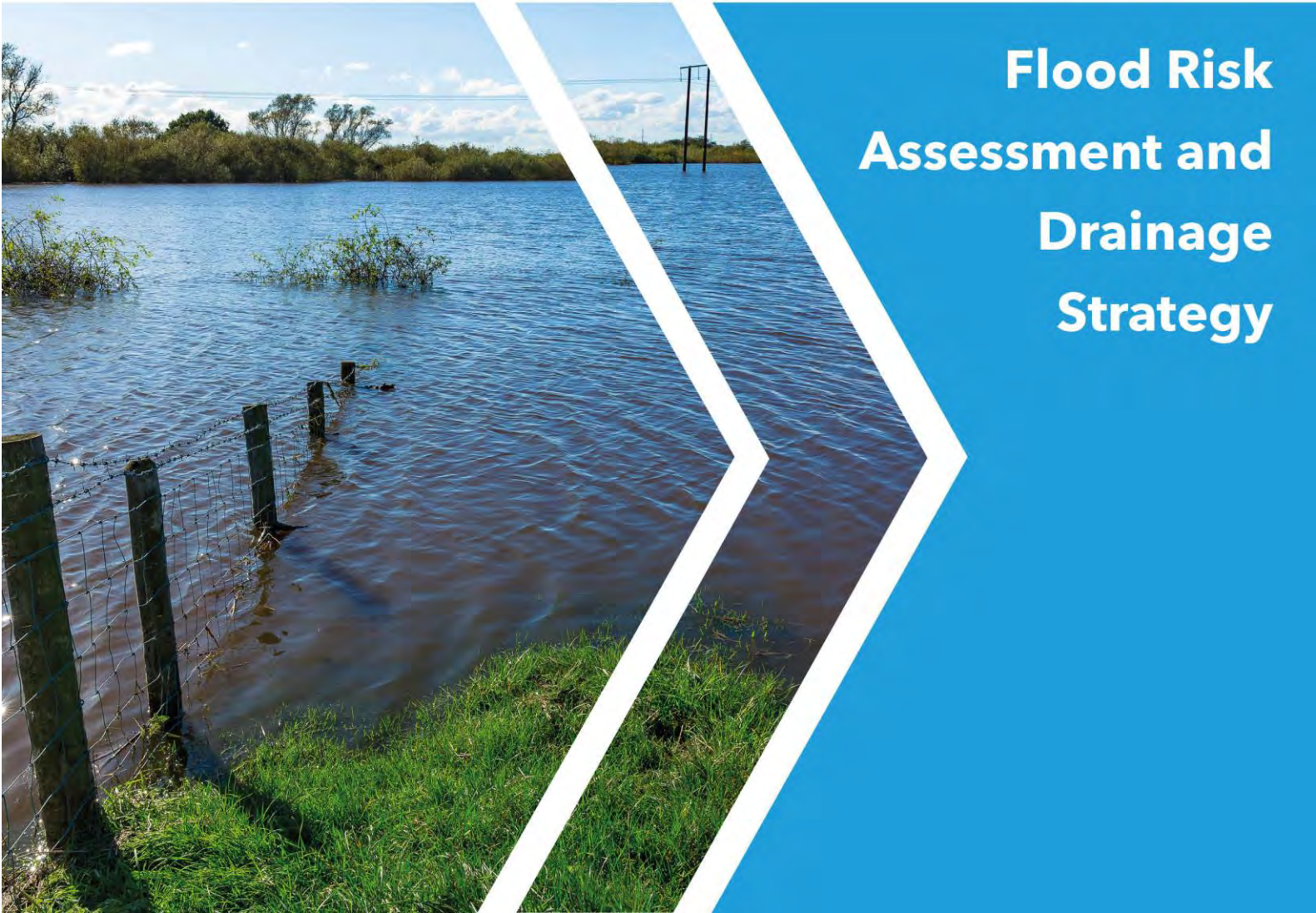


Proposed Residential Development

Shaw Lane, Carlton



Flood Risk Assessment and Drainage Strategy

Reference	24307-RWO-XX-XX-RP-C-001
Client Name	Countryside Properties (UK) Ltd
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CONFIDENTIALLY STATEMENT

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.

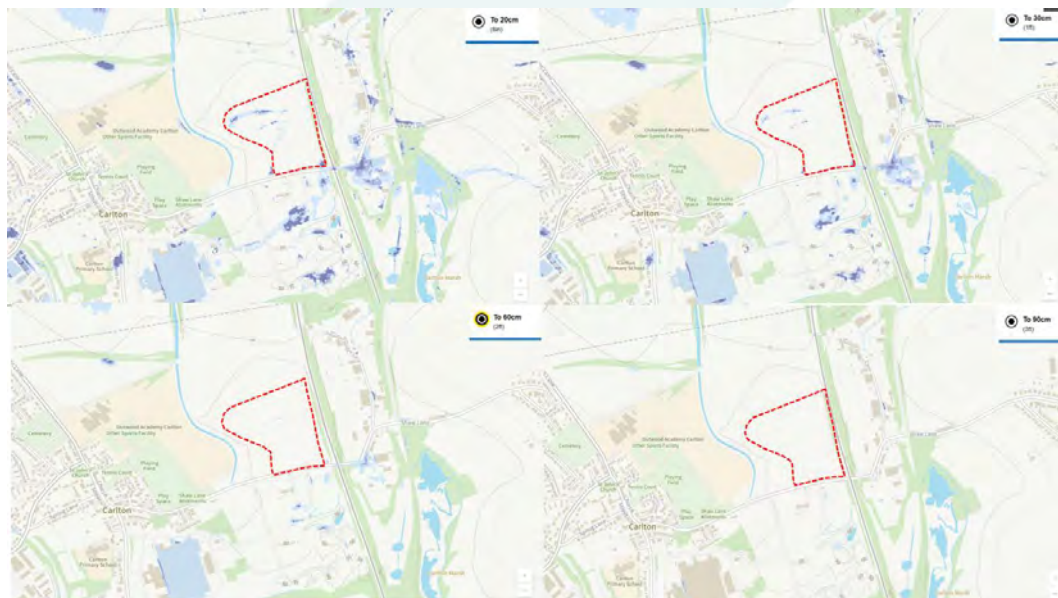


Figure 3 Surface Water Depths – Yearly chance of flooding between 2040 and 2060

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 Dike.

It should be noted that a direct connection to Shaw Dike 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	<ul style="list-style-type: none"> • 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. <p>“+” In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.</p> <p>“*” In Flood Zone 3b (functional floodplain) essential infrastructure that has passed the Exception Test, and water-compatible uses, should be designed and constructed to:</p> <ul style="list-style-type: none"> • 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 carparks, 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.

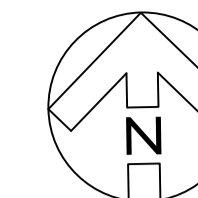
15.0 FRA & DRAINAGE STRATEGY CREDENTIALS

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
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ISSUED

Client Name
 Network Space

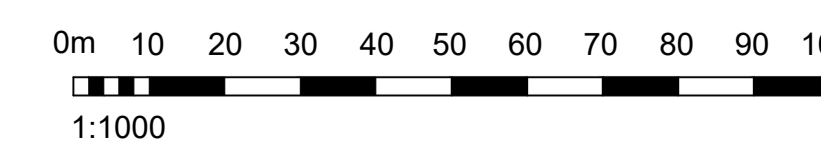
Project Title
 Shaw Lane

Drawing Title
 Red Line Boundary

Drawn By EH	Reviewed By DK	Scale @ A1 1:1000	Date July 2021
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Drawing No. P3921	SPAW	XX	ZZ	M2	A	10 001	Revision A
<small>PROJECT NO.</small>	<small>CORPORATE</small>	<small>ZONE</small>	<small>LEVEL</small>	<small>TYPE</small>	<small>ROLE</small>	<small>NUMBER</small>	

File Path P3921-DG-LIVE-CURRENT-10-001



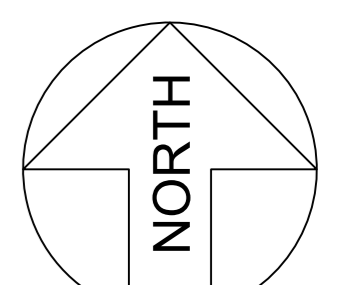
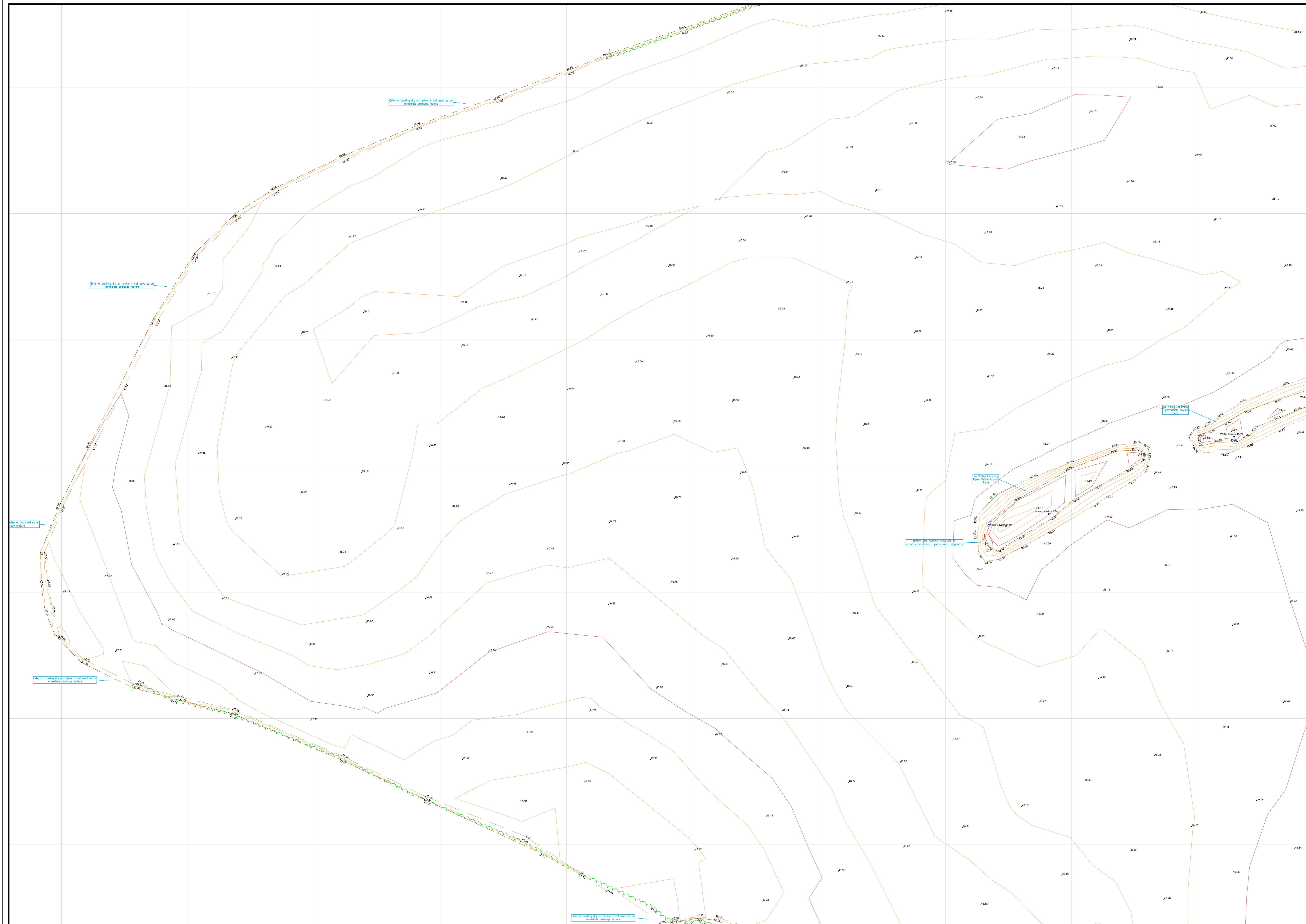
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Red Line Boundary



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
Cab	Cabinet	Post	Post
CL	Cover Level	RE	Roading Eye
COL	Column	RS(L)	Road Sign (Illuminated)
Conc	Concrete	RWP	Rain Water Pipe
DC	Drainage Channel	SPL	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	TOWL	Top of Wall Level
GV	Gas Valve	TP	Telecoms Pole
GY	Gully	VP	Vent Pipe
IC	Inspection Cover	WB	Waste Bin
KO	Kerb Outlet	WBm	Window Bottom Level
LP	Lamp Post	WM	Water Meter
MH	Manhole	WO	Wash Out
Marker	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	Records Route
Band of Cables	Cable Rise
Empty Service Duct	Drainage Backdrop

Utility Abbreviations			
CP	Cathodic Protection	LoS	Loss of Signal
Dis	Disconnected Utility	MDPE	Middle Density PE
DI	Ductile Iron	SI	Spin Iron
DoB	Depth of Bottom	TLC	Traffic Light Control
DoC	Depth of Cover	UDI	Unreliable Depth Info
ED	Empty Duct	Unpl	Unplasticised
EoT	End of Trace	uPVC	Polyvinyl Chloride
PE	Polyethylene	UTR	Unable to Raise
HDPE	High Density PE	VC	Verified City

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 ± 2.5% of depth reading.
⊙	Detected Using Electromagnetic Location Methods e.g. Using a Scale to locate drainage pipework. Accuracy ± 2.5% of depth reading.
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Notes

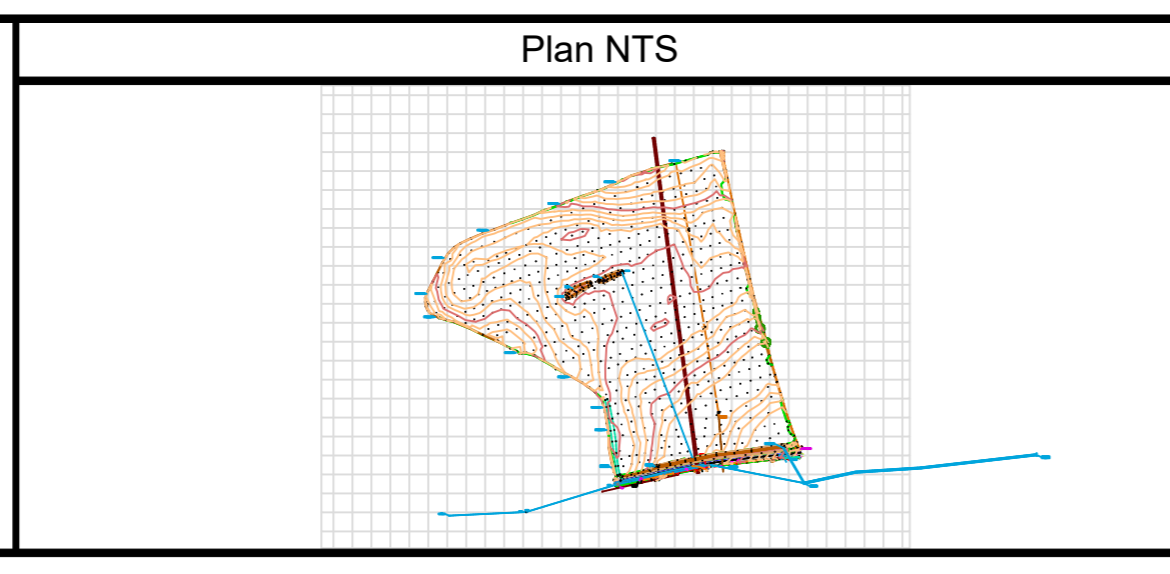
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ALL LEVELS RELATED OSTN15 GRID PROJECTION.

ALL DIMENSIONS SHOULD BE VERIFIED ON SITE PRIOR TO CONSTRUCTION.

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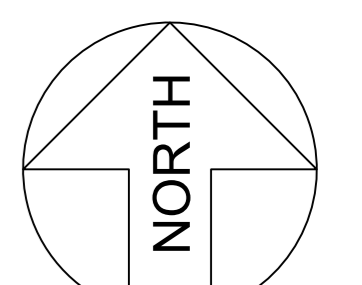
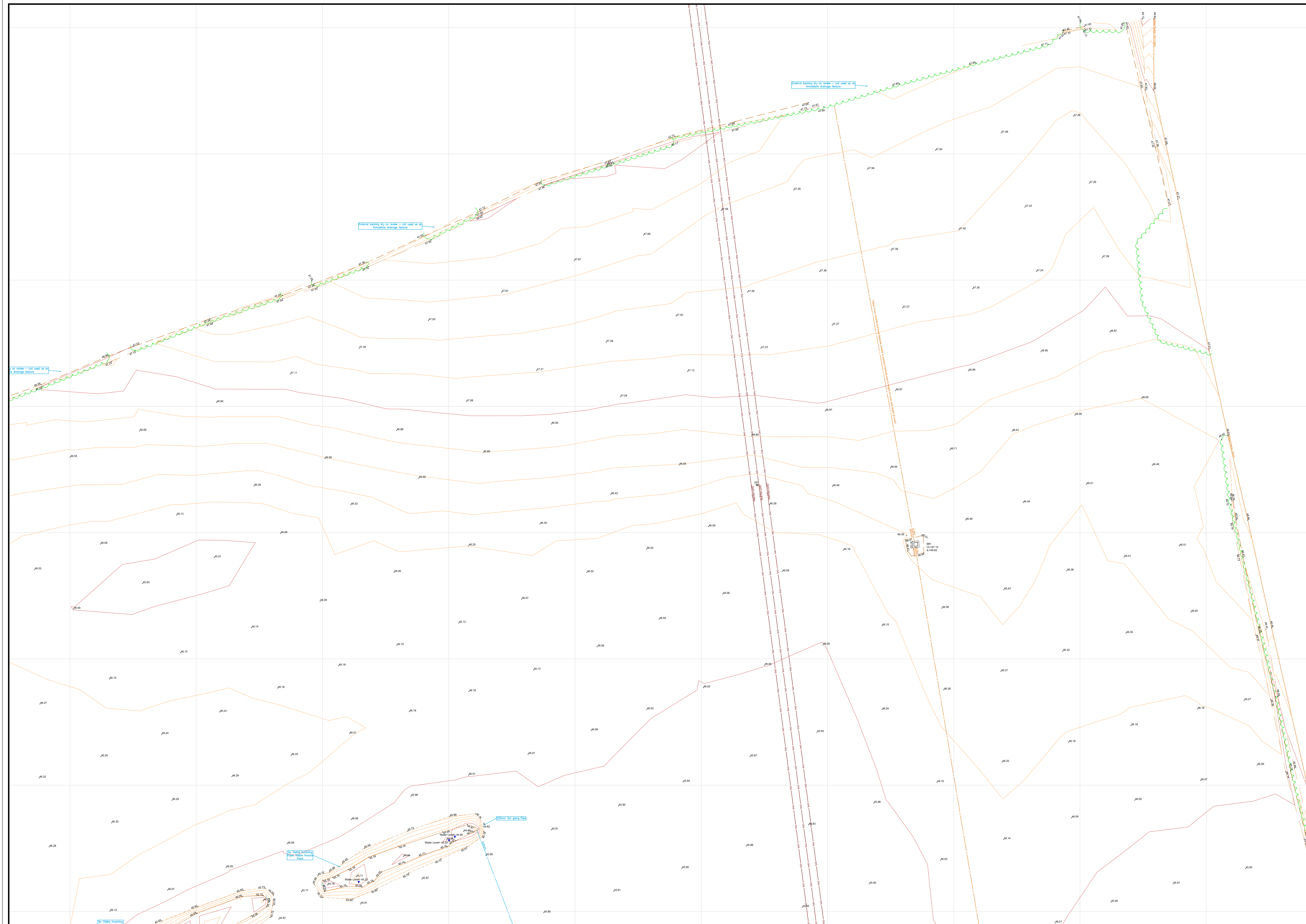
PAS128 Legend	
M4P - EML SEARCH TRANSECT AT 2m INTERVALS - TRACED AT 0.5m INTERVALS. GPR SURVEY GRID AT 0.5m INTERVALS OR HIGH DENSITY ARRAY. POST PROCESSING OF GPR DATA.	M4 - EML SEARCH TRANSECT AT 2m INTERVALS - TRACED AT 0.5m INTERVALS. GPR SURVEY GRID AT 0.5m INTERVALS. GPR MARK-UP ON SITE.
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M2P - 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.
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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 BY MULTIPLE METHODS (Estimated Accuracy: ±150mm OR ±15% 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
ZS Surveys Ltd	
Land, Building & Engineering Surveyors www.zsurveys.com info@zsurveys.com	
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
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Kerb Top	Water Edge
OH Comms	

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BH	Borehole	PBx	Post Box
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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	S(L)	Sign Post (Illuminated)
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DP	Down Pipe	ST	Stop Tap
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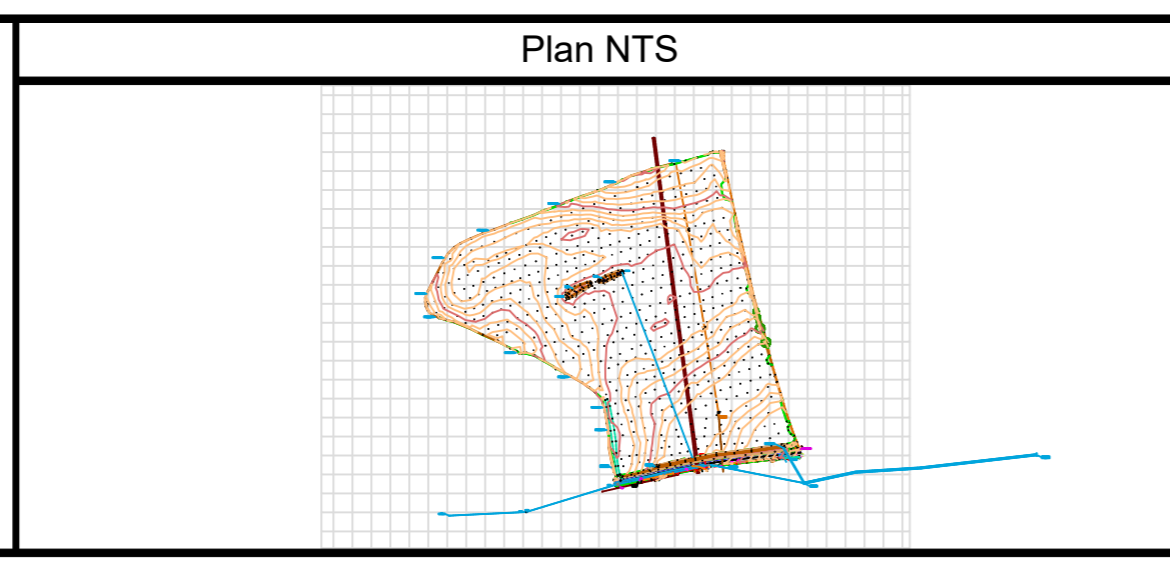
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PAS128 Legend

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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)

(B1) HORIZONTAL AND VERTICAL POSITION DETECTED BY MULTIPLE METHODS (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

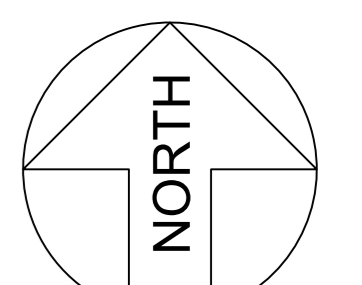
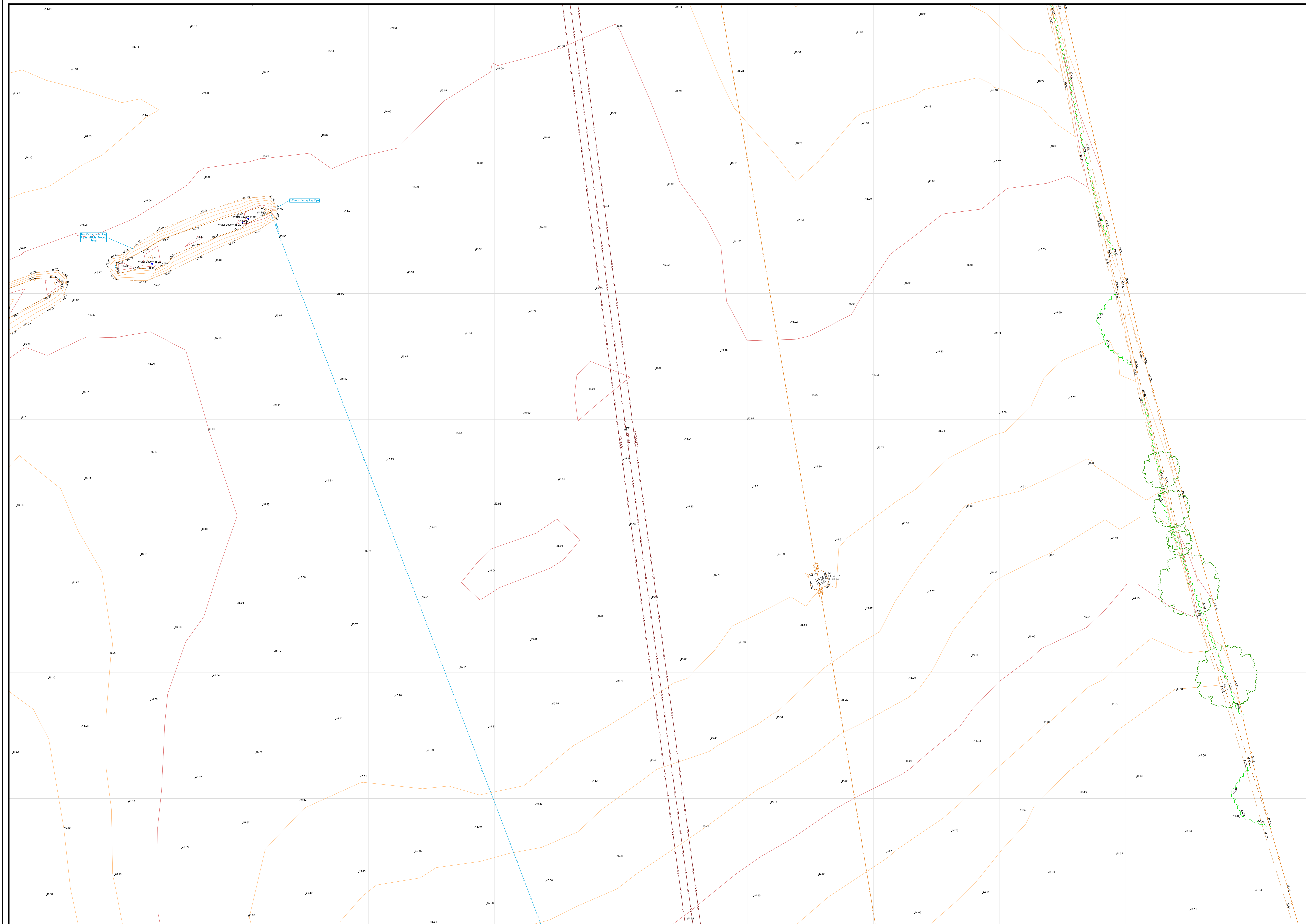
Surveyed: DH SS **Drawn:** DH SS

Checked: ZS **Authorised:** ZS

Date: 03/03/2026 **Scale:** 1:200@A0

ZS Surveys Ltd
Land, Building & Engineering Surveyors
www.zssurveys.com info@zssurveys.com

Project Number: 4620
Sheet Number: 2 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

Topographic Abbreviations			
AV	Air Valve	PB	Pedestrian Beacon
BH	Borehole	POB	Post Box
BOL(L)	Bollard (Illuminated)	PGR	Pedestrian Guard Rail
BS	Bus Stop	PM	Parking Meter
Cab	Cabinet	PO	Post
CL	Cover Level	RE	Roading Eye
COL	Column	RS(L)	Road Sign (Illuminated)
Conc	Concrete	RWP	Rain Water Pipe
DC	Drainage Channel	SPL	Sign Post (Illuminated)
DFBin	Dog Foul Bin	SPCam	Speed Camera
EP	Electric 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	TOP	Top of Fence Level
GV	Gas Valve	TOW	Top of Wall Level
Gully	Gully	TP	Telecoms Pole
IC	Inspection Cover	VP	Vent Pipe
KO	Kerb Outlet	WB	Waste Bin
LP	Lamp Post	WBR	Window Bottom Level
NH	Manhole	WM	Water Meter
Marker	Marker	WO	Wash Out
MP	Marker Post	WTR	Window Top Level
MW	Monitoring Well	WV	Water Valve

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 Rise
Empty Service Duct	Drainage Backdrop

Utility Abbreviations			
CP	Cathodic Protection	LoS	Loss of Signal
Disconn	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	Unplanned	Unplanned
EoT	End of Trace	uPVC	Polyvinyl Chloride
PE	Polyethylene	UTR	Unable to Raise
HDPE	High Density PE	VC	Verified City

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

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 e.g. Using a Scale 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.

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Notes

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ALL LEVELS RELATED OSTN15 GRID PROJECTION.

ALL DIMENSIONS SHOULD BE VERIFIED ON SITE PRIOR TO CONSTRUCTION.

ALL HATCHING IS FOR PRESENTATIONAL PURPOSES ONLY.

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

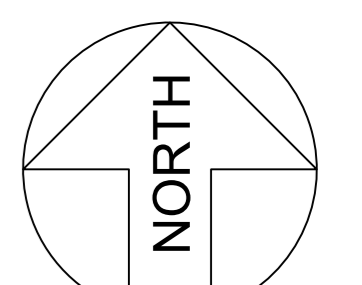
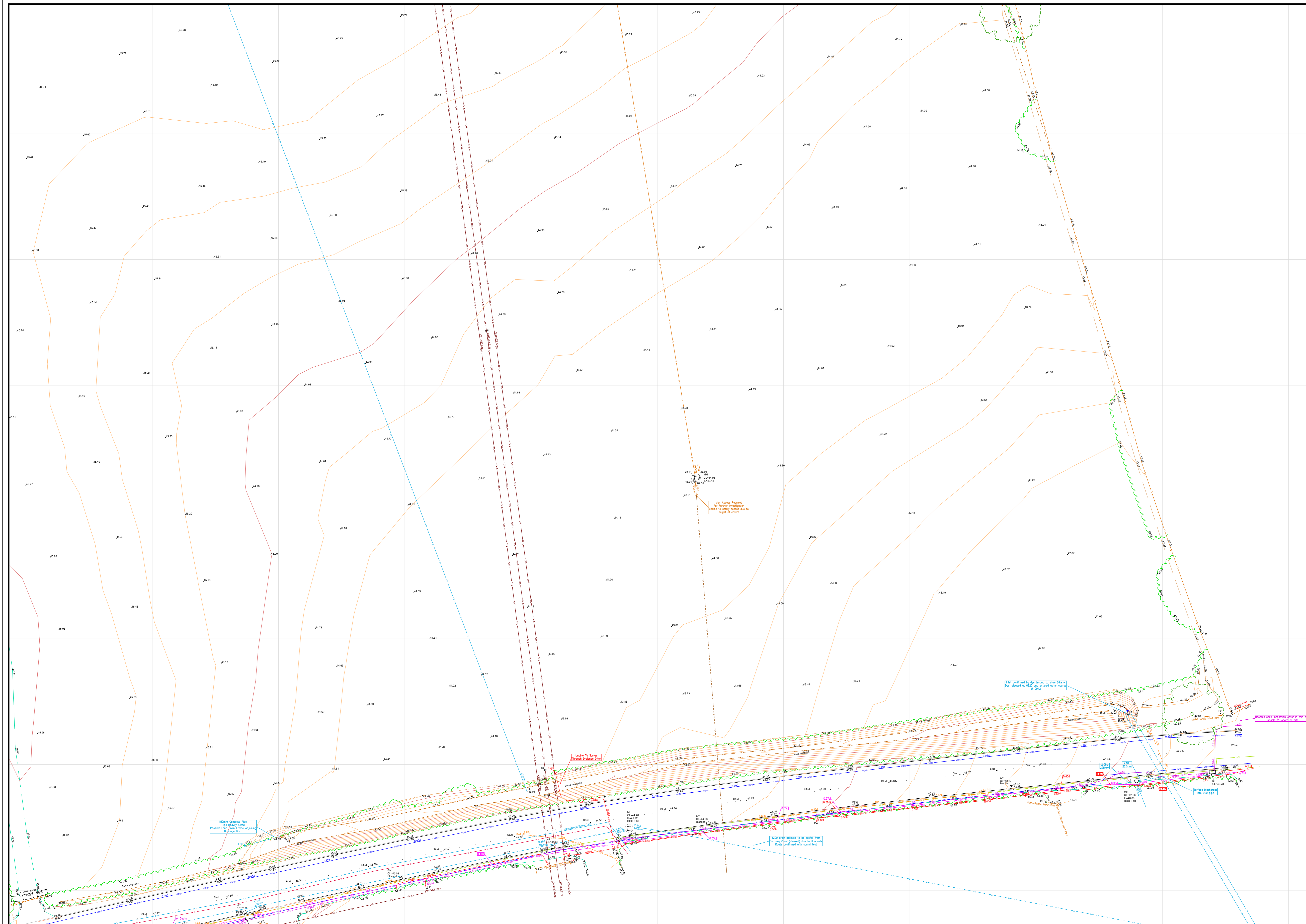
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Land, Building & Engineering Surveyors
www.zsurveys.com - Accredited
info@zsurveys.com
Constructionline

Project Number:	4620
Sheet Number:	3 OF 5

PAS128 Legend	
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	
(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 BY MULTIPLE METHODS (Estimated Accuracy: ±150mm 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	
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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	Roading Eye
COL	Column	RS(L)	Road Sign (Illuminated)
Conc	Concrete	RWP	Rain Water Pipe
DC	Drainage Channel	SR(L)	Sign Post (Illuminated)
DFBin	Dog Foul Bin	SV	Speed Camera
DP	Down Pipe	ST	Stop Tap
EP	Electricity Pole	SV	Sluice Valve
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	TOWL	Top of Wall Level
GV	Gas Valve	TP	Telecoms Pole
GV	Gully	VP	Vent Pipe
IC	Inspection Cover	WB	Waste Bin
KO	Kerb Outlet	WBR	Window Bottom Level
LP	Lamp Post	WM	Water Meter
MH	Manhole	WO	Wash Out
MR	Marker	WTL	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

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

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 ± 2.5% of depth reading.
⊙	Detected Using Electromagnetic Location Methods e.g. Using a Scribe 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.

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Notes

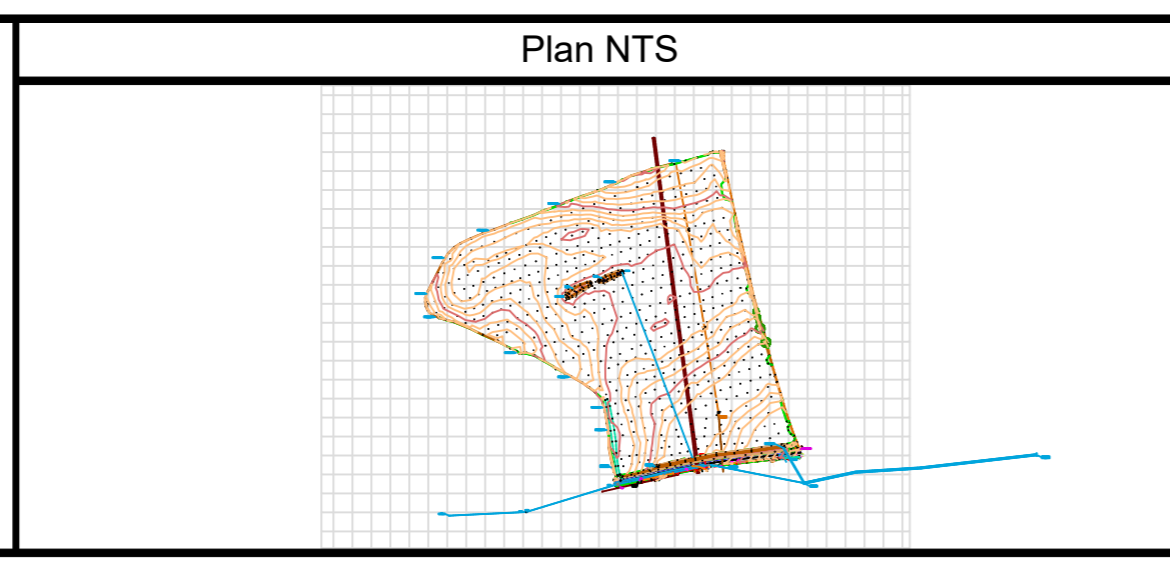
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ALL LEVELS RELATED OSTN15 GRID PROJECTION.

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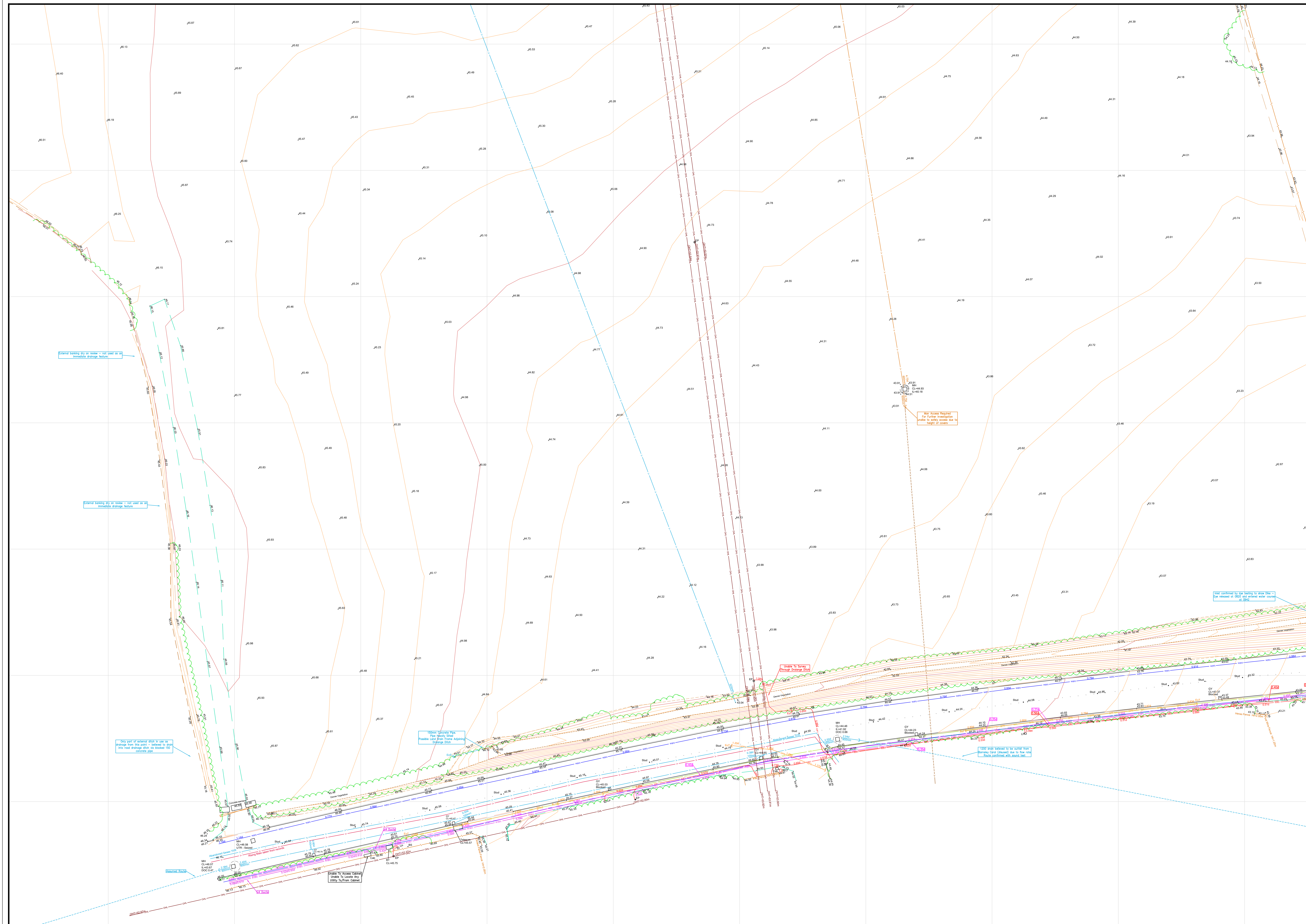
PAS128 Legend	
M4P - EML SEARCH TRANSECT AT 2m INTERVALS - TRACED AT 0.5m INTERVALS. GPR SURVEY GRID AT 0.5m INTERVALS OR HIGH DENSITY ARRAY. POST PROCESSING OF GPR DATA.	M4 - EML SEARCH TRANSECT AT 2m INTERVALS - TRACED AT 0.5m INTERVALS. GPR SURVEY GRID AT 0.5m INTERVALS. GPR MARK-UP ON SITE.
M3P - EML SEARCH TRANSECT AT 2m INTERVALS - TRACED AT 1m INTERVALS. GPR SURVEY GRID AT 1m INTERVALS. GPR MARK-UP ON SITE. 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 BY MULTIPLE METHODS (Estimated Accuracy: ±150mm OR ±15% of detected depth)
(B3P)	HORIZONTAL AND VERTICAL POSITION DETECTED VIA POST-PROCESSED GPR (Estimated Accuracy: ±250mm OR ±40% of detected depth)
(C)	ROUTE TRANSCRIBED FROM UTILITY ASSET PLANS AND CORRELATED TO VISUAL INDICATORS AND SURFACE FEATURES (Accuracy Undefined)

PAS 128 SURVEY METHODOLOGY KEY	
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Client	Vistry Group
Site Location	SHAW LANE CARLTON BARNESLEY S71 3HJ
Drawing Type	PAS128 Utility Mapping & Topographic Survey REV A
Surveyed:	DH SS Drawn: DH SS
Checked:	ZS Authored: ZS
Date:	03/03/2026 Scale: 1:200@A0
ZS Surveys Ltd	
Land, Building & Engineering Surveyors www.zssurveys.com info@zssurveys.com	
Project Number:	4620
Sheet Number:	4 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

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	SPL Sign Post (Illuminated)
DFBin Dog Foul Bin	SCM Speed Camera
DP Down Pipe	ST Stop Tap
EP Electricity Pole	SV Sluice Valve
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	TOW= Top of Wall Level
GV Gas Valve	TP Telecoms Pole
GY Gully	VP Vent Pipe
IC Inspection Cover	WB Waste Bin
KO Kerb Outlet	WBR= Window Bottom Level
LP Lamp Post	WM Water Meter
NH Manhole	WO Wash Out
Mrk Marker	WTA 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
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Gas Pipe	Records Route
Band of Cables	Cable Riser
Empty Service Duct	Drainage Backdrop

Utility Abbreviations

CP Cathodic Protection	LoS Loss of Signal
CU Disconnected Utility	MDPE Middle Density PE
DI Ductile Iron	SI Span Iron
D-B Depth of Bottom	TLC Traffic Light Control
DoC Depth of Cover	UDI Unreliable Depth Info
ED Empty Duct	Unplasticised
EoT End of Trace	uPVC Polyvinyl Chloride
PE Polyethylene	UTR Unable to Raise
HDPE High Density PE	VC Verified Cavity

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

Manufacturer Stated Depths

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- Detected Using Electromagnetic Location Methods e.g. Using a Scale to locate drainage pipework. Accuracy ± 2.5% of depth reading.
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PAS128 Legend

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.
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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

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)

(B1) HORIZONTAL AND VERTICAL POSITION DETECTED BY MULTIPLE METHODS (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.

ZS Surveys Ltd
Land, Building & Engineering Surveyors
www.zssurveys.com
info@zssurveys.com

Client: **Vistry Group**

Site Location: SHAW LANE, 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: 5 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 (Diversionary 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










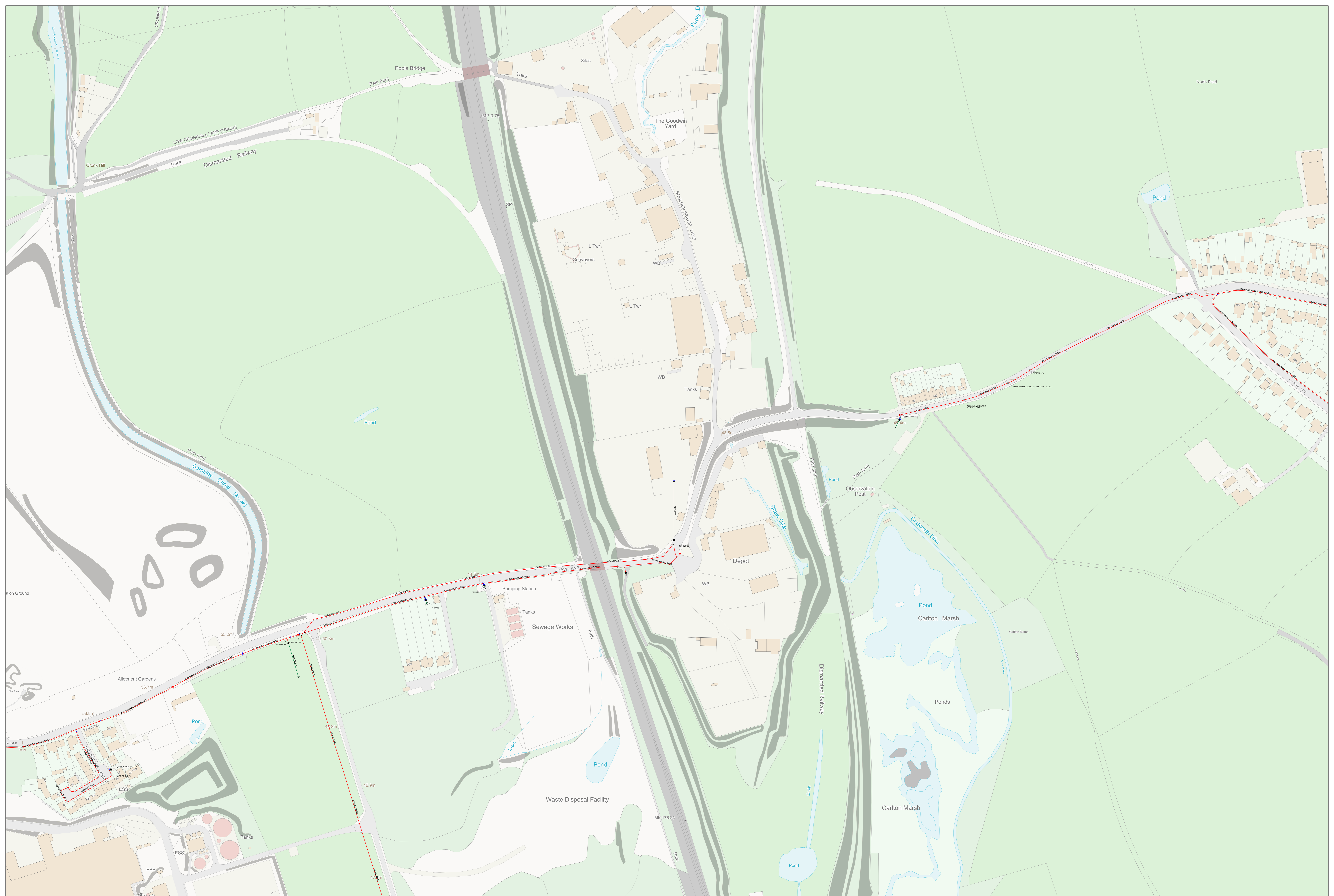
Sewer Legend

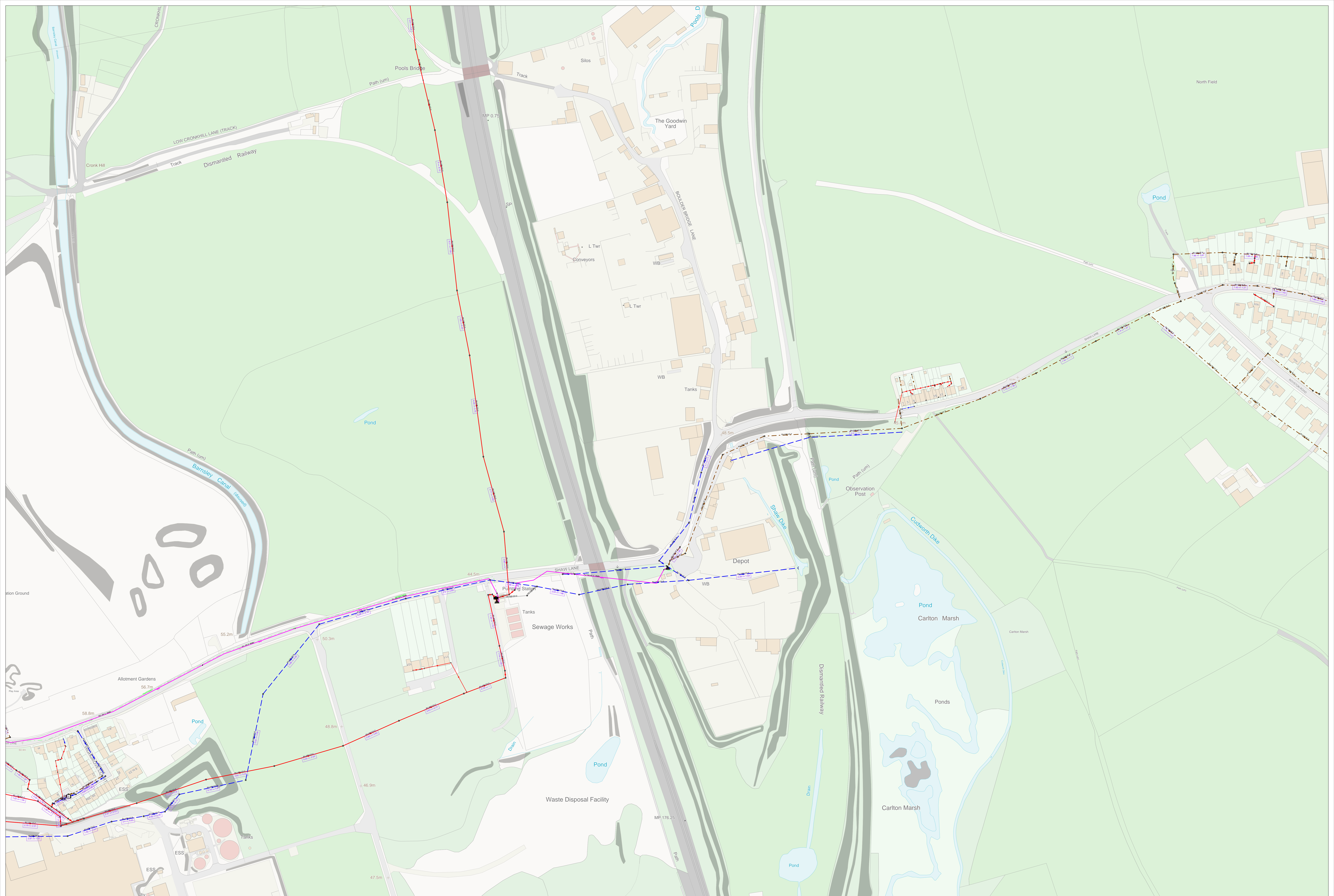
	Combined Sewer		S24 Combined Sewer
	Surface Water Sewer		S24 Surface Water Sewer
	Foul Sewer		S24 Foul Sewer
	Section 104 Sewer		Rising Main
	Overflow Sewer		Abandoned Sewer
	Manhole		Syphone Sewer & Vacuum Sewer
	Pumping Station		Public Sewer Treatment Works

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







APPENDIX D: FLOOD MAP FOR PLANNING

Flood map for planning

Your reference	Location (easting/northing)	Created
Unspecified	437376/410330	12 February 2026 14:08

Your selected location is in flood zone 2, an area with a medium probability of flooding.

This means:

- you must complete a flood risk assessment for development in this area
- you should follow the Environment Agency's standing advice for carrying out a flood risk assessment (see <https://www.gov.uk/guidance/flood-risk-assessment-standing-advice>)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Flood risk data is covered by the Open Government Licence which sets out the terms and conditions for using government data. <https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3>

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2026 AC0000807064. <https://flood-map-for-planning.service.gov.uk/os-terms>



Flood map for planning

Your reference

Unspecified

Location (easting/northing)






437376/410330


Scale

1:2,500

Created

12 Feb 2026 14:08

-  Selected area
-  Flood zone 3
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Water storage area



0 20 40 60m



**APPENDIX E: ENVIRONMENT AGENCY
MODELLED FLOOD DATA**

Flood risk assessment data



Location of site: 437375 / 410331 (shown as easting and northing coordinates)

Document created on: 20 November 2025

This information was previously known as a product 4.

Customer reference number: 4PM4KVXAP3JP

Map showing the location that flood risk assessment data has been requested for.



How to use this information

You can use this information as part of a flood risk assessment for a planning application. To do this, you should include it in the appendix of your flood risk assessment.

We recommend that you work with a flood risk consultant to get your flood risk assessment.

Included in this document

In this document you'll find:

- how to find information about surface water and other sources of flooding
- definitions for the terminology used throughout
- flood map for planning (rivers and the sea)
- past floods
- information about strategic flood risk assessments
- information about this data
- information about flood risk activity permits
- help and advice

Information that's unavailable

This document **does not** contain:

- flood defences and attributes
- modelled data

We aren't able to display flood defence locations and attributes as there are no formal flood defences in the area of interest.

There is not any modelled data available for this location. This is because detailed modelling hasn't been carried out in this area.

Surface water and other sources of flooding

When using the surface water map on the [check your long term flood risk service](#) the following considerations apply:

- surface water extents are suitable for use in planning
- surface water climate change scenarios may help to inform risk assessments, but the available data fall short of what is required to assess planned development
- surface water depth information should not be used for planning purposes

To find out about other factors that might affect the flood risk of this location, you should also check:

- [reservoir flood risk](#)
- groundwater flood risk - you could use the [British Geological Survey groundwater flooding data](#), [groundwater: current status and flood risk](#) and the guide on [mining and groundwater constraints for development](#) - further information may be available from the lead local flood authority (LLFA)
- your local planning authority's SFRA, which includes future flood risk

Your Lead Local Flood Authority is Barnsley District.

For information about sewer flooding, contact the relevant water company for the area.

Terminology used

Annual exceedance probability (AEP)

This refers to the probability of a flood event occurring in any year. The probability is expressed as a percentage. For example, a large flood which is calculated to have a 1% chance of occurring in any one year, is described as 1% AEP.

Metres above ordnance datum (mAOD)

All flood levels are given in metres above ordnance datum which is defined as the mean sea level at Newlyn, Cornwall.

Flood map for planning (rivers and the sea)

Your selected location is in flood zone 2.

Flood zone 3 shows the area at risk of flooding for an undefended flood event with a:

- 0.5% or greater probability of occurring in any year for flooding from the sea
- 1% or greater probability of occurring in any year for fluvial (river) flooding

Flood zone 2 shows the area at risk of flooding for an undefended flood event with:

- between a 0.1% and 0.5% probability of occurring in any year for flooding from the sea
- between a 0.1% and 1% probability of occurring in any year for fluvial (river) flooding

It's important to remember that the flood zones on this map:

- refer to the land at risk of flooding and do not refer to individual properties
- refer to the probability of river and sea flooding, ignoring the presence of defences
- do not take into account potential impacts of climate change



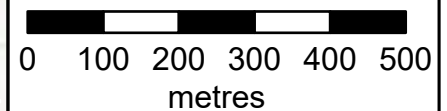
Flood map for planning

Location (easting/northing)
437375/410331

Scale
1:10,000

Created
20 Nov 2025

- Selected area
- Flood Zone 3
- Flood Zone 2



Past floods

Past flood events included in this document

The recorded flood outlines included in this document are for areas of land local to your site location that have been flooded by any of these sources:

- ephemeral water
- main rivers
- ordinary watercourses
- the sea
- unknown

Data limitations

The outlines do not include flooding from:

- drainage where rainfall has led to surface water ponding or overland runoff
- artificial, water-bearing sewer, water supply and wastewater treatment pipelines

Changes to flood defences

The defences (also known as assets) that were in place may also have changed. For example, assets may have been built more recently than the last recorded flood outline.

What the recorded flood outlines dataset is

The recorded flood outlines are a geographical information system (GIS) data layer that show our verified records of areas that have flooded in the past from:

- rivers
- the sea
- groundwater
- surface water

[Download the complete recorded flood outlines dataset](#), which includes data quality flags for outlines recorded after April 2020. This indicates the confidence we have in an outline.

Get flood information from other organisations

Contact Barnsley District Lead Local Flood Authority (LLFA) and your drainage board to get information about past flooding caused by surface water or drainage systems.







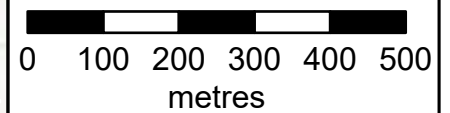
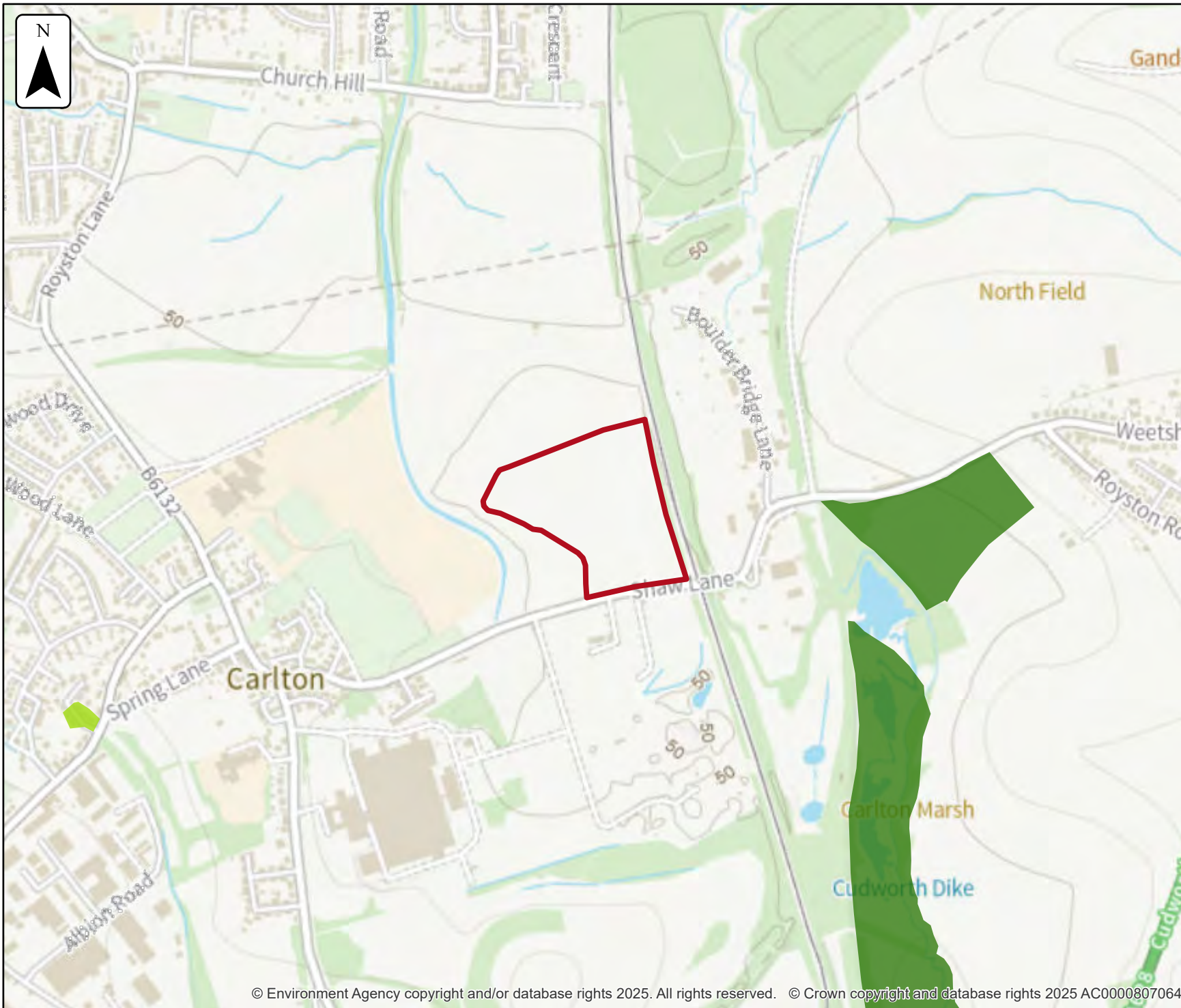
Past floods

Location (easting/northing)
437375/410331

Scale
1:10,000

Created
20 Nov 2025

-  Selected area
-  Main river
- Date of flood event
 -  June, 2007
 -  March, 1947



Data on past flood events

Start date	End date	Source of flood	Cause of flood	Affects location
25 June 2007	26 June 2007	main river	unknown	No
19 March 1947	22 March 1947	ordinary watercourse	channel capacity exceeded (no raised defences)	No

Strategic flood risk assessments

We recommend that you check the relevant local authority's strategic flood risk assessment (SFRA) as part of your work to prepare a site specific flood risk assessment.

This should give you information about:

- the potential impacts of climate change in this catchment
- areas defined as functional floodplain
- flooding from other sources, such as surface water, ground water and reservoirs

Your Lead Local Flood Authority is Barnsley District.

About this data

This data has been generated by strategic scale flood models and is not intended for use at the individual property scale. If you're intending to use this data as part of a flood risk assessment, please include an appropriate modelling tolerance as part of your assessment. The Environment Agency regularly updates its modelling. We recommend that you check the data provided is the most recent, before submitting your flood risk assessment.

Flood risk activity permits

Under the Environmental Permitting (England and Wales) Regulations 2016 some developments may require an environmental permit for flood risk activities from the Environment Agency. This includes any permanent or temporary works that are in, over, under, or nearby a designated main river or flood defence structure.

[Find out more about flood risk activity permits](#)

Help and advice

Contact the Yorkshire Environment Agency team at neyorkshire@environment-agency.gov.uk for:

- [more information about getting a product 5, 6, 7 or 8](#)
- general help and advice about the site you're requesting data for

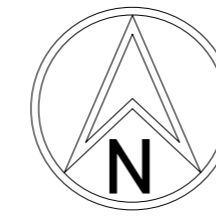
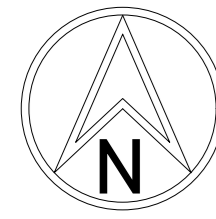


APPENDIX F: PROPOSED SITE PLAN

Room Type	Type	Bedrooms	Person	Amount	%	m ²	Cost	Total m ²	Total Cost
200	Self-Def/Terrace	2	3	11	5.1	748	21.95	4933.00	703.35
206	Self-Def	2	4	17	7.8	827	78.63	1459.00	1084.11
241	Self-Def	2	4	8	3.7	886	74.41	6948.00	605.84
460	Self-Def	2	4	38	18.1	847	79.85	22487.00	2493.80
461	Self-Def	3	4	37	17.6	847	84.05	22883.00	2377.58
462	Self-Def/Terrace	3	5	30	14.0	1022	84.05	3530.00	2871.00
464	Self-Def	3	5	30	14.0	1171	108.97	11532.00	1088.70
465	Self-Def	3	5	18	8.4	1153.78	108.27	22577.00	1833.68
467	Self-Def	4	5	10	4.7	1176	109.41	11202.00	1264.50
468	Self-Def	4	5	14	6.5	1176	109.41	14493.00	1517.74
469	Self-Def	4	5	10	4.7	1464	136.46	9502.00	653.20
470	Self-Def	4	5	10	4.7	1285	119.24	13833.00	1382.80
471	Apartment	1	2	8	3.8	823	87.8	5607.00	521.50
472	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
473	Apartment	1	2	8	3.8	823	87.8	5607.00	521.50
474	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
475	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
476	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
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531	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
532	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
533	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
534	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
535	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
536	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
537	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
538	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
539	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
540	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
541	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
542	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
543	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
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550	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
551	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
552	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
553	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
554	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
555	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
556	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
557	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
558	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
559	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
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561	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
562	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
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564	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
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566	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
567	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
568	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
569	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
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573	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
574	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
575	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
576	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
577	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
578	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
579	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
580	Apartment	1	2	8	3.8	823	87.8	3089.00	287.00
581									



**APPENDIX G: DRAWING 25280-RWO-XX-XX-
DR-C-0900 FLOOD RISK ANALYSIS**

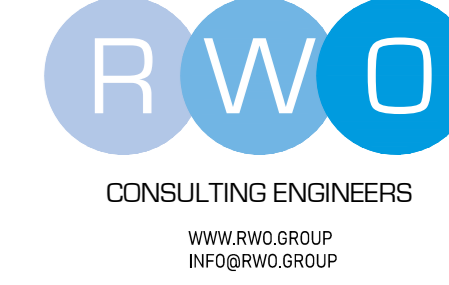


- DESIGN NOTES:**
- IN ACCORDANCE WITH THE CONSTRUCTION (DESIGN & MANAGEMENT) REGULATIONS 2018, IT IS THE POLICY OF THIS PRACTICE TO DESIGN OUT AS MANY IDENTIFIABLE RISKS AS POSSIBLE FOR THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE PROJECT.
 - ALL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE PRELIMINARY INFORMATION WHICH IS SUPPLIED BY THE CONSTRUCTION OPERATOR AND DESIGN MANAGEMENT CONSULTANT.
 - A COMPETENT CONTRACTOR SHOULD BE AWARE OF 'NORMAL' RISKS INVOLVED WITH THE CONSTRUCTION PROCESS. HOWEVER, ADDITIONAL PRECAUTIONS WILL NEED TO BE CONSIDERED FOR THE FOLLOWING ITEMS:
 - AS IDENTIFIED.
 - SAFE METHODS AND SYSTEMS OF WORK REMAIN THE RESPONSIBILITY OF THE CONTRACTOR AND MUST BE IDENTIFIED IN THE CONSTRUCTION PHASE PLAN. THE CONSTRUCTION PHASE PLAN MUST BE IN PLACE PRIOR TO THE START OF ANY INSTALLATION OR WORK.
 - RESIDUAL RISKS THAT HAVE BEEN IDENTIFIED AND CANNOT BE 'DESIGNED OUT' ARE AS FOLLOWS:
 - AS IDENTIFIED.
 - IF ANY PARTY USING THIS DRAWING CONSIDERS THAT THERE ARE 'MEMORABLE' RISKS THAT HAVE NOT BEEN IDENTIFIED ABOVE, THEN THE ENGINEER SHOULD BE NOTIFIED.
- ADDITIONAL HEALTH & SAFETY NOTES:**
- CONTRACTOR SHOULD BE AWARE OF GENERAL CONSTRUCTION RISKS TO PREVENT SLIPS, TRIPS AND FALLS AND THAT NECESSARY PRECAUTIONS WITHOUT SPECIAL INSTRUCTION.
 - CONTRACTOR TO PROVIDE TRENCH SUPPORTS AS APPROPRIATE AND ENSURE THAT PLANT REMAINS A SAFE DISTANCE FROM TRENCHES PRIOR TO INSTALLING DRAINAGE.
 - THE TIME THAT EXCAVATIONS ARE OPEN ON SITE SHOULD BE KEPT TO A MINIMUM AND ALL TRENCHES SHOULD BE SURROUNDED BY A BARRIER.
 - CONNECTIONS TO EXISTING SERVICES TO BE MADE BY APPROVED CONTRACTOR ONLY.
 - CONTRACTOR TO MAKE OPERATIVES AWARE OF ASSOCIATED DANGERS TO HEALTH SUCH AS LETHARGIC/WEIL DISEASE AND RECOMMENDED PRECAUTIONS. ADEQUATE WELFARE FACILITIES AND PROTECTIVE CLOTHING TO BE PROVIDED AS REQUIRED.
 - DANGERED MACHINERY MUST BE COVERED WITH LOAD BEARING MATERIALS AND SURROUNDED WITH BARRIERS.
- PERMITS & SCAFFOLD:**
- CONTRACTOR TO OBTAIN ALL SERVICE RECORDS PRIOR TO WORK COMMENCING.
 - SERVICE RECORDS TO BE REFERRED TO PRIOR TO WORK COMMENCING. CONTRACTOR TO PROCEED WITH CAUTION AND SERVICES TO BE LOCATED BY HAND ON AND PROTECTED ACCORDINGLY.
 - CONTRACTOR TO ENSURE RELEVANT HEALTH AND SAFETY MEASURES ARE TAKEN TO KEEP PLANT AND PEOPLE A SAFE DISTANCE FROM STEEP SLOPES DURING THE WORKS.
 - CONTRACTOR TO ENSURE THAT PROCEDURES ARE IN PLACE TO KEEP PEOPLE A SAFE DISTANCE FROM WORKING PLANT WHERE NECESSARY.
 - CONTRACTOR TO REFER TO SOIL AND INVESTIGATION REPORT FOR CONTAMINATION TESTS AND TO PROVIDE ADEQUATE WELFARE FACILITIES AND PROTECTIVE CLOTHING AS REQUIRED.

KEY:

- FLOOD ZONE - CLIMATE CHANGE
- PRESENT FLOOD ZONE 2
- PRESENT FLOOD ZONE 3
- EXISTING LEVELS SURROUNDING CC/FLOOD ZONE AREA

46.872

Date	Revisions	SR	AE	1
18.02.2024	FIRST ISSUE			
SCHEMATIC				
				
NORTH EAST 010 258432 WORKSHOPS 013 335 3920 WWW.RWOGROUP.COM #RWOENGINEERS				
Client: VISTRY GROUP				
Project: SHAW LANE CARLTON				
Title: FLOOD RISK ANALYSIS				
DO NOT SCALE	Scale @ A3: 1:500	Drawn: SR	Checked: AE	Date: 13.02.24
Job No: 24307		Drawn: D900	Checked: AE	Rev: 01



APPENDIX H: GREENFIELD RUNOFF RATE ESTIMATION - AREA NORTH OF SHAW LANE

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Project details

Date	<input type="text" value="17/02/2026"/>
Calculated by	<input type="text" value="RWO"/>
Reference	<input type="text" value="24307"/>
Model version	<input type="text" value="2.2.2"/>

Location

Site name	<input type="text" value="Area North of Shaw Lane"/>
Site location	<input type="text" value="Carlton"/>



Site easting (British National Grid)	<input type="text" value="437312"/>
Site northing (British National Grid)	<input type="text" value="410386"/>

Site details

Total site area (ha)	<input type="text" value="21.82"/>	ha
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OK, I AGREE

MORE INFO

Greenfield runoff

Method

Method

IH124

	<u>My value</u>	<input type="text" value="628"/>	mm	<input type="radio"/>	<u>Map value</u>	<input type="text" value="628"/>
SAAR (mm)						
How should SPR be derived?		<input type="text" value="WRAP soil type"/>				
WRAP soil type		<input type="text" value="4"/>		<input type="radio"/>		<input type="text" value="4"/>
SPR		<input type="text" value="0.47"/>				
QBar (IH124) (l/s)		<input type="text" value="92.8"/>				<input type="text" value="l/s"/>

Growth curve factors

	<u>My value</u>	<input type="text" value="3"/>		<input type="radio"/>	<u>Map value</u>	<input type="text" value="3"/>
Hydrological region						
1 year growth factor		<input type="text" value="0.86"/>				
2 year growth factor		<input type="text" value="0.94"/>				
10 year growth factor		<input type="text" value="1.45"/>				
30 year growth factor		<input type="text" value="1.75"/>				
100 year growth factor		<input type="text" value="2.08"/>				
200 year growth factor		<input type="text" value="2.37"/>				

Results

Method	<input type="text" value="IH124"/>	
Flow rate 1 year (l/s)	<input type="text" value="79.8"/>	<input type="text" value="l/s"/>
Flow rate 2 year (l/s)	<input type="text" value="87.2"/>	<input type="text" value="l/s"/>
Flow rate 10 years (l/s)	<input type="text" value="134.5"/>	<input type="text" value="l/s"/>
Flow rate 30 years (l/s)	<input type="text" value="162.4"/>	<input type="text" value="l/s"/>
Flow rate 100 years (l/s)	<input type="text" value="193.0"/>	<input type="text" value="l/s"/>
Flow rate 200 years (l/s)	<input type="text" value="219.9"/>	<input type="text" value="l/s"/>

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent 'zero' figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

Disclaimer

This report was produced using the Greenfield runoff rate estimation tool (2.2.2) developed by HR Wallingford and available at [uksuds.com](https://www.uksuds.com/) (<https://www.uksuds.com/>). The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at [uksuds.com/terms-conditions](https://www.uksuds.com/terms-conditions) (<https://www.uksuds.com/terms-conditions>). The outputs from this tool have been used to estimate Greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, Centre for Ecology and Hydrology, Wallingford Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

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**APPENDIX I: GREENFIELD RUNOFF RATE
ESTIMATION - DEVELOPMENT SITE (L11)**

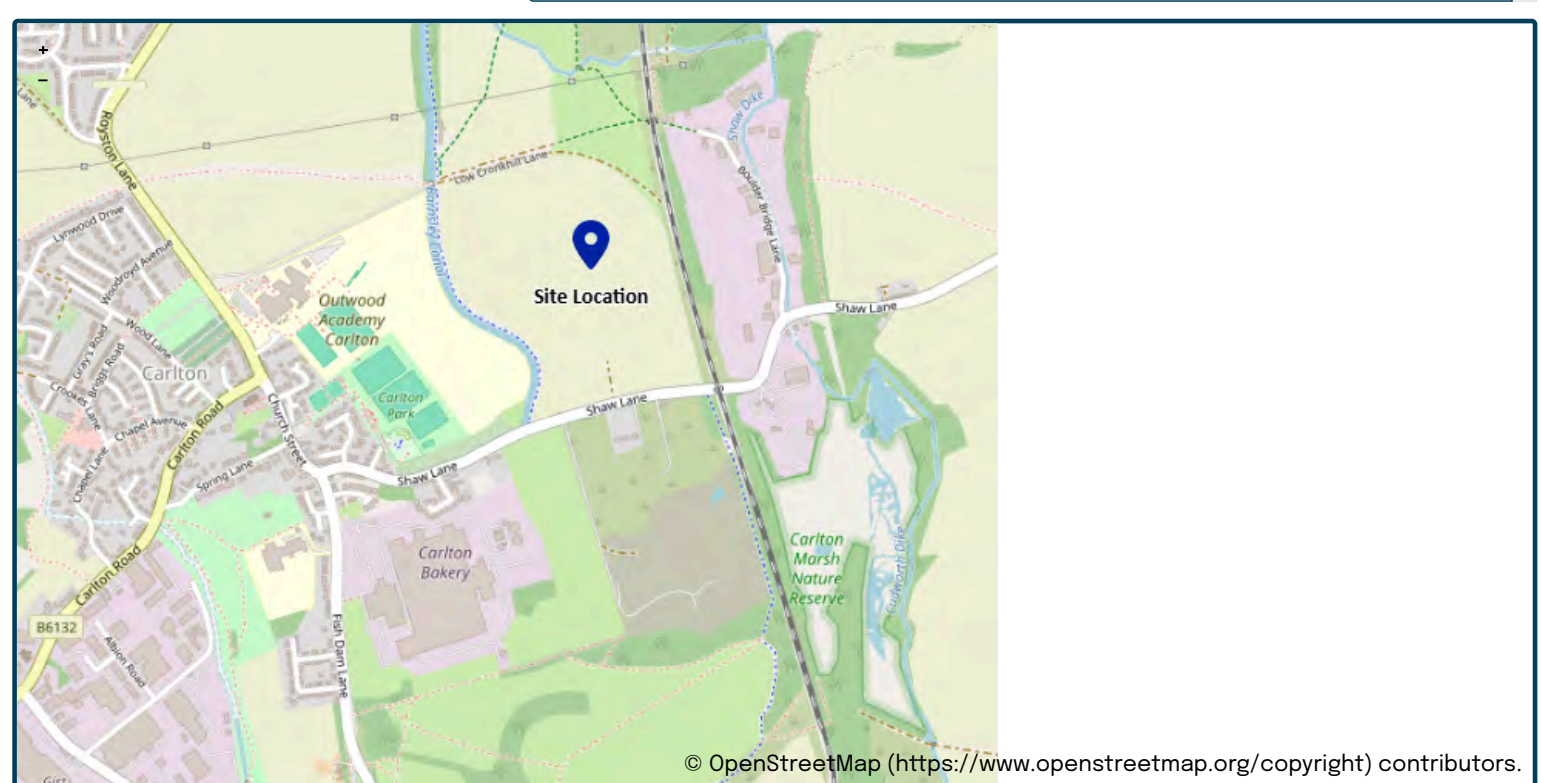
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Project details

Date	17/02/2026
Calculated by	RWO
Reference	24307
Model version	2.2.2

Location

Site name	Area North of Shaw Lane
Site location	Carlton



Site easting (British National Grid)	437312
Site northing (British National Grid)	410386

Site details

Total site area (ha)	7.57	ha
----------------------	------	----

Greenfield runoff

Method

Method

IH124

	<u>My value</u>		<u>Map value</u>
SAAR (mm)	<input type="text" value="628"/>	mm	<input type="text" value="628"/>
How should SPR be derived?	<input type="text" value="WRAP soil type"/>		
WRAP soil type	<input type="text" value="4"/>		<input type="text" value="4"/>
SPR	<input type="text" value="0.47"/>		
QBar (IH124) (l/s)	<input type="text" value="32.2"/>	l/s	

Growth curve factors

	<u>My value</u>		<u>Map value</u>
Hydrological region	<input type="text" value="3"/>		<input type="text" value="3"/>
1 year growth factor	<input type="text" value="0.86"/>		
2 year growth factor	<input type="text" value="0.94"/>		
10 year growth factor	<input type="text" value="1.45"/>		
30 year growth factor	<input type="text" value="1.75"/>		
100 year growth factor	<input type="text" value="2.08"/>		
200 year growth factor	<input type="text" value="2.37"/>		

Results

Method	<input type="text" value="IH124"/>	
Flow rate 1 year (l/s)	<input type="text" value="27.7"/>	l/s
Flow rate 2 year (l/s)	<input type="text" value="30.3"/>	l/s
Flow rate 10 years (l/s)	<input type="text" value="46.7"/>	l/s
Flow rate 30 years (l/s)	<input type="text" value="56.3"/>	l/s
Flow rate 100 years (l/s)	<input type="text" value="67.0"/>	l/s
Flow rate 200 years (l/s)	<input type="text" value="76.3"/>	l/s

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent 'zero' figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

Disclaimer

This report was produced using the Greenfield runoff rate estimation tool (2.2.2) developed by HR Wallingford and available at [uksuds.com](https://www.uksuds.com/) (<https://www.uksuds.com/>). The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at [uksuds.com/terms-conditions](https://www.uksuds.com/terms-conditions) (<https://www.uksuds.com/terms-conditions>). The outputs from this tool have been used to estimate Greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, Centre for Ecology and Hydrology, Wallingford Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.



APPENDIX J: PROPOSED DRAINAGE STRATEGY



APPENDIX K: HYDRAULIC CALCULATIONS

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	19.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.365	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
SW1	0.072	5.00	47.850	1200	437434.168	410477.192	1.950	45.900
SW2	0.088	5.00	47.110	1350	437440.444	410432.906	1.510	45.600
SW3	0.035	5.00	46.950	1350	437442.470	410417.412	1.550	45.400
SW4	0.101	5.00	46.767	1350	437408.155	410411.704	1.617	45.150
SW5	0.047	5.00	46.352	1350	437362.024	410395.233	1.602	44.750
SW6	0.112	5.00	46.457	1350	437380.491	410351.527	1.557	44.900
SW7	0.065	5.00	46.288	1800	437363.580	410345.203	1.888	44.400
SW8	0.155	5.00	45.810	1350	437413.545	410311.620	1.710	44.100
SW9	0.091	5.00	46.967	1350	437464.841	410407.917	1.567	45.400
SW10	0.053	5.00	46.831	1350	437444.630	410405.147	1.581	45.250
SW11	0.053	5.00	46.128	1350	437480.310	410353.842	1.378	44.750
SW12	0.126	5.00	45.967	1350	437452.511	410349.151	1.667	44.300
SW13	0.073	5.00	45.390	1350	437457.591	410318.824	1.740	43.650
SW14	0.052	5.00	45.386	1350	437488.918	410302.321	1.436	43.950
SW15	0.126	5.00	45.172	1500	437461.135	410297.586	1.772	43.400
SW16	0.127	5.00	45.410	1350	437429.333	410249.746	1.510	43.900
SW17	0.092	5.00	44.746	1500	437468.221	410255.798	1.796	42.950
SW18	0.068	5.00	44.810	1350	437443.986	410217.049	1.360	43.450
SW19	0.191	5.00	43.927	1800	437474.622	410221.707	1.427	42.500
SW20	0.066	5.00	47.221	1350	437302.534	410437.495	1.621	45.600
SW21	0.216	5.00	47.140	1350	437313.979	410441.341	1.690	45.450
SW22	0.081	5.00	46.505	1350	437332.254	410392.415	1.355	45.150
SW23	0.036	5.00	46.392	1350	437334.675	410384.846	1.442	44.950
SW24	0.152	5.00	46.548	1350	437237.713	410402.414	1.498	45.050
SW25	0.172	5.00	46.778	1500	437259.101	410347.015	2.178	44.600
SW26	0.099	5.00	47.050	2100	437247.448	410341.790	2.600	44.450
SW27	0.000		47.249	1200	437254.881	410329.351	2.899	44.350
SW28	0.144	5.00	46.997	1200	437286.427	410321.468	2.797	44.200
SW29	0.210	5.00	46.336	1350	437358.012	410271.451	2.586	43.750
SW30	0.085	5.00	45.980	1350	437381.102	410241.248	2.580	43.400
SW31	0.018	5.00	45.938	1200	437363.998	410206.625	2.138	43.800
SW32	0.174	5.00	45.816	1500	437391.371	410217.341	2.516	43.300
SW33	0.040	5.00	45.429	1500	437406.596	410176.252	2.279	43.150
SW34	0.125	5.00	44.330	1500	437476.323	410189.594	1.780	42.550
SW35			43.975	2700	437490.021	410187.834	2.075	41.900
SWHW1			45.800	450	437362.537	410381.756	1.297	44.503
SWHW2			45.800	450	437371.561	410358.705	1.297	44.503
SWHW3		5.00	45.800	450	437365.380	410356.510	1.300	44.500
SWHW5			43.300	450	437482.561	410216.284	1.297	42.003
SWHW6		5.00	43.300	450	437490.758	410199.508	1.300	42.000

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
SWHW7			43.433	450	437507.238	410185.353	1.633	41.800
1	0.500	5.00	47.200	1800	437424.561	410519.219	1.100	46.100
2	0.500	5.00	46.350	1800	437218.736	410446.410	1.100	45.250
3	0.500	5.00	46.000	1200	437338.390	410196.225	1.800	44.200

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
S1	SW1	SW2	44.729	0.600	45.900	45.600	0.300	149.1	300	6.25	50.0
S2	SW2	SW3	15.626	0.600	45.600	45.400	0.200	78.1	300	6.40	50.0
S3	SW3	SW4	34.786	0.600	45.400	45.225	0.175	198.8	300	6.92	50.0
S4	SW4	SW5	48.984	0.600	45.150	44.750	0.400	122.5	375	7.42	50.0
S5	SW5	SWHW1	13.487	0.600	44.750	44.650	0.100	134.9	375	7.57	50.0
S6	SW6	SWHW2	11.457	0.600	44.900	44.650	0.250	45.8	225	5.10	50.0
S7	SW7	SW8	60.203	0.600	44.400	44.100	0.300	200.7	300	6.04	50.0
S8	SW8	SW13	44.631	0.600	44.100	43.800	0.300	148.8	300	6.62	50.0
S9	SW9	SW10	20.400	0.600	45.400	45.250	0.150	136.0	225	5.30	50.0
S10	SW10	SW12	56.547	0.600	45.250	44.375	0.875	64.6	225	5.88	50.0
S11	SW11	SW12	28.192	0.600	44.750	44.450	0.300	94.0	150	5.45	50.0
S12	SW12	SW13	30.750	0.600	44.300	43.800	0.500	61.5	300	6.14	50.0
S13	SW13	SW15	21.532	0.600	43.650	43.400	0.250	86.1	450	6.78	50.0
S14	SW14	SW15	28.184	0.600	43.950	43.700	0.250	112.7	150	5.50	50.0
S15	SW15	SW17	42.384	0.600	43.400	43.025	0.375	113.0	450	7.15	50.0
S16	SW16	SW17	39.356	0.600	43.900	43.250	0.650	60.5	225	5.39	50.0
S17	SW17	SW19	34.687	0.600	42.950	42.500	0.450	77.1	525	7.38	50.0
S18	SW18	SW19	30.988	0.600	43.450	42.875	0.575	53.9	150	5.38	50.0
S19	SW19	SWHW5	9.614	0.600	42.500	42.250	0.250	38.5	525	7.42	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
S1	1.285	90.8	77.5	1.650	1.210	0.572	0.0	214	1.437
S2	1.780	125.8	89.4	1.210	1.250	0.660	0.0	187	1.926
S3	1.111	78.6	94.2	1.250	1.242	0.695	0.0	300	1.126
S4	1.636	180.7	107.9	1.242	1.227	0.796	0.0	209	1.705
S5	1.558	172.1	114.2	1.227	0.775	0.843	0.0	224	1.662
S6	1.937	77.0	15.2	1.332	0.925	0.112	0.0	67	1.512
S7	1.106	78.2	8.8	1.588	1.410	0.065	0.0	68	0.739
S8	1.287	90.9	29.8	1.410	1.290	0.220	0.0	118	1.156
S9	1.119	44.5	12.3	1.342	1.356	0.091	0.0	80	0.958
S10	1.629	64.8	19.5	1.356	1.367	0.144	0.0	85	1.433
S11	1.037	18.3	7.2	1.228	1.367	0.053	0.0	65	0.975
S12	2.008	141.9	43.8	1.367	1.290	0.323	0.0	114	1.775
S13	2.191	348.5	83.5	1.290	1.322	0.616	0.0	149	1.812
S14	0.945	16.7	7.0	1.286	1.322	0.052	0.0	68	0.904
S15	1.911	304.0	107.6	1.322	1.271	0.794	0.0	184	1.752
S16	1.684	66.9	17.2	1.285	1.271	0.127	0.0	78	1.418
S17	2.553	552.6	137.3	1.271	0.902	1.013	0.0	177	2.133
S18	1.373	24.3	9.2	1.210	0.902	0.068	0.0	64	1.281
S19	3.619	783.5	172.4	0.902	0.525	1.272	0.0	166	2.931

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
S20	SW20	SW21	12.074	0.600	45.600	45.525	0.075	161.0	225	5.20	50.0
S21	SW21	SW22	52.228	0.600	45.450	45.225	0.225	232.1	300	6.04	50.0
S22	SW22	SW23	7.946	0.600	45.150	44.950	0.200	39.7	375	6.09	50.0
S23	SW23	SW25	84.514	0.600	44.950	44.675	0.275	307.3	375	7.46	50.0
S24	SW24	SW25	59.384	0.600	45.050	44.750	0.300	197.9	300	6.68	50.0
S25	SW25	SW26	12.770	0.600	44.600	44.525	0.075	170.3	450	7.60	50.0
S26	SW26	SW27	14.491	0.600	44.450	44.350	0.100	144.9	300	7.78	50.0
S27	SW27	SW28	32.516	0.600	44.350	44.200	0.150	216.8	300	8.29	50.0
S28	SW28	SW29	87.328	0.600	44.200	43.825	0.375	232.9	300	9.71	50.0
S29	SW29	SW30	38.019	0.600	43.750	43.475	0.275	138.3	375	10.12	50.0
S30	SW30	SW32	26.019	0.600	43.400	43.300	0.100	260.2	450	10.47	50.0
S31	SW31	SW32	29.396	0.600	43.800	43.525	0.275	106.9	225	5.81	50.0
S32	SW32	SW33	43.818	0.600	43.300	43.150	0.150	292.1	450	11.08	50.0
S33	SW33	SW34	70.992	0.600	43.150	42.550	0.600	118.3	450	11.72	50.0
S34	SW34	SW35	13.810	0.600	42.550	41.975	0.575	24.0	450	11.77	50.0
S35	SW35	SWHW7	17.395	0.600	41.900	41.800	0.100	174.0	450	11.96	50.0
S7A	SWHW3	SW7	11.449	0.600	44.500	44.400	0.100	114.5	300	5.13	50.0
S35A	SWHW6	SW35	11.697	0.600	42.000	41.900	0.100	117.0	525	5.09	50.0
1	1	SW1	43.111	0.600	46.100	45.900	0.200	215.6	300	5.67	50.0
2	2	SW24	47.914	0.600	45.250	45.050	0.200	239.6	300	5.79	50.0
3	3	SW31	27.639	0.600	44.200	43.875	0.325	85.0	150	5.42	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
S20	1.028	40.9	8.9	1.396	1.390	0.066	0.0	72	0.828
S21	1.027	72.6	38.2	1.390	0.980	0.282	0.0	154	1.039
S22	2.882	318.3	49.2	0.980	1.067	0.363	0.0	99	2.116
S23	1.028	113.5	54.1	1.067	1.728	0.399	0.0	182	1.016
S24	1.114	78.7	88.4	1.198	1.728	0.652	0.0	300	1.128
S25	1.555	247.3	165.7	1.728	2.075	1.223	0.0	270	1.662
S26	1.304	92.2	179.2	2.300	2.599	1.322	0.0	300	1.321
S27	1.064	75.2	179.2	2.599	2.497	1.322	0.0	300	1.077
S28	1.026	72.5	198.7	2.497	2.211	1.466	0.0	300	1.039
S29	1.539	170.0	227.1	2.211	2.130	1.676	0.0	375	1.558
S30	1.255	199.7	238.7	2.130	2.066	1.761	0.0	450	1.271
S31	1.264	50.3	70.2	1.913	2.066	0.518	0.0	225	1.287
S32	1.184	188.3	332.4	2.066	1.829	2.453	0.0	450	1.199
S33	1.868	297.0	337.9	1.829	1.330	2.493	0.0	450	1.891
S34	4.161	661.8	354.8	1.330	1.550	2.618	0.0	234	4.227
S35	1.538	244.6	354.8	1.625	1.183	2.618	0.0	450	1.558
S7A	1.468	103.8	0.0	1.000	1.588	0.000	0.0	0	0.000
S35A	2.070	448.1	0.0	0.775	1.550	0.000	0.0	0	0.000
1	1.067	75.4	67.8	0.800	1.650	0.500	0.0	223	1.201
2	1.011	71.5	67.8	0.800	1.198	0.500	0.0	234	1.145
3	1.090	19.3	67.8	1.650	1.913	0.500	0.0	150	1.111

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Detailed
Rainfall Events	Singular	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	19.000	Additional Storage (m ³ /ha)	20.0
Ratio-R	0.365	Starting Level (m)	
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160
30	120	240	480	720	1440	2880

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	35	0	0
100	40	0	0

Node SW7 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	44.400	Product Number	CTL-SHE-0139-9200-1100-9200
Design Depth (m)	1.100	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	9.2	Min Node Diameter (mm)	1200

Node SW26 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	44.450	Product Number	CTL-SHE-0188-1780-1050-1780
Design Depth (m)	1.050	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	17.8	Min Node Diameter (mm)	1500

Node SW35 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	41.900	Product Number	CTL-SHE-0381-9280-1100-9280
Design Depth (m)	1.100	Min Outlet Diameter (m)	0.450
Design Flow (l/s)	92.8	Min Node Diameter (mm)	2700

Node 1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	46.100	Product Number	CTL-SHE-0225-2700-1100-2700
Design Depth (m)	1.100	Min Outlet Diameter (m)	0.300
Design Flow (l/s)	27.0	Min Node Diameter (mm)	1800

Node 2 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	45.250	Product Number	CTL-SHE-0225-2700-1100-2700
Design Depth (m)	1.100	Min Outlet Diameter (m)	0.300
Design Flow (l/s)	27.0	Min Node Diameter (mm)	1800

Node 3 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	44.200	Product Number	CTL-SHE-0119-6600-1100-6600
Design Depth (m)	1.100	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	6.6	Min Node Diameter (mm)	1200

Node SWHW3 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	30.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	44.500	Main Channel Slope (1:X)	10000.0
Safety Factor	2.0	Time to half empty (mins)		Main Channel n	0.035

Inlets

SWHW1 | SWHW2

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	550.0	0.0	1.000	550.0	0.0	1.001	0.0	0.0

Node SW26 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	44.500
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	600.0	600.0	1.000	600.0	686.8	1.001	0.0	686.8

Node SWHW6 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	30.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	42.000	Main Channel Slope (1:X)	10000.0
Safety Factor	2.0	Time to half empty (mins)	136	Main Channel n	0.035

Inlets

SWHW5

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	780.0	780.0	1.000	780.0	879.0	1.001	0.0	879.0

Node 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	46.200
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	69

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	150.0	150.0	1.000	150.0	193.4	1.001	0.0	193.4

Node 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	45.350
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	67

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	165.0	165.0	1.000	165.0	210.5	1.001	0.0	210.5

Node 3 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	44.300
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	260.0	260.0	1.000	260.0	317.2	1.001	0.0	317.2

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.89%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
30 minute winter	SW1	22	45.995	0.095	19.2	0.1766	0.0000	OK
15 minute winter	SW2	11	45.701	0.101	28.3	0.2634	0.0000	OK
15 minute winter	SW3	12	45.537	0.137	32.2	0.2584	0.0000	OK
15 minute winter	SW4	11	45.275	0.125	43.3	0.3349	0.0000	OK
15 minute winter	SW5	12	44.897	0.147	48.5	0.2974	0.0000	OK
15 minute winter	SW6	10	44.970	0.070	14.5	0.2002	0.0000	OK
240 minute winter	SW7	200	44.680	0.280	26.1	0.9049	0.0000	OK
15 minute winter	SW8	11	44.212	0.112	26.8	0.3633	0.0000	OK
15 minute winter	SW9	10	45.481	0.081	11.8	0.2105	0.0000	OK
15 minute winter	SW10	11	45.332	0.082	18.5	0.1729	0.0000	OK
15 minute winter	SW11	11	44.814	0.064	6.9	0.1406	0.0000	OK
15 minute winter	SW12	11	44.414	0.114	40.2	0.3345	0.0000	OK
15 minute winter	SW13	11	43.802	0.152	75.5	0.3447	0.0000	OK
15 minute winter	SW14	11	44.016	0.066	6.7	0.1425	0.0000	OK
15 minute winter	SW15	11	43.583	0.183	97.6	0.5824	0.0000	OK
15 minute winter	SW16	10	43.976	0.076	16.5	0.2375	0.0000	OK
15 minute winter	SW17	11	43.126	0.176	124.7	0.4924	0.0000	OK
15 minute winter	SW18	10	43.513	0.063	8.8	0.1527	0.0000	OK
15 minute winter	SW19	11	42.689	0.189	156.5	0.9863	0.0000	OK
15 minute winter	SW20	10	45.673	0.073	8.6	0.1641	0.0000	OK
15 minute winter	SW21	11	45.601	0.151	36.4	0.6012	0.0000	OK
15 minute winter	SW22	11	45.259	0.109	45.2	0.2851	0.0000	OK
15 minute winter	SW23	12	45.121	0.171	49.6	0.3305	0.0000	OK
15 minute winter	SW24	12	45.171	0.121	27.5	0.4191	0.0000	OK
15 minute winter	SW25	12	44.809	0.209	91.0	0.6984	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
30 minute winter	SW1	S1	SW2	19.1	1.033	0.210	0.8631	
15 minute winter	SW2	S2	SW3	27.9	1.075	0.222	0.4081	
15 minute winter	SW3	S3	SW4	31.9	1.046	0.406	1.0621	
15 minute winter	SW4	S4	SW5	42.9	1.194	0.237	1.7602	
15 minute winter	SW5	S5	SWHW1	48.3	1.282	0.281	0.5088	
15 minute winter	SW6	S6	SWHW2	14.3	1.429	0.186	0.1147	
240 minute winter	SW7	Hydro-Brake®	SW8	9.2				
15 minute winter	SW8	S8	SW13	26.1	1.111	0.287	1.0492	
15 minute winter	SW9	S9	SW10	11.6	0.903	0.260	0.2617	
15 minute winter	SW10	S10	SW12	18.1	1.396	0.279	0.7331	
15 minute winter	SW11	S11	SW12	6.7	0.948	0.364	0.1984	
15 minute winter	SW12	S12	SW13	40.4	1.706	0.285	0.7292	
15 minute winter	SW13	S13	SW15	75.7	1.413	0.217	1.1556	
15 minute winter	SW14	S14	SW15	6.5	0.879	0.387	0.2075	
15 minute winter	SW15	S15	SW17	97.6	1.681	0.321	2.4598	
15 minute winter	SW16	S16	SW17	15.9	1.375	0.238	0.4573	
15 minute winter	SW17	S17	SW19	124.6	1.868	0.226	2.3146	
15 minute winter	SW18	S18	SW19	8.5	1.241	0.350	0.2129	
15 minute winter	SW19	S19	SWHW5	155.9	2.531	0.199	0.5935	
15 minute winter	SW20	S20	SW21	8.4	0.762	0.206	0.1368	
15 minute winter	SW21	S21	SW22	35.3	1.022	0.486	1.8027	
15 minute winter	SW22	S22	SW23	45.2	1.313	0.142	0.2952	
15 minute winter	SW23	S23	SW25	47.2	1.019	0.416	3.9167	
15 minute winter	SW24	S24	SW25	26.3	1.006	0.334	1.5540	
15 minute winter	SW25	S25	SW26	91.6	1.371	0.371	0.8539	

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.89%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
240 minute winter	SW26	184	44.693	0.243	32.0	117.0054	0.0000	OK
240 minute winter	SW27	188	44.438	0.088	13.6	0.0993	0.0000	OK
15 minute winter	SW28	12	44.302	0.102	19.9	0.2198	0.0000	OK
15 minute winter	SW29	11	43.883	0.133	43.2	0.4054	0.0000	OK
15 minute winter	SW30	11	43.571	0.171	53.5	0.3564	0.0000	OK
30 minute winter	SW31	22	43.858	0.058	7.0	0.0748	0.0000	OK
15 minute winter	SW32	11	43.509	0.209	81.2	0.6591	0.0000	OK
15 minute winter	SW33	12	43.324	0.174	85.4	0.3681	0.0000	OK
15 minute winter	SW34	12	42.668	0.118	98.1	0.3752	0.0000	OK
360 minute winter	SW35	248	42.270	0.370	47.2	2.1191	0.0000	OK
15 minute winter	SWHW1	12	44.668	0.165	48.3	0.0263	0.0000	OK
180 minute winter	SWHW2	172	44.646	0.143	3.8	0.0227	0.0000	OK
240 minute winter	SWHW3	196	44.646	0.146	36.1	0.0232	0.0000	OK
360 minute winter	SWHW5	248	42.270	0.267	34.1	0.0425	0.0000	OK
360 minute winter	SWHW6	248	42.270	0.270	21.1	0.0430	0.0000	OK
360 minute winter	SWHW7	248	41.932	0.132	47.2	0.0000	0.0000	OK
60 minute winter	1	43	46.350	0.250	34.6	25.4745	0.0000	OK
60 minute winter	2	44	45.492	0.242	34.6	26.3683	0.0000	OK
120 minute winter	3	92	44.434	0.234	22.2	36.6657	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
240 minute winter	SW26	S26	SW27	13.6	0.834	0.148	0.2370	
240 minute winter	SW27	S27	SW28	13.6	0.774	0.181	0.5756	
15 minute winter	SW28	S28	SW29	18.0	0.861	0.248	1.8210	
15 minute winter	SW29	S29	SW30	43.1	1.275	0.254	1.2855	
15 minute winter	SW30	S30	SW32	53.4	0.841	0.268	1.6547	
30 minute winter	SW31	S31	SW32	7.0	0.887	0.139	0.2316	
15 minute winter	SW32	S32	SW33	80.5	1.256	0.427	2.8105	
15 minute winter	SW33	S33	SW34	84.9	1.908	0.286	3.1822	
15 minute winter	SW34	S34	SW35	98.1	1.810	0.148	0.8723	
360 minute winter	SW35	S35	SWHW7	47.2	1.158	0.193	0.7090	817.0
15 minute winter	SWHW1	Flow through Pond	SWHW3	50.9	0.080	0.016	32.5920	
180 minute winter	SWHW2	Flow through Pond	SWHW3	34.6	0.024	0.011	79.0589	
240 minute winter	SWHW3	S7A	SW7	26.1	0.624	0.251	0.5817	
360 minute winter	SWHW5	Flow through Pond	SWHW6	21.1	0.017	0.005	209.6709	
360 minute winter	SWHW6	S35A	SW35	22.2	0.307	0.049	1.6065	
60 minute winter	1	1	SW1	15.8	0.848	0.210	0.8113	
60 minute winter	2	2	SW24	15.0	0.760	0.209	0.9788	
120 minute winter	3	3	SW31	6.2	0.963	0.322	0.1779	

Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 99.93%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
15 minute winter	SW1	11	46.068	0.168	56.3	0.3145	0.0000	OK
15 minute winter	SW2	12	45.913	0.313	91.7	0.8134	0.0000	SURCHARGED
15 minute winter	SW3	12	45.782	0.382	97.5	0.7194	0.0000	SURCHARGED
15 minute winter	SW4	11	45.406	0.256	136.8	0.6876	0.0000	OK
360 minute winter	SW5	360	45.198	0.448	47.0	0.9043	0.0000	SURCHARGED
360 minute winter	SW6	360	45.197	0.297	7.1	0.8532	0.0000	SURCHARGED
360 minute winter	SW7	360	45.196	0.796	24.0	2.5745	0.0000	SURCHARGED
15 minute winter	SW8	10	44.314	0.214	75.5	0.6956	0.0000	OK
15 minute winter	SW9	10	45.577	0.177	39.0	0.4592	0.0000	OK
15 minute winter	SW10	10	45.426	0.176	60.9	0.3710	0.0000	OK
15 minute winter	SW11	11	44.981	0.231	22.7	0.5083	0.0000	SURCHARGED
15 minute winter	SW12	11	44.557	0.257	133.0	0.7562	0.0000	OK
15 minute winter	SW13	11	43.985	0.335	235.9	0.7603	0.0000	OK
15 minute winter	SW14	11	44.211	0.261	22.3	0.5622	0.0000	SURCHARGED
15 minute winter	SW15	11	43.817	0.417	307.6	1.3313	0.0000	OK
15 minute winter	SW16	10	44.059	0.159	54.5	0.4954	0.0000	OK
15 minute winter	SW17	11	43.323	0.373	393.6	1.0418	0.0000	OK
15 minute winter	SW18	11	43.742	0.292	29.2	0.7108	0.0000	SURCHARGED
15 minute winter	SW19	11	42.907	0.407	497.4	2.1231	0.0000	OK
15 minute winter	SW20	12	46.218	0.618	28.3	1.3880	0.0000	SURCHARGED
15 minute winter	SW21	12	46.178	0.728	115.8	2.9043	0.0000	SURCHARGED
15 minute winter	SW22	12	45.664	0.514	137.5	1.3497	0.0000	SURCHARGED
15 minute winter	SW23	12	45.592	0.642	144.0	1.2406	0.0000	SURCHARGED
15 minute winter	SW24	12	45.425	0.375	89.0	1.2992	0.0000	SURCHARGED
240 minute winter	SW25	236	45.232	0.632	87.8	2.1143	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
15 minute winter	SW1	S1	SW2	56.1	1.192	0.618	2.4782	
15 minute winter	SW2	S2	SW3	85.6	1.288	0.680	1.1004	
15 minute winter	SW3	S3	SW4	98.5	1.421	1.254	2.2902	
15 minute winter	SW4	S4	SW5	137.4	1.514	0.761	4.4153	
360 minute winter	SW5	S5	SWHW1	47.1	1.247	0.273	1.4876	
360 minute winter	SW6	S6	SWHW2	7.1	1.130	0.092	0.4557	
360 minute winter	SW7	Hydro-Brake®	SW8	9.2				
15 minute winter	SW8	S8	SW13	73.6	1.417	0.809	2.3166	
15 minute winter	SW9	S9	SW10	38.2	1.151	0.858	0.6829	
15 minute winter	SW10	S10	SW12	60.2	1.792	0.930	1.9145	
15 minute winter	SW11	S11	SW12	20.8	1.184	1.135	0.4785	
15 minute winter	SW12	S12	SW13	132.8	2.191	0.936	1.8647	
15 minute winter	SW13	S13	SW15	236.3	1.690	0.678	3.0138	
15 minute winter	SW14	S14	SW15	20.3	1.157	1.214	0.4764	
15 minute winter	SW15	S15	SW17	303.8	2.124	1.000	6.3002	
15 minute winter	SW16	S16	SW17	53.0	1.834	0.791	1.1419	
15 minute winter	SW17	S17	SW19	394.3	2.304	0.714	5.9596	
15 minute winter	SW18	S18	SW19	25.9	1.486	1.069	0.5376	
15 minute winter	SW19	S19	SWHW5	497.6	3.238	0.635	1.4670	
15 minute winter	SW20	S20	SW21	26.2	0.786	0.640	0.4802	
15 minute winter	SW21	S21	SW22	102.8	1.461	1.416	3.6779	
15 minute winter	SW22	S22	SW23	131.8	1.457	0.414	0.8764	
15 minute winter	SW23	S23	SW25	145.5	1.319	1.282	9.3216	
15 minute winter	SW24	S24	SW25	77.6	1.186	0.986	4.1818	
240 minute winter	SW25	S25	SW26	85.5	1.157	0.346	2.0233	

Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 99.93%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
240 minute winter	SW26	240	45.231	0.781	94.0	442.0490	0.0000	SURCHARGED
30 minute winter	SW27	52	44.452	0.102	17.8	0.1148	0.0000	OK
15 minute winter	SW28	11	44.418	0.218	67.3	0.4714	0.0000	OK
15 minute winter	SW29	12	44.151	0.401	150.2	1.2244	0.0000	SURCHARGED
15 minute winter	SW30	12	43.918	0.518	177.8	1.0832	0.0000	SURCHARGED
15 minute winter	SW31	10	43.880	0.080	14.0	0.1042	0.0000	OK
15 minute winter	SW32	11	43.823	0.523	246.3	1.6479	0.0000	SURCHARGED
15 minute winter	SW33	11	43.503	0.353	264.7	0.7469	0.0000	OK
15 minute winter	SW34	12	42.812	0.262	314.8	0.8318	0.0000	OK
120 minute winter	SW35	94	42.744	0.844	135.4	4.8323	0.0000	SURCHARGED
360 minute winter	SWHW1	344	45.199	0.696	47.1	0.1107	0.0000	OK
360 minute winter	SWHW2	360	45.197	0.694	7.1	0.1104	0.0000	OK
360 minute winter	SWHW3	360	45.197	0.697	40.3	0.1109	0.0000	SURCHARGED
180 minute winter	SWHW5	132	42.735	0.732	252.1	0.1164	0.0000	OK
180 minute winter	SWHW6	140	42.736	0.736	346.7	0.1170	0.0000	SURCHARGED
240 minute winter	SWHW7	164	41.988	0.188	92.8	0.0000	0.0000	OK
60 minute winter	1	49	46.837	0.737	113.0	104.1261	0.0000	SURCHARGED
60 minute winter	2	49	45.937	0.687	113.0	104.8757	0.0000	SURCHARGED
240 minute winter	3	232	44.944	0.744	42.8	172.6741	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
240 minute winter	SW26	S26	SW27	17.8	0.911	0.193	0.2904	
30 minute winter	SW27	S27	SW28	17.8	0.848	0.236	1.1000	
15 minute winter	SW28	S28	SW29	65.3	1.120	0.900	5.4036	
15 minute winter	SW29	S29	SW30	142.5	1.475	0.838	4.1934	
15 minute winter	SW30	S30	SW32	171.0	1.079	0.857	4.1225	
15 minute winter	SW31	S31	SW32	13.9	0.938	0.276	0.7710	
15 minute winter	SW32	S32	SW33	248.6	1.606	1.320	6.3911	
15 minute winter	SW33	S33	SW34	264.3	2.303	0.890	8.1319	
15 minute winter	SW34	S34	SW35	310.4	2.573	0.469	1.7426	
120 minute winter	SW35	S35	SWHW7	92.8	1.378	0.379	1.1714	1263.6
360 minute winter	SWHW1	Flow through Pond	SWHW3	34.2	0.028	0.011	382.6547	
360 minute winter	SWHW2	Flow through Pond	SWHW3	34.2	0.028	0.011	382.6547	
360 minute winter	SWHW3	S7A	SW7	21.6	0.543	0.208	0.8062	
180 minute winter	SWHW5	Flow through Pond	SWHW6	346.7	0.035	0.076	571.1140	
180 minute winter	SWHW6	S35A	SW35	72.0	0.333	0.161	2.5269	
60 minute winter	1	1	SW1	26.9	1.011	0.357	1.3406	
60 minute winter	2	2	SW24	26.9	0.972	0.376	1.8931	
240 minute winter	3	3	SW31	6.6	0.979	0.342	0.1863	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 97.14%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
15 minute winter	SW1	12	46.275	0.375	68.1	0.7012	0.0000	SURCHARGED
15 minute winter	SW2	12	46.136	0.536	107.5	1.3932	0.0000	SURCHARGED
15 minute winter	SW3	12	45.968	0.568	115.4	1.0704	0.0000	SURCHARGED
15 minute winter	SW4	11	45.551	0.401	169.9	1.0748	0.0000	SURCHARGED
480 minute winter	SW5	440	45.520	0.770	49.8	1.5534	0.0000	SURCHARGED
360 minute winter	SW6	352	45.517	0.617	9.5	1.7707	0.0000	SURCHARGED
360 minute winter	SW7	344	45.514	1.114	22.7	3.6007	0.0000	SURCHARGED
15 minute winter	SW8	11	44.625	0.525	97.6	1.7038	0.0000	SURCHARGED
15 minute winter	SW9	12	46.197	0.797	52.3	2.0675	0.0000	SURCHARGED
15 minute winter	SW10	12	46.032	0.782	73.7	1.6432	0.0000	SURCHARGED
15 minute winter	SW11	12	45.607	0.857	30.5	1.8871	0.0000	SURCHARGED
15 minute winter	SW12	11	45.009	0.709	156.2	2.0859	0.0000	SURCHARGED
15 minute winter	SW13	11	44.316	0.666	273.3	1.5121	0.0000	SURCHARGED
15 minute winter	SW14	12	44.715	0.765	29.9	1.6489	0.0000	SURCHARGED
15 minute winter	SW15	11	44.085	0.685	364.3	2.1834	0.0000	SURCHARGED
15 minute winter	SW16	11	44.177	0.277	73.0	0.8639	0.0000	SURCHARGED
15 minute winter	SW17	11	43.407	0.457	479.5	1.2755	0.0000	OK
15 minute winter	SW18	12	44.201	0.751	39.1	1.8264	0.0000	SURCHARGED
240 minute winter	SW19	160	43.031	0.531	148.4	2.7749	0.0000	SURCHARGED
15 minute winter	SW20	12	47.119	1.519	38.0	3.4120	0.0000	FLOOD RISK
15 minute winter	SW21	12	47.055	1.605	144.9	6.4023	0.0000	FLOOD RISK
15 minute winter	SW22	12	46.191	1.041	171.8	2.7354	0.0000	SURCHARGED
15 minute winter	SW23	12	46.071	1.121	187.3	2.1642	0.0000	SURCHARGED
15 minute winter	SW24	11	45.665	0.615	103.2	2.1288	0.0000	SURCHARGED
360 minute winter	SW25	328	45.593	0.993	88.3	3.3236	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
15 minute winter	SW1	S1	SW2	68.3	1.192	0.752	3.1498	
15 minute winter	SW2	S2	SW3	97.7	1.387	0.776	1.1004	
15 minute winter	SW3	S3	SW4	113.9	1.625	1.450	2.4496	
15 minute winter	SW4	S4	SW5	162.4	1.533	0.899	5.4028	
480 minute winter	SW5	S5	SWHW1	48.6	1.216	0.283	1.4876	
360 minute winter	SW6	S6	SWHW2	9.5	1.155	0.123	0.4557	
360 minute winter	SW7	Hydro-Brake®	SW8	9.2				
15 minute winter	SW8	S8	SW13	85.2	1.419	0.937	3.1429	
15 minute winter	SW9	S9	SW10	45.1	1.160	1.013	0.8113	
15 minute winter	SW10	S10	SW12	67.8	1.851	1.047	2.2489	
15 minute winter	SW11	S11	SW12	25.5	1.451	1.394	0.4963	
15 minute winter	SW12	S12	SW13	152.0	2.174	1.071	2.1654	
15 minute winter	SW13	S13	SW15	272.2	1.718	0.781	3.4116	
15 minute winter	SW14	S14	SW15	25.2	1.432	1.508	0.4962	
15 minute winter	SW15	S15	SW17	362.6	2.290	1.193	6.5593	
15 minute winter	SW16	S16	SW17	68.5	1.851	1.023	1.5356	
15 minute winter	SW17	S17	SW19	478.3	2.348	0.866	7.1104	
15 minute winter	SW18	S18	SW19	33.1	1.882	1.365	0.5400	
240 minute winter	SW19	S19	SWHW5	148.9	2.325	0.190	2.0769	
15 minute winter	SW20	S20	SW21	34.3	0.861	0.838	0.4802	
15 minute winter	SW21	S21	SW22	132.4	1.880	1.823	3.6779	
15 minute winter	SW22	S22	SW23	171.0	1.551	0.537	0.8764	
15 minute winter	SW23	S23	SW25	188.7	1.711	1.662	9.3216	
15 minute winter	SW24	S24	SW25	88.3	1.254	1.122	4.1818	
360 minute winter	SW25	S25	SW26	85.1	0.958	0.344	2.0233	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 97.14%



Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
360 minute winter	SW26	328	45.592	1.142	93.5	605.4266	0.0000	SURCHARGED
15 minute winter	SW27	12	44.850	0.500	28.1	0.5655	0.0000	SURCHARGED
15 minute winter	SW28	11	44.843	0.643	82.8	1.3901	0.0000	SURCHARGED
15 minute winter	SW29	12	44.579	0.829	181.9	2.5337	0.0000	SURCHARGED
15 minute winter	SW30	12	44.292	0.892	206.5	1.8647	0.0000	SURCHARGED
15 minute winter	SW31	12	44.207	0.407	17.1	0.5284	0.0000	SURCHARGED
15 minute winter	SW32	12	44.156	0.856	307.6	2.6967	0.0000	SURCHARGED
15 minute winter	SW33	12	43.695	0.545	323.3	1.1544	0.0000	SURCHARGED
180 minute winter	SW34	124	43.024	0.474	137.9	1.5038	0.0000	SURCHARGED
120 minute winter	SW35	92	43.067	1.167	201.3	6.6843	0.0000	SURCHARGED
360 minute winter	SWHW1	352	45.521	1.018	55.1	0.1619	0.0000	OK
360 minute winter	SWHW2	352	45.519	1.016	9.5	0.1616	0.0000	OK
360 minute winter	SWHW3	352	45.520	1.020	42.6	0.1622	0.0000	FLOOD RISK
120 minute winter	SWHW5	88	43.094	1.091	5153.2	0.1734	0.0000	OK
120 minute winter	SWHW6	88	43.040	1.040	2353.7	0.1654	0.0000	FLOOD RISK
30 minute winter	SWHW7	60	41.988	0.188	92.8	0.0000	0.0000	OK
60 minute winter	1	58	47.172	1.072	153.9	158.2896	0.0000	FLOOD RISK
60 minute winter	2	58	46.248	0.998	153.9	159.8169	0.0000	FLOOD RISK
240 minute winter	3	236	45.252	1.052	58.0	254.7352	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
360 minute winter	SW26	S26	SW27	17.8	0.911	0.193	0.2898	
15 minute winter	SW27	S27	SW28	32.7	0.848	0.435	2.2898	
15 minute winter	SW28	S28	SW29	74.1	1.244	1.022	6.1496	
15 minute winter	SW29	S29	SW30	157.6	1.478	0.927	4.1934	
15 minute winter	SW30	S30	SW32	202.9	1.280	1.016	4.1225	
15 minute winter	SW31	S31	SW32	20.6	0.915	0.409	1.1691	
15 minute winter	SW32	S32	SW33	301.6	1.904	1.601	6.9427	
15 minute winter	SW33	S33	SW34	317.8	2.290	1.070	9.9686	
180 minute winter	SW34	S34	SW35	173.7	1.489	0.262	2.1881	
120 minute winter	SW35	S35	SWHW7	92.8	1.381	0.379	1.1713	1447.2
360 minute winter	SWHW1	Flow through Pond	SWHW3	35.3	0.031	0.011	553.1541	
360 minute winter	SWHW2	Flow through Pond	SWHW3	35.3	0.031	0.011	553.1541	
360 minute winter	SWHW3	S7A	SW7	20.3	0.585	0.195	0.8062	
120 minute winter	SWHW5	Flow through Pond	SWHW6	-4965.3	-0.210	-1.091	783.2029	
120 minute winter	SWHW6	S35A	SW35	86.3	-0.440	0.193	2.5269	
60 minute winter	1	1	SW1	26.9	1.011	0.357	1.3978	
60 minute winter	2	2	SW24	26.9	0.938	0.377	2.0949	
240 minute winter	3	3	SW31	6.6	0.979	0.342	0.1863	

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