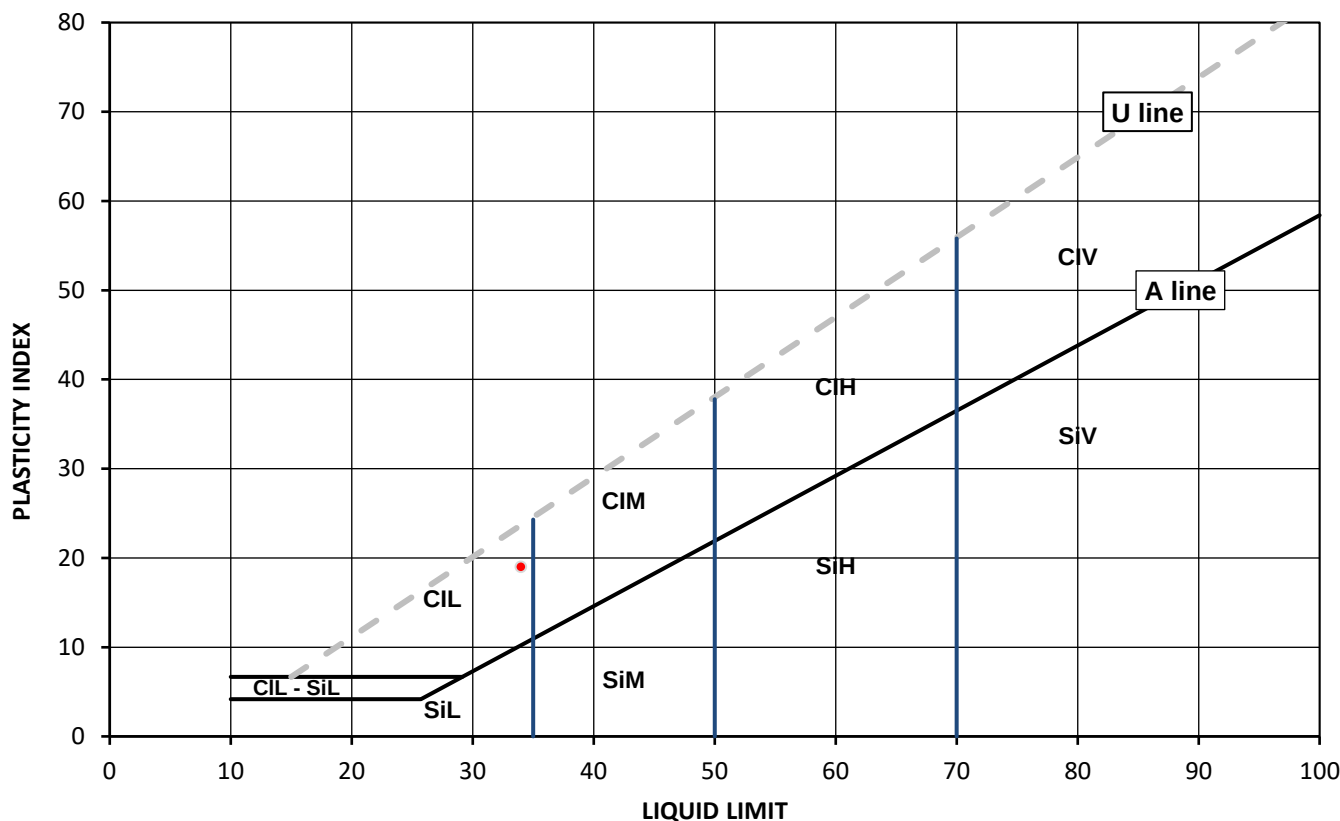
Test Results:

Laboratory Reference: 306791
Hole No.: DSBH 7-01
Sample Reference: Not Given
Sample Description: Orangish brown slightly gravelly very sandy CLAY

Depth Top [m]: 3.00
Depth Base [m]: 3.45
Sample Type: D

Sample Preparation: Tested after >0.425mm removed by hand; The water content in the sample was increased
Cone Type: 80g/30deg

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	Liquidity Index [IL] % #	Consistency Index [IC] % #	% Passing 425µm BS Test Sieve
17.1	34	15	19	0.11	0.89	94



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

Plasticity		Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
L	Low	50 to 70
M	Medium	exceeding 70
H	High	append to classification for organic material (eg ClHO)
V	Very high	
O	Organic	

Note: Water Content by BS EN 17892-1: 2014; # Non accredited

Remarks:

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TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with: BS EN ISO 17892-12:2018+A2:2022,
cl 5.3 and 5.5, Fall Cone Method, 4 Pt Test, BS 1377-2:2022,
cl 5.2 and 6

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Client: Curtins
Client Address: Units 5/6, 40 Compton Street,
London

Contact: Lucy Woods-
Site Address: Iron Line, Millom

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Client Reference: B080874
Job Number: 24-040250-1
Date Sampled: 03/09/2024
Date Received: 05/09/2024
Date Tested: 09/09/2024
Sampled By: Not Given

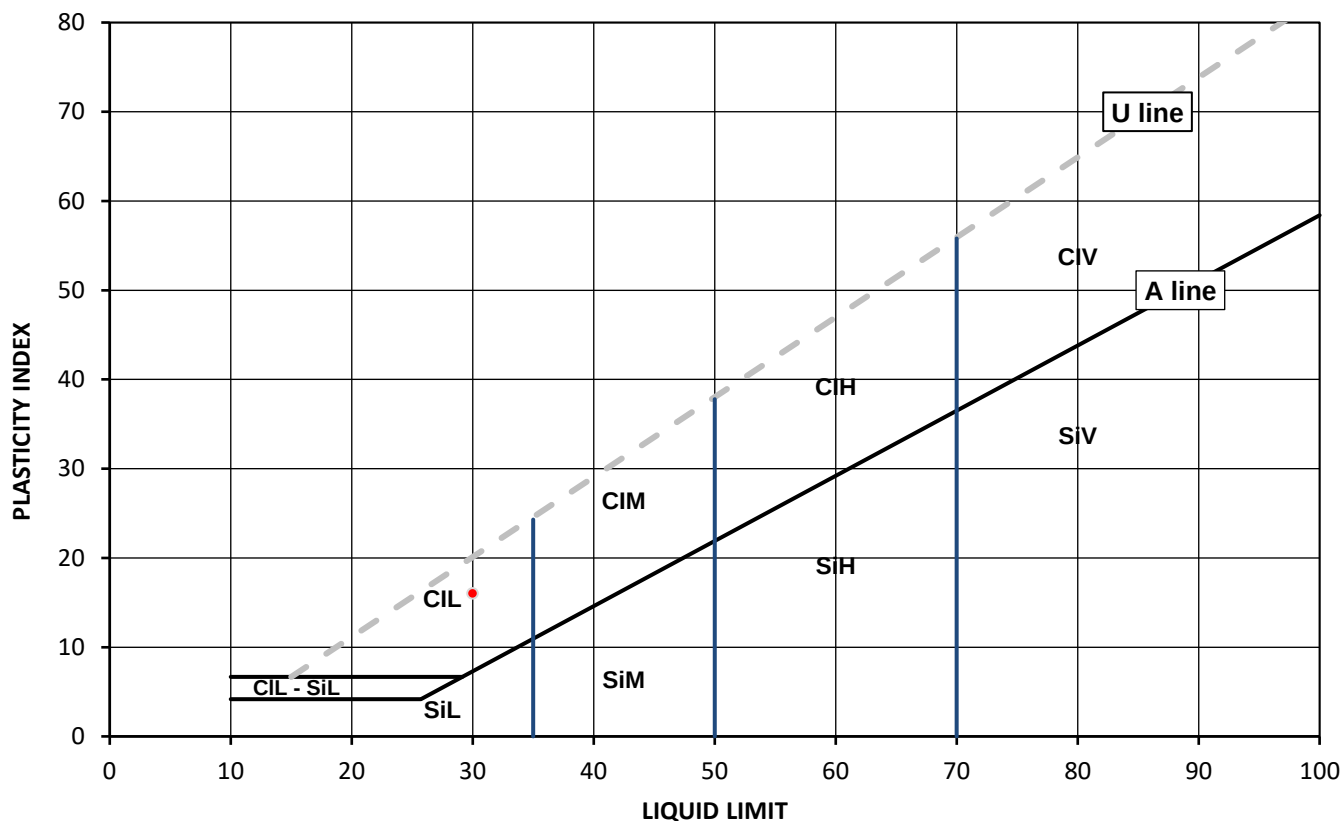
Test Results:

Laboratory Reference: 306792
Hole No.: DSBH 5-02
Sample Reference: Not Given
Sample Description: Orangish brown slightly gravelly very sandy CLAY

Depth Top [m]: 2.50
Depth Base [m]: Not Given
Sample Type: D

Sample Preparation: Tested after washing to remove >0.425mm; The water content in the sample was increased
Cone Type: 80g/30deg

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	Liquidity Index [IL] % #	Consistency Index [IC] % #	% Passing 425µm BS Test Sieve
19.3	30	14	16	0.31	0.69	89



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L	Low
	M	Medium
	H	High
	V	Very high
	O	Organic
		50 to 70
		exceeding 70
		append to classification for organic material (eg ClHO)

Note: Water Content by BS EN 17892-1: 2014; # Non accredited

Remarks:

Signed:

Katarzyna Banys
Reporting Specialist
for and on behalf of i2 Analytical Ltd

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SUMMARY REPORT

SUMMARY OF CLASSIFICATION TEST RESULTS

Tested in Accordance with:

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Client: Curtins
Client Address: Units 5/6, 40 Compton Street,
London

BS EN ISO 17892-12:2018+A2:2022 cl 5.3 and 5.5, Fall Cone Method, 4 Pt
Test, BS 1377-2:2022, cl 5.2 and 6. W by BS EN ISO 17892-1:2014+A1:2022.

Client Reference: B080874
Job Number: 24-040250-1
Date Sampled: 03/09/2024
Date Received: 05/09/2024
Date Tested: 09/09/2024
Sampled By: Not Given

Contact: Lucy Woods
Site Address: Iron Line, Millom

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	W	Liquid & Plastic Limit							Density		
		Reference	Depth Top	Depth Base	Type				% Passing 425um	WL*	Correlation Factor	Wp	Ip	Cone type	Sample Preparation	bulk	dry	PD
			m	m					%	%		%	%			Mg/m3	Mg/m3	Mg/m3
306788	DSBH 3-01	Not Given	2.00	2.50	D	Brown slightly gravelly sandy CLAY	Atterberg 4 Point	17.8	77	42	-	19	23	80g/30 deg	W / I			
306789	DSBH 7-02	Not Given	1.20	1.50	D	Orangish brown slightly gravelly slightly sandy CLAY	Atterberg 4 Point	19.8	98	50	-	20	30	80g/30 deg	R / I			
306790	DSBH 7-02	Not Given	4.00	4.45	D	Brown slightly gravelly sandy CLAY	Atterberg 4 Point	14.8	95	37	-	16	21	80g/30 deg	W / I			
306791	DSBH 7-01	Not Given	3.00	3.45	D	Orangish brown slightly gravelly very sandy CLAY	Atterberg 4 Point	17.1	94	34	-	15	19	80g/30 deg	R / I			
306792	DSBH 5-02	Not Given	2.50	Not Given	D	Orangish brown slightly gravelly very sandy CLAY	Atterberg 4 Point	19.3	89	30	-	14	16	80g/30 deg	W / I			

Note: # Non accredited; NP - Non plastic; N - Tested in natural condition, R - Tested after >0,425mm removed by hand, W - Tested after washing to remove >425mm; I - The water content in the sample was increased , D - The water content in the sample was decreased; * - One point liquid limit corrected as per the report Correlation Factor by Clayton C.R.I and Jukes A.W (1978)

Comments:

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Signed:



Katarzyna Banyas
Reporting Specialist
for and on behalf of i2 Analytical Ltd



SUMMARY REPORT
DETERMINATION OF WATER CONTENT

Tested in Accordance with: BS EN ISO 17892-1:2014+A1:2022, BS 1377-2: 2022, clause 4.1

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041
Client: Curtins
Client Address: Units 5/6, 40 Compton Street,
London

Contact: Lucy Woods
Site Address: Iron Line, Millom

Client Reference: B080874
Job Number: 24-040250-1
Date Sampled: 03/09/2024
Date Received: 05/09/2024
Date Tested: 09/09/2024
Sampled By: Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	WC											
		Reference	Depth Top m	Depth Base m	Type														
306788	DSBH 3-01	Not Given	2.00	2.50	D	Brown slightly gravelly sandy CLAY		17.8											
306789	DSBH 7-02	Not Given	1.20	1.50	D	Orangish brown slightly gravelly slightly sandy CLAY		19.8											
306790	DSBH 7-02	Not Given	4.00	4.45	D	Brown slightly gravelly sandy CLAY		14.8											
306791	DSBH 7-01	Not Given	3.00	3.45	D	Orangish brown slightly gravelly very sandy CLAY		17.1											
306792	DSBH 5-02	Not Given	2.50	Not Given	D	Orangish brown slightly gravelly very sandy CLAY		19.3											

Comments:

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Signed:



Katarzyna Banyś
Reporting Specialist
for and on behalf of i2 Analytical Ltd



4041



TEST CERTIFICATE

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Tested in Accordance with: BS EN ISO 17892-4:2016,
BS 1377-2:2022 cl. 10

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

Client: Curtins
Client Address: Units 5/6, 40 Compton Street,
London

Contact: Lucy Woods
Site Address: Iron Line, Millom

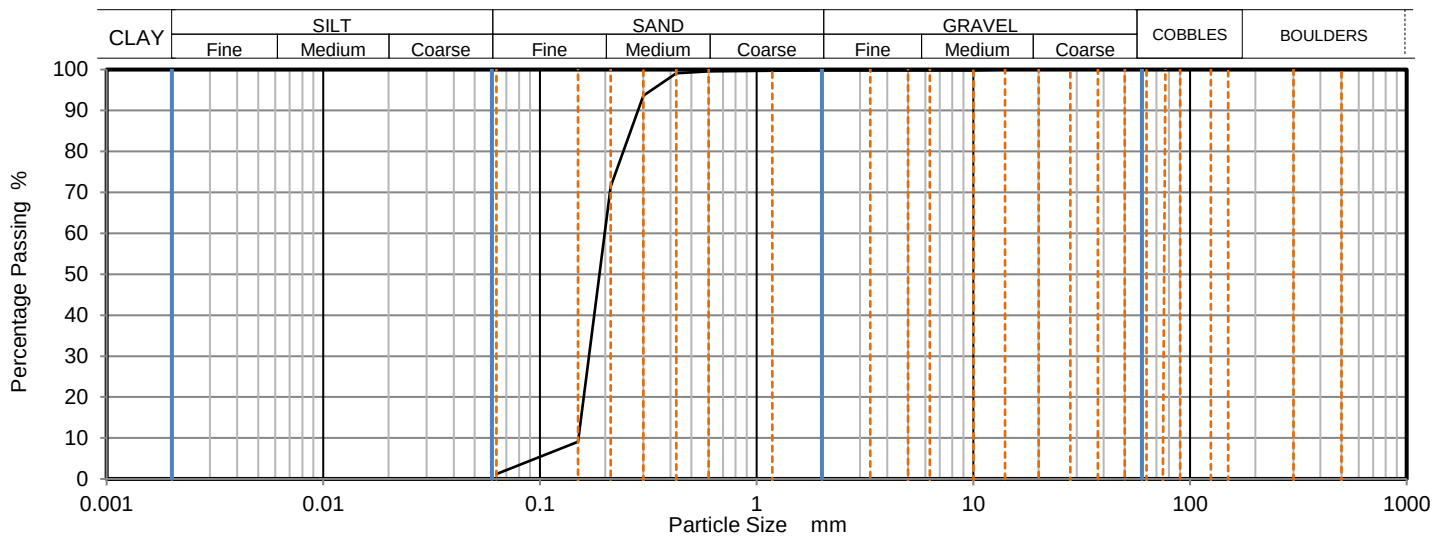
Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Client Reference: B080874
Job Number: 24-040250-1
Date Sampled: 03/09/2024
Date Received: 05/09/2024
Date Tested: 10/09/2024
Sampled By: Not Given

Test Results:

Laboratory Reference: 306793
Hole No.: DSBH 5-02
Sample Reference: Not Given
Sample Description: Yellowish brown SAND
Sample Preparation: Sample was quartered, oven dried at 109.0 °C and broken down by hand.

Depth Top [m]: 4.00
Depth Base [m]: 5.00
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
150	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	99		
0.3	94		
0.212	71		
0.15	9		
0.063	1		

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	0.00
Sand	99.00
Fines <0.063 mm	1.00

Grading Analysis	
D100	mm 14
D60	mm 0.199
D30	mm 0.168
D10	mm 0.151
Uniformity Coefficient	1.3
Curvature Coefficient	0.95

Uniformity and Curvature Coefficient calculated in accordance with BS EN ISO 14688-2:2018

Note: Tested in Accordance with ISO 17892 -4, by sieving on as received or wet sample

Remarks:

Signed:

Katarzyna Banys
Reporting Specialist
for and on behalf of i2 Analytical Ltd

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Appendix F – GAC Screening Thresholds

Human Health GQRA Rationale and Hierarchy

Background

Detailed guidance on human health risk assessment is available within several documents, published by both the Environment Agency, Defra, CL:AIRE, LQM/CIEH and Public Health England as referenced below (references a-h).

A Generic Quantitative Risk Assessment (GQRA) is carried out for the Potential Contaminant Linkages (PCLs) investigated by screening of soil contamination data against relevant Generic Assessment Criteria where available.

Generic Assessment Criteria are available for a range of different land use scenarios, soil organic matter (SOM) and soil types. Curtins have adopted available GACs for a sandy loam soil at 1%, 2.5% and 6% SOM using various sources.

GAC Hierarchy

A summary of and hierarchy for adopted GACs is identified below:

- i) **Category 4 Screening Levels (C4SLs):** In March 2014 Defra published C4SLs for arsenic, benzene, benzo(a)pyrene, cadmium, hexavalent chromium, and lead as part of the 'Phase 1 Project'. These values were derived to support the revised Part 2A Statutory Guidance issued in 2012 in which four categories of contaminated land are included, ranging from Category 1 (significant/high risk) to Category 4 (low risk). In 2018 the 'Phase 2 Project' commenced which aims to develop C4SLs for a range of further contaminants. Currently available Phase 2 C4SLs include vinyl chloride, trichloroethene, tetrachloroethene, naphthalene, cis-1,2 dichloroethene, trans 1, 2 dichloroethene and per / polyfluoroalkyl substances (PFAS) and inorganic mercury. Where contaminant concentrations do not exceed C4SLs, there is no risk that the land poses a significant possibility of significant harm (SPoSH) or the level of risk is low, as such land can be demonstrated to be in Category 4 and cannot be determined as contaminated land. The C4SLs are proposed to be more pragmatic (whilst still strongly precautionary) in comparison with SGVs and S4UL's outlined below.
- ii) **Suitable for Use Levels (S4ULs):** In 2015 LQM and the Chartered Institute of Environmental Health published generic assessment criteria for 89 substances including metals, BTEX, TPH, polycyclic aromatic hydrocarbons, phenols, chlorinated solvents and other volatile organic compounds. The S4ULs represent a minimal risk to long term human health, derived using health criteria values. The methodology for deriving the S4ULs is based on the Environment Agency CLEA model with consideration of developments in UK human health exposure assessment, in particular the additional land uses and exposure assumptions.
- iii) **Other Supplementary Screening Criteria:** In addition to those developed by LQM/CIEH (outlined above), other third party organisations have derived SSVs for a wider range of contaminants and land uses using the CLEA Model. Curtins have adopted these numbers where applicable, including those developed EIC/AGS/CL:AIRE and SoBRA published thresholds.

Alternative Assessment Approaches

PAH – Benzo(a)pyrene Surrogate Marker Assessment

In September 2017 Public Health England (PHE) (Ref. h) published guidance for the use of a surrogate marker approach to assess the risk posed by soil contamination with the genotoxic polycyclic aromatic hydrocarbons (PAHs). The guidance indicates that the use of a marker compound, such as Benzo(a)pyrene, provides a consistent indicator of the amount of 7 other genotoxic PAHs commonly tested for in soil including benz(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, indeno(123cd)pyrene and benzo(ghi)perylene.

Where PAH concentrations of these 8 no. PAHs are present within pre-determined ratios in soil, provided in the guidance, this approach is used, comparing soil concentrations of the marker compound with a Category 4 Screening Level, or site specific assessment criteria. An individual compound assessment is carried out for other PAH compounds not considered in the PHE guidance.

An individual compound assessment is carried out for all PAH compounds where pre-determined ratios are not met for the surrogate marker approach.

Notes

Curtins Generic Assessment Criteria provide further information and notes to be read in conjunction with this assessment rationale.

Human Health GQRA Rationale and Hierarchy



References

- a) Environmental Agency. (2009) Contaminated Land Exposure Assessment (CLEA) v1.071 model.
- b) Environment Agency. (2009) Human Health Toxicological Assessment of Contaminants in Soil (report no. SC050021/SR2).
- c) Environment Agency. (2009) Updated Technical Background to the CLEA Model (report no.SC050021/SR3).
- d) Environment Agency (2005) The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils Science Report P5-080/TR3.
- e) Department of Environment Food and Rural Affairs (DEFRA). (2012) Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance (report no. PB13735).
- f) CL:AIRE (2014) Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination, SP1010 Rev 2.
- g) LQM & CIEH (2015) S4ULs for Human Health Risk Assessment.
- h) Public Health England (2017) Contaminated Land Information Sheet: Risk Assessment Approaches for Polycyclic Aromatic Hydrocarbons (PAHs)

Contaminants	Residential with Home Grown Produce	Residential Without Home Grown Produce	Allotments	Commercial	Public open space (Residential)	Public park POS _{park}	Solubility Saturation Limit (mg/kg)	Vapour Satuation Limit (mg/kg)
Metals, Semi-Metals & non-metals								
Antimony	-	550	-	7500	-	-		
Arsenic	37	40	49	640	79	170		
Beryllium	1.7	1.7	35	12	2.2	63		
Boron	290	11000	45	240000	21000	46000		
Cadmium	22	150	3.9	410	220	880		
Chromium III	910	910	18000	8600	1500	33000		
Chromium VI	21	21	170	49	21	250		
Copper	2400	7100	520	68000	12000	44000		
Lead	200	310	80	2300	630	1300		
Mercury (elemental)	1.2	1.2	21	58	16	30		25.8
Mercury (inorganic)	200	300	86	5100	610	1300		
Methylmercury	11	15	6	320	40	68		
Nickel	130	180	53	980	230	800		
Selenium	250	430	88	12000	1100	1800		
Vanadium	410	1200	91	9000	2000	5000		
Zinc	3700	40000	620	730000	81000	170000		
Inorganic Compounds								
Cyanide	24	24	24	1400	24	24		
Organic contaminants								
Aliphatic Risk Banded Hydrocarbons - TPH CWG method								
Aliphatic EC5 - EC6 TPHs	42	42	730	3200	570000	95000	304	
Aliphatic EC6 - EC8 TPHs	100	100	2300	7800	600000	150000		
Aliphatic EC>8 - EC10 TPHs	27	27	320	2000	13000	14000		
Aliphatic EC>10-EC12 TPHs	130	130	2200	9700	13000	21000	48	
Aliphatic EC>12-EC16 TPHs	1100	1100	11000	59000	13000	25000	24	
Aliphatic EC>16 - EC35 TPHs	65000	65000	260000	1600000	250000	450000	8.48	
Aliphatic EC>35 - EC44 TPHs	65000	65000	260000	1600000	250000	450000	8.48	
Aromatic Risk Banded Hydrocarbons - TPH CWG method								
Aromatic EC5 - EC7 TPHs	70	370	13	26000	56000	76000	1220	
Aromatic EC>7 - EC8 TPHs	130	860	22	56000	56000	87000		869
Aromatic EC>8 - EC10 TPHs	34	47	8.6	3500	5000	7200		613
Aromatic EC10 - EC12 TPHs	74	250	13	16000	5000	9200	364	
Aromatic EC12 - EC16 TPHs	140	1800	23	36000	5100	10000	169	
Aromatic EC>16 - EC21 TPHs	260	1900	46	28000	3800	7600		
Aromatic EC>21 - EC35 TPHs	1100	1900	370	28000	3800	7800		
Aromatic EC>35 - EC44 TPHs	1100	1900	370	28000	3800	7800		
Long Chain Aliphatic and Aromatic Hydrocarbons								
Aliphatic and Aromatic EC >44-70	1600	1900	1200	28000	3800	7800		
Aromatic Hydrocarbons								
Benzene	0.2	0.89	0.039	27	140	190		
Ethyl benzene	47	83	16	5700	24000	17000		518
Toluene	130	880	22	56000	56000	87000		869
Xylene	56	79	28	5900	41000	17000	478 (o-xylene) 576 (p-xylene)	625 (m-xylene)
MTBE	49	73	23	7900			20400	
Phenol	280	750	66	760	760	760		
Polycyclic Aromatic Hydrocarbons (PAH) - Benzo(a)pyrene Surrogate Marker Approach, with reference to C4SL PAH Surrogate Marker Check Sheet where appropriate								
Benzo(a)Pyrene (C4SL Surrogate Marker Approach)	5	5.3	5.7	77	10	21		
Naphthalene	15	15	65	1600	11000	800	76.4	
Acenaphthylene	170	2900	28	83000	15000	29000	86.1	
Acenaphthene	210	3000	34	84000	15000	29000	57	
Fluorene	170	2800	27	63000	9900	20000	30.9	
Phenanthrene	95	1300	15	22000	3100	6200	36	
Anthracene	2400	31000	380	520000	74000	150000		1.17
Fluoranthene	280	1500	52	23000	3100	6300		
Pyrene	620	3700	110	54000	7400	15000		
Polycyclic Aromatic Hydrocarbons (PAH) - Individual Compound Assessment								
Naphthalene	15	15	65	1600	11000	800	76.4	
Acenaphthylene	170	2900	28	83000	15000	29000	86.1	
Acenaphthene	210	3000	34	84000	15000	29000	57	
Fluorene	170	2800	27	63000	9900	20000	30.9	
Phenanthrene	95	1300	15	22000	3100	6200	36	
Anthracene	2400	31000	380	520000	74000	150000		1.17
Fluoranthene	280	1500	52	23000	3100	6300		
Pyrene	620	3700	110	54000	7400	15000		
Benzo(a)anthracene	7.2	11	2.9	170	29	49		
Chrysene	15	30	4.1	350	57	93		
Benzo(b)fluoranthene	2.6	3.9	0.99	44	7.1	13		
Benzo(k)fluoranthene	77	110	37	1200	190	370		
Benzo(a)pyrene (only)	2.2	3.2	0.97	35	5.7	11		
Indeno(123cd)pyrene	27	45	9.5	500	82	150		
Dibenzo(ah)anthracene	0.24	0.31	0.14	3.5	0.57	1.1		
Benzo(ghi)perylene	320	360	290	3900	640	1400		
Chlorinated Aliphatic Hydrocarbons								
Chloroethene (Vinyl chloride)	0.0064	0.015	0.0017	1.1	7.8	18		
1,1-Dichloroethene (DCE)	0.23	0.23	2.8	26			2230	
Cis 1,2, Dichloroethene (DCE)	0.46	0.5	0.89	38	3800	2800	3940	
Trans 1,2, Dichloroethene (DCE)	0.9	0.93	3.7	69	13000	5600	3420	
Trichloroethene (TCE)	0.0093	0.0097	0.032	0.73	76	41		
Tetrachloroethene (PCE)	0.31	0.32	2	24	3200	1400		
1,1,1,2 Tetrachloroethane	1.2	1.5	0.79	110	1400	1500		
1,1,1 Trichloroethane	8.8	9	48	660	140000	57000		1425
1,2-Dichloroethane (Ethylene Dichloride)	0.11	0.16	0.054	12	300	300		
Tetrachloromethane	0.026	0.026	0.45	2.9	890	190		
Trichloromethane (Chloroform)	0.91	1.2	0.42	99	2500	2600		
Per- and Polyfluoroalkyl Substances (PFAS)								
Perfluorooctanoic Acid (PFOA)	0.0076	0.041	0.0014	0.6	0.079	0.17		
Perfluorononanoic Acid (PFNA)	0.013	0.041	0.0027	0.6	0.079	0.17		
Perfluorohexane Sulfonic Acid (PFHxS)	0	0.041	0.0015	0.6	0.079	0.17		
Perfluorooctane Sulfonic Acid (PFOS)	0.0073				9	0.17		

Contaminants	Residential with Home Grown Produce	Residential Without Home Grown Produce	Allotments	Commercial	Public open space (Residential)	Public park POS _{park}	Solubility Saturation Limit (mg/kg)	Vapour Satuation Limit (mg/kg)
Metals, Semi-Metals & non-metals								
Antimony		550		7500				
Arsenic	37	40	49	640	79	170		
Beryllium	1.7	1.7	35	12	2.2	63		
Boron	290	11000	45	240000	21000	46000		
Cadmium	22	150	3.9	410	220	880		
Chromium III	910	910	18000	8600	1500	33000		
Chromium VI	21	21	170	49	21	250		
Copper	2400	7100	520	68000	12000	44000		
Lead	200	310	80	2300	630	1300		
Mercury (elemental)	1.2	1.2	21	58	16	30		25.8
Mercury (inorganic)	200	300	86	5100	610	1300		
Methylmercury	11	15	6	320	40	68		
Nickel	130	180	53	980	230	800		
Selenium	250	430	88	12000	1100	1800		
Vanadium	410	1200	91	9000	2000	5000		
Zinc	3700	40000	620	730000	81000	170000		
Inorganic Compounds								
Cyanide	24	24	24	1400	24	24		
Organic contaminants								
Aliphatic Risk Banded Hydrocarbons - TPH CWG method								
Aliphatic EC5 - EC6 TPHs		78	1700	5900	590000	130000	558	
Aliphatic EC>6 - EC8 TPHs	23	230	5600	17000	610000	220000		
Aliphatic EC>8 - EC10 TPHs	65	65	770	4800	13000	18000		190
Aliphatic EC>10-EC12 TPHs	330	330	4400	23000	13000	23000		118
Aliphatic EC>12-EC16 TPHs	2400	2400	13000	82000	13000	25000	59	
Aliphatic EC>16 - EC35 TPHs	92000	92000	270000	1700000	250000	480000	21	
Aliphatic EC>35 - EC44 TPHs	92000	92000	270000	1700000	250000	480000	21	
Aromatic Risk Banded Hydrocarbons - TPH CWG method								
Aromatic EC5 - EC7 TPHs	140	0	27	46000	56000	84000	2260	
Aromatic EC>7 - EC8 TPHs	290		51	110000	56000	95000	1920	
Aromatic EC>8 - EC10 TPHs	83	1	21	8100	5000	8500		1500
Aromatic EC10 - EC12 TPHs	180	590	31	28000	5000	9700	899	
Aromatic EC12 - EC16 TPHs	330	2300	57	37000	5100	10000	419	
Aromatic EC>16 - EC21 TPHs	540	1900	110	28000	3800	7700		
Aromatic EC>21 - EC35 TPHs	1500	1900	820	28000	3800	7800		
Aromatic EC>35 - EC44 TPHs	1500	1900	820	28000	3800	7800		
Lo Main Aliphatic and Aromatic Hydrocarbons								
Aliphatic and Aromatic EC >44-70	1800	1900	00	28000	3800	7800		
Aromatic Hydrocarbons								
Benzene	0.17	0.7	0.0	47	72	100		
Ethyl benzene	110	190	39	13000	24000	22000		1220
Toluene	290	1900	51	110000	56000	95000		1920
Xylene	130	180	67	14000	42000	23000	1120	1470
MTBE	84	120	44	13000			33100	
Phenol	550	1300	140	1500	1500	1500		
Polycyclic Aromatic Hydrocarbons (PAH) - Benzo(a)pyrene Surrogate Marker Approach, with reference to C4SL PAH Surrogate Marker Check Sheet where appropriate								
Benzo(a)Pyrene (C4SL Surrogate Marker Approach)	5	5.3	5.7	77	10	21		
Naphthalene	36	36	130	3	15000	1200	183	
Acenaphthylene	420	4600	69	9700	15000	30000	212	
Acenaphthene	510	4700	85	97000	15000	30000		
Fluorene	400	3800	67	68000	9900	20000	7	
Phenanthrene	220	1500	38	22000	3100	6200		
Anthracene	5400	35000	950	540000	74000	150000		
Fluoranthene	560	1600	130	23000	3100	6300		
Pyrene	1200	3800	270	54000	7400	15000		
Polycyclic Aromatic Hydrocarbons (PAH) - Individual Compound Assessment								
Naphthalene	36	36	130	3700	15 0	1200	183	
Acenaphthylene	420	4600	69	97000	1500	30000	212	
Acenaphthene	510	4700	85	97000	15000	30000	141	
Fluorene	400	3800	67	68000	9900	20000	76.5	
Phenanthrene	220	1500	38	22000	3100	6200		
Anthracene	5400	35000	950	540000	74000	150000		
Fluoranthene	560	1600	130	23000	3100	6300		
Pyrene	1200	3800	270	54000	7400	15000		
Benzo(a)anthracene	11	14	6.5	170	29	56		
Chrysene	22	31	9.4	350	57	10		
Benzo(b)fluoranthene	3.3	4	2.1	44	7.2	15		
Benzo(k)fluoranthene	93	110	75	1200	190	410		
Benzo(a)pyrene (only)	2.7	3.2	2	35	5.7	12		
Indeno(123cd)pyrene	36	46	21	510	82	170		
Dibenzo(ah)anthracene	0.28	0.32	0.27	3.6	0.57	1.3		
Benzo(ghi)perylene	340	360	470	4000	640	1500		
Chlorinated Aliphatic Hydrocarbons								
Chloroethene (Vinyl chloride)	0.01	0.019	0.0031	1.4	7.8	19		
1,1-Dichloroethene (DCE)	0.4	0.41	5.6	46			3940	
Cis 1,2, Dichloroethene (DCE)	0.78	0.84	1.7	64	3800	2400	6610	
Trans 1,2, Dichloroethene (DCE)	1.6	1.7	0.75	120	13000	7000	6170	
Trichloroethene (TCE)	0.02	0.02	0.072	1.5	78	54		
Tetrachloroethene (PCE)	0.7	0.71	4.8	55	3300	1900		
1,1,1,2 Tetrachloroethane	2.8	3.5	1.9	250	1400	1800		
1,1,1 Trichloroethane	18	18	110	1300	140000	76000		2915
1,2-Dichloroethane (Ethylene Dichloride)	0.18	0.24	0.1	17	210	330		
Tetrachloromethane	0.056	0.056	1	6.3	920	270		
Trichloromethane	1.7	2.1	0.83	170	2500	2800		
PFAS								
Perfluorooctanoic Acid (PFOA)	0.0076	0.041	0.0014	0.6	0.079	0.17		
Perfluorononanoic Acid (PFNA)	0.013	0.041	0.0027	0.6	0.079	0.17		
Perfluorohexane Sulfonic Acid (PFHxS)	0.0081	0.041	0.0015	0.6	0.079	0.17		
Perfluorooctane Sulfonic Acid (PFOS)	0.0073	0.041	0.0013	0.6	0.079	0.17		

Contaminants	Residential with Home Grown Produce	Residential Without Home Grown Produce	Allotments	Commercial	Public open space (Residential)	Public park POS _{park}	Solubility Saturation Limit (mg/kg)	Vapour Satuation Limit (mg/kg)
Metals, Semi-Metals & non-metals								
Antimony		550		7500				
Arsenic	37	40	49	640	79	170		
Beryllium	1.7	1.7	35	12	2.2	63		
Boron	290	11000	45	240000	21000	46000		
Cadmium	22	150	3.9	410	220	880		
Chromium III	910	910	18000	8600	1500	33000		
Chromium VI	21	21	170	49	21	250		
Copper	2400	7100	520	68000	12000	44000		
Lead	200	310	80	2300	630	1300		
Mercury (elemental)	1.2	1.2	21	58	16	30		25.8
Mercury (inorganic)	200	300	86	5100	610	1300		
Methylmercury	11	15	6	320	40	68		
Nickel	130	180	53	980	230	800		
Selenium	250	430	88	12000	1100	1800		
Vanadium	410	1200	91	9000	2000	5000		
Zinc	3700	40000	620	730000	81000	170000		
Inorganic Compounds								
Cyanide	24	24	24	1400	24	24		
Organic Compounds								
Aliphatic Risk Banded Hydrocarbons - TPH CWG method								
Aliphatic EC5 - EC6 TPHs	160	160	3900	12000	600000	180000	1150	
Aliphatic EC>6 - EC8 TPHs	530	530	13000	40000	620000	320000		
Aliphatic EC>8 - EC10 TPHs	150	150	1700	11000	13000	21000		451
Aliphatic EC>10-EC12 TPHs	760	770	7300	47000	13000	24000		283
Aliphatic EC>12-EC16 TPHs	4300	4400	13000	90000	13000	26000	142	
Aliphatic EC>16 - EC35 TPHs	110000	110000	270000	1800000	250000	490000		
Aliphatic EC>35 - EC44 TPHs	110000	110000	270000	1800000	250000	490000		
Aromatic Risk Banded Hydrocarbons - TPH CWG method								
Aromatic EC5 - EC7 TPHs	300	1400	57	86000	56000	92000	4710	
Aromatic EC>7 - EC8 TPHs	660	3900	120	180000	56000	100000		4360
Aromatic EC>8 - EC10 TPHs	190	270	51	17000	5000	9300		3590
Aromatic EC10 - EC12 TPHs	380	1200	74	34000	5000	10000	2150	
Aromatic EC12 - EC16 TPHs	660	2500	130	38000	5000	10000		
Aromatic EC>16 - EC21 TPHs	930	1900	260	28000	3800	7800		
Aromatic EC>21 - EC35 TPHs	1700	1900	1600	28000	3800	7900		
Aromatic EC>35 - EC44 TPHs	1700	1900	1600	28000	3800	7900		
Long Chain Aliphatic and Aromatic Hydrocarbons								
Aliphatic and Aromatic EC >44-70	1900	1900	3000	28000	3800	7900		
Aromatic Hydrocarbons								
Benzene	0.87	3.3	0.18	98	140	230		
Ethyl benzene	260	440	91	27000	25000	27000		2840
Toluene	690	3900	120	180000	56000	100000		4360
Xylene	310	430	160	30000	43000	31000	2620	
MTBE	160	220	90	24000			62700	
Phenol	420	2300	280	3200	3200	3200		
Polycyclic Aromatic Hydrocarbons (PAH) - Benzo(a)pyrene Surrogate Marker Approach, with reference to C4SL PAH Surrogate Marker Check Sheet where appropriate								
Benzo(a)Pyrene (C4SL Surrogate Marker Approach)	5	5.3	5.7	77	10	21		
Naphthalene	85	85	200	8400	17000	1900	432	
Acenaphthylene	920	6000	160	100000	15000	30000	506	
Acenaphthene	1100	6000	200	100000	15000	30000	336	
Fluorene	860	4500	160	71000	9900	20000	183	
Phenanthrene	440	1500	90	23000	3100	6300		
Anthracene	11000	37000	2200	540000	74000	150000		
Fluoranthene	890	1600	290	23000	3100	6400		
Pyrene	2000	3800	620	54000	7400	15000		
Polycyclic Aromatic Hydrocarbons (PAH) - Individual Compound Assessment								
Naphthalene	85	85	200	8400	17000	1900	432	
Acenaphthylene	920	6000	160	100000	15000	30000	506	
Acenaphthene	1100	6000	200	100000	15000	30000	336	
Fluorene	860	4500	160	71000	9900	20000	183	
Phenanthrene	440	1500	90	23000	3100	6300		
Anthracene	11000	37000	2200	540000	74000	150000		
Fluoranthene	890	1600	290	23000	3100	6400		
Pyrene	2000	3800	620	54000	7400	15000		
Benzo(a)anthracene	13	15	13	180	29	62		
Chrysene	27	32	19	350	57	120		
Benzo(b)fluoranthene	3.7	4	3.9	45	7.2	16		
Benzo(k)fluoranthene	100	110	130	1200	190	440		
Benzo(a)pyrene (only)	3	3.2	3.5	36	5.7	13		
Indeno(123cd)pyrene	41	46	39	510	82	180		
Dibenzo(ah)anthracene	0.3	0.32	0.43	3.6	0.58	1.4		
Benzo(ghi)perylene	350	360	640	4000	640	1600		
Chlorinated Aliphatic Hydrocarbons								
Chloroethene (Vinyl chloride)	0.017	0.029	0.0058	2.2	7.8	19		
1,1-Dichloroethene (DCE)	0.82	0.82	12	92			7940	
Cis 1,2, Dichloroethene (DCE)	1.5	1.6	3.6	120	3900	3100	12900	
Trans 1,2, Dichloroethene (DCE)	3.3	3.4	16	260	13000	9100	12600	
Trichloroethene (TCE)	0.043	0.045	0.16	3.4	79	69		
Tetrachloroethene (PCE)	1.6	1.6	11	130	3400	2500		
1,1,1,2 Tetrachloroethane	6.4	8.2	4.4	560	1400	2100		
1,1,1 Trichloroethane	39	40	240	3000	140000	100000		6392
1,2-Dichloroethane (Ethylene Dichloride)	0.31	0.41	0.19	29	310	380		
Tetrachloromethane	0.13	0.13	2.4	14	950	400		
Trichloromethane	3.4	4.2	1.7	350	2500	3100		
PFAS								
Perfluorooctanoic Acid (PFOA)	0.0076	0.041	0.0014	0.6	0.079	0.17		
Perfluorononanoic Acid (PFNA)	0.013	0.041	0.0027	0.6	0.079	0.17		
Perfluorohexane Sulfonic Acid (PFHxS)	0	0.041	0.0015	0.6	0.079	0.17		
Perfluorooctane Sulfonic Acid (PFOS)	0.0073				9	0.17		

- 1) All Values are in mg/kg, reported to 2 significant figures.
- 2) Numbers in bold are C4SLs, Numbers in italics are S4ULs, Numbers underlined are EIC/AGS/CL:AIRE GACs, Numbers in red are SoBRA Acute Generic Assessment Criteria.
- 3) Assumptions and key notes made when deriving the Generic Assessment Criteria are contained within the relevant guidance documents, references:
 - a) Contaminated Land: Applications in Real Environments (2014) SP1010 - Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination, Final Project Report (Revision 2b)
 - b) Land Quality Management Ltd. (2015) The LQM/CIEH S4ULs for Human Health Risk Assessment.
 - c) CL:AIRE, EIC, AGS (2010) Soil Generic Assessment Criteria for Human Health Risk Assessment.
 - d) Society of Brownfield Risk Assessment (2020) Development of Acute Generic Assessment Criteria for Assessing Risks to Human Health from Contaminants in Soil.
 - e) Environment Agency (2009) Human Health Toxicological Assessment of Contaminants in Soil, Science Report - SC050021/SR2.
- 4) Generic Assessment Criteria listed in the following order of preference: C4SLs, S4ULs, CL:AIRE/AGS/EIC Generic Assessment Criteria, Other relevant Generic Assessment Criteria where GACS associated with the prioritised GACs are not available as outlined further in Curtins Rationale and Hierarchy notes.
- 5) To use Benzo(a)pyrene as a surrogate marker for PAH contamination, the assumptions set out in the relevant C4SL documentation must be met. A C4SL PAH surrogate marker checklist is appended.
- 6) Naphthalene is a volatile PAH. The C4SL values are derived on the basis of chronic exposure and risks to human health, and do not explicitly account for acute risks (e.g. a one off ingestion of a significant amount of soil by a young child) where the inhalation pathway is the main risk driver. Further consideration of the acute risk may be required in external settings (POS_{park} and POS_{resi}) where the GAC is substantially greater than the residential equivalent, to account for the possibility of acute exposure to the ingestion of naphthalene. The theoretical solubility saturation limit of naphthalene in soil is substantially lower than the GAC value, and therefore it is likely that free phase contamination would be present where the GAC is exceeded. In such a situation, it is unlikely that the product would remain in-situ untreated, and consideration of remediation / mitigation methods would be required.
- 7) Where the C4SL surrogate marker checklist indicates the PAH ratios are not suitable, individual PAH compounds must be assessed individually against the relevant contaminant specific assessment criteria.
- 8) Risk associated with additive effects of TPH contamination needs to be assessed in addition to the individual bandings, using the following equation:

$$HI = \sum HQ \quad Fi = \sum \frac{\text{Measured Concentration, } Fi \text{ (mg/kg)}}{\text{Relevant GAC (mg/kg)}} Fi$$

Where: **HI** = Hazard Index **HQ** = Hazard Quotient **Fi** = Fraction index

Where the HI > 1, there may be a risk to human health.
- 9) Exposure to all xylene isomers to be considered together. Values detailed in this table are the lowest (most conservative) of o-, m- and p- xylene isomers.
- 10) PFAS assessment also uses a hazard index approach to ensure the total exposure from all four PFAS compounds combined does not exceed the LLTC_{oral}. Where the hazard index exceeds 1, further consideration or assessment of the risk is required, even where none of the individual C4SL values are exceeded.
- 11) PFAS C4SL values are interim. The C4SL has been derived using the sum of the four PFAS compounds as the basis of the low level of toxicological concern. The term interim reflects concerns raised by the Committee on Toxicity (COT) and the fact that further work by the COT and others may result in the need for the LLTC to be updated.
- 12) Generic Assessment Criteria assume no free phase contamination is present. Where free phase contamination is present, further assessment may be required.
- 13) Solubility Saturation Limit and Vapour Saturation Limit are provided in accordance with relevant guidance documents. Where these values are exceeded, and the vapour pathway is an important contributing pathway to exposure, then the following should be considered:
 - Free phase contamination may be present
 - Exposure from vapour pathways will be over predicted.
 - Where the vapour pathway is >90% of exposure then it is unlikely that the relevant HCV will be exceeded at soil concentrations at least a factor of ten higher than the relevant HCV.

Additional assessment should be undertaken where this is the case, with consideration that:

 - Exposure is unlikely to reach the relevant HCV and the risk based on the assumed conceptual model is likely to be negligible.
 - Vapour pathway exposure should be calculated using algorithms suitable for free phase or NAPL sources
 - Screening could be considered using the lower saturation limit, which is the approach adopted by the USEPA. However, this may not be practical in many cases because of very low limits and is in any case highly conservative.

Where the vapour pathway is the only exposure pathway considered then effective assessment criteria should be derived manually in accordance with guidance outlined in CLEA Science Report SC050021/SR4
- 14) The C4SL for inorganic mercury considers chronic exposure risk only. Further assessment of acute risks may be required. Refer to guidance provided in SoBRA (2020) Development of Acute Generic Assessment Criteria for Assessing Risks to Human Health from Contaminants in Soil.

Appendix G – Risk Assessment Rationale

The site-specific risk assessment, presented in this report, follows the principle of establishing whether there is a viable linkage between a contaminant source to a potential receptor, via an exposure pathway.

The risk assessment corresponds with the total site area and incorporates both descriptive (qualitative) and, where available, numerical (quantitative) lines of evidence.

Risk assessment is the process of collating known information on a hazard or set of hazards to estimate actual or potential risk to receptors. The receptor may be humans, a water resource, a sensitive local ecosystem, or future construction materials. Receptors can be connected to the source by one or several exposure pathways such as direct contact for example. Risks are managed by isolating the receptor or intercepting the exposure pathway or by isolating or removing the hazard.

Without the three essential components of a source, pathway, and receptor there can be no risk. Therefore, the presence of contaminant source on a site does not necessarily mean there is a risk.

The risk assessment considers the likelihood of a particular event taking place (accounting for the presence of the source and receptor and the viability of the exposure pathway) in conjunction with the severity of the potential consequence (accounting for the potential severity of the hazard and the sensitivity of the receptor).

In the risk assessment the consequence of the hazard has been classified as severe, medium, mild, or minor and the probability (likelihood) of the circumstances occurring classified as high likelihood or low likelihood or unlikely.

The consequences and probabilities are subsequently cross correlated to give a qualitative estimation of the risk using Department of the Environment risk classifications as detailed in the table below and as referenced in CIRIA C552.

		Consequence			
		Severe	Medium	Mild	Minor
Probability (Likelihood)	High Likelihood	Very High Risk	High Risk	Moderate Risk	Moderate/Low Risk
	Likely	High Risk	Moderate Risk	Moderate/Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate/Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate/Low Risk	Low Risk	Very Low Risk	Very Low Risk

In accordance with DoE guidance, the following categorisation of **consequence** has been developed.

Classification	Definition	Examples
Severe	Short-term (acute) risk to human health likely to result in “significant harm” as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resource. Catastrophic damage to buildings/property. A short-term risk to an ecosystem or organisation forming part of such ecosystem.	High concentrations of cyanide on the surface of an informal recreation area. Major spillage of contaminants from site into controlled water. Explosion, causing building collapse (can also equate to a short-term human health risk if buildings are occupied).
Medium	Chronic damage to Human Health. Pollution of sensitive water resources. A significant change in an ecosystem or organism forming part of such ecosystem.	Concentration of a contaminant from site exceeds the generic or site-specific assessment criteria. Leaching of contaminants from a site to a Principal or Secondary A aquifer. Death of a species within a designated nature reserve. Lesser toxic and asphyxiate effects
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures, and services. Damage to sensitive buildings/structures/services or the environment.	Pollution of non-classified groundwater (Inc. Secondary B aquifers). Damage to building rendering it unsafe to occupy (e.g. foundation damage resulting in instability).
Minor	Harm, although not necessarily significant harm, which may result in a financial loss or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing, etc). Easily repairable effects of damage to buildings, structures, and services.	The presence of contaminants at such concentrations that protective equipment is required during site works. The loss of plants in a landscaping scheme. Discoloration of concrete.

In accordance with DoE guidance, the following categorisation of **probability** has been developed.

Classification	Definition
High Likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and over the long term.
Low Likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place and is less likely in the shorter term.
Unlikely	There is a pollution linkage, but circumstances are such that it is improbable that an event would occur even in the very long term.

In accordance with DoE guidance, the following categorisation of **risk** has been developed.

Classification	Definition
Very High Risk	There is a <i>high probability</i> that <i>severe harm</i> could arise to a designated receptor from an identified hazard at the site without appropriate further action.
High Risk	<i>Harm is likely to arise</i> to a designated receptor from an identified hazard at the site without appropriate further action.
Moderate Risk	<i>It is possible</i> that without appropriate further action <i>harm could arise</i> to a designated receptor. It is relatively <i>unlikely</i> that any such harm would be <i>severe</i> , and if any harm were to occur it is <i>more likely</i> that such harm would be <i>relatively mild</i> .
Low Risk	<i>It is possible</i> that <i>harm could arise</i> to a designated receptor from an identified hazard. It is <i>likely</i> that, at worst, if any harm was realised any effects would be <i>mild</i> .
Negligible Risk	The presence of an identified hazard does not give rise to the potential to cause harm to a designated receptor.

The term 'risk' in this instance refers to the risk that the source, pathway, receptor linkage for a given source of contamination is complete. It does not refer to immediate risk to individuals or features present on the site from potential contaminants and is intended to be used as a tool to assess the necessity of further investigation.