

Proposed Residential Development

Shaw Lane, Carlton



Reference	24307-RWO-XX-XX-RP-C-001
Client Name	Countryside Properties (UK) Ltd
Date	March 2026
Version	02

CONTENTS

Confidentiality Statement

Document History

1.0 EXECUTIVE SUMMARY	4
2.0 INTRODUCTION	6
3.0 DEVELOPMENT SITE AND LOCATION	7
4.0 DEVELOPMENT PROPOSALS.....	9
5.0 SEQUENTIAL TEST.....	10
6.0 CLIMATE CHANGE	11
7.0 SITE SPECIFIC FLOOD RISK	12
8.0 SURFACE WATER MANAGEMENT & SUDS COMPLIANCE	17
9.0 OCCUPANTS AND USERS OF THE DEVELOPMENT.....	20
10.0 EXCEPTION TEST	21
11.0 RESIDUAL RISK.....	22
12.0 FOUL DRAINAGE STRATEGY	22
13.0 WATER QUALITY.....	23
14.0 CONCLUSIONS	24
15.0 FRA & DRAINAGE STRATEGY CREDENTIALS	25

APPENDICES

APPENDIX A:	SITE LOCATION PLAN
APPENDIX B:	TOPOGRAPHICAL SURVEY
APPENDIX C:	YW SEWER RECORDS
APPENDIX D:	FLOOD MAP FOR PLANNING
APPENDIX E:	ENVIRONMENT AGENCY MODELLED FLOOD DATA
APPENDIX F:	PROPOSED SITE PLAN
APPENDIX G:	DRAWING 25280-RWO-XX-XX-DR-C-0900 FLOOD RISK ANALYSIS
APPENDIX H:	GREENFIELD RUNOFF RATE ESTIMATION - AREA NORTH OF SHAW LANE
APPENDIX I:	GREENFIELD RUNOFF RATE ESTIMATION - DEVELOPMENT SITE (L11)
APPENDIX J:	PROPOSED DRAINAGE STRATEGY
APPENDIX K:	HYDRAULIC CALCULATIONS

CONFIDENTIALLY STATAMENT

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

Countryside Properties (UK) Ltd

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

This report includes an interpretation and assessment of data provided by third parties. Whilst every care has been taken to ensure that this information is accurate and up to date, RWO Ltd cannot guarantee the accuracy of third-party data.

The report findings and conclusions may be subject to change if this data is amended or updated after the consultation has taken place.

DOCUMENT HISTORY

VERSION	PURPOSE/DESCRIPTION	DATE
1	First Issue	05.03.2026
2	Issued for Planning	19.03.2026

1.0 EXECUTIVE SUMMARY

RWO Associates (RWO) has been instructed by Countryside Properties (UK) Ltd to prepare a Flood Risk Assessment and Drainage Strategy in support of proposals for a proposed residential development located off Shaw Lane, Carlton. It is the client's intention to develop the site for 214 residential dwellings. The development site is part of the phase 3 Carlton Master Plan Framework and is referred to as the L11 Area within the Carlton Masterplan Framework Delivery Strategy.

The aim of the report is to allow Barnsley Metropolitan Borough Council to assess the site in accordance with the National Planning Policy Framework published by the Ministry of Housing, Communities and Local Government.

This assessment has considered the implications of the proposed residential development in relation to fluvial and surface water flood risk and concludes that all identified risks are low. The site is predominantly located within Flood Zone 1, with a small portion extending into Flood Zone 2. No residential development is proposed within Flood Zone 2; however, an attenuation basin is proposed within this area, which is considered appropriate given its classification as water-compatible development.

The impact of flood risk, including allowances for climate change, has been assessed. It is proposed that finished floor levels across the site shall be set no lower than 44.70 m AOD. This will ensure that the development remains at a low risk of flooding throughout its lifetime.

The risk of surface water flooding across the site has also been assessed. The surface water flood mechanism is considered to be primarily influenced by localised low-lying topography, with some contribution from overland flow paths across the currently undeveloped land. Following development, the site will be served by a positive surface water drainage system. Finished floor levels and external ground levels will be designed to maintain a managed overland exceedance flow route in the event of blockage or exceedance of the drainage system, directing flows towards the site boundary or designated attenuation basins and away from more vulnerable built development.

No other sources of flooding have been identified for the site, and there are no known historical records of flooding affecting the development area.

As infiltration has been demonstrated to be unfeasible, surface water runoff from the development will discharge to the existing ditch located to the south of the site, restricted to the equivalent greenfield run-off rate of 92.8l/s. This discharge rate includes an allowance of 60.6 l/s to accommodate flows from Parcel L12 located to the north and west of the site.

Appropriate water quality mitigation measures have been incorporated into the drainage strategy, including the use detention basins treat run-off treatment prior to discharge.

Foul drainage from the development will connect to the existing 525 mm diameter combined sewer crossing the site. An allowance for 100 dwellings has been made within the foul drainage network to accommodate additional foul flows from the future development within Parcel L12 located to the west of the site. Development within Parcel L12 to the north of the site will discharge directly to the existing 525 mm diameter combined sewer.

Overall, the proposed development incorporates appropriate mitigation measures and a robust drainage design to ensure that flood risk is effectively managed on site and that there will be no increase in flood risk elsewhere as a result of the development.



2.0 INTRODUCTION

RWO Associates (RWO) has been instructed by Vistry Group to prepare a Flood Risk Assessment and Drainage Strategy in support of proposals for a proposed residential development located off Shaw Lane, Carlton. It is the client's intention to develop the site for 214 residential dwellings. The development site is part of the phase 3 Carlton Master Plan Framework and is referred to as the L11 Area within the Carlton Masterplan Framework Delivery Strategy.

The aim of the report is to allow Barnsley Metropolitan Borough Council to assess the site in accordance with the National Planning Policy Framework published by the Ministry of Housing, Communities and Local Government.

This document reviews the risks of flooding in accordance with current guidance and identifies the risk of flooding along with proposed mitigation and provides a drainage overview to demonstrate that there is a viable strategy for managing surface and foul water at the site within the policy and planning requirements.

COMPLIANCE

The scope of the Flood Risk Assessment and the drainage strategy has been developed based on all relevant policy information, along with requirements outlined in the consultation responses.

PLANNING POLICY & GUIDANCE DOCUMENTS

The following planning policy documents were reviewed for this report:

- National Planning Policy Framework and Planning Practice Guidance (2024)
- Flood And Water Management Act (April 2010)
- Defra Sustainable Drainage Systems Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015)
- Sustainable Drainage Systems Written Statement Hcws161 (2014)
- Environment Agency Flood Maps
- Local Government Flood Maps
- South Yorkshire Interim Local Guidance of Sustainable Drainage Systems
- CIRIA C753 – The SuDS Manual
- Carlton Masterplan framework Design Code
- Carlton Masterplan framework Delivery Strategy

3.0 DEVELOPMENT SITE AND LOCATION

The proposed development site is located approximately 0.5 km east of the village of Carlton, within the Metropolitan Borough of Barnsley in South Yorkshire. The site is accessed via Shaw Lane and is identified by Ordnance Survey Grid Reference 437375E, 410331N. It forms part of Phase 3 of the Carlton Master Plan Framework and is designated as the L11 Area within the Carlton Masterplan Framework Delivery Strategy.

The site is bounded by greenfield land to the north and west. This adjoining greenfield land comprises Area L12 of the Carlton Master Plan Framework and is allocated for future residential development. The disused Barnsley Canal is situated immediately west of Area L12, at an approximate minimum distance of 60 m from the closest point of the L11 development site.

A railway line runs immediately adjacent to the eastern boundary of the site, while Shaw Lane forms the southern boundary.

The site extends to approximately 7.5 hectares and is currently undeveloped greenfield land. An aerial photograph of the site is provided below, and a site location plan is included in **Appendix A** of this report.



Figure 1 AERIAL VIEW OF DEVELOPMENT SITE

Site Topography

A topographical and utility survey of the site was undertaken by ZS Surveys Ltd and has been presented within **Appendix B** of this report. The survey data indicates the site generally falls from north to southeast. Ground Levels along northern boundary range from 47.7 to 46.4m AOD. Along the southern boundary the levels decrease from approximately 45.9m AOD at the western end to approximately 42.3m AOD at the eastern end.

The survey identifies a relatively flat area in the central part of the site, where ground levels are approximately 46.0 m AOD. Two ditches are located close to the northern boundary. These are approximately 0.8 m deep, with top-of-bank levels around 46.0 m AOD and invert levels around 45.0 m AOD.

A further ditch is present along the southern boundary of the site. A formal outfall from the ditch is located at the southeast corner of the site and comprises a 900 mm diameter culvert with an invert level of approximately 40.9 m AOD.

Water bodies

The disused Barnsley Canal is located approximately 60 m to the west of the site. Shaw Dike is situated approximately 250 m to the east of the site. Further downstream, Shaw Dike continues as Cudworth Dike as it flows through Carlton Marsh.

The River Dearne is the nearest designated Main River and lies approximately 3.8 km to the south of the site.

Existing Drainage Infrastructure

The utility survey presented within **Appendix B** of this report shows a 600mm combined drain thought to be Yorkshire Water sewer pipe cutting through the site from north to south.

The survey further shows that the two ditches towards the northern boundary to drain via 525mm diameter drain which discharges into the ditch located along the southern boundary of the site.

Furthermore, the survey indicates the ditch along the southern boundary to drain to the south of the site via a 900mm pipe which discharges into manhole located approximately 40m to the south of the site. Dye testing of this drain has proven that the runoff within this drain ultimately discharges into the Shaw Dike approximately 250m to the east of the site.

Yorkshire Water sewer records presented in **Appendix C** of this report show that the 600mm diameter drain crossing the site is a Yorkshire Water-owned combined sewer. However, the records indicate the diameter to be 525mm rather than 600mm and show the depth of the sewer within the site to be approximately 5–6m. Given the large diameter and significant depth of this sewer, diversion would be challenging. It is therefore recommended that the site layout be designed to accommodate the sewer and ensure that an adequate easement is maintained. Yorkshire Water has confirmed that a 5m easement is required on either side of the sewer.

The Yorkshire Water records also indicate the presence of a public surface water sewer beyond the southern site boundary. The sewer increases in size from 825mm where it enters Shaw Lane up to 1500mm where it outfalls into Shaw Dike. Based on the proven connectivity

of the ditch from the site to Shaw Dike, it is understood that surface water from the site is conveyed into this sewer prior to its discharge into Shaw Dike via the sewer network.

Flood Zone

According to the Environment Agency's Flood Map for Planning (available via the GOV.UK website), a majority of the site is located within Flood Zone 1. A small area in the southeast of the site is shown to lie within Flood Zones 2.

As defined in Table 1 of the Flood Risk and Coastal Change Guidance,

- Flood Zone 1 comprises land with a less than 0.1% annual probability of river or sea flooding (i.e. a flood event with a return period greater than 1 in 1,000 years), or land located outside Flood Zones 2, 3a, and 3b.
- Flood Zone 2 is defined as land having between a 1% and 0.1% annual probability of river flooding, or between a 0.5% and 0.1% annual probability of sea flooding.

A copy of the Flood Map for Planning has been presented within **Appendix D** of this report. As a small portion of the development site lies within flood zone 2, detailed flood risk data (product 4) was ordered from Environment agency to support the assessment. The data received has been presented within **Appendix E** of this report.

4.0 DEVELOPMENT PROPOSALS

The proposal for the site is a residential development comprising of 214 residential dwellings, each with private gardens, arranged around roads that connect to the existing highway network via Shaw Lane. The layout includes designated parking spaces for each plot and soft landscaping and sustainable drainage features such as attenuation basins to manage surface water runoff. The proposed layout of the development site has been presented within **Appendix F** of this report.

In accordance with Annex 3 of the National Planning Policy Framework (NPPF), the proposed development involves a change of use of the site from "land and buildings used for agriculture and forestry to buildings" to "land used for dwelling houses.". The existing use of the site falls within the "Less Vulnerable" flood risk classification, whereas the proposed residential use is categorised as "More Vulnerable." This constitutes a change in the flood risk vulnerability classification from Less Vulnerable to More Vulnerable.

In accordance with Paragraph 006 of the Flood Risk and Coastal Change Planning Practice Guidance, residential developments are assumed to have a design life of at least 100 years. Given the residential nature of the proposed development, a 100-year design life has been adopted as the basis for this Flood Risk Assessment.

5.0 SEQUENTIAL TEST

The Sequential Test is intended to steer new development to areas with the lowest probability of flooding. According to the Environment Agency Flood Map for Planning, the majority of the site is located within Flood Zone 1, with localised low-lying areas located in Flood Zone 2.

The Technical Guidance to the National Planning Policy Framework lists policy aims for sites within Flood Zone 2, which are; *Developers should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems.*

Paragraph 175 of the NPPF states *The sequential test should be used in areas known to be at risk now or in the future from any form of flooding, except in situations where a site-specific flood risk assessment demonstrates that no built development within the site boundary, including access or escape routes, land raising or other potentially vulnerable elements, would be located on an area that would be at risk of flooding from any source, now and in the future (having regard to potential changes in flood risk).*

The site proposals, including the layout and finished levels, have been designed to ensure that all 'more vulnerable' land uses and access routes are located outside areas identified as Flood Zone 2. Where any part of the development is situated within areas identified as being at risk of flooding as a result of climate change allowances, finished floor levels will be set a minimum of 300 mm above the modelled climate change flood levels. This approach provides an appropriate freeboard allowance and ensures the development remains resilient to the predicted impacts of climate change over its lifetime.

Furthermore, It has been demonstrated that the risk of flooding from surface water is associated with the local site topography where existing levels are to be maintained therefore the risk of surface water flooding in the wider area will be unaffected. It is therefore considered that it has been demonstrated that design proposals and mitigation measures ensure that occupiers and users remain safe from current and future surface water flood risk for the lifetime of the development without increasing flood risk elsewhere, therefore the sequential test need not be applied.

6.0 CLIMATE CHANGE

Peak River Flow Allowance

The development is located within the Don and Rother management catchment area. The DEFRA Climate Change Allowances map for peak river flow, based on projections generated by the UK Centre for Ecology and Hydrology using UK climate change scenarios, presents the central, higher central, and upper-end allowances for the 2020s, 2030s, and 2080s epochs.

Environment Agency guidance on the application of peak river flow allowances recommends using the central allowance for more vulnerable developments situated within Flood Zone 2. As a small portion of the site lies within Flood Zone 2, a central allowance of 28% is to be considered for the 2080s epoch, consistent with the assumed 100-year design life of the development.

Peak Rainfall Intensity Allowance

The DEFRA climate change allowances map for peak rainfall allowances shows the central and upper end allowances for the 2050s and 2070s epoch based on the 3.3% and 1% annual exceedance event.

The Environment Agency guidance on using peak rainfall intensity allowances to assess surface water flood risk suggests that the upper end allowance should be assessed for both 3.3% and 1% annual exceedance probability events for the 2070s epoch. In this case the allowances stand at 35% for 3.3% and 40% for the 1% Annual Exceedance Rainfall Event and have been utilised to estimate attenuation requirements for the site.

7.0 SITE SPECIFIC FLOOD RISK

Fluvial and Sea Flooding

According to the Environment Agency's Flood Map for Planning (available via the GOV.UK website), a majority of the site is located within Flood Zone 1. A small area in the southeast of the site is shown to lie within Flood Zones 2.

As defined in Table 1 of the Flood Risk and Coastal Change Guidance,

- Flood Zone 1 comprises land with a less than 0.1% annual probability of river or sea flooding (i.e. a flood event with a return period greater than 1 in 1,000 years), or land located outside Flood Zones 2, 3a, and 3b.
- Flood Zone 2 is defined as land having between a 1% and 0.1% annual probability of river flooding, or between a 0.5% and 0.1% annual probability of sea flooding.
- Flood zone 3a is defined as Land having a 1% or greater annual probability of river flooding; or Land having a 0.5% or greater annual probability of sea.

A copy of the Flood Map for Planning is provided in **Appendix D** of this report. A small area within the site is identified as lying within Flood Zone 2 (medium probability of flooding). In accordance with national guidance, a Product 4 modelled flood data request was submitted to the Environment Agency. The response, presented in **Appendix E**, confirms that no detailed hydraulic modelling data is currently held for the site. The presence of Flood Zone 2 mapping is likely attributable to recent updates to the Flood Map for Planning, as the site was previously shown to lie entirely within Flood Zone 1 (low probability of flooding).

In accordance with the Sequential Approach set out within the NPPF, development has been directed to areas of lowest flood risk within the site. The proposed layout, presented in **Appendix F**, demonstrates that no built development is located within Flood Zone 2. As such, all proposed buildings are situated within Flood Zone 1. Only an attenuation basin is proposed within flood zone 2, which is considered appropriate given its classification as water-compatible development.

To further ensure the development will be safe for its lifetime, flood risk has been assessed taking account of climate change allowances in accordance with PPG guidance. Flood Zone 2, Flood Zone 3, and the climate change flood extent have been overlain onto the site topographical survey and are shown on Drawing D900 – *Flood Risk Analysis – Rev 1*, included within **Appendix G**. Existing ground levels at the boundaries of Flood Zone 2 range between 43.43 m and 43.52 m AOD, whilst levels along the climate change flood extent range between 44.18 m and 44.36 m AOD. As mapped flood extents are indicative, conservative design levels of 43.6 m AOD for Flood Zone 2 and 44.4 m AOD for the climate change flood extent have been adopted.

Finished floor levels for all proposed buildings will be set a minimum of 300 mm above the adopted climate change flood level of 44.4m AOD, resulting in a minimum finished floor level of 44.7m AOD across the site. This approach ensures that finished floor levels remain above areas identified as being at risk during the 0.1% AEP plus climate change event. Accordingly, the proposed development will be at **LOW** risk of fluvial flooding for the duration of its design life.

Pluvial Flooding



Figure 2 EA Surface Water Map

Figure 2 illustrates the projected extent of surface water flooding associated with the annual exceedance probability event for the 2040–2060 epoch. The mapping identifies areas within the site that fall within the Low to High surface water flood risk categories.

The northern portion of the site is predominantly identified as being at High risk of surface water flooding. The mapping also indicates a continuous overland flow path traversing the site. This flow route is inferred to extend from north to south, consistent with the prevailing site topography, which generally falls in a southerly direction. A more detailed assessment of predicted flood depths has been undertaken and is presented below.



Figure 3 Surface Water Depths – Yearly chance of flooding between 2040 and 2060

Figure 3 presents the predicted surface water flood depths across the site for the same annual exceedance probability event (2040–2060 epoch). The mapping indicates that flood depths of up to 0.20 m are primarily confined to the northern part of the site and the south-eastern corner. A similar spatial pattern is observed for depths up to 0.30 m, although with slightly reduced extents.

Flood depths approaching 0.60 m are limited to very small, isolated areas, which correspond to the two existing ditches located adjacent to the northern site boundary. No areas within the site are predicted to experience flood depths of 0.90 m.

Based on the analysis of both flood extents and depths, the surface water flooding mechanism is considered to be primarily driven by localised low-lying topography, with some contribution from overland flow pathways across the undeveloped site. At present, the site does not benefit from a formal drainage system.

Upon development, the site will be served by a positive surface water drainage system. Finished floor levels and external ground levels will be designed to preserve a managed overland exceedance flow route in the event of system blockage, directing flows towards the site boundary or designated attenuation basins and away from more vulnerable built development.

Taking these mitigation measures into account, the residual risk of surface water flooding to the developed site is considered to be **LOW**.

Tidal/Coastal Flood Risk

The development site is located inland within Yorkshire, approximately 100 km west of the eastern coastline, and is therefore not subject to tidal or coastal flooding influences. There is no hydraulic connectivity between tidal water levels and local watercourses within Carlton.

Accordingly, tidal and coastal flooding is not considered a relevant flood mechanism for the site, and the associated flood risk is assessed to be **LOW**.

Ground Water Flooding

Groundwater conditions at the site have been informed by the findings of the Ground Investigation (GI) report undertaken by Tetra Tech and dated January 2022. During the investigation, groundwater seepage was encountered in Trial Pit TP01 at approximately 1.70 m below ground level (bgl), with more significant inflow observed from 2.05 m bgl, before stabilising at approximately 1.70 m bgl. In TP03, seepage was recorded at approximately 2.20 m bgl, with increased inflow from 3.00 m bgl, stabilising at approximately 2.80 m bgl.

These observations indicate the presence of shallow groundwater within the underlying strata, with levels likely to fluctuate seasonally in response to antecedent rainfall conditions. While groundwater was encountered at depth, there is no evidence to suggest artesian conditions or widespread groundwater emergence at the surface. Given the recorded depths and the absence of documented groundwater flooding in the locality, the risk of groundwater flooding affecting finished floor levels is considered to be **LOW**.

Nevertheless, foundation design and below-ground construction should account for the observed groundwater levels, and appropriate drainage measures should be incorporated where necessary to manage potential seasonal variation.

Flooding from Existing Sewers/Drains

There are no records of existing sewers flooding

On this basis, it is concluded that the risk of sewer flooding impacting the proposed development is **LOW**.

Reservoir Flooding

Reference to the Environment Agency information confirms that the site is outside of the zone of influence from any reservoir flooding. Based on the available information, it is assessed that the site is at **LOW** risk of reservoir flooding.

Historical Flood Records

The Past floods map provided shown on page 4 of EA product 4 flood risk assessment data provided within **Appendix E** show the flood outlines of multiple recorded floods events in the past as far back as 1947. This map shows the development site was not flooded in any of the recorded events. No additional records of on-site flooding from other sources have been identified.

Management of Flood Risk

Design of External Surfaces

The external surfaces are to be designed with minimal low point to provide positive drainage away from buildings and other sensitive receptors, directing surface water towards the site drainage infrastructure. Proposed highway levels to be designed to fall towards the site boundary to ensure runoff is directed away from the site. Where a low point within the highway is unavoidable, double gullies to be installed at the low point to enhance drainage capacity and positive drainage in case of blockages. At such low points, finished floor levels (FFLs) to be set above the anticipated standing water level to provide resilience in the event of gully blockages.

Finished Floor Levels

All proposed finished floor levels have been designed to be 300mm the 0.1% + climate change predicted flood levels thereby ensuring a high level of protection to the proposed plots in the event of extreme flooding events. The minimum floor level across the site is to be no lower than 44.7m AOD.

Compensatory Flood Storage

Not Applicable

Flood Resilience /Resistance

No development classified as 'More Vulnerable' (in accordance with the National Planning Policy Framework vulnerability classifications) shall be located within Flood Zone 2. The only

element of the proposed scheme situated within Flood Zone 2 will comprise the attenuation basin, which is classified as water-compatible development.

All built development located outside Flood Zone 2 shall be constructed with finished floor levels set a minimum of 300 mm above the predicted flood level associated with the 0.1% Annual Exceedance Probability (AEP) event, including an allowance for climate change.

Access and Egress

The principal site access will be positioned outside areas identified as being at risk of flooding to ensure safe access and egress can be maintained for the lifetime of the development.

Surface Water Management

Managing surface water from site as discussed in section 8 so no flooding occurs on site.

Flood Risk Summary

RWO have assessed the risk of flooding to the site from all known current and future potential.

The table below summarises the findings of the assessment.

Flood Risk		
Source of Flooding	Risk	Control Measures
Fluvial and sea	Low	Elevated FFL's with levels above predicted 1000 year + climate change. Minimum FFLS of 44.7m AOD
Pluvial	Low	External Surface design for Runoff away from buildings. Low spots to be avoided. Positive drainage system to be provided
Flood defences	Low	None
Groundwater flooding	Low	None
Sewers and Private Drainage	Low	Proposed Site Drainage
Other Sources	None Identified	

8.0 SURFACE WATER MANAGEMENT & SUDS COMPLIANCE

It is recommended and in accordance with good practice that the offsite surface water flows are reduced by the introduction of an attenuation system following the hierarchy as laid out in the national standards for sustainable drainage systems (SuDS)

The following destinations must be considered for surface runoff in order of preference:

- Collected for non-potable use
- Discharge into the ground
- Discharge to a surface water body
- Discharge to a surface water sewer
- Discharge to a combined sewer

The Ground Investigation Report, prepared by Tetra Tech and dated January 2022, includes the results of infiltration testing undertaken at the site. The testing demonstrated that water levels did not reduce to below 75% of the initial volume within a 24-hour monitoring period.

In accordance with prevailing drainage design guidance, this performance indicates inadequate infiltration capacity. Therefore, disposal of surface water via infiltration has been deemed unfeasible for the proposed development.

Whilst the disposal of surface water by infiltration methods is not feasible Sustainable Urban Drainage System (SUDS) may be used in conjunction with conventional drainage systems to improve water quality as well as manage surface water discharge.

The following audit has been carried out relating to suitability of SUD's systems:

Drainage Method	Description/Suitability	Proposal/Feasibility
1. Infiltration.	Due to anticipated ground conditions infiltration will not be feasible.	Excluded.
2. Ponds and wetlands.	Suitable subject to land being made available & ground water levels	Applicable.
3. Infiltration Basins.	Due to anticipated ground conditions infiltration will not be feasible.	Excluded.
4. Detention Basins.	Suitable subject to land being made available & ground water levels	Applicable.
5. Swale.	May be utilised convey water/improve water quality.	Applicable.
6. French/Filter drain.	May be utilised convey water/improve water quality.	Applicable.
7. Geo cellular Systems/Tank systems.	May be used as surface water attenuation.	Applicable.
8. Oversized pipes.	May be used as surface water attenuation.	Applicable.
9. Box culverts.	May be used as surface water attenuation.	Applicable.
10. Purpose designed tanks.	May be used as surface water attenuation.	Applicable.

Surface Water Drainage

The site is currently greenfield, with topography generally falling from north to south. As a result, existing greenfield runoff is understood to drain naturally towards the ditch located along the southern boundary of the site. This ditch subsequently conveys flows into an existing 900 mm diameter culvert which discharges into the Shaw Dyke approximately 250m to the east of site via the Yorkshire Water public surface water sewer.

As noted in the SuDS section, disposal of surface water via infiltration methods is not considered suitable for this site. In accordance with the drainage hierarchy, the next preferred option for surface water disposal is discharge to a watercourse, followed by discharge to a surface water sewer.

The proposed surface water drainage strategy is therefore to discharge attenuated runoff into the southern ditch, thereby replicating the established greenfield drainage regime in line with the principles of sustainable drainage.

Discharge to the southern ditch represents the most appropriate outfall option as it reflects the existing drainage pathway from the site and accords with the drainage hierarchy set out in the Non-Statutory Technical Standards for Sustainable Drainage Systems.

As outlined in section 3.0 (existing drainage infrastructure) The southern ditch is proven to connect via a culvert to the Yorkshire Water surface water sewer. Consequently, the restricted runoff from the site will ultimately pass through this sewer before discharging into Shaw Dyke.

It should be noted that a direct connection to Shaw Dyke is not considered reasonably practicable due to the distance from the site and the requirement to cross third-party land to reach the watercourse. In such circumstances, discharge via the existing surface water sewer network represents the next sequentially preferable option within the drainage hierarchy.

With respect to the proposed discharge rate, the Carlton Masterplan Framework Delivery Strategy identifies Parcel L11 (the development site) as providing surface water drainage infrastructure to accommodate runoff from Parcel L12 (future development land to the north and west of L11). The strategy states that the surface water drainage system within Parcel L11, including the outfall, shall cater for runoff from Parcel L12 based on a maximum permissible discharge rate of 5 l/s/ha. This approach implicitly applies the same discharge restriction to Parcel L11.

The Carlton Masterplan Framework Design Code identifies the combined area of Parcels L11 and L12 (north of Shaw Lane) as 21.82 ha. The red line boundary for Parcel L11 extends to 7.57 ha, leaving 14.25 ha attributable to Parcel L12. Applying the 5 l/s/ha rate results in a discharge of 37.85 l/s for Parcel L11 and 109.1 l/s for the combined parcels.

However, in accordance with the South Yorkshire Interim Local Guidance for Sustainable Drainage Systems and the Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015), discharge from greenfield sites should be restricted to the equivalent greenfield runoff rate (Q_{bar}). Greenfield runoff calculations presented within **Appendices H and I** confirm a Q_{bar} rate of 92.8 l/s for the total 21.82 ha area and 32.2 l/s for Parcel L11 (7.57 ha). These values are marginally lower than those derived using the 5l/s/ha methodology.

It is therefore proposed that discharge from Parcel L11 be restricted to its calculated greenfield runoff rate (Q_{bar}), while also accommodating runoff from Parcel L12 at an equivalent greenfield rate. On this basis, Parcel L12 would discharge at 60.6 l/s into the drainage system

within Parcel L11, resulting in a combined discharge rate of 92.8 l/s from Parcel L11 to the receiving watercourse to the south, thereby aligning with greenfield runoff principles and current SuDS guidance.

The engineering plan provided in **Appendix J** of this report illustrates the proposed drainage layout for the site. As indicated on the drawing, restricted runoff from Parcel L12 will discharge into the development site via surface water manholes SW1 and SW24 at a restricted rate of 27.0 l/s each, and via SW31 at a restricted rate of 6.6 l/s. This equates to a total combined restricted inflow of 60.6 l/s.

Two attenuation tanks are proposed upstream within the site, each incorporating a flow control device to provide upstream storage within the development boundary and closer to the source of runoff. This distributed approach avoids conveying all surface water runoff to a single location for attenuation within one large tank, thereby improving hydraulic management and operational efficiency.

The discharge from Attenuation Basin 1 will be restricted to 17.8 l/s, and the discharge from Attenuation Basin 2 will be restricted to 9.2 l/s. These flow control devices are internal to the site and are provided solely to manage surface water runoff within the development. They do not affect the permitted discharge rate associated with Parcel L12 or the final discharge rate from the overall development site.

The restricted flows from Basin 1 and Basin 2 are conveyed to Attenuation Basin 3, where the combined discharge is further restricted to 92.8 l/s prior to outfall to the existing ditch located along the southern boundary of the site.

Hydraulic modelling of the site has been undertaken using Flow software. The restricted discharge from Parcel L12 has been represented within the model at Nodes 1, 2 and 3, with inflows of 27.0 l/s entering the site at Nodes 1 and 2, and 6.6 l/s entering at Node 3. Internal flow control rates have been applied within the model in accordance with the values set out above.

The modelling indicates attenuation storage requirements of 600 m³ within Basin 1, 550 m³ within Basin 2, and 780 m³ within Basin 3. The locations and extents of these basins are illustrated on the proposed engineering layout contained in **Appendix J**.

The detailed hydraulic calculations are provided in **Appendix K** of this report. The results demonstrate that no on-site flooding occurs during the 1 in 100-year storm event, including an allowance of 40% for climate change.

Maintenance

A maintenance regime and strategy will be required to determine the details for inspection and maintenance specification for sustainable drainage systems (SuDS) maintained by a management company on behalf of the developer if they are not to be adopted by the Local Authority or Water Authority.

The private plot drainage system will be maintained by the plot owner within their private curtilage.

9.0 OCCUPANTS AND USERS OF THE DEVELOPMENT

An important component of a Flood Risk Assessment is the consideration of the potential impact of flooding on the occupants and users of the development. The proposed development will result in a significant increase in the number of occupants on-site, with the nature and timing of occupancy potentially increasing their vulnerability to flooding. However, as outlined in Section 7 of this report, the site is at low risk of flooding from all identified sources. Therefore, the proposed development is considered safe for future occupants.



10.0 EXCEPTION TEST

Essential Infrastructure		Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Flood Zone	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	Exception Test required	✓	✓	✓
	Zone 3a †	Exception Test required †	X	Exception Test required	✓	✓
	Zone 3b *	Exception Test required *	X	X	X	✓ *
Key:		✓ Exception test is not required X Development should not be permitted				
Notes to Table 2		• This table does not show the application of the Sequential Test which should be applied first to guide development to the lowest flood risk areas; nor does it reflect the need to avoid flood risk from sources other than rivers and the sea; • The Sequential and Exception Tests do not need to be applied to those developments set out in National Planning Policy Framework footnote 56. The Sequential and Exception Tests should be applied to 'major' and 'non major' development; • Some developments may contain different elements of vulnerability and the highest vulnerability category should be used, unless the development is considered in its component parts. "†" In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood. "*" In Flood Zone 3b (functional floodplain) essential infrastructure that has passed the Exception Test, and water-compatible uses, should be designed and constructed to: • remain operational and safe for users in times of flood; • result in no net loss of floodplain storage; • not impede water flows and not increase flood risk elsewhere.				

Table 1: NPPF Table 2 Flood Risk Vulnerability & Flood Zone Compatibility.

As described in preceding sections, the site is located within Flood Zone 3a; however, no development is proposed within Flood Zone 3a. The majority of the proposed development is located within Flood Zone 1, with only a small section of the site access road extending into Flood Zone 2.

With reference to NPPF Table 1 Flood Zones and to Environment Agency mapping, the site is located within Flood Zone 2. With reference to NPPF Table 2 Flood Risk Vulnerability Classification, the proposed usage would be of a more vulnerable classification. With the site being located within Flood Zone 2 and being of a more vulnerable classification, reference to NPPF Table 2 Flood Risk Vulnerability and Flood Zone Compatibility, shows that 'Development is Appropriate'.

On this basis, it is considered that no further input with regards to Exception Testing is required

11.0 RESIDUAL RISK

A flood risk Assessment should consider the residual risk to a proposed development for its intended lifecycle. In this case, with the proposal consisting of a residential development, a 100- year design life is assumed.

The detailed assessment in the preceding sections has considered the impacts of climate change over the development lifecycle and all risks are considered low. Furthermore, mitigation measures have also been provided for the 0.1% AEP flooding event. Therefore, the residual risk for the lifecycle of the development is considered **LOW**.

12.0 FOUL DRAINAGE STRATEGY

A separate surface water and foul water drainage system shall be provided across the site.

The foul water drainage from the development is proposed to discharge into the existing 525 mm diameter combined sewer that runs through the site and is shown on public sewer records presented within **Appendix C**.

An allowance shall be incorporated within the foul water drainage network for Parcel L11 to accommodate foul flows from the limited number of plots within Parcel L12 located to the west of Parcel L11. The drainage network serving Parcel L11 has capacity to accommodate foul flows from up to 100 dwellings in Parcel L12, the remaining plots, situated to the north of Parcel L11, can discharge directly into the existing combined sewer.

13.0 WATER QUALITY

Water quality treatment measures have been reviewed and implemented in accordance with the CIRIA SuDS Manual C753 using the Simple Index Approach (SIA), ensuring pollutants are effectively mitigated across the development.

A detention basin is proposed as the means to balance surface water flows during storm events, which will treat as well as store excess surface water.

The Simple Index Approach requires that the Total SuDS Mitigation Index for each contaminant (suspended solids, metals, hydrocarbons) equals or exceeds the Pollution Hazard Index for the proposed land use:

Total SuDS mitigation index $\geq$ Pollution hazard index

This principle has been applied to the proposed drainage design, ensuring compliance with C753 guidance. The highest risk land use within the development (e.g., private driveways with frequent traffic and vehicle storage) has been selected for assessment, ensuring a conservative and robust approach.

Table 4 – Pollution Hazard Index (Ciria SuDS Manual C753)

Land Use	Total Suspended Solids	Metals	Hydrocarbons
Individual property driveways, residential car parks, low traffic roads	0.5	0.4	0.4

Table 5 – Total SuDS mitigation index (Ciria SuDS Manual C753)

SuDS Component	Total Suspended Solids	Metals	Hydrocarbons
Attenuation Basins	0.5	0.5	0.6
Road gullies (RG)	unstated	-	-

Table 4 and 5 illustrate that the detention basins will provide sufficient treatment for Total Suspended Solids (TSS), Metals and Hydrocarbons for individual driveways, shared drives and residential carparking, and is also sufficient to provide treatment of runoff from low traffic roads, with additional pre-treatment provided by the road gullies.

14.0 CONCLUSIONS

This assessment has considered the implications of the proposed residential development in relation to fluvial and surface water flood risk and concludes that all identified risks are low. The site is predominantly located within Flood Zone 1, with a small portion extending into Flood Zone 2. No residential development is proposed within Flood Zone 2; however, an attenuation basin is proposed within this area, which is considered appropriate given its classification as water-compatible development.

The impact of flood risk, including allowances for climate change, has been assessed. It is proposed that finished floor levels across the site shall be set no lower than 44.70 m AOD. This will ensure that the development remains at a low risk of flooding throughout its lifetime.

The risk of surface water flooding across the site has also been assessed. The surface water flood mechanism is considered to be primarily influenced by localised low-lying topography, with some contribution from overland flow paths across the currently undeveloped land. Following development, the site will be served by a positive surface water drainage system. Finished floor levels and external ground levels will be designed to maintain a managed overland exceedance flow route in the event of blockage or exceedance of the drainage system, directing flows towards the site boundary or designated attenuation basins and away from more vulnerable built development.

No other sources of flooding have been identified for the site, and there are no known historical records of flooding affecting the development area.

In accordance with the drainage hierarchy, as infiltration has been demonstrated to be unfeasible, surface water runoff from the development will discharge to the existing ditch located to the south of the site at a restricted rate of 92.8 l/s. This discharge rate includes an allowance of 60.6 l/s to accommodate flows from Parcel L12 located to the north and west of the site.

Foul drainage from the development will connect to the existing 525 mm diameter combined sewer crossing the site. An allowance for 100 dwellings has been made within the foul drainage network to accommodate additional foul flows from the future development within Parcel L12 located to the west of the site. Development within Parcel L12 to the north of the site will discharge directly to the existing 525 mm diameter combined sewer.

Appropriate water quality mitigation measures have been incorporated into the drainage strategy, including the use detention basins treat run-off treatment prior to discharge.

Overall, the proposed development incorporates appropriate mitigation measures and a robust drainage design to ensure that flood risk is effectively managed on site and that there will be no increase in flood risk elsewhere as a result of the development.

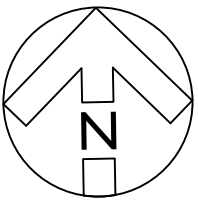
15.0 FRA & DRAINAGE STRATEGY CREDENTIALS

This flood risk assessment and drainage strategy has been carried out by the RWO Consulting Ltd civil engineering team, who have extensive knowledge of carrying out flood risk assessments and producing drainage strategies for residential sites.





APPENDIX A: SITE LOCATION PLAN



KEY

NETWORK SPACE 7.571Ha

Revision | A Drawn | EH Reviewed | DK Date | July 2021

planners | urbanists | architects



Junction 41 Business Court, Thorpe Road, East Ardsley, Leeds, West Yorkshire, WF3 2AB
T: 01924 873873 www.spawforths.co.uk mail@spawforths.co.uk

ISSUED

Client Name
Network Space

Project Title
Shaw Lane

Drawing Title
Red Line Boundary

Drawn By EH	Reviewed By DK	Scale @ A1 1:1000	Date July 2021
----------------	-------------------	----------------------	-------------------

Drawing No. P392I	SPA	XX	ZZ	M2	A	10 001	Revision A
----------------------	-----	----	----	----	---	--------	---------------

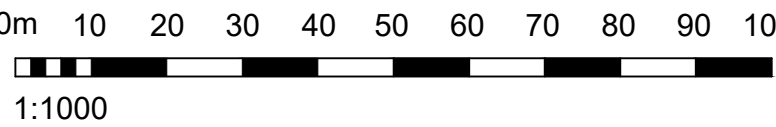
File Path P392I-DG-LIVE-CURRENT-10-001

Important notice:
Do not scale off this drawing. Critical dimensions should be checked on site prior to works commencing. Dimensional conflicts should be brought to the company's attention as soon as they become apparent. Failure to do so could render the contractor liable for subsequent losses. Copyright in this drawing and any work executed from this drawing remains the property of Spawforths.

© Copyright Spawforths

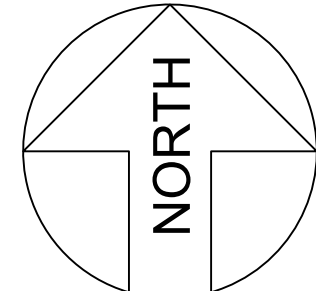
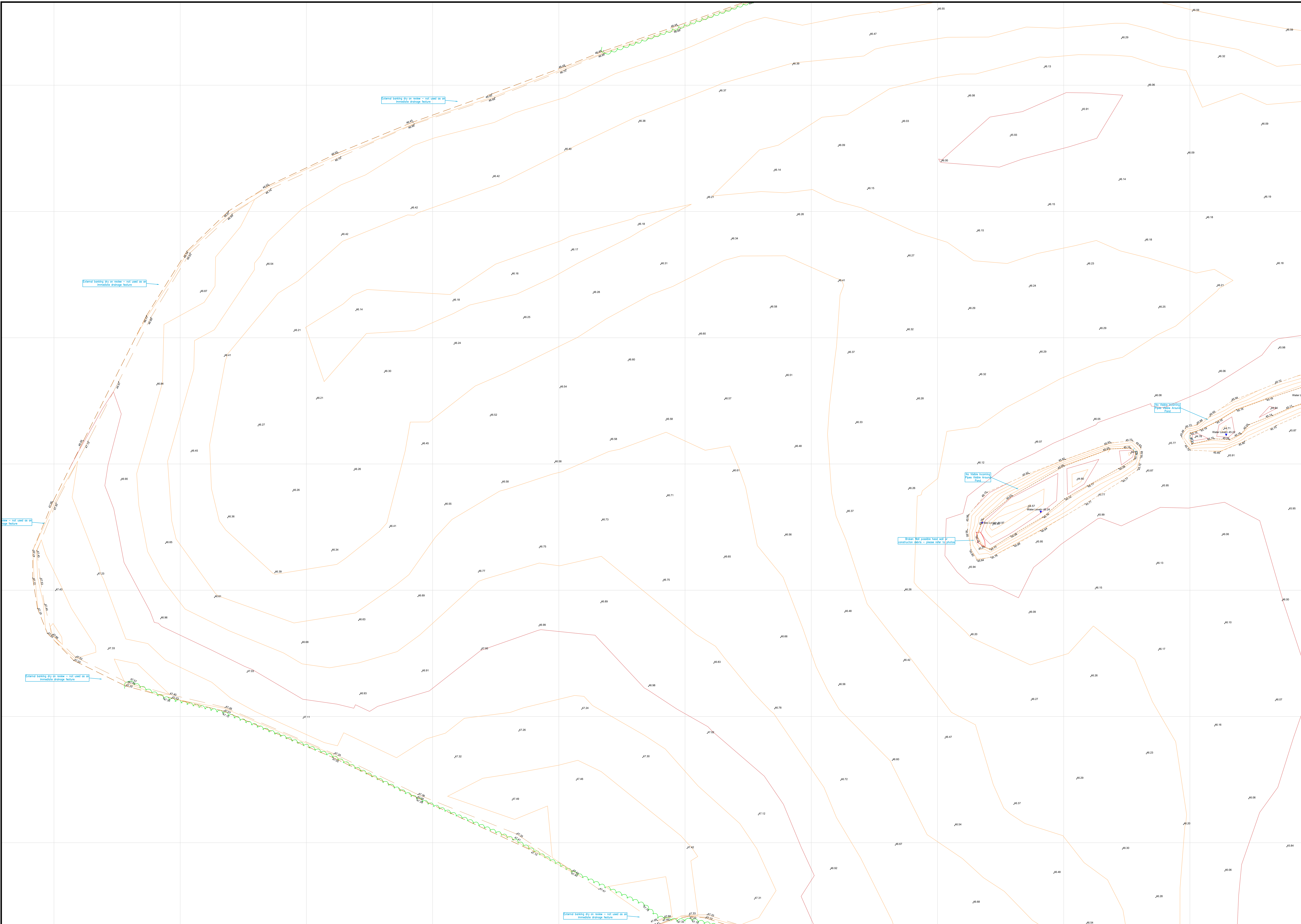
Red Line Boundary

When printing feed this edge first





APPENDIX B: TOPOGRAPHICAL SURVEY



Topographic Legend

Bottom of Bank	OH Electric
Top of Banking	Railway Line
Building	Road Centre
Building Canopy	Road Markings
Concrete Base	SC Hard-Hard
Contour Major	SC Hard-Soft
Contour Minor	SC Soft-Soft
Fences	Steps
General	Tree Canopy
Kerb Bottom	Vegetation
Kerb Drop	Visible Trench
Kerb Top	Walls
OH Comms	Water Edge

Topographic Abbreviations

AV	Air Valve	PB	Pedestrian Beacon
BH	Borehole	PBx	Post Box
BO(L)	Bollard (Illuminated)	PGR	Pedestrian Guard Rail
BS	Bus Stop	PM	Parking Meter
CB	Cabinet	PO	Post
CL	Cover Level	RE	Rodding Eye
COL	Column	RS(L)	Road Sign (Illuminated)
Conc	Concrete	RWP	Rain Water Pipe
DC	Drainage Channel	SP(L)	Sign Post (Illuminated)
DFBin	Dog Foul Bin	SPCam	Speed Camera
DP	Down Pipe	SV	Sluice Valve
EP	Electricity Pole	ST	Stop Tap
ER	Earth Rod	SVP	Soil Vent Pipe
FFL	Finished Floor Level	Tbox	Telephone Box
FH	Fire Hydrant	TL	Traffic Light
FP	Flag Pole	TOF	Top of Fence Level
GP	Gate Post	TOWF	Top of Wall Level
GV	Gas Valve	TP	Telecoms Pole
GY	Gully	VP	Vent Pipe
IC	Inspection Cover	WB	Waste Bin
KO	Kerb Outlet	WBx	Window Bottom Level
LP	Lamp Post	WM	Water Meter
MH	Manhole	WO	Wash Out
Mx	Marker	WT	Window Top Level
MP	Marker Post	WV	Water Valve
MW	Monitoring Well		

Utility Legend

Air Line	SWD Sewer
Alarm Cable	Survey Extents
BT Cable	Heating Pipe
CATV Cable	HV Electric Cable
Chamber Extent	Kingston Comms
Comms Cable	Oil Pipe
CWD Sewer	Rising Main
Earth Wire/Tape	Traffic Control
Electric Cable	Unknown Detection
Fibre Optic Cable	Vent Pipe
Fuel Line	GPR Detection
FWD Sewer	Assumed Route
Gas Pipe	Cable Riser
Band of Cables	Drainage
Empty Service Duct	Backdrop

Utility Abbreviations

CP	Cathodic Protection	LoS	Loss of Signal
Out	Disconnected Utility	MDPE	Middle Density PE
DI	Ductile Iron	SI	Spun Iron
DoB	Depth of Bottom	TLC	Traffic Light Control
DoC	Depth of Cover	UDI	Unreliable Depth Info
ED	Empty Duct	Unspliced	
EOT	End of Trace	uPVC	Polyvinyl Chloride
PE	Polyethylene	UTR	Unable to Raise
HDPE	High Density PE	VC	Verified Clay

Example PAS128 Legend

BT Cable - B1	BT Cable - B1
CATV Cable - B1(P)	CATV Cable - B1(P)
Comms Cable - B2	Comms Cable - B2
CWD Sewer - B2(P)	CWD Sewer - B2(P)
Electric Cable - B1	Electric Cable - B1
Fibre Optic Cable - D	Fibre Optic Cable - D
Fuel Line - B3(P)	Fuel Line - B3(P)
FWD Sewer - B1	FWD Sewer - B1
Gas Pipe - B1(P)	Gas Pipe - B1(P)
SWD Sewer - D	SWD Sewer - D
HV Electric Cable - B3	HV Electric Cable - B3
Rising Main - D	Rising Main - D
Utility - Confidence Level	Utility - Confidence Level

Manufacturer Stated Depths

- Detected Using Electromagnetic Location Methods
e.g. Any metallic pipe/cable. Accuracy $\pm 2.5\%$ of depth reading.
- Detected Using Electromagnetic Location Methods
eg. Using a Sonde to locate drainage pipework.
Accuracy $\pm 2.5\%$ of depth reading.
- Detected Using Ground Penetrating Radar
e.g. A plastic pipe or service not located by other means.
Accuracy depends on ground conditions.

CAUTION - LIVE SERVICES PRESENT - EXTREME CARE SHOULD BE TAKEN WHEN EXCAVATING

ZS Surveys Ltd, and their agents or partners, are not responsible for any situation, incident or loss resulting from actions or planning resulting from total reliance upon this drawing or accompanying information. The completeness of the underground network information cannot be wholly guaranteed and as such no guarantees or warranties are provided or implied. The location and/or identification of a service will not positively indicate whether it is live or dead. A service indicated from records that has not been located or identified on site does not necessarily imply that it does not exist or is dead, however, its presence should be anticipated. The results of Electro Magnetic and GPR detection techniques are not infallible and ground profiling for the actual position and depth of services should be established.

If this drawing and any associated drawings should be used in relation to works, we advise that the users of this information follow the principles detailed by the Health and Safety Executive guidance directive HSG 47, 'Avoiding Danger from Underground Services'. Further details of this directive are available at www.hse.gov.uk <<http://www.hse.gov.uk>>.

Notes

THIS DRAWING SHOULD ONLY BE USED FOR ITS ORIGINAL PURPOSE. ZS SURVEYS LTD ACCEPTS NO RESPONSIBILITY FOR THIS DRAWING IF SUPPLIED TO ANY PARTY OTHER THAN THE ORIGINAL CLIENT.
ALL LEVELS RELATED OSTN15 GRID PROJECTION.
ALL DIMENSIONS SHOULD BE VERIFIED ON SITE PRIOR TO CONSTRUCTION.
ALL HATCHING IS FOR PRESENTATIONAL PURPOSES ONLY.

M4P - EML SEARCH TRANSECT AT 2m INTERVALS - TRACED AT 0.5m INTERVALS. GPR SURVEY GRID AT 0.5m INTERVALS OR HIGH DENSITY ARRAY. POST PROCESSING OF GPR DATA.	M4 - EML SEARCH TRANSECT AT 2m INTERVALS - TRACED AT 0.5m INTERVALS. GPR SURVEY GRID AT 0.5m INTERVALS. GPR MARK-UP ON SITE.
M3P - EML SEARCH TRANSECT AT 2m INTERVALS - TRACED AT 1m INTERVALS. GPR SURVEY GRID AT 1m INTERVALS. GPR MARK-UP ON SITE.	M3 - EML SEARCH TRANSECT AT 2m INTERVALS - TRACED AT 1m INTERVALS. GPR SURVEY GRID AT 1m INTERVALS. GPR MARK-UP ON SITE.
M2P - EML SEARCH TRANSECT AT 5m INTERVALS - TRACED AT 2m INTERVALS. GPR SURVEY GRID AT 2m INTERVALS OR HIGH DENSITY ARRAY. POST PROCESSING OF GPR DATA.	M2 - EML SEARCH TRANSECT AT 5m INTERVALS - TRACED AT 2m INTERVALS. GPR SURVEY GRID AT 2m INTERVALS. GPR MARK-UP ON SITE.
M1P - EML SEARCH TRANSECT AT 10m INTERVALS - TRACED AT 5m INTERVALS. GPR SURVEY AS APPROPRIATE. POST PROCESSING OF GPR DATA.	M1 - EML SEARCH TRANSECT AT 10m INTERVALS - TRACED AT 5m INTERVALS. GPR SURVEY AS APPROPRIATE. GPR MARK-UP ON SITE.

Plan NTS



PAS128 Legend

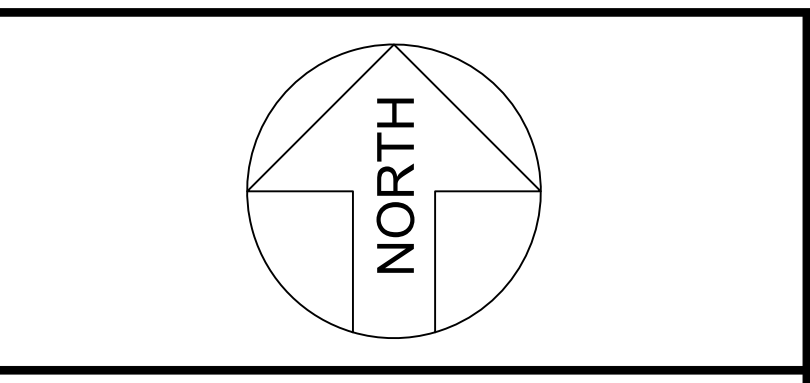
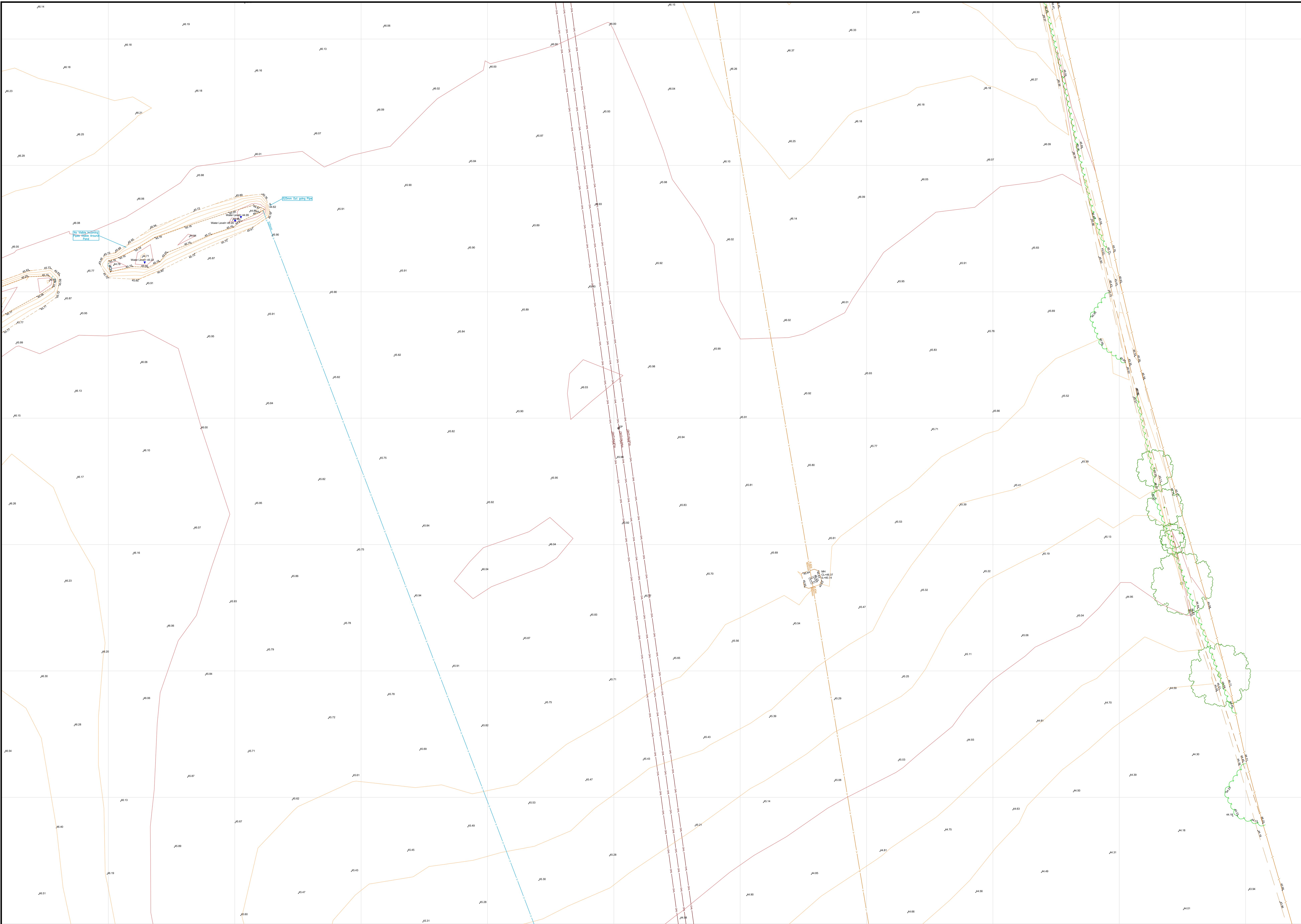
UTILITY CONFIDENCE LEVELS (Listed from High to Low)

- (A) HORIZONTAL AND VERTICAL POSITION VERIFIED VISUALLY (Accuracy: Horizontal $\pm 25mm$ Vertical $\pm 50mm$)
- (B1P) HORIZONTAL AND VERTICAL POSITION DETECTED BY MULTIPLE METHODS WITH POST PROCESSING OF GPR DATA (Estimated Accuracy $\pm 150mm$ OR $\pm 15\%$ of detected depth)
- (B1) HORIZONTAL AND VERTICAL POSITION DETECTED BY MULTIPLE METHODS (Estimated Accuracy: $\pm 150mm$ OR $\pm 15\%$ of detected depth)
- (B2P) HORIZONTAL AND VERTICAL POSITION DETECTED VIA POST-PROCESSED GPR (Estimated Accuracy: $\pm 250mm$ OR $\pm 40\%$ of detected depth)
- (B2) HORIZONTAL AND VERTICAL POSITION DETECTED BY A SINGLE METHOD (Estimated Accuracy: $\pm 250mm$ OR $\pm 40\%$ of detected depth)
- (B3P) HORIZONTAL POSITION DETECTED VIA POST-PROCESSED GPR (Estimated Accuracy: $\pm 500mm$ in the Horizontal - Depth is undefined)
- (B3) HORIZONTAL POSITION DETECTED BY A SINGLE METHOD (Estimated Accuracy: $\pm 500mm$ in the Horizontal - Depth is undefined)
- (C) ROUTE TRANSCRIBED FROM UTILITY ASSET PLANS AND CORRELATED TO VISUAL INDICATORS AND SURFACE FEATURES (Accuracy Undefined)
- (D) ROUTE TRANSCRIBED FROM UTILITY ASSET PLANS (Accuracy Undefined)

PAS 128 SURVEY METHODOLOGY KEY

THIS SURVEY HAS BEEN CARRIED OUT IN ACCORDANCE WITH THE PAS128 SPECIFICATION FOR UNDERGROUND UTILITY DETECTION, VERIFICATION & LOCATION. THE SPECIFICATION ALLOWS FOR A RANGE OF TECHNIQUES AND METHODS OF VARYING INTENSITY TO BE DEPLOYED. THE COLOUR CODED SCHEME INDICATES WHERE DIFFERENT SURVEY METHODOLOGIES HAVE BEEN USED ON SITE, AND THE LIST BELOW IDENTIFIES EQUIPMENT USED TO OBTAIN THE SURVEY RESULTS. NB: PLEASE SEE ACCOMPANYING REPORT FOR FULL DETAILS.

Client		Vistry Group	
Site Location:		SHAW LANE CARLTON BARNESLEY S71 3HJ	
Drawing Type:		PAS128 Utility Mapping & Topographical Survey REV A	
Surveyed:	DH SS	Drawn:	DH SS
Checked:	ZS	Authorised:	ZS
Date:	03/03/2026	Scale:	1:200@A0
Project Number:		4620	
Sheet Number:		1 OF 5	



Topographic Legend	
Bottom of Bank	OH Electric
Top of Banking	Railway Line
Building	Road Centre
Building Canopy	Road Markings
Concrete Base	SC Hard/Hard
Contour Major	SC Hard/Soft
Contour Minor	SC Soft/Soft
Fences	Steps
General	Tree Canopy
Kerb Bottom	Vegetation
Kerb Drop	Visible Trench
Kerb Top	Walls
OH Comms	Water Edge

AV	Air Valve	PB	Pedestrian Beacon
BH	Borehole	PBx	Post Box
BO(L)	Bollard (Illuminated)	PGR	Pedestrian Guard Rail
BS	Bus Stop	PM	Parking Meter
Cab	Cabinet	PO	Post
CL	Cover Level	RE	Rodding Eye
COL	Column	RS(L)	Road Sign (Illuminated)
Conc	Concrete	RWP	Rain Water Pipe
DC	Drainage Channel	SP(L)	Sign Post (Illuminated)
DFBin	Dog Foul Bin	SPCam	Speed Camera
EP	Electricity Pole	ST	Stop Tap
ER	Earth Rod	SV	Sluice Valve
FFL	Finished Floor Level	SVP	Soil Vent Pipe
FH	Fire Hydrant	TBox	Telephone Box
FP	Flag Pole	TL	Traffic Light
GP	Gate Post	TOF	Top of Fence Level
GV	Gas Valve	TOWL	Top of Wall Level
GY	Gully	TP	Telecoms Pole
IC	Inspection Cover	VB	Waste Bin
KO	Kerb Outlet	WB	Window Bottom Level
LP	Lamp Post	WM	Water Meter
MH	Manhole	WO	Wash Out
Mx	Marker	WTC	Window Top Level
MP	Marker Post	WV	Water Valve
MW	Monitoring Well		

Utility Legend	
Air Line	SWD Sewer
Alarm Cable	Survey Extents
BT Cable	Heating Pipe
CATV Cable	HV Electric Cable
Chamber Extent	Kingston Comms
Comms Cable	Oil Pipe
CWD Sewer	Rising Main
Earth Wire/Tape	Traffic Control
Electric Cable	Unknown Detection
Fibre Optic Cable	Vent Pipe
Fuel Line	GPR Detection
FWD Sewer	Assumed Route
Gas Pipe	Records Route
Band of Cables	Cable Riser
Empty Service Duct	Drainage
	Backdrop

<u>Utility Abbreviations</u>			
CP	Cathodic Protection	LoS	Loss of Signal
Cut	Disconnected Utility	MDPE	Middle Density PE
DI	Ductile Iron	SI	Spun Iron
DoB	Depth of Bottom	TLC	Traffic Light Control
DoC	Depth of Cover	UDI	Unreliable Depth Info
ED	Empty Duct	Unspliced	
EOT	End of Trace	uPVC	Polyvinyl Chloride
PE	Polyethylene	UTR	Unable to Raise
HDPE	High Density PE	VC	Vitrified Clay

Example PAS128 Legend	
BT Cable - B1	
CATV Cable - B1(P)	
Comms Cable - B2	
CWD Sewer - B2(P)	
Electric Cable - B1	
Fibre Optic Cable - D	
Fuel Line - B3(P)	
FWD Sewer - B1	
Gas Pipe - B1(P)	
SWD Sewer - D	
HV Electric Cable - B3	
Rising Main - D	
Utility - Confidence Level	

Manufacturer Stated Depths	
Detected Using Electromagnetic Location Methods e.g. Any metallic pipe/cable. Accuracy ± 2.5% of depth reading.	
Detected Using Electromagnetic Location Methods eg. Using a Sonde to locate drainage pipework. Accuracy ± 2.5% of depth reading.	
Detected Using Ground Penetrating Radar e.g. A plastic pipe or service not located by other means. Accuracy depends on ground conditions.	

CAUTION - LIVE SERVICES PRESENT - EXTREME CARE SHOULD BE TAKEN WHEN EXCAVATING

ZS Surveys Ltd, and their agents or partners, are not responsible for any situation, incident or loss resulting from actions or omissions resulting from total reliance upon this drawing or accompanying information. The completeness of the underground network information cannot be wholly guaranteed and as such no guarantees or warranties are provided or implied. The location and/or identification of a service will not positively indicate whether it is live or dead. A service indicated from records that has not been located or identified on site does not necessarily imply that it does not exist or is dead, however, its presence should be anticipated. The results of Electric Magnetic and GPR detection techniques are not infallible and ground profiling for the actual position and depth of services should be established.

If this drawing and any associated drawings should be used in relation to works, we advise that the users of this information follow the principles detailed by the Health and Safety Executive guidance directive HSG 47, "Avoiding Danger from Underground Services". Further details of this directive are available at www.hse.gov.uk <<http://www.hse.gov.uk>>

Notes

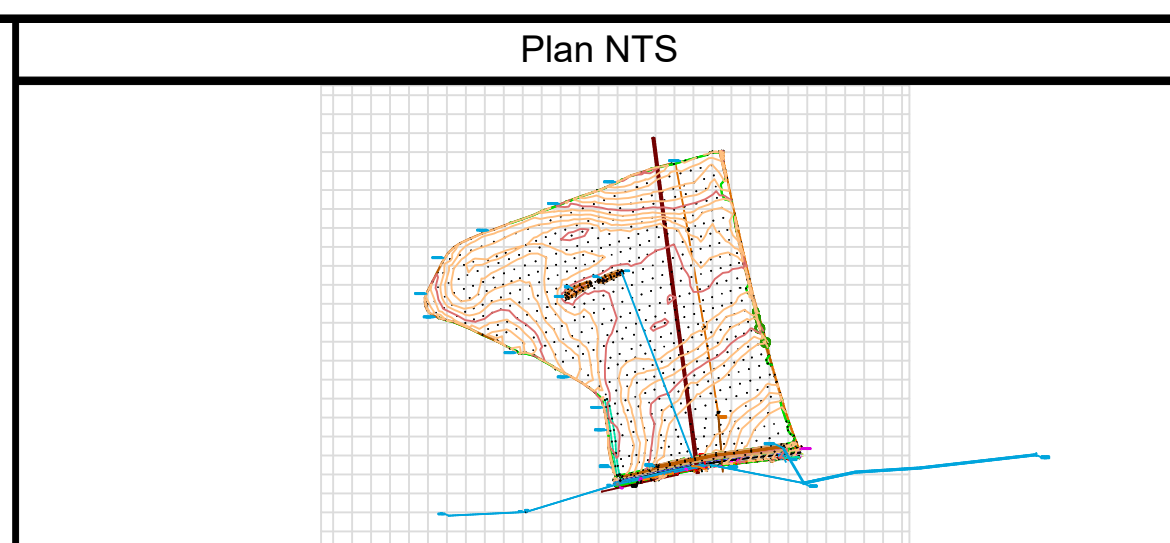
THIS DRAWING SHOULD ONLY BE USED FOR ITS ORIGINAL PURPOSE. ZS SURVEYS LTD. ACCEPTS NO RESPONSIBILITY FOR THIS DRAWING IF SUPPLIED TO ANY PARTY OTHER THAN THE ORIGINAL CLIENT.

ALL LEVELS RELATED OSTN15 GRID PROJECTION.

ALL DIMENSIONS SHOULD BE VERIFIED ON SITE PRIOR TO CONSTRUCTION.

ALL HATCHING IS FOR PRESENTATIONAL PURPOSES ONLY.

M4P - EML SEARCH TRANSECT AT 2m INTERVALS - TRACED AT 0.5m INTERVALS. GPR SURVEY GRID AT 0.5m INTERVALS OR HIGH DENSITY ARRAY. POST PROCESSING OF GPR DATA.	M4 - EML SEARCH TRANSECT AT 2m INTERVALS - TRACED AT 0.5m INTERVALS. GPR SURVEY GRID AT 0.5m INTERVALS. GPR MARK-UP ON SITE.
M3P - EML SEARCH TRANSECT AT 2m INTERVALS - TRACED AT 1m INTERVALS. GPR SURVEY GRID AT 1m INTERVALS OR HIGH DENSITY ARRAY. POST PROCESSING OF GPR DATA.	M3 - EML SEARCH TRANSECT AT 2m INTERVALS - TRACED AT 1m INTERVALS. GPR SURVEY GRID AT 1m INTERVALS. GPR MARK-UP ON SITE.
M2P - EML SEARCH TRANSECT AT 5m INTERVALS - TRACED AT 2m INTERVALS. GPR SURVEY GRID AT 2m INTERVALS OR HIGH DENSITY ARRAY. POST PROCESSING OF GPR DATA.	M2 - EML SEARCH TRANSECT AT 5m INTERVALS - TRACED AT 2m INTERVALS. GPR SURVEY GRID AT 2m INTERVALS. GPR MARK-UP ON SITE.
M1P - EML SEARCH TRANSECT AT 10m INTERVALS - TRACED AT 5m INTERVALS. GPR SURVEY AS APPROPRIATE. POST PROCESSING OF GPR DATA.	M1 - EML SEARCH TRANSECT AT 10m INTERVALS - TRACED AT 5m INTERVALS. GPR SURVEY AS APPROPRIATE. GPR MARK-UP ON SITE.



UTILITY CONFIDENCE LEVELS (Listed from High to Low)	
(A) HORIZONTAL AND VERTICAL POSITION VERIFIED VISUALLY (Accuracy: Horizontal ±25mm Vertical ±50mm)	
(B1P) HORIZONTAL AND VERTICAL POSITION DETECTED BY MULTIPLE METHODS WITH POST PROCESSING OF GPR DATA (Estimated Accuracy: ±150mm OR ±15% of detected depth)	
(B2P) HORIZONTAL AND VERTICAL POSITION DETECTED VIA POST-PROCESSED GPR (Estimated Accuracy: ±250mm OR ±40% of detected depth)	
(B2) HORIZONTAL AND VERTICAL POSITION DETECTED BY A SINGLE METHOD (Estimated Accuracy: ±250mm OR ±40% of detected depth)	
(B3P) HORIZONTAL POSITION DETECTED VIA POST-PROCESSED GPR (Estimated Accuracy: ±500mm in the Horizontal - Depth is undefined)	
(B3) HORIZONTAL POSITION DETECTED BY A SINGLE METHOD (Estimated Accuracy: ±500mm in the Horizontal - Depth is undefined)	
(C) ROUTE TRANSCRIBED FROM UTILITY ASSET PLANS AND CORRELATED TO VISUAL INDICATORS AND SURFACE FEATURES (Accuracy Undefined)	
(D) ROUTE TRANSCRIBED FROM UTILITY ASSET PLANS (Accuracy Undefined)	

PAS 128 SURVEY METHODOLOGY KEY	
THIS SURVEY HAS BEEN CARRIED OUT IN ACCORDANCE WITH THE PAS128 SPECIFICATION FOR UNDERGROUND UTILITY DETECTION, VERIFICATION & LOCATION. THE SPECIFICATION ALLOWS FOR A RANGE OF TECHNIQUES AND METHODS OF VARYING INTENSITY TO BE DEPLOYED. THE COLOUR CODED SCHEME INDICATES WHERE DIFFERENT SURVEY METHODOLOGIES HAVE BEEN USED ON SITE, AND THE LIST BELOW IDENTIFIES EQUIPMENT USED TO OBTAIN THE SURVEY RESULTS. NB: PLEASE SEE ACCOMPANYING REPORT FOR FULL DETAILS.	

Client	Vistry Group		
Site Location:	SHAW LANE CARLTON BARNESLEY S71 3HJ		
Drawing Type:	PAS128 Utility Mapping & Topographical Survey REV A		
Surveyed:	DH SS	Drawn:	DH SS
Checked:	ZS	Authorised:	ZS
Date:	03/03/2026	Scale:	1:200@A0
Project Number:		4620	
Sheet Number:		3 OF 5	

ZS Surveys Ltd

Land, Building & Engineering Surveyors

www.zssurveys.com info@zssurveys.com

Constructionline

Project Number: 4620

Sheet Number: 3 OF 5



APPENDIX C: YW SEWER RECORDS

YORKSHIRE WATER PROTECTION OF MAINS AND SERVICES

1. The position of Yorkshire Water Services Ltd (YWS) apparatus shown on the existing mains record drawing(s) indicates the **general** position and nature of our apparatus and the accuracy of this information cannot be guaranteed. Any damage to YWS apparatus as a result of your works may have serious consequences and you will be held responsible for all costs incurred. Prior to commencing major works, the exact location of apparatus must be determined on site, if necessary by excavating trial holes. The actual position of such apparatus and that of service pipes which have not been indicated must be established on site by contacting the Customer Helpline on 0345 124 24 24 for both water and sewerage.
2. The public sewer and water network is lawfully retained in its existing position and the sewerage and water undertaker is entitled to have it remain so without any disturbance. The provisions of section 159 of the Water Industry Act 1991 provides that the undertaker may "inspect, maintain, adjust, repair or alter" the network. Those rights are given to enable the undertaker to perform its statutory duties. Any development of the land or any other action that unacceptably hindered the exercise of those rights would be unlawful. The provisions contained in Section 185 of the Water Industry Act 1991 state that where it is reasonable to do so, a person may require the water supply undertaker to alter or remove a pipe where it is necessary to enable that person to carry out a proposed change of use of the land. The provisions contained in Section 185 also require the person making the request to pay the full cost of carrying out the necessary works.
3. Ground levels over existing YWS apparatus are to be maintained. Sewers in highways will **generally** be laid to give 1200mm of cover from finished ground level working to kerb races, other permanent identification of the limits of the road or to an agreed line and level. Substantial increases or decreases to this 1200mm depth of cover will result in the sewer being re-laid at your expense. Water mains and services will **generally** be laid with a minimum of 750mm depth of cover however some mains and services usually those installed over 50 years ago may have less ground cover.
4. If surface levels are to be decreased / increased significantly the effects on existing water supply apparatus will be carefully considered and if any alterations are necessary, the costs of the alterations will be recharged to you in full. Outlets on fire hydrants must be no more than 300mm below the new levels and all surface boxes must be adjusted as part of the scheme.
5. To enable future repair works to be carried out without hindrance; any pipe, cable, duct, etc. installed parallel to a water main or service pipe should not be installed directly over or within 300mm of a water main or service pipe or 1000mm of a waste water asset. Where a pipe, cable, duct, etc. crosses a main or service it should preferably cross perpendicular or at an angle of no less than 45° and with a minimum clearance of 150mm. These requirements apply to activities within an existing highway and are relevant to the installation of pipes, cables, ducts, etc. up to and including 250mm in diameter (*see illustration below*). Necessary protection measures for installations greater than 250mm in diameter and/or in private land will need to be agreed on an individual basis. Installations within a new development site must comply with the National Joint Utilities Group publication Volume 2: NJUG Guidelines On The Positioning Of Underground Utilities Apparatus For New Development Sites.
6. All excavation works near to YW apparatus should be by hand digging only.
7. Backfilling with a suitable material to a minimum 300mm above YW apparatus is required.
8. Adequate support must be provided where any works pass under YW apparatus.
9. Jointing chambers, lighting columns and other structures must be installed in such a way that future repair or maintenance works to YW apparatus will not be hindered.
10. Apparatus such as; railings, sign posts, etc. must not be placed in such a way that they prevent access to or full operation of controlling valves, hydrants or similar apparatus. YWS surface boxes must not be covered or buried. Any adjustment, alteration or replacement of manhole covers must be agreed on site prior to the commencement of the works with a YWS Inspector who may be contacted via our Call Centre on 0345 124 24 24.
11. Explosives shall not be used within 100 metres of any Yorkshire Water Services apparatus or installations.
12. Vibrating plant should not be used directly over any apparatus. Movement or operation by vehicles or heavy plant is not to be permitted in the immediate vicinity of YWS plant or apparatus unless there has been prior consultation and, if necessary, adequate protection provided without cost to YWS.
13. **Under no circumstances** should thrust boring or similar trenchless techniques commence until the actual position of the Company's mains/services along the proposed route have been confirmed by trial holes.
14. Any alterations to the highway should be notified following the procedures outlined in the New Road and Street Works Act 1991 Code of Practice; Measures Necessary Where Apparatus Is Affected By Major Works (Diversiary Works).
15. You will be held responsible for any damage or loss to YWS apparatus during and after completion of work, caused by yourselves, your servant or agent. Any damage caused or observed to YWS plant or apparatus should be immediately reported to YWS. Should YW incur any costs as a result of non-compliance with the above, all costs will be rechargeable in full.
16. You should ensure that nothing is done on the site to prejudice the safety or operation of YWS employees, plant or apparatus.
17. In accordance with the New Roads and Street Works Act 1991, Chapter 22, Part 3, Section 80. The location of any identified YW asset "which is not marked, or is wrongly marked, on the records made available" should be communicated back to Yorkshire Water. The location of the apparatus should be identified on copies of the supplied plans which should be returned to Yorkshire Water (Asset Records Team) with photographic supporting evidence where possible.
18. The Government has decided that responsibility for private sewers serving two or more properties and lateral drains (the section of pipe beyond the boundary of a single property, connecting it to the public sewer) will be transferred to the water companies on Oct 1 2011.

Private pumping stations will also transfer during the period 1 October 2011 – 1 Oct 2016. Records of these assets may not yet be shown on the existing mains record drawing(s). If you encounter any of these assets you must inform Yorkshire Water Services Ltd (YWS).

19. Please note that the information supplied on the enclosed plans is reproduced from Ordnance Survey material with the permission of the Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office, © Crown Copyright. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings. Licence Number AC0000857457.
20. This information is for guidance only and the position and depth of any YW apparatus is approximate only. Likewise, the nature and condition of any YW apparatus cannot be guaranteed. YW has no responsibility for recording the locations of privately owned apparatus. As of 1 October 2011, there may be some lateral drains and/or public sewers which are not documented on YW records but may still be present. For the avoidance of doubt, this information is not a substitute for appropriate professional and/or legal advice. YW accepts no responsibility for any inaccuracy or omissions in this information. The actual position of YW apparatus must be determined on site by excavating trial holes by hand. YW requires a minimum of two working days' written notice of the intention to excavate any trial holes before any excavation can be undertaken. If there are any queries in this respect please contact Yorkshire Water on 0345 124 24 24.

Property Identifier



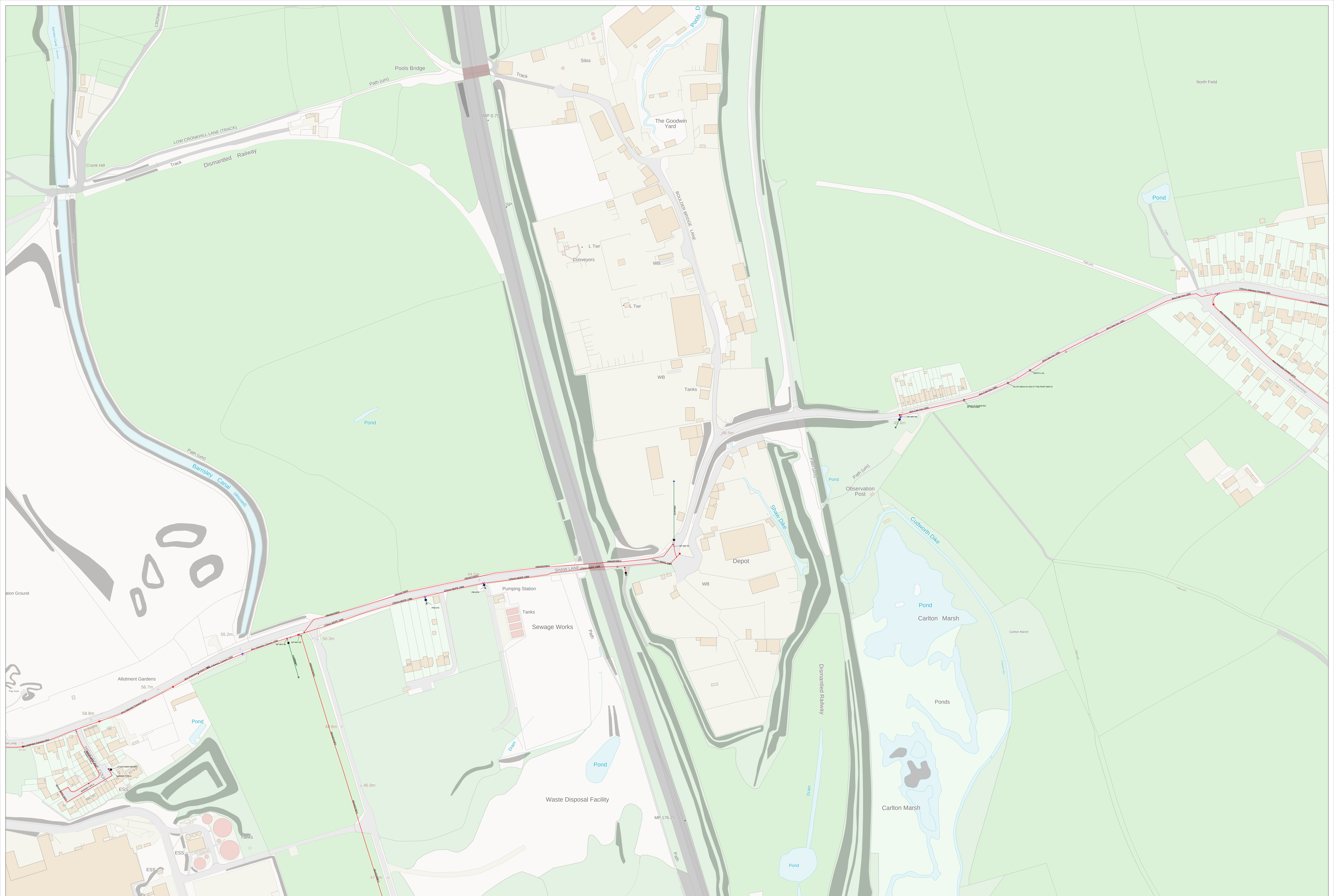
Sewer Legend

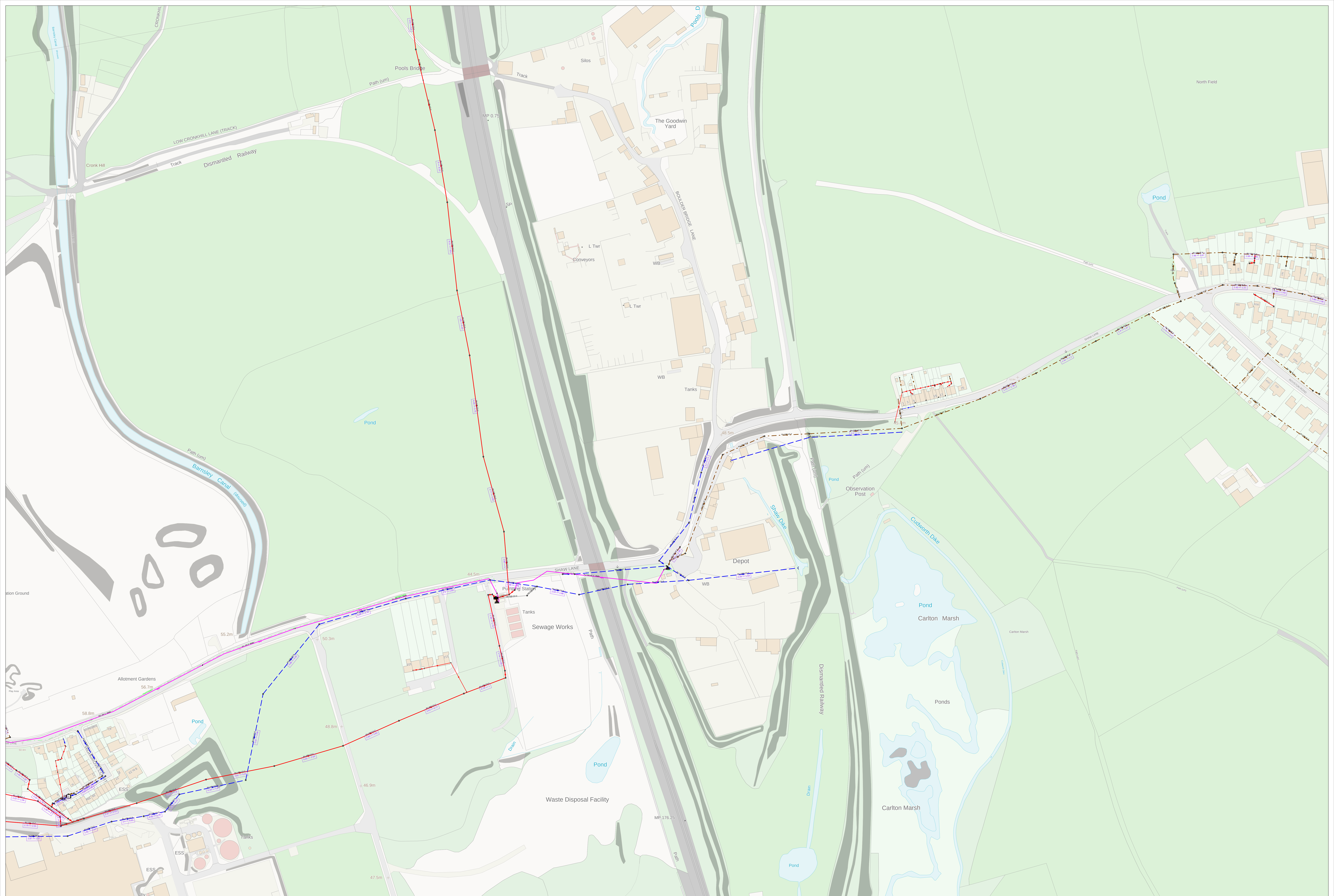
	Combined Sewer		S24 Combined Sewer
	Surface Water Sewer		S24 Surface Water Sewer
	Foul Sewer		S24 Foul Sewer
	Section 104 Sewer		Rising Main
	Overflow Sewer		Abandoned Sewer
	Manhole		Syphone Sewer & Vacuum Sewer
	Pumping Station		Public Sewer Treatment Works

Please note that the direction of flow arrows may not always appear depending on the scale of the map.

Water Legend

	Water Main 4" and below
	Water Main 4" and above
	Raw Water Main
	Private Water Main
	Fire Hydrant
	Pumping Station
	The assets in this area are the responsibility of another Water Undertaker







E-mail: info@rwo.group | Website: www.rwo.group | Telephone: 0330 0566900

 [RwoAssociates](#) |  [RwoAssociates](#)

