



LAND AT TRANSVAAL TERRACE, BATLEY

FLOOD RISK AND DRAINAGE ASSESSMENT

Final Report v1.1

October 2019

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Report Title **Land at Transvaal Terrace, Batley**
 Flood Risk and Drainage Assessment
 Final Report v1.1

Client Fernbrook Associates Ltd

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1 INTRODUCTION

1.1 PURPOSE OF REPORT

Weetwood Services Ltd ('Weetwood') has been instructed by Fernbrook Associates Ltd to prepare a Flood Risk and Drainage Assessment (FRDA) report to accompany a planning application for the proposed redevelopment of land at Transvaal Terrace, Batley.

The assessment has been undertaken in accordance with the requirements of the National Planning Policy Framework (NPPF) and National Planning Practice Guidance (NPPG).

1.2 STRUCTURE OF THE REPORT

The report is structured as follows:

- | | |
|------------------|--|
| Section 1 | Introduction and report structure |
| Section 2 | Provides background information relating to the development site, the development proposals, ground conditions and existing site access arrangements |
| Section 3 | Presents national and local flood risk and drainage planning policy |
| Section 4 | Assesses the potential sources of flooding to the development site |
| Section 5 | Presents flood risk mitigation measures based on the findings of the assessment |
| Section 6 | Addresses the effect of the proposed development on the existing public foul drainage infrastructure and the receiving wastewater treatment works |
| Section 7 | Addresses the effect of the proposed development on surface water runoff and presents an illustrative surface water drainage scheme to ensure that surface water runoff is sustainably managed and flood risk is not increased elsewhere |
| Section 8 | Presents a summary of key findings and recommendations |

1.3 RELEVANT DOCUMENTS

The assessment has been informed by the following documents:

- Calder Catchment Strategic Flood Risk Assessment (SFRA), Volume I, Kirklees Council, Calderdale Council, Wakefield Council, April 2016
- Calder Catchment Strategic Flood Risk Assessment (SFRA), Volume II, Kirklees Council, July 2016

2 SITE DETAILS AND PROPOSED DEVELOPMENT

2.1 SITE LOCATION

The approximately 1.22 ha site is located on land at Transvaal Terrace, Batley at Ordnance Survey National Grid Reference SE 237 251, as shown in **Figure 1**.

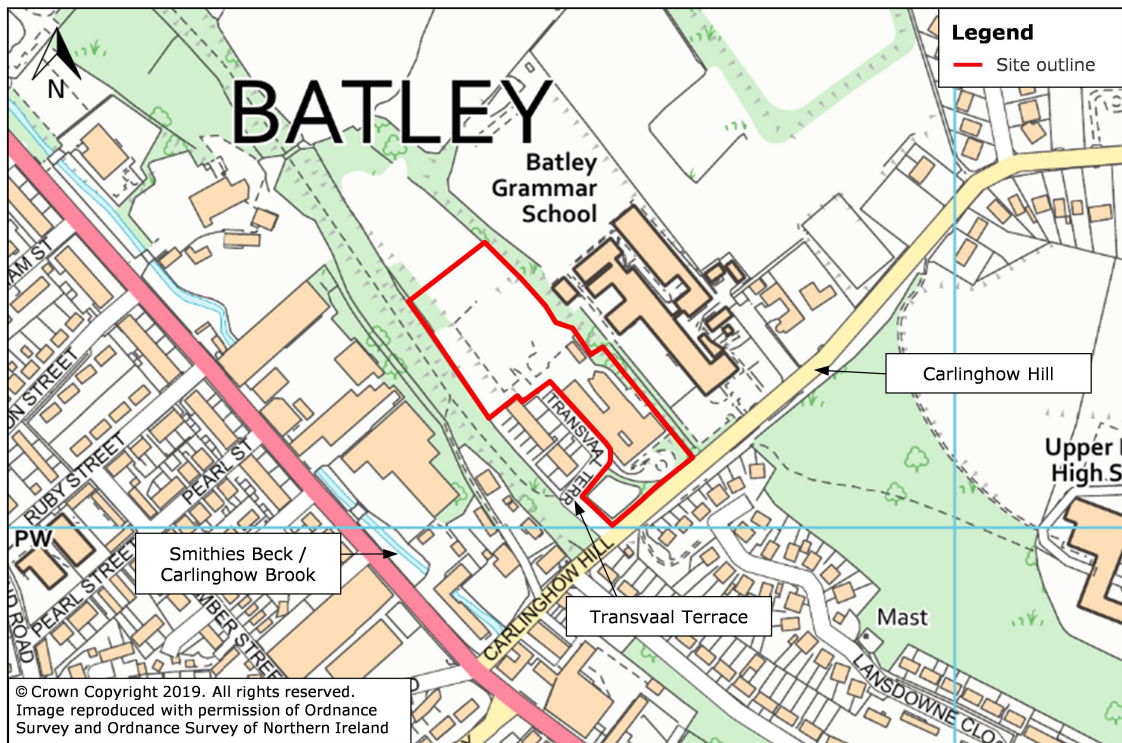


Figure 1: Site Location

2.2 EXISTING AND PROPOSED DEVELOPMENT

The site is currently occupied by a former hospital building with areas of hardstanding including a car park, rough ground and dense vegetation. It is understood that New Hall quarry was located in the central part of the site prior to the site being occupied by a hospital.

The development proposals entail the partial demolition of the former hospital building, the conversion of the remaining building to 20 residential apartments and the construction of 20 new dwellings (**Appendix A**) with associated access, car parking and landscaped areas.

The NPPG classifies residential development as More Vulnerable land use.

2.3 WATERBODIES IN THE VICINITY OF THE SITE

Smithies Beck/Carlinghow Brook, a designated main river, flows in a south-easterly direction approximately 115 m to the southwest of the site.

2.4 GROUND CONDITIONS

British Geological Survey (BGS) mapping¹ indicates the underlying bedrock formation within the north-western/south-western portion of the site comprises mudstone, siltstone and sandstone (Pennine Lower Coal Measures formation) and within the north-eastern/south-western portion of the site comprises sandstone (Emley formation). No superficial deposits have been recorded.

A Phase I and Phase II Geo-environmental Appraisal of the site was undertaken by G&M Consulting Ltd in June 2019. Fieldwork included twelve trial pits and eleven window sample boreholes and seven combined gas and groundwater monitoring wells.

The report² describes ground conditions to comprise of made ground or topsoil over weathered coal measure strata. Made ground was found to be thinner or absent in the north-west third of the site i.e. beyond the assumed location of the quarry. No groundwater strikes were encountered, however, standing groundwater levels ranged between 1.29 to 2.87 m bgl during the fieldwork period.

Potential sources of contamination have been assessed as part of the appraisal. This includes both current and historical on site sources and those originating from off-site locations which have the potential to migrate onto the site through shallow coal mine workings and made ground pollutants. The assessment determined a moderate risk of contamination.

DEFRA mapping classifies the underlying bedrock as a Secondary A aquifer. The site is not shown to be located within a designated Groundwater Source Protection Zone.

2.5 SITE LEVELS

A topographic survey of the site has been undertaken and is provided in **Appendix B**. Site levels are shown to be in the region of 77.5 to 87.0 metres Above Ordnance Datum (m AOD), with site levels generally sloping down in a south-westerly direction.

2.6 ACCESS AND EGRESS

Access and egress to the site is via Transvaal Terrace. Levels along Transvaal Terrace range between 75.2 to 82.9 m AOD with levels generally sloping down in a south-westerly direction.

¹ <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>

² Geoenvironmental Appraisal of land at Carlinghow Hill, Batley, West Yorkshire, prepared for KUFIC, Report No: C316, June 2019, G&M Consulting Ltd

3 PLANNING POLICY AND GUIDANCE

3.1 NATIONAL PLANNING POLICY AND GUIDANCE

3.1.1 National Planning Policy Framework

The aim of the NPPF is to ensure that flood risk is taken into account at all stages in the planning process and is appropriately addressed.

3.1.1.1 Sequential Test

Paragraph 155 of the NPPF states that *"inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere"*.

This policy is implemented through the application of the sequential test (NPPF paragraph 158).

3.1.1.2 Exception Test

Paragraphs 159-161 of the NPPF state:

"If it is not possible for the development to be located in zones with a lower risk of flooding (taking into account wider sustainable development objectives) the exception test may have to be applied. The need for the exception test will depend on the potential vulnerability of the site and of the development proposed, in line with the Flood Risk Vulnerability Classification set out in the national planning guidance" (Paragraph 159).

"The application of the exception test should be informed by a strategic or site-specific FRA, depending on whether it is being applied during plan production or at the application stage. For the exception test to be passed it should be demonstrated that: a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and b) the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall" (Paragraph 160).

"Both elements of the exception test should be satisfied for development to be allocated or permitted" (Paragraph 161).

3.1.1.3 Surface Water Drainage

Paragraph 163 of the NPPF states that development should only be allowed in areas at risk of flooding if it incorporates sustainable drainage systems unless there is clear evidence that this would be inappropriate.

The NPPF also states, in paragraph 165 that applications for major developments as defined in the Town and Country Planning (Development Management Procedure) (England) Order 2015, should incorporate sustainable drainage systems to appropriate operational standards and with maintenance arrangements in place unless there is clear evidence that this would be inappropriate.

3.1.2 DEFRA Technical Standards for Sustainable Drainage Systems, March 2015

DEFRA non-statutory technical standards state that surface water drainage systems should be designed so that:

- Flooding does not occur on any part of the site for a 1:30 annual probability rainfall event, unless an area is designed to hold and/or convey water as part of the design;
- Flooding does not occur in any part of a building during a 1:100 annual probability event; and
- Flows resulting from rainfall in excess of a 1:100 annual probability rainfall event are managed in exceedance routes that minimise the risks to people and property, so far as is reasonably practicable.
- For developments which were previously developed, the peak runoff rate must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.
- Where reasonably practicable, for developments which have been previously developed, the runoff volume must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event.
- Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body, the runoff volume must be discharged at a rate that does not adversely affect flood risk.

3.2 LOCAL PLANNING POLICY AND GUIDANCE

The Kirklees Local Plan was adopted on 27 February 2019. The following policies are relevant in respect of flood risk and drainage:

'Policy LP5: Masterplanning Sites Part M' states that masterplans will be expected to provide appropriate measures to mitigate flood risk and ensure that the development is resilient to the potential impacts of climate change.

'Policy LP24: Design Part D vii' states that proposals should promote good design by ensuring high levels of sustainability through designing buildings that are resilient and resistant to flood risk.

'Policy LP27: Flood Risk' is summarised as follows:

- Proposals for development which require a Sequential Test in accordance with national planning guidance will need to demonstrate that development has been directed to areas at the lowest probability of flooding, following a sequential risk based approach
- Proposals within flood zone 3ai will be assessed in accordance with national policies relating to flood zone 3a but with all of the following additional restrictions:
 - No new highly vulnerable or more vulnerable uses will be permitted
 - Less vulnerable uses may only be permitted where the sequential test has been passed and where extensions are linked operationally to an existing business or where redevelopment of a site provides buildings with the same or a smaller footprint
- All proposals will be expected to include flood mitigation measures which should be identified and considered through a site specific flood risk assessment
- Development will not be permitted within the functional floodplain

'Policy LP28: Drainage' is summarised as follows:

- The presumption is that Sustainable Drainage Systems (SuDS) will be used to assist in achieving the following:
 - Greenfield sites: Greenfield runoff rates should not be exceeded
 - Brownfield sites: A minimum 30% reduction in surface water runoff where previous positive surface water connections from the site can be proven. New connections will be subject to at least greenfield restrictions
 - No negative impact on water quality and improvements made where practicable
 - Consider whether proposed open spaces/green infrastructure within sites can contribute to the sustainable drainage of the site
- Local conditions including critical drainage areas may require a lower runoff rate
- There will be a general presumption against pumping surface water
- Flow paths accommodating water from outside the site should be designed to avoid buildings and curtilages
- Development will only be permitted if it can be demonstrated that the water supply and wastewater infrastructure required is available or can be co-ordinated to meet the demand generated by the new development

3.3 CONSENTS

An Environmental Permit for Flood Risk Activities may be required from the Environment Agency (EA) for work:

- In, under, over or near a main river (including where the river is in a culvert)
- On or near a flood defence on a main river
- In the flood plain of a main river
- On or near a sea defence

Further information can be found at <https://www.gov.uk/guidance/flood-risk-activities-environmental-permits>.

Land drainage consent may be required from the Lead Local Flood Authority or Internal Drainage Board for work to an Ordinary Watercourse. Undertaking activities controlled by local byelaws (made under the Water Resources Act 1991) also requires the relevant consent.

4 REVIEW OF FLOOD RISK

4.1 FLOOD ZONE DESIGNATION

Flood zones refer to the probability of river and sea flooding. The NPPG defines flood zones as follows:

- Flood Zone 1: Low Probability. Land having a less than 1:1,000 annual probability of river or sea flooding.
- Flood Zone 2: Medium Probability. Land having between a 1:100 and 1:1,000 annual probability of river flooding; or Land having between a 1:200 and 1:1,000 annual probability of sea flooding.
- Flood Zone 3a: High Probability. Land having a 1:100 or greater annual probability of river flooding; or Land having a 1:200 or greater annual probability of sea flooding.
- Flood Zone 3b: Functional Floodplain. Land where water has to flow or be stored in times of flood.

The flood zones are shown on the Flood Map for Planning. The zones do not account for possible future changes in flooding due to the impact of climate change or the presence of flood defences (although areas benefitting from flood defences may be indicated).

According to the Flood Map for Planning (**Figure 2**) the site is located in Flood Zone 1. Map EE of the 2016 SFRA reaffirms the sites Flood Zone 1 designation.



Figure 2: Flood Map for Planning
(Source: gov.uk website)

4.2 SEQUENTIAL TEST AND EXCEPTION TEST

The proposed development site is situated within Flood Zone 1 and therefore satisfies the requirements of the sequential test. Furthermore, the application of the exception test is subsequently not deemed to be necessary; however, the proposals should still meet the requirements for site specific FRAs.

4.3 HISTORICAL RECORDS OF FLOODING

The EA, SFRA and Kirklees Council do not hold any records of historical flood events at the site.

4.4 FLUVIAL FLOOD RISK

The site is a minimum of 12 m above ground levels adjacent to Smithies Beck/Carlinghow Brook. In addition, the Flood Map for Planning indicates the site to be located within Flood Zone 1 (see **Section 4.1**). As such, the site is assessed not to be at risk of flooding from this source.

4.5 FLOOD RISK FROM SURFACE WATER

The Flood Risk from Surface Water map (**Figure 3** and **Figure 4**) indicates that the site is predominantly at 'Very Low' risk of flooding from surface water but with the potential for the accumulation of surface water due to ponding and obstructions from buildings during an extreme event.

Off-site, a surface water flow path is indicated to be present along Carlinghow Hill during more extreme events with flood depths less than 300 mm deep. There is also the potential for surface water ponding adjacent to the north-western boundary of the site; however, this area is approximately 5.0 m below the level of the development platform area.

4.6 FLOOD RISK FROM RESERVOIRS, CANALS AND OTHER ARTIFICIAL SOURCES

There are no canals or other impounded waterbodies located within the immediate vicinity of the site. The Flood Risk from Reservoirs map indicates that the site is not at risk of flooding from such sources. The site is therefore assessed not to be at risk of flooding from reservoirs, canals or other artificial sources.

4.7 FLOOD RISK FROM GROUNDWATER

According to the BGS Groundwater Flooding Hazard map (**Figure 5**) the susceptibility to groundwater flooding is 'Low'. Furthermore, as discussed in **Section 2.4** no groundwater strikes were encountered during the Phase II Geo-environmental Appraisal fieldwork, however, standing groundwater levels ranged between 1.29 to 2.87 m bgl during the fieldwork period.

The JBA Groundwater Flood risk Indicator map (**Figure 6**) indicates groundwater levels across the south-western and north-western portions of the site are estimated to be between 0.025 – 0.5 m below the ground surface in the 100 year return period flood event. Within this zone there is the possibility of groundwater emerging at the surface locally and a risk of groundwater flooding to surface and subsurface assets.

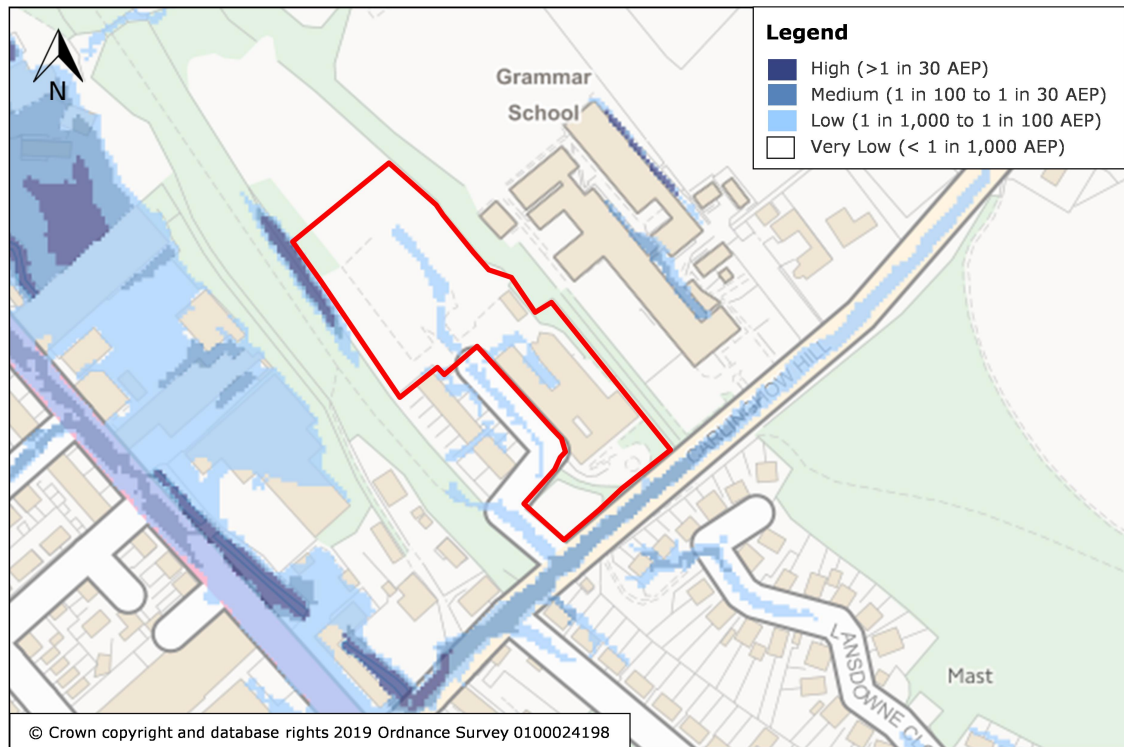


Figure 3: Flood Risk from Surface Water
(Source: gov.uk website)

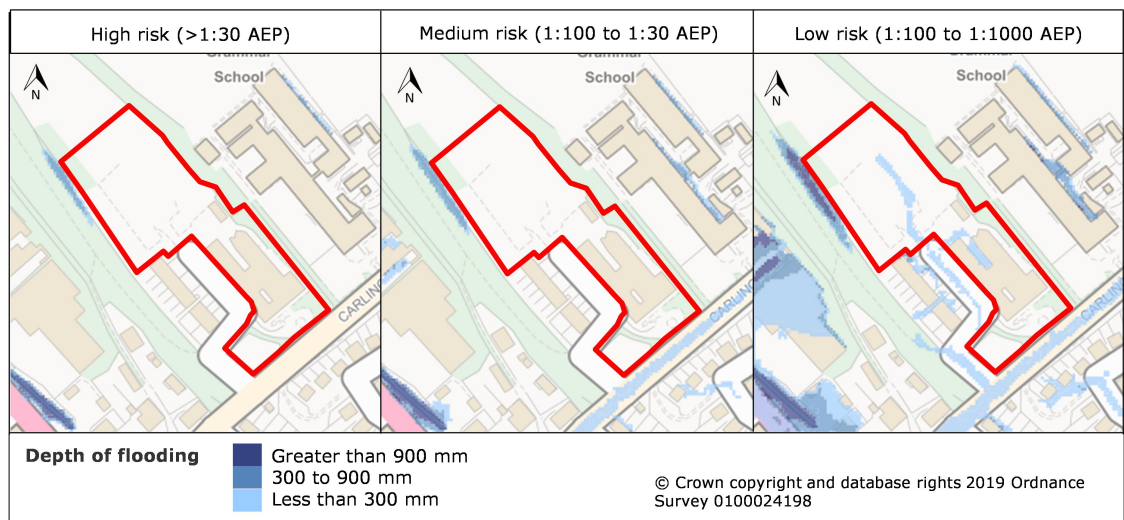


Figure 4: Flood Risk from Surface Water - Depth
(Source: gov.uk website)

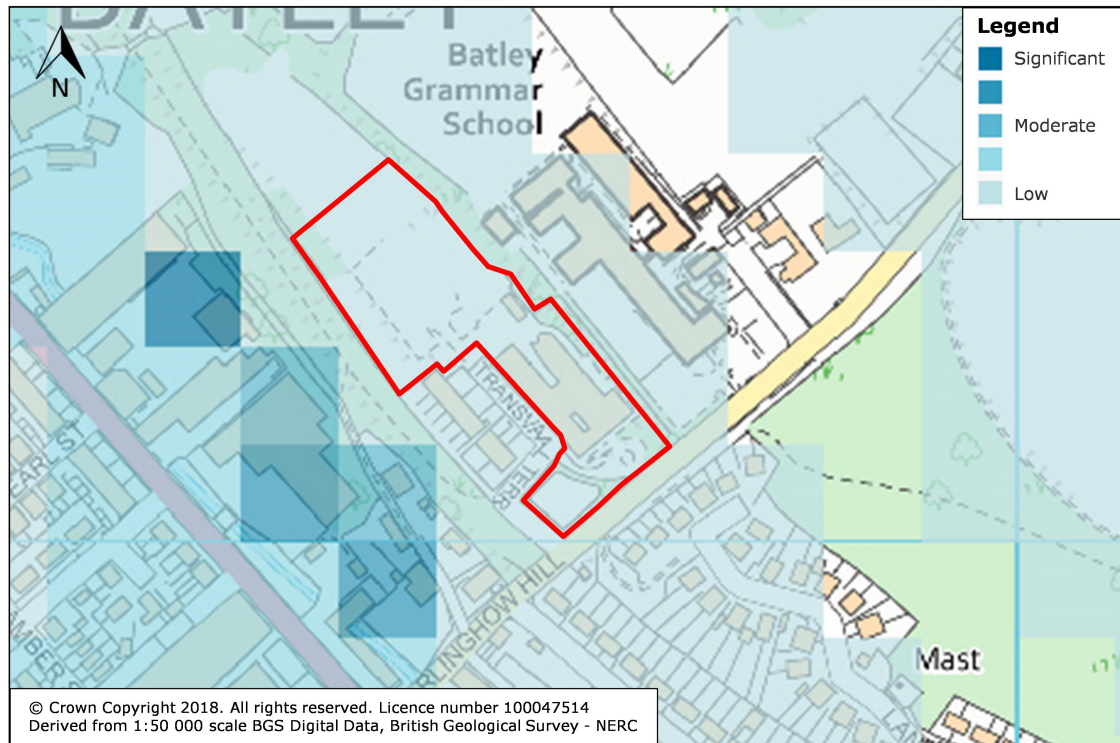


Figure 5: Groundwater Flooding Hazard Map
(Source: Findmaps)

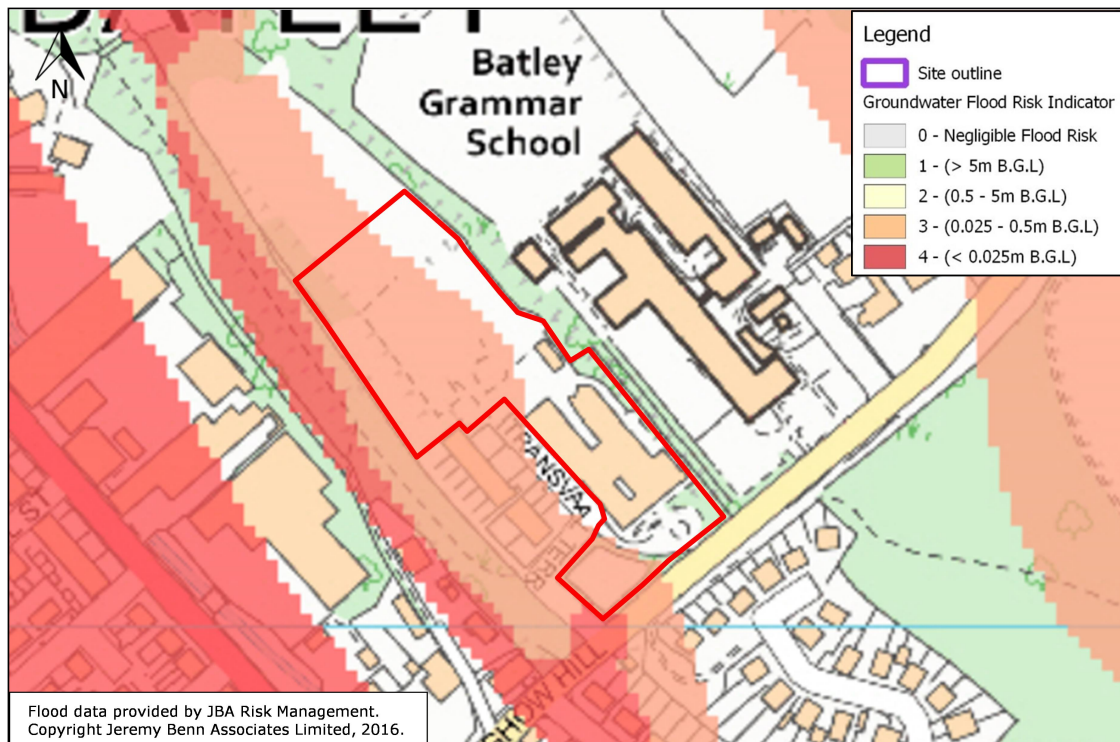


Figure 6: Groundwater Flood Risk Indicator Map
(Source: Blue Sky Maps – JBA Risk Management)

5 FLOOD RISK MITIGATION MEASURES

The flood risk to the site from surface water and groundwater will be mitigated through the implementation of the measures proposed within the following section of this report.

5.1 FINISHED FLOOR LEVELS

Finished floor levels should be set at a minimum of 0.15 m above adjacent ground levels following any re-profiling of the site.

This will, subject to the implementation of an appropriately designed surface water drainage scheme (**Section 7**), enable any potential overland flows to be conveyed safely across the site without affecting property in accordance with the approach promoted by government policy³.

³ Making Space for Water, Taking forward a new Government strategy for flood and coastal erosion risk management in England, March 2005, Dept for Environment, Food and Rural Affairs

6 FOUL WATER MANAGEMENT

6.1 EXISTING ASSETS

Yorkshire Water public sewer records (see extract in **Figure 7** and detailed record in **Appendix C**) indicate that a 300 mm diameter public combined sewer is present along Transvaal Terrace and flows into a 300 mm diameter public combined sewer along Carlinghow Hill.

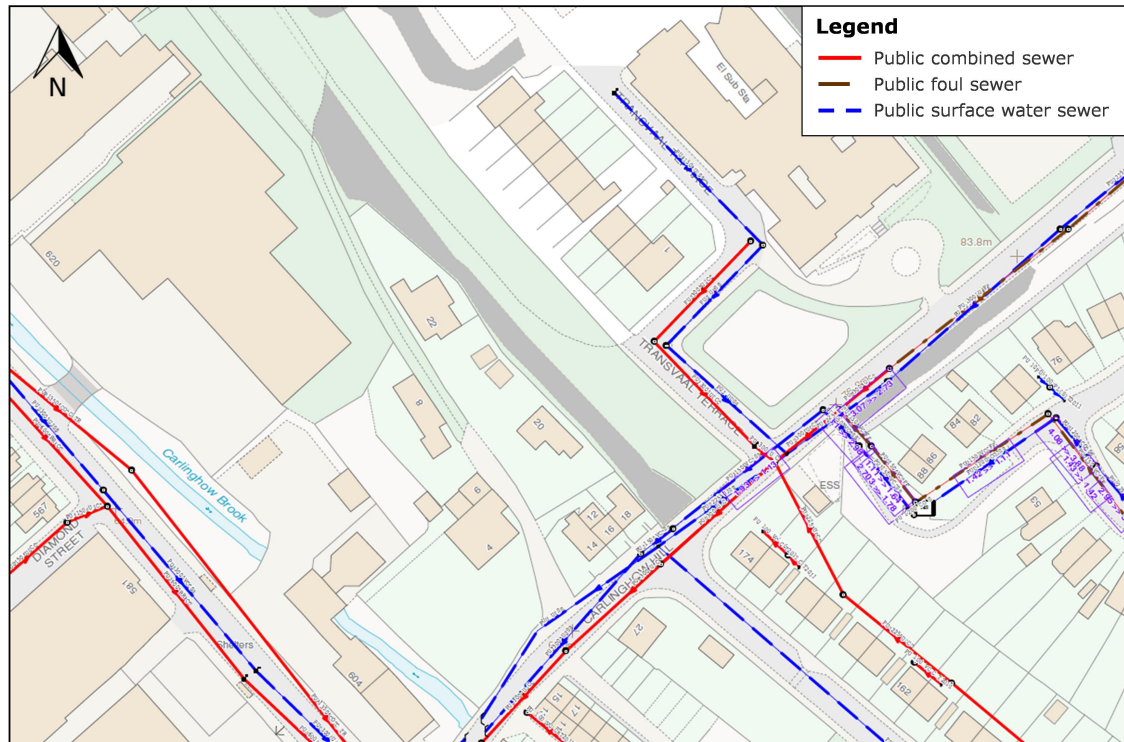


Figure 7: Yorkshire Water Infrastructure

6.2 FOUL LOADING ESTIMATE

The projected peak foul flow from the development has been calculated to be 2.5⁴ l/s (based on 54 no. dwellings and a domestic water consumption of 4000 litres/dwelling/day).

6.3 NEW CONNECTIONS

Under the Water Industry Act (1991), developers have a right to connect foul water flows from new developments to public sewer.

⁴ At the time of enquiry, the foul loading was estimated on 54 no. dwellings as per the pre-application with Kirklees Council; the proposals have since been reduced to 40 no. dwellings, and as such, the projected peak foul flow from the development is overestimated.

The Act also places a general duty on sewerage undertakers to provide the additional capacity that may be required to accommodate additional flows and loads arising from new domestic development.

Yorkshire Water has advised, by way of letter dated 19 September 2019 (see **Appendix D**) that:

- There is existing capacity in the local foul sewerage network to receive and treat foul flows from the proposed development;
- No off-site reinforcement of the sewer network or receiving wastewater treatment works is required to facilitate the proposed development;
- Foul water should discharge into the 300 mm diameter public combined sewer along Transvaal Terrace at a point to the south-west of the site.

7 SURFACE WATER MANAGEMENT

7.1 EXISTING ASSETS

Yorkshire Water public sewer records (see extract in **Figure 6** and detailed record in **Appendix C**) indicate that a 150 mm diameter public surface water sewer is present along Transvaal Terrace and flows into a 225 mm diameter public surface water sewer along Carlinghow Hill. The sewer outfalls into Carlinghow Brook.

7.2 SURFACE WATER DRAINAGE AT THE EXISTING SITE

An assessment of the topographic survey and a site visit indicates that surface water runoff from approximately 0.211 ha of impermeable surfaces (roof areas only; see **Appendix E**) at the site is positively drained (indicated by rainwater downpipes, gullies and manholes).

Based on Yorkshire Water sewer records (**Figure 6; Appendix C**), it is assumed that the private drainage system discharges to the 150 mm diameter public surface water sewer along Transvaal Terrace at a point(s) adjacent to the site. This would be confirmed by a drainage survey at the discharge of condition/reserved matters stage.

Given site topography and ground conditions, surface water runoff from permeable surfaces would be expected to slowly infiltrate and flow overland as governed by site topography.

Runoff rates from existing impermeable areas have been calculated using the Modified Rational Method. Details of the input parameters and the output results are provided in **Appendix F**. The runoff rates from the existing site are presented in **Table 1**.

Table 1: Peak Runoff Rate – Existing Site

Annual probability of rainfall event	Greenfield Runoff Rate for 0.211 ha Site (l/s)
1:1	29.0
1:30	68.2
1:100	86.4

7.3 SURFACE WATER DRAINAGE AT THE REDEVELOPED SITE

7.3.1 Disposal of Surface Water

In accordance with the NPPG⁵, surface water runoff should be disposed of according to the following hierarchy: Into the ground (infiltration); To a surface water body; To a surface water sewer, highway drain, or another drainage system; To a combined sewer.

As detailed in **Section 2.4** the site is underlain by made ground with the potential for contamination. As such the disposal of surface water via infiltration is unlikely to be feasible. .

⁵ Paragraph 080, Reference ID: 7-080-20150323

Given the presence of intervening infrastructure between the site and the nearest watercourse to the site, Carlinghow Brook, it is proposed to maintain existing connections to the public surface water sewer system in Transvaal Terrace.

7.3.2 Post Development Impermeable Area

Based on the development proposals, the total area of impermeable surfaces within the development has been estimated to be 0.442 ha, as illustrated in **Appendix G**.

7.3.3 Peak Flow Control

It is proposed to restrict surface water runoff from the redeveloped site to 20.3 l/s. This is a 30% reduction on the existing peak runoff rate for the 1:1 annual probability event, and a reduction of 70% and 76% for the 1:30 and 1:100 annual probability events respectively.

7.3.4 Attenuation Storage

Given the proposed site layout, it is proposed to divide the site into two drainage areas for the purposes of this assessment; Drainage Area 1 (DA1) and DA2.

Attenuation storage will be provided to store surface water runoff generated across the proposed roofs and hardstanding surfaces within each drainage area.

The attenuation storage facilities have been modelled using the Detailed Design module of MicroDrainage Source Control (**Appendix H**). The required storage volumes have been sized to store the 1:100 annual probability rainfall event including a 30% increase in rainfall intensity in order to allow for climate change in accordance with Kirklees Council pre-application consultation response on 9 July 2019 (ref: 2018/20473).

Assuming a peak discharge rate of 10.3 l/s within DA1 and 10.0 l/s within DA2, storage volumes of approximately 63 m³ and 60 m³ would be required respectively.

The storage volumes could be accommodated as follows:

- DA1: Oversized pipe; 1.2 m diameter, 55.0 m in length
- DA2: Permeable paving with attenuation storage provided within the sub base of the pavement structure; an area of 468 m² and a depth of 0.430 m

Additional SuDS features, such as rainwater harvesting, green roofs, permeable paving on driveways and an attenuation basin may be incorporated into the surface water drainage strategy at the detailed design stage.

A preliminary surface water drainage layout is provided in **Appendix I**.

It should be noted that the calculations assume that all storage is provided within the formal attenuation storage facilities; with no storage being provided in the proposed pipe network. As such, the volumes of storage presented are likely to be an overestimate.

7.3.5 Exceedance Routes

Flows resulting from rainfall in excess of the 1:100 annual probability rainfall event including an allowance for climate change will be managed in exceedance routes. It is assumed that as the development proposals progress, the design of the site would ensure flood flows are directed towards carriageways, with the site being profiled to ensure that flood flows are directed away from built development. Indicative exceedance flow routes are provided in Figure 8. These exceedance routes would need to be re-confirmed following detailed design of the drainage network.



Figure 8: Indicative Exceedence Flow Routes

7.3.6 Pollution Control

Permeable paving can improve the water quality of the runoff generated across proposed roof areas and hardstanding surfaces by filtration as surface water percolates through the porous sub-base of the permeable paving.

7.3.7 Adoption and Maintenance of SuDS

The pipe network, designed to Sewers for Adoption (6th edition) standard, may be offered for adoption by the sewerage undertaker.

SuDS elements within the curtilage of residential dwellings would be the responsibility of the owner of the property.

SuDS in open spaces may be maintained by a management company.

An indicative maintenance schedule is presented in **Table 2**.

Table 2: Permeable Paving Maintenance Requirements

Schedule	Required action	Frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations.
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth- if required, take remedial action	Three-monthly, 48h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies accumulation rates and establish appropriate removal frequencies	Annually
	Monitor inspection chambers	

7.3.8 Summary

The purpose of this report is to demonstrate that a surface water drainage strategy is feasible for the site given the development proposals and the land available.

The proposals provide the opportunity for the inclusion of SuDS elements, ensuring that there will be no increase in surface water runoff from the proposed development.

The storage calculations may be refined at the detailed design stage and a final decision made on the types of storage to be provided.

8 SUMMARY AND RECOMMENDATIONS

This report has been prepared on behalf of Fernbrook Associates Ltd and relates to the proposed redevelopment land at Transvaal Terrace, Batley.

According to the Flood Map for Planning the proposed development is located outside the 1:1,000 annual probability flood outline and is therefore defined by the NPPF as being situated within Flood Zone 1.

As the site is in Flood Zone 1, the sequential test is deemed to have been addressed and the exception test need not be applied.

The site is not at risk of flooding from fluvial sources, reservoirs, canals or other artificial sources and there is a low risk of flooding from groundwater.

The Flood Risk from Surface Water map indicates that the site is predominantly at 'Very Low' risk of flooding from surface water but with the potential for the accumulation of surface water due to ponding and obstructions from buildings during an extreme event.

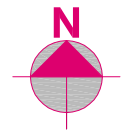
This report has demonstrated that the proposed development may be completed in accordance with the requirements of planning policy subject to finished floor levels being set at a minimum of 0.15 m above adjacent ground levels following any re-profiling at the site.

Surface water runoff from the developed site can be sustainably managed in accordance with planning policy and the development is not expected to impact flood risk elsewhere. The detailed drainage design should be submitted to and approved by the local planning authority prior to the commencement of development.

Yorkshire Water has confirmed that there is existing capacity in the local foul sewerage network to receive and treat foul flows from the proposed development. In addition, foul water can discharge without restriction into the public combined sewer along Transvaal Terrace at a point to the south-west of the site.

APPENDIX A:

Development Proposals



Key:

- Extent of greenbelt
- Extent of previously developed land within greenbelt
- Demolition
- Soft Landscaping
- Grass
- Hard Landscaping

SCHEDULE:

Houses
Detached Units - 6
Semi-Detached Units - 6
Town Houses - 8
Total - 20

Flats

1 Bed - 9
2 Bed - 6
3 Bed - 5
Total - 20

No. of units in GB (brownfield) - 7
No. of units outside GB (brownfield) - 13+20=33

Total site area - 1.88 Ha (18786 sqm)

Existing GIA - 4062sqm
GIA lost to demolition - 2187 sqm
GIA retained as flats- 1875 sqm

Allocation for Urban green
space extending walkway to
Batley Park
(0.21 Ha / 2156 sqm)



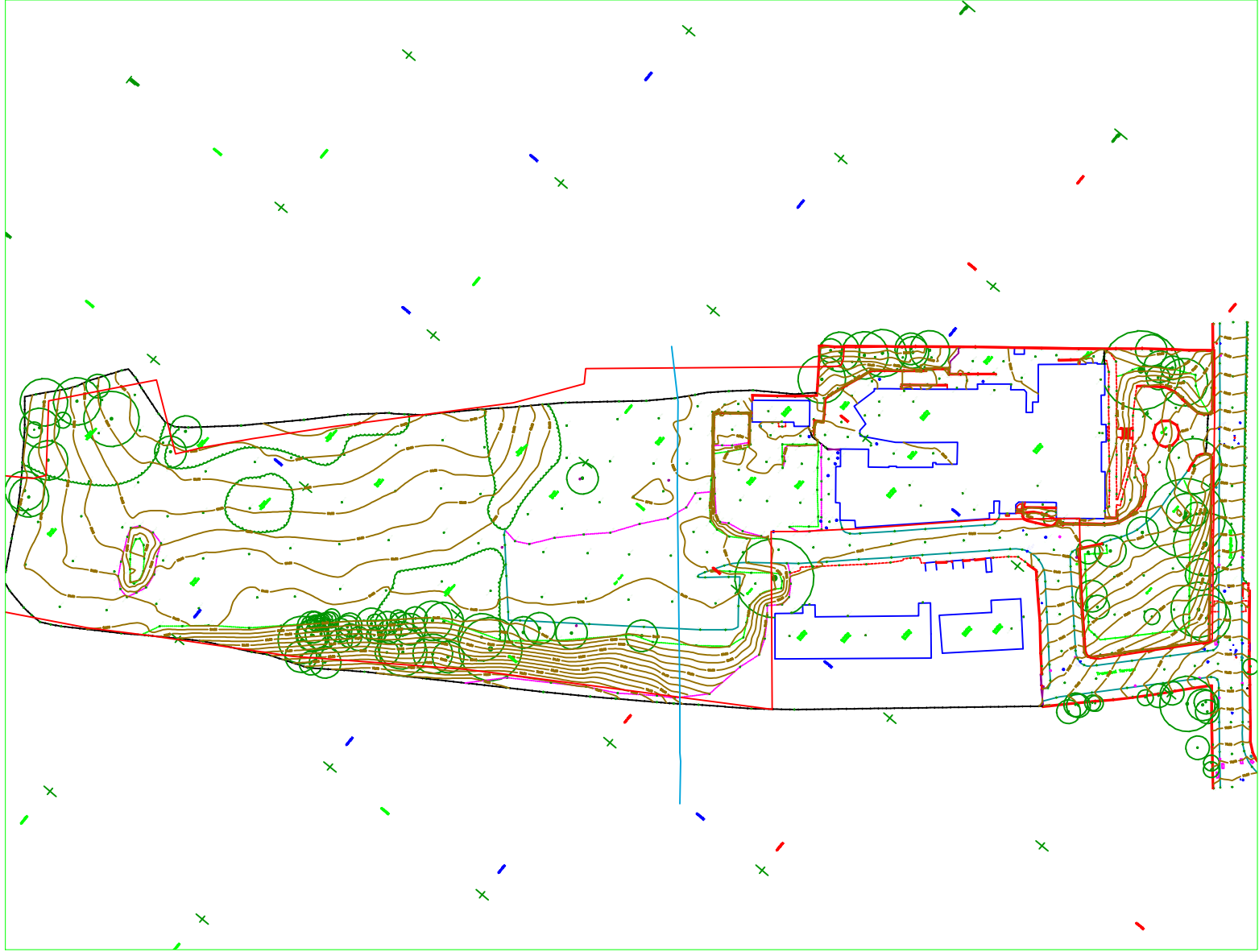
PROPOSED SITE PLAN
SCALE 1:1000 @ A3

KUFIC
Suite 24 Batley Business Park
Technology Drive
Batley WF17 6ER . UK
t: 01924 694 404
e: info@kufic.co.uk
w: www.kufic.co.uk

DRAWN BY: HD	STAGE: DESIGN	DATE: 05/08/19
LOCATION:	CARLINGHOW HILL, BATLEY	
TITLE:	RESIDENTIAL DEVELOPMENT	
DESCRIPTION:	SITE PLAN	
REF:	18007-D02-A	

APPENDIX B:

Topographic Survey



APPENDIX C:

Public Sewer Record

YORKSHIRE WATER PROTECTION OF MAINS AND SERVICES

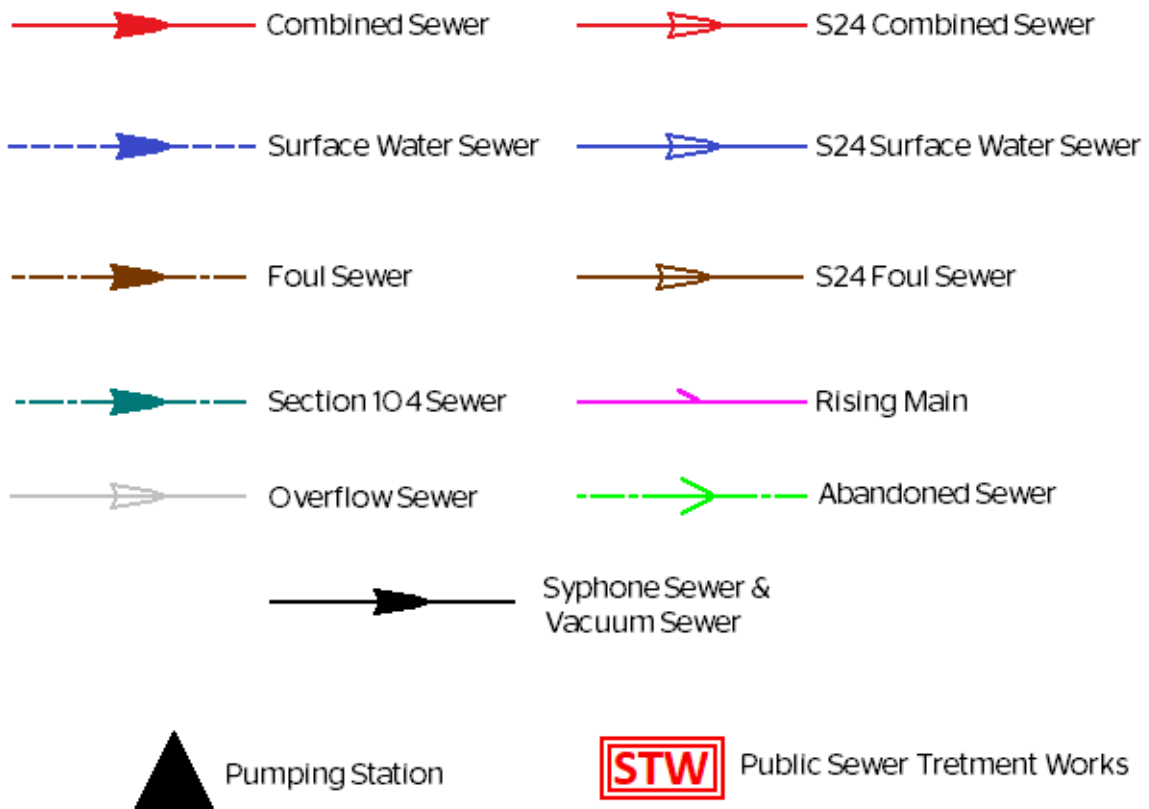
1. The position of Yorkshire Water Services Ltd (YWS) apparatus shown on the existing mains record drawing(s) indicates the **general** position and nature of our apparatus and the accuracy of this information cannot be guaranteed. Any damage to YWS apparatus as a result of your works may have serious 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 0845 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 0845 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 (Diversions 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 1000019559.
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.

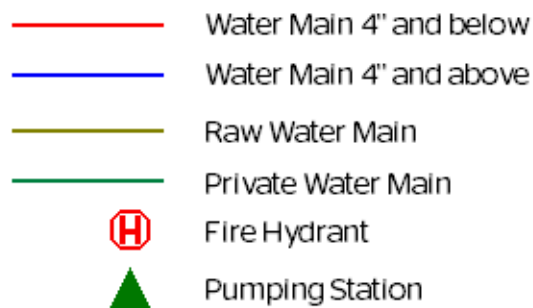
Property Identifier



Sewer Legend



Water Legend





423639 : 424919		Map Name : SE2324NE	Title	
		Yorkshire Water, PO Box 500, Halifax Road, Bradford BD6 2LZ Contact Name : Ms H Webster Contact Tel :	Notes	
			Partial Key Water mains up to 4" in diameter Water mains over 4" in diameter Raw water mains Private water mains	The position and depths of apparatus shown on this plan are approximate only. The exact positions and depths should be obtained by excavation trial holes. Scale : 1:1250
			Drg No :	Maris No :
			Date Req : 08/08/2019, 15:06:28	Date Gen : 08/08/2019, 15:06:30
			Source : Water Network Enquiry	



423639 : 424919		Map Name : SE2324NE		Title	
		Yorkshire Water, PO Box 500, Halifax Road, Bradford BD6 2LZ Contact Name : Ms H Webster Contact Tel :		Notes	
				Partial Key Foul Sewer = F Combined Sewer = C Surface Water Sewer = SW Trade Sewer = TD Partially Separate = PS	This plan is furnished as a general guide only and no warranty as to its correctness is given or implied. This plan must not be relied upon in the event of excavations or other works made in the vicinity of public sewers. No house or property connections are shown.
				Date Req : 08/08/2019, 15:06:51	Date Gen : 08/08/2019, 15:06:54
				Source : Sewer Network Enquiry	

APPENDIX D:

Correspondence with Yorkshire Water



YorkshireWater

Ms K Bonser
Weetwood Services Ltd
Suite 22C Josephs Well
Hanover Walk
Leeds
LS3 1AB

Yorkshire Water Services
Developer Services
Sewerage Technical Team
PO BOX 52
Bradford
BD3 7AY

Tel: 0345 120 8482
Fax: (01274) 372 834

Your Ref:
Our Ref: V014995

Email:
technical.sewerage@yorkshirewater.co.uk

For telephone enquiries ring:
Chris Roberts on 0345 120 8482

19th September 2019

Dear Ms K Bonser,

Land at Transvaal Terrace, Batley, WF17 0AA - Pre-Planning Sewerage-Enquiry-Residential T559615

Thank you for your recent enquiry and remittance. Our official VAT receipt has been sent to you under separate cover. Please find enclosed a complimentary extract from the Statutory Sewer Map which indicates the recorded position of the public sewers. Please note that as of October 2011 and the private to public sewer transfer, there are many uncharted Yorkshire Water assets currently not shown on our records.

The following comments reflect our view, with regard to the public sewer network only, based on a 'desk top' study of the site and are valid for a maximum period of twelve months.

Development of the site should take place with separate systems for foul and surface water drainage. The separate systems should extend to the points of discharge to be agreed.

Foul Water

Foul water domestic waste should discharge to the 300 mm diameter public combined sewer recorded in Transvaal Terrace, at a point to the south west of the site.

Surface Water

The developer's attention is drawn to Requirement H3 of the Building Regulations 2000. This establishes a preferred hierarchy for surface water disposal. Consideration should firstly be given to discharge to soakaway, infiltration system and watercourse in that priority order.

Sustainable Drainage Systems (SuDS), for example the use of soakaways and/or permeable hardstanding etc, may be a suitable solution for surface water disposal appropriate in this situation. You are advised to seek comments on the suitability of SuDS in this instance from the appropriate authorities.

It is understood that Carlinghow Beck is located to the west of the site. This appears to be the obvious place for surface water disposal (if SuDS are not viable). Please contact the Lead Local Flood Authority for more details.

While impermeable areas have been evidenced, positive connectivity to the public network has not. Please follow the below guidance.



YorkshireWater

If other methods of surface water disposal are not viable and subject to providing satisfactory evidence as to why they have been discounted, curtilage surface water discharges to the public sewer will be restricted to the level of run-off - i.e. same rate of discharge - to that from the existing use of the site less a 30% reduction in the existing discharge. Any discharge of surface water from the site should discharge to similar points of connection to that of the existing use of the site. You will need to demonstrate positive drainage, based on a 1 in 1 year storm, to the public sewer to Yorkshire Water by means of investigation and calculation carried out at your expense.

To do this, Yorkshire Water requires to see existing drainage plans showing existing drainage layouts with pipe sizes, gradients and connection points to the public sewer network.

Please note further restrictions on surface water disposal from the site may be imposed by other parties. You are strongly advised to seek advice/comments from the Environment Agency/Land Drainage Authority/Internal Drainage Board, with regard to surface water disposal from the site.

Other Observations

Any new connection to an existing public sewer will require the prior approval of Yorkshire Water. You may apply on line or obtain an application form from our website (www.yorkshirewater.com) or by telephoning 0345 120 84 82.

An off-site foul and surface water sewer may be required which may be provided by the developer and considered for adoption under Section 104 of the Water Industry Act 1991. Please telephone 0345 120 84 82 for advice on sewer adoptions. Alternatively, the developer may in certain circumstances be able to requisition off-site sewers under Section 98 of the Water Industry Act 1991 for which an application must be made in writing. For further information, please telephone 0345 120 84 82.

Prospectively adoptable sewers and pumping stations must be designed and constructed in accordance with the WRc publication "Sewers for Adoption - a design and construction guide for developers" 6th Edition as supplemented by Yorkshire Water's requirements, pursuant to an agreement under Section 104 of the Water Industry Act 1991. An application to enter into a Section 104 agreement must be made in writing prior to any works commencing on site. Please contact our Developer Services Team (telephone 0345 120 84 82) for further information.

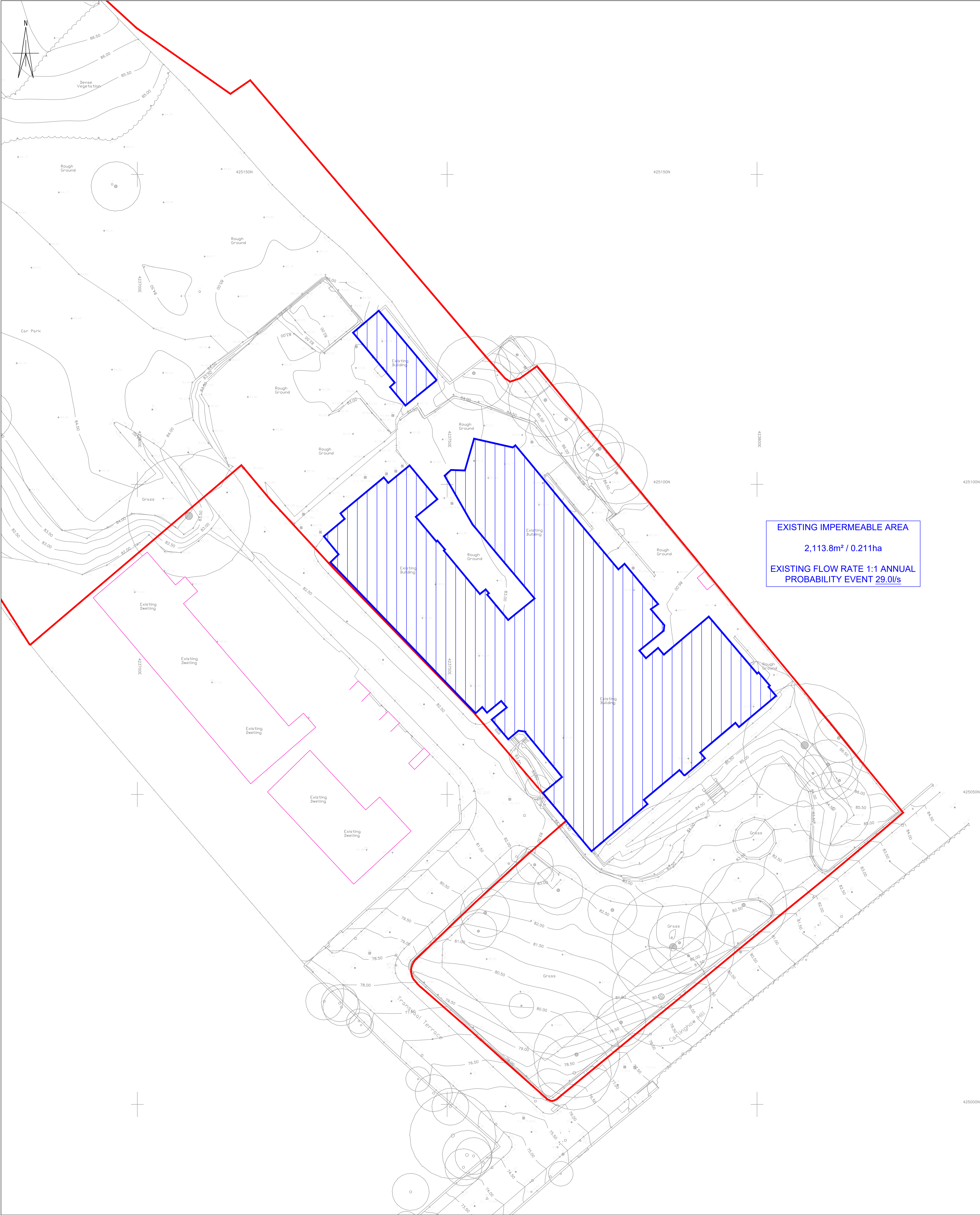
All the above comments are based upon the information and records available at the present time and is subject to formal planning approval agreement. The information contained in this letter together with that shown on any extract from the Statutory Sewer Map that may be enclosed is believed to be correct and is supplied in good faith. Please note that capacity in the public sewer network is not reserved for specific future development. It is used up on a 'first come, first served' basis. You should visit the site and establish the line and level of any public sewers affecting your proposals before the commencement of any design work.

Yours sincerely

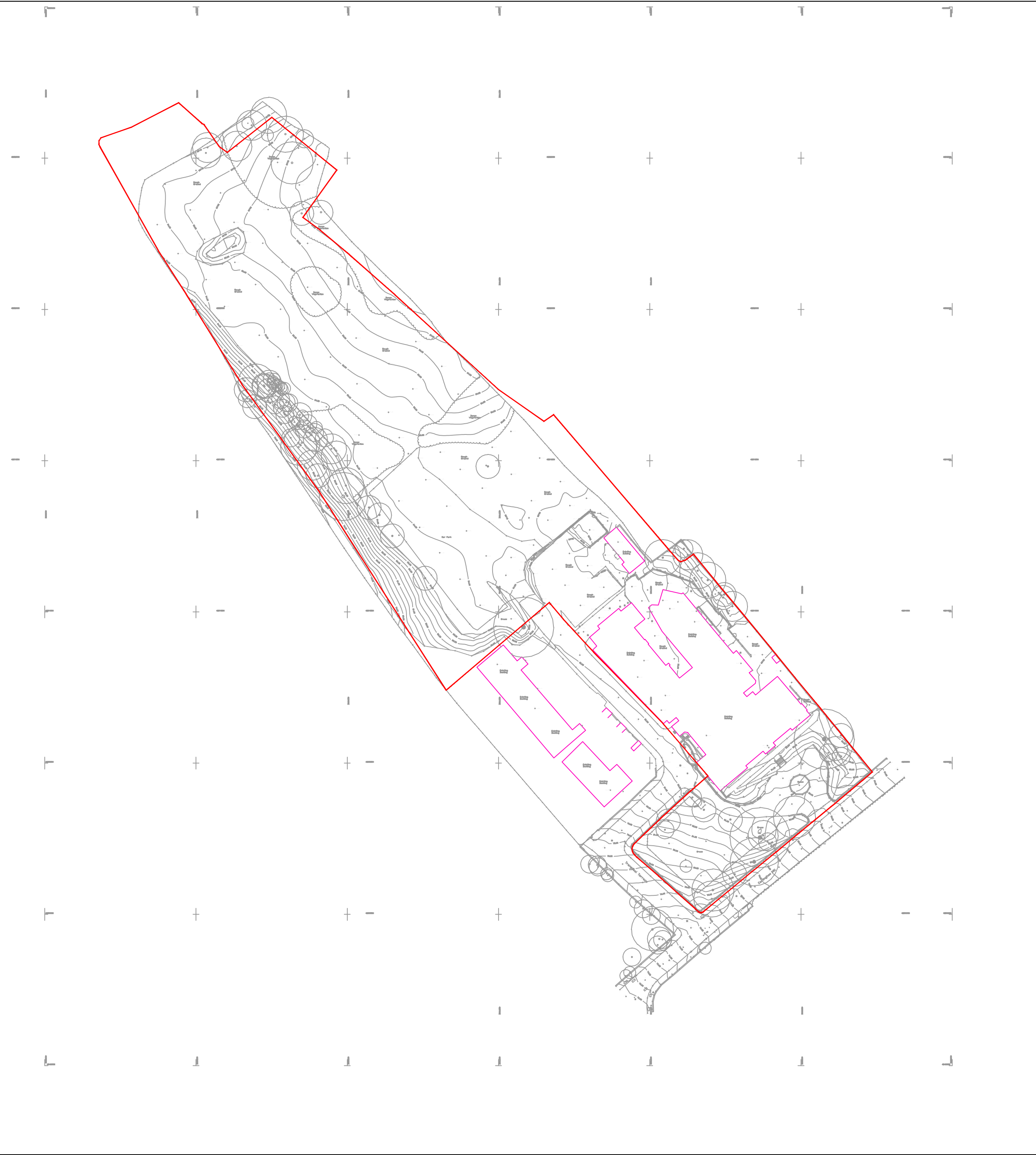
Chris Roberts
Sewerage Technician
Developer Services

APPENDIX E:

Existing Impermeable Areas



EXISTING IMPERMEABLE AREA
2,113.8m² / 0.211ha
EXISTING FLOW RATE 1:1 ANNUAL
PROBABILITY EVENT 29.0l/s



SITE PLAN
1:1000

NOTES
1. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL
RELEVANT WEETWOOD DRAWINGS.

P1	02.10.19	INITIAL ISSUE	TB	KB
REV	DATE	DESCRIPTION	DRAWN CHECK	
W Development • Planning • Environment Suite C22 Josephs Wells Hanover Walk, Leeds LS3 1AB Tel 0113 244 1377 info@weetwood.net www.weetwood.net				
Client FERNBROOK ASSOCIATES LTD				
Drawing Status PRELIMINARY			Date OCT 2019	
Project TRANSVAAL TERRACE BATLEY			Scale (A0) 1:250	
			Drawn TB	
			Checked KB	
			Project No 4605	
Title EXISTING IMPERMEABLE AREA LAYOUT			Drawing No 100	
			Revision P1	

APPENDIX F:

Peak Runoff Rate from Existing Site Area

The peak discharge rates of surface water runoff from the impermeable areas at the site have been calculated based on the Modified Rational Method⁶.

The following parameters have been obtained from the maps in Volume 3 of the Wallingford Procedure:

M5-60 minute rainfall depth:	19 mm
Ratio of M5-60 to M5-2 day rainfall:	36/0.36
Average Annual Rainfall:	700 mm
Winter Rain Acceptance Potential/ Soil Type:	4/0.45
The Urban Catchment Wetness Index (UCWI) value:	70

A time of concentration of 5.5 minutes has been used.

A rainfall estimation calculation has been carried out to convert the M5-60 minute rainfall to the 5-minute duration rainfall for the 1:1 and 1:100 annual probability rainfall events. The calculated rainfall intensities for these events are 48.1 and 143.5 mm/hr respectively.

The flow rate as given by the Modified Rational Method is:

$$Q = 2.78 \times C_v \times C_r \times \text{rainfall intensity} \times \text{impermeable area}$$

where:

C_v is the volumetric runoff coefficient = $P_r / \text{PIMP} = 0.78$

where P_r is Percentage Runoff and PIMP is Percentage Impermeable Area

C_r is the routing coefficient = 1.3

Impermeable Area = 0.211 ha

The peak discharges of surface runoff from impermeable areas of the existing site are shown in the table below:

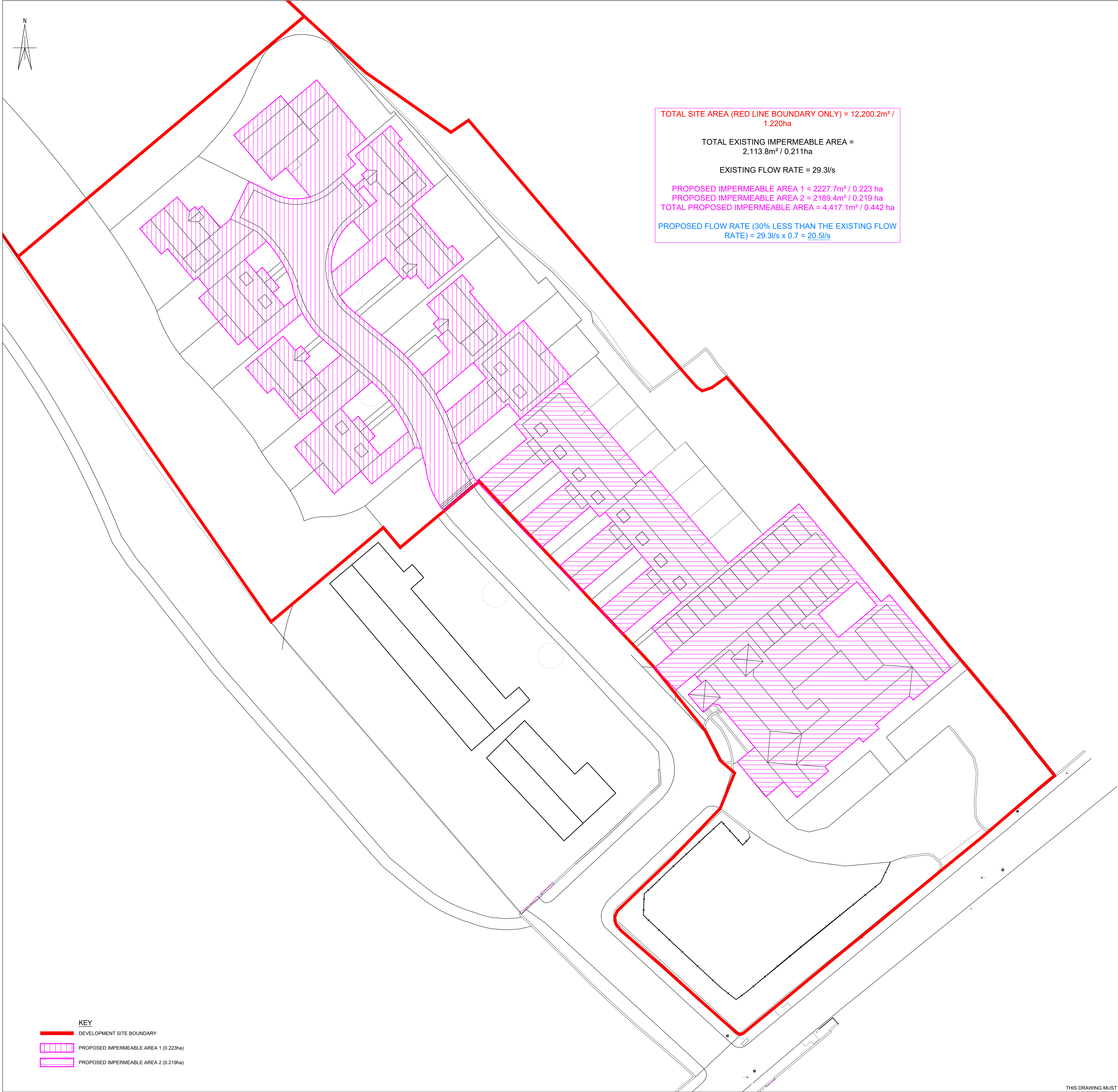
Peak Runoff Rate

Annual probability of rainfall event	Peak discharge for 0.211 ha impermeable area (l/s)
1:1	29.0
1:30	68.2
1:100	86.4

⁶ The Wallingford Procedure, Volume 4, 1981

APPENDIX G:

Post Development Impermeable Area



TOTAL SITE AREA (RED LINE BOUNDARY ONLY) = 12,200.2m² / 1.220ha

TOTAL EXISTING IMPERMEABLE AREA = 2,113.8m² / 0.211ha

EXISTING FLOW RATE = 29.3l/s

PROPOSED IMPERMEABLE AREA 1 = 2227.7m² / 0.223 ha
PROPOSED IMPERMEABLE AREA 2 = 2189.4m² / 0.219 ha
TOTAL PROPOSED IMPERMEABLE AREA = 4,417.1m² / 0.442 ha

PROPOSED FLOW RATE (30% LESS THAN THE EXISTING FLOW RATE) = 29.3l/s x 0.7 = 20.5l/s

NOTES

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT WEETWOOD DRAWINGS.

P1	02.10.19	INITIAL ISSUE	TB	KB
REV	DATE	DESCRIPTION	DRAWN CHECKED	
W weetwood Development • Planning • Environment Suite C22 Josephs Wells Hanover Walk, Leeds LS3 1AB Tel 0113 244 1377 info@weetwood.net www.weetwood.net				
Client FERNBROOK ASSOCIATES LTD				
Drawing Status PRELIMINARY			Date OCT 2019	
Project TRANSVAAL TERRACE BATLEY			Scale (A0) 1:250	
			Drawn TB	
			Checked KB	
			Project No 4605	
Title PROPOSED IMPERMEABLE AREA LAYOUT			Drawing No 101	
			Revision P1	

APPENDIX H:

Surface Water Attenuation - Storage Volume Calculation

Weetwood				Page 1	
Joseph's Well Hanover Walk Leeds, LS3 1AB					
Date 01/10/2019 15:20 File 2019-10-01 4605 DA1 Pipe...		Designed by KeelyBonser Checked by			
XP Solutions		Source Control 2019.1			
Summary of Results for 100 year Return Period (+30%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	98.275	0.775	10.3	39.7	O K
30 min Summer	98.428	0.928	10.3	49.4	O K
60 min Summer	98.499	0.999	10.3	53.4	O K
120 min Summer	98.478	0.978	10.3	52.3	O K
180 min Summer	98.419	0.919	10.3	48.8	O K
240 min Summer	98.341	0.841	10.3	44.0	O K
360 min Summer	98.187	0.687	10.3	33.9	O K
480 min Summer	98.061	0.561	10.3	25.5	O K
600 min Summer	97.956	0.456	10.3	18.7	O K
720 min Summer	97.870	0.370	10.2	13.5	O K
960 min Summer	97.751	0.251	9.9	6.9	O K
1440 min Summer	97.651	0.151	8.5	2.6	O K
2160 min Summer	97.615	0.115	6.3	1.4	O K
2880 min Summer	97.598	0.098	5.0	1.0	O K
4320 min Summer	97.581	0.081	3.6	0.6	O K
5760 min Summer	97.571	0.071	2.9	0.5	O K
7200 min Summer	97.564	0.064	2.4	0.4	O K
8640 min Summer	97.559	0.059	2.1	0.3	O K
10080 min Summer	97.555	0.055	1.9	0.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	115.731	0.0	48.4	17	
30 min Summer	77.804	0.0	65.1	31	
60 min Summer	49.937	0.0	83.5	54	
120 min Summer	30.956	0.0	103.5	88	
180 min Summer	23.058	0.0	115.7	122	
240 min Summer	18.577	0.0	124.3	158	
360 min Summer	13.656	0.0	137.0	220	
480 min Summer	10.974	0.0	146.8	280	
600 min Summer	9.254	0.0	154.8	338	
720 min Summer	8.046	0.0	161.5	394	
960 min Summer	6.447	0.0	172.5	504	
1440 min Summer	4.709	0.0	189.0	734	
2160 min Summer	3.432	0.0	206.6	1084	
2880 min Summer	2.739	0.0	219.9	1456	
4320 min Summer	1.989	0.0	239.5	2200	
5760 min Summer	1.583	0.0	254.1	2888	
7200 min Summer	1.325	0.0	265.9	3648	
8640 min Summer	1.147	0.0	276.2	4352	
10080 min Summer	1.015	0.0	285.3	5072	
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Weetwood				Page 2	
Joseph's Well Hanover Walk Leeds, LS3 1AB					
Date 01/10/2019 15:20		Designed by KeelyBonser			
File 2019-10-01 4605 DA1 Pipe...		Checked by			
XP Solutions		Source Control 2019.1			
Summary of Results for 100 year Return Period (+30%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	98.368	0.868	10.3	45.7	O K
30 min Winter	98.569	1.069	10.3	57.1	O K
60 min Winter	98.714	1.214	10.3	62.6	O K
120 min Winter	98.647	1.147	10.3	60.5	O K
180 min Winter	98.532	1.032	10.3	55.2	O K
240 min Winter	98.410	0.910	10.3	48.3	O K
360 min Winter	98.156	0.656	10.3	31.8	O K
480 min Winter	97.968	0.468	10.3	19.5	O K
600 min Winter	97.827	0.327	10.2	11.0	O K
720 min Winter	97.731	0.231	9.8	6.0	O K
960 min Winter	97.650	0.150	8.4	2.5	O K
1440 min Winter	97.614	0.114	6.2	1.4	O K
2160 min Winter	97.592	0.092	4.5	0.8	O K
2880 min Winter	97.580	0.080	3.6	0.6	O K
4320 min Winter	97.567	0.067	2.6	0.4	O K
5760 min Winter	97.559	0.059	2.1	0.3	O K
7200 min Winter	97.554	0.054	1.8	0.2	O K
8640 min Winter	97.549	0.049	1.5	0.2	O K
10080 min Winter	97.546	0.046	1.3	0.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Winter	115.731	0.0	54.2	17	
30 min Winter	77.804	0.0	72.9	31	
60 min Winter	49.937	0.0	93.5	58	
120 min Winter	30.956	0.0	116.0	94	
180 min Winter	23.058	0.0	129.6	132	
240 min Winter	18.577	0.0	139.2	172	
360 min Winter	13.656	0.0	153.5	234	
480 min Winter	10.974	0.0	164.4	292	
600 min Winter	9.254	0.0	173.3	344	
720 min Winter	8.046	0.0	180.9	392	
960 min Winter	6.447	0.0	193.2	490	
1440 min Winter	4.709	0.0	211.7	736	
2160 min Winter	3.432	0.0	231.4	1104	
2880 min Winter	2.739	0.0	246.2	1468	
4320 min Winter	1.989	0.0	268.2	2156	
5760 min Winter	1.583	0.0	284.6	2912	
7200 min Winter	1.325	0.0	297.8	3632	
8640 min Winter	1.147	0.0	309.3	4400	
10080 min Winter	1.015	0.0	319.5	5000	
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Weetwood		Page 3
Joseph's Well Hanover Walk Leeds, LS3 1AB		
Date 01/10/2019 15:20	Designed by KeelyBonser	
File 2019-10-01 4605 DA1 Pipe...	Checked by	
XP Solutions		Source Control 2019.1

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.223

Time (mins)		Area
From:	To:	(ha)
0	4	0.223

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Weetwood		Page 4
Joseph's Well Hanover Walk Leeds, LS3 1AB		
Date 01/10/2019 15:20 File 2019-10-01 4605 DA1 Pipe...	Designed by KeelyBonser Checked by	
XP Solutions Source Control 2019.1		

Model Details

Storage is Online Cover Level (m) 100.000

Pipe Structure

Diameter (m) 1.200 Length (m) 55.000
Slope (1:X) 500.000 Invert Level (m) 97.500

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0142-1030-1350-1030
Design Head (m)	1.350
Design Flow (l/s)	10.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	142
Invert Level (m)	97.500
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.350	10.3	Kick-Flo®	0.855	8.3
Flush-Flo™	0.398	10.3	Mean Flow over Head Range	-	8.9

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.1	1.200	9.7	3.000	15.0	7.000	22.5
0.200	9.5	1.400	10.5	3.500	16.2	7.500	23.3
0.300	10.1	1.600	11.1	4.000	17.2	8.000	24.0
0.400	10.3	1.800	11.8	4.500	18.2	8.500	24.7
0.500	10.2	2.000	12.4	5.000	19.2	9.000	25.4
0.600	10.0	2.200	13.0	5.500	20.1	9.500	26.1
0.800	8.9	2.400	13.5	6.000	20.9		
1.000	8.9	2.600	14.0	6.500	21.7		

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File 2019-09-30 4605 DA2 PERM...							
XP Solutions		Designed by KeelyBonser Checked by					
Source Control 2019.1							
Summary of Results for 100 year Return Period (+30%)							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	99.425	0.000	0.0	1.8	1.8	0.0	O K
15 min Winter	99.730	0.305	0.0	9.6	9.6	42.8	O K
30 min Winter	99.811	0.386	0.0	9.9	9.9	54.1	Flood Risk
60 min Winter	99.850	0.425	0.0	10.0	10.0	59.7	Flood Risk
120 min Winter	99.835	0.410	0.0	9.9	9.9	57.6	Flood Risk
180 min Winter	99.799	0.374	0.0	9.8	9.8	52.5	O K
240 min Winter	99.755	0.330	0.0	9.7	9.7	46.3	O K
360 min Winter	99.668	0.243	0.0	9.3	9.3	34.1	O K
480 min Winter	99.593	0.168	0.0	9.0	9.0	23.5	O K
600 min Winter	99.529	0.104	0.0	8.8	8.8	14.6	O K
720 min Winter	99.478	0.053	0.0	8.6	8.6	7.5	O K
960 min Winter	99.425	0.000	0.0	8.3	8.3	0.0	O K
1440 min Winter	99.425	0.000	0.0	6.1	6.1	0.0	O K
2160 min Winter	99.425	0.000	0.0	4.4	4.4	0.0	O K
2880 min Winter	99.425	0.000	0.0	3.5	3.5	0.0	O K
4320 min Winter	99.425	0.000	0.0	2.6	2.6	0.0	O K
5760 min Winter	99.425	0.000	0.0	2.0	2.0	0.0	O K
7200 min Winter	99.425	0.000	0.0	1.7	1.7	0.0	O K
8640 min Winter	99.425	0.000	0.0	1.5	1.5	0.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
10080 min Summer	1.015	0.0	268.0	0			
15 min Winter	115.731	0.0	50.7	17			
30 min Winter	77.804	0.0	68.9	31			
60 min Winter	49.937	0.0	89.5	58			
120 min Winter	30.956	0.0	111.7	92			
180 min Winter	23.058	0.0	124.9	130			
240 min Winter	18.577	0.0	134.1	166			
360 min Winter	13.656	0.0	147.7	236			
480 min Winter	10.974	0.0	159.0	300			
600 min Winter	9.254	0.0	167.0	360			
720 min Winter	8.046	0.0	174.6	414			
960 min Winter	6.447	0.0	186.5	0			
1440 min Winter	4.709	0.0	204.2	0			
2160 min Winter	3.432	0.0	222.9	0			
2880 min Winter	2.739	0.0	236.7	0			
4320 min Winter	1.989	0.0	256.9	0			
5760 min Winter	1.583	0.0	271.6	0			
7200 min Winter	1.325	0.0	283.1	0			
8640 min Winter	1.147	0.0	293.0	0			
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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.219

Time (mins)	Area
From:	To: (ha)
0	4 0.219

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Model Details

Storage is Online Cover Level (m) 100.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	46.8
Membrane Percolation (mm/hr)	1000	Length (m)	10.0
Max Percolation (l/s)	130.0	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	99.425	Cap Volume Depth (m)	0.430

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0141-1000-1350-1000
Design Head (m)	1.350
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	141
Invert Level (m)	98.500
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.350	10.0	Kick-Flo®	0.858	8.1
Flush-Flo™	0.401	10.0	Mean Flow over Head Range	-	8.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.1	1.200	9.5	3.000	14.6	7.000	21.9
0.200	9.2	1.400	10.2	3.500	15.7	7.500	22.6
0.300	9.8	1.600	10.8	4.000	16.7	8.000	23.3
0.400	10.0	1.800	11.4	4.500	17.7	8.500	24.0
0.500	9.9	2.000	12.0	5.000	18.6	9.000	24.7
0.600	9.7	2.200	12.6	5.500	19.5	9.500	25.3
0.800	8.7	2.400	13.1	6.000	20.3		
1.000	8.7	2.600	13.6	6.500	21.1		

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APPENDIX I:

Indicative Surface Water Drainage Layout



NOTES

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT WEETWOOD DRAWINGS.

P1 02.10.19 INITIAL ISSUE KB TB

REV DATE DESCRIPTION DRAWN CHECK

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Client
FERNBROOK ASSOCIATES LTD

Drawing Status Date
PRELIMINARY OCT 2019

Scale (A0) 1:250

Project
**TRANNSVAAL TERRACE
BATLEY**

Drawn KB

Checked TB

Project No
4605

Drawing No

Revision
P1

Title
**PROPOSED DRAINAGE
LAYOUT**

Delivering client focussed services from offices in Leeds, London and Mold

Flood Risk Assessments
Flood Consequences Assessments
Surface Water Drainage
Foul Water Drainage
Environmental Impact Assessments
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