LAND OFF LINDLEY MOOR ROAD, LINDLEY, HUDDERSFIELD, HD3 3SX

FLOOD RISK AND DRAINAGE ASSESSMENT

Final Report v1.6
March 2024

Weetwood Services Ltd
info@weetwood.net
www.weetwood.net

Report Title	**Land off Lindley Moor Road, Lindley, Huddersfield, HD3 3SX** Flood Risk and Drainage Assessment Final Report v1.6
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Prepared by	Keely Bonser BSc (Hons) MSc PhD MCIWEM *Director* Tim Brook BSc (Hons) *Principal Engineer*
Checked and Approved by	Kevin Tilford BSc MSc PhD MBA CWEM FCIWEM CEnv *Managing Director*

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1 INTRODUCTION

1.1 Purpose of Report

Weetwood Services Ltd ('Weetwood') has been instructed by 2SH Developments to prepare a Flood Risk and Drainage Assessment (FRDA) report to accompany a hybrid planning application for the proposed development of land off Lindley Moor Road, Lindley ("the site") for mixed-uses.

The assessment has been undertaken in accordance with the requirements of the revised National Planning Policy Framework (NPPF) updated on 27 July 2021 and the Planning Practice Guidance (PPG) updated on 20 August 2021.

This report presents an assessment of flood risk from all identified sources and presents measures to mitigate the identified risk so that the development would be safe for its lifetime and would not increase flood risk elsewhere, in accordance with planning policy. The report includes a drainage strategy for foul and surface water.

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
Section 3 Presents national and local flood risk and drainage planning policy
Section 4 Assesses the potential sources of flooding to the development site and presents flood risk mitigation measures based on the findings of the assessment
Section 5 Presents an illustrative foul water drainage scheme
Section 6 Presents an illustrative surface water drainage scheme
Section 7 Presents a summary of key findings and the recommendations

1.3 Relevant Documents

1.4 Relevant Documents

The assessment has been informed by the following documents:

- Calder Catchment Strategic Flood Risk Assessment (SFRA), Volume I, Kirklees Council, Calderdale Metropolitan Borough Council and Wakefield Council, April 2016
- Calder Catchment Strategic Flood Risk Assessment (SFRA), Volume II, Kirklees Council, July 2016
- Consultation Response from Kirklees Council Lead Local Flood Authority, ref: 2020/20447, 5 December 2020

2 SITE DETAILS AND PROPOSED DEVELOPMENT

2.1 Site Location

The approximately 6.26 hectare (ha) greenfield site is located to the south of Lindley Moor Road, Lindley, Huddersfield at Ordnance Survey National Grid Reference SE 109 190, as shown in **Figure 1**. The site is bounded by Crosland Road to the west, Weatherhill Road to the east and residential dwellings and open fields to the south.

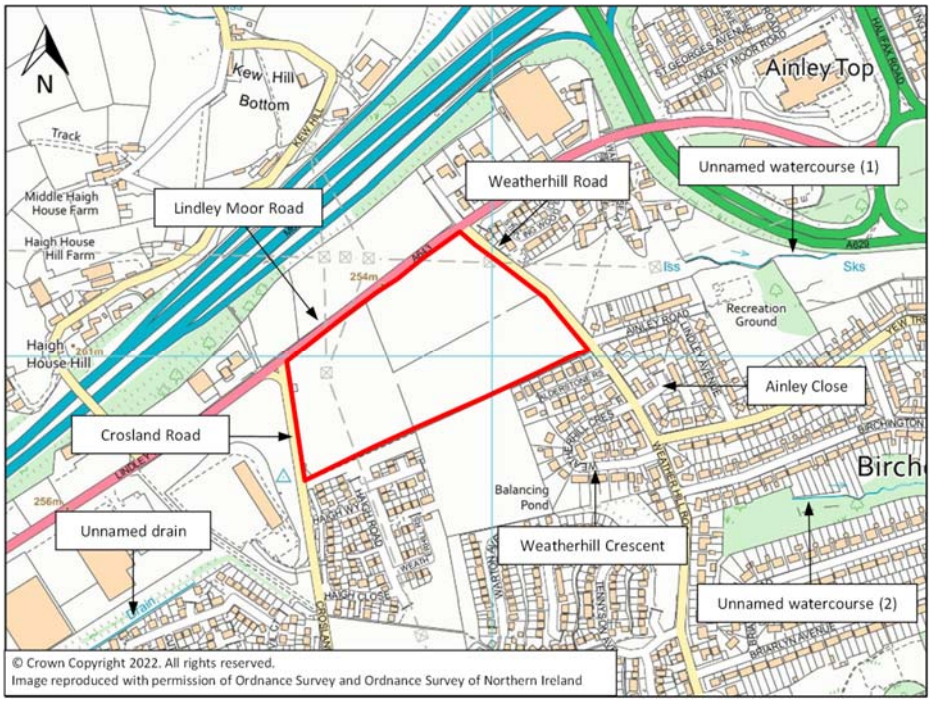


Figure 1: Site Location

2.2 Proposed Development

The development proposals entail the construction of 15 units accommodating a fast-food outlet, supermarket, restaurant, café/takeaways and a number of industrial and storage/distribution warehouses with associated access via Lindley Moor Road and areas of landscaping (**Appendix A**).

The detailed element of the planning application is for the proposed access road and Unit P, with the outline element being for Units A – N.

The PPG classifies food and general industry development as Less Vulnerable to flood risk.

2.3 Waterbodies in the Vicinity of the Site

An unnamed watercourse (referred to as Unnamed Watercourse (1) for the purposes of this report) emerges approximately 190 m to the east of the site and flows in an easterly direction.

An unnamed watercourse (Unnamed Watercourse (2)) emerges approximately 380 m to the south-east of the site and flows in an easterly direction.

An unnamed drain is located approximately 195 m to the south-west of the site.

An unnamed stone culvert (Unnamed Watercourse (3)) was reported by Haigh Huddleston & Associates (**Appendix B**) and was encountered at the eastern boundary of the site and appears to discharge to Unnamed Watercourse (1).

The above watercourses are classed as ordinary watercourses. Lead local flood authorities, district councils and internal drainage boards carry out flood risk management work on ordinary watercourses.

2.4 Ground Conditions

According to the Soilscapes soils dataset produced by the Cranfield Soil and AgriFood Institute[1], soil conditions at the site and within the surrounding area are freely draining loamy soils.

British Geological Survey mapping of surface geology[2] indicates the underlying bedrock formation comprises Sandstone (80 Yard Rock) within the northern portion and Pennine Lower Coal Measures Formation (mudstone, siltstone and sandstone) within the southern portion. No superficial deposits are recorded at the site.

According to the MAGIC website[3] the underlying Sandstone and Pennine Lower Coal Measures Formation bedrock are classified as Secondary A aquifers. 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 by Martin Walsh Architectural and is provided in **Appendix C**. LiDAR data has been used to develop a digital terrain model of the site and surrounding area as illustrated in **Figure 2**.

Ground levels are highest towards the western boundary and lowest to the east of the site with site gradients falling away from the high point in a northerly/easterly/southerly direction. Ground levels across the site range between 236.0 metres Above Ordnance Datum (m AOD) to 265.5 m AOD.

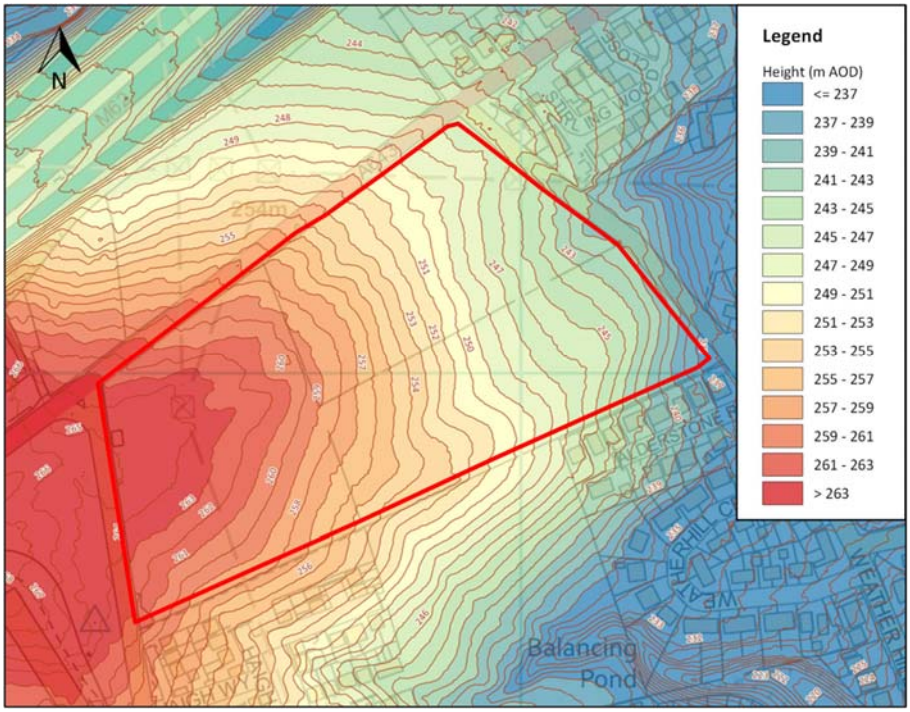


Figure 2: Digital Terrain Model from LiDAR Data

1 www.landis.org.uk/soilscapes/
2 http://mapapps.bgs.ac.uk/geologyofbritain/home.html
3 https://magic.defra.gov.uk/MagicMap.aspx

3 PLANNING POLICY AND GUIDANCE

3.1 National Planning Policy and Policy Guidance

The thrust of national planning policy, as articulated in the NPPF is that inappropriate development in areas at risk of flooding should be avoided where possible, as summarised below:

- Inappropriate development in areas at risk of flooding should be avoided and that development should be directed away from areas at highest risk (whether existing or future), but where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere (NPPF para. 159).
- The policy of seeking to steer development to areas with the lowest risk of flooding, from any source, is implemented through the application of the flood risk sequential test. Development should not be allocated or permitted if there are reasonably available sites, appropriate for the proposed development in areas with a lower risk of flooding. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding (NPPF para. 162).
- If it is not possible for 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 test will depend on the potential vulnerability of the site and of the vulnerability of the development proposed (as set out in Annex 3 of NPPF; also PPG Table 2 and Table 3) (NPPF para. 163). For example, the exception test need not be applied for less vulnerable development in any flood zone, or for more vulnerable development in flood zones 1 or 2.
- Where the exception test must be applied, application of the test for development proposals at the application stage should be informed by a site-specific flood risk assessment. For the 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; (b) and 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 (NPPF para. 164). Both elements of the test should be satisfied for the development to be permitted (NPPF para. 165).
- Development should not increase flood risk elsewhere (NPPF para. 167).
- Where appropriate, planning applications should be supported by a site-specific flood risk assessment, and development should only be allowed in areas at risk of flooding where the flood risk assessment (and the sequential and exception tests, as required), demonstrate that: a) within the site, the most vulnerable development is located in areas of lowest flood risk (unless there are overriding reasons to prefer a different location); b) the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment; c) the development incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate; d) any residual (flood) risk can be safely managed; and e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan (NPPF para.167).
- NPPF para. 167 references Footnote 55. The footnote states that a site-specific flood risk assessment should be provided for all development in flood zones 2 and 3 [whilst] in flood zone 1, an assessment should accompany all proposals involving: sites of 1 ha or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use (NPPF para. 167).
- Applications for some minor development and changes of use should not be subject to the sequential or exception tests (NPPF para. 168). The exceptions are stated in Footnote 56.
- Major development should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems should: a) take account of advice from the lead local flood authority; b) have appropriate proposed minimum operational standards; c) have maintenance

arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and d) where possible, provide multifunctional benefits (NPPF para. 169).

Guidance on application of the sequential and exception test is provided in the PPG. For example:

- This general approach is designed to ensure that areas at little or no risk of flooding from any source are developed in preference to areas at higher risk. The aim should be to keep development out of medium and high flood risk areas (flood zones 2 and 3) and other areas affected by other sources of flooding where possible (PPG para. 18).
- Where there are no reasonably available sites in flood zone 1, local planning authorities in their decision making should take into account the flood risk vulnerability of land uses and consider reasonably available sites in flood zone 2 (areas with a medium probability of river or sea flooding), applying the Exception Test if required. Only where there are no reasonably available sites in flood zones 1 or 2 should the suitability of sites in flood zone 3 (areas with a high probability of river or sea flooding) be considered, taking into account the flood risk vulnerability of land uses and applying the exception test if required. Within each flood zone, surface water and other sources of flooding also need to be taken into account in applying the sequential approach to the location of development (PPG para. 19).
- The sequential test does not need to be applied for individual developments on sites which have been allocated in development plans through the sequential test, or for applications for minor development or change of use (except for a change of use to a caravan, camping or chalet site, or to a mobile home or park home site) (PPG para. 33)
- It should not normally be necessary to apply the sequential test to development proposals in flood zone 1, unless the Strategic Flood Risk Assessment for the area, or other more recent information, indicates there may be flooding issues now or in the future (for example, through the impact of climate change) (PPG para. 33).
- For individual planning applications where there has been no sequential testing of the allocations in the development plan, or where the use of the site being proposed is not in accordance with the development plan, the area to apply the sequential test across will be defined by local circumstances relating to the catchment area for the type of development proposed. For some developments this may be clear, for example, the catchment area for a school. In other cases it may be identified from other Local Plan policies, such as the need for affordable housing within a town centre, or a specific area identified for regeneration. For example, where there are large areas in flood zones 2 and 3 (medium to high probability of flooding) and development is needed in those areas to sustain the existing community, sites outside them are unlikely to provide reasonable alternatives (PPG para. 33).
- When applying the Sequential Test, a pragmatic approach on the availability of alternatives should be taken. For example, in considering planning applications for extensions to existing business premises it might be impractical to suggest that there are more suitable alternative locations for that development elsewhere. For nationally or regionally important infrastructure the area of search to which the Sequential Test could be applied will be wider than the local planning authority boundary.
- Any development proposal should take into account the likelihood of flooding from other sources, as well as from rivers and the sea. The sequential approach to locating development in areas at lower flood risk should be applied to all sources of flooding, including development in an area which has critical drainage problems, as notified to the local planning authority by the Environment Agency, and where the proposed location of the development would increase flood risk elsewhere (PPG para. 33).

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, in part, 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, in part, 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 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:
  - SuDS will be used to assist in achieving the following:
    - Greenfield runoff rates should not be exceeded
    - Brownfield sites should have a minimum 30% reduction in 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 local water quality
    - Consider whether proposed open spaces and green infrastructure within sites can contribute to sustainable drainage of the site
  - Local conditions may require a lower runoff rate to be agreed to reflect volume control, local surface water risks, watercourse capacity and flood risk further downstream
  - There will be a general presumption against pumping surface water. Also demonstrate that the surface water management solution is designed for the lifetime of the development including maintenance arrangements
  - Accommodate flow paths by ensuring paths are designed to avoid buildings and curtilages
  - Development will only be permitted if water supply and waste water infrastructure is available or can be co-ordinated to meet the demand from the new development.

3.3 Legislation Originating from the European Union

The Water Framework Directive (WFD) provides a legal framework for the protection, improvement and sustainable use of inland surface waters, groundwater, transitional waters, and coastal waters across England, and seeks to:

- Prevent deterioration in the status of aquatic ecosystems, protect them and improve the ecological condition of waters
- Achieve at least 'good' status for all waterbodies by 2015
- Promote the sustainable use of water as a natural resource
- Conserve habitats and species that depend directly on water
- Progressively reduce or phase out the release of individual pollutants or groups of pollutants that present a significant threat to the aquatic environment
- Progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants; and
- Contribute to mitigating the effects of floods and droughts.

The WFD applies to any proposed development which has the potential to impact on a waterbody. Where this is the case, the Environment Agency may require evidence demonstrating that the proposed development does not compromise the aims of the WFD.

3.4 Land Drainage Consent

Land drainage consent may be required from the lead local flood authority (LLFA) or drainage board for work to an ordinary watercourse.

Undertaking activities controlled by local byelaws also requires the relevant consent.

4 REVIEW OF FLOOD RISK

4.1 Historical Records of Flooding

The Environment Agency Recorded Flood Outlines map[4] (not shown) and the SFRA do not hold any records of historic flooding within the vicinity of the site.

However, Kirklees Council has advised by way of a pre-application consultation response letter (ref: 2020/20447; 5 December 2020) that it holds several records of surface water flooding incidents within the vicinity of the site including on Lindley Moor Road adjacent to the site due to blocked gullies, on Weatherhill Road to the east of the site, and to the rear gardens on Ainley Close and Weatherhill Crescent to the south/south-east of the site.

4.2 Flood Zone Designation

The Environment Agency Flood Map for Planning (Rivers and Sea) [5] (Error! Reference source not found.) indicates the site to be located in flood zone 1. Table 1 of the PPG defines flood zones in the vicinity of the site as follows[6]:

- Flood zone 1: Low Probability. Land having a less than 1 in 1,000 annual probability of river or sea flooding
- Flood zone 2: Medium Probability. Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding
- Flood zone 3a: High Probability. Land having a 1 in 100 or greater annual probability of river flooding or a 1 in 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.

Figure 3: Flood Map for Planning
Source: gov.uk website; Accessed: February 2022

[4] https://environment.data.gov.uk/DefraDataDownload/?mapService=EA/RecordedFloodOutlines&Mode=spatial
[5] https://flood-map-for-planning.service.gov.uk/
[6] https://www.gov.uk/guidance/flood-risk-and-coastal-change#flood-zone-and-flood-risk-tables

The eastern portion of the site is located approximately 15 m and 33 m above Unnamed Watercourses (1) and (2) respectively, with the western portion of the site located approximately 5 m above the unnamed drain. On this basis, and given that the site is located within flood zone 1 on the Flood Map for Planning, the site is assessed not to be at risk of flooding from fluvial sources.

4.3 Flood Risk from Surface Water

The Flood Risk from Surface Water map (**Figure 4**) indicates that the site is at 'Very Low' risk of flooding from surface water.

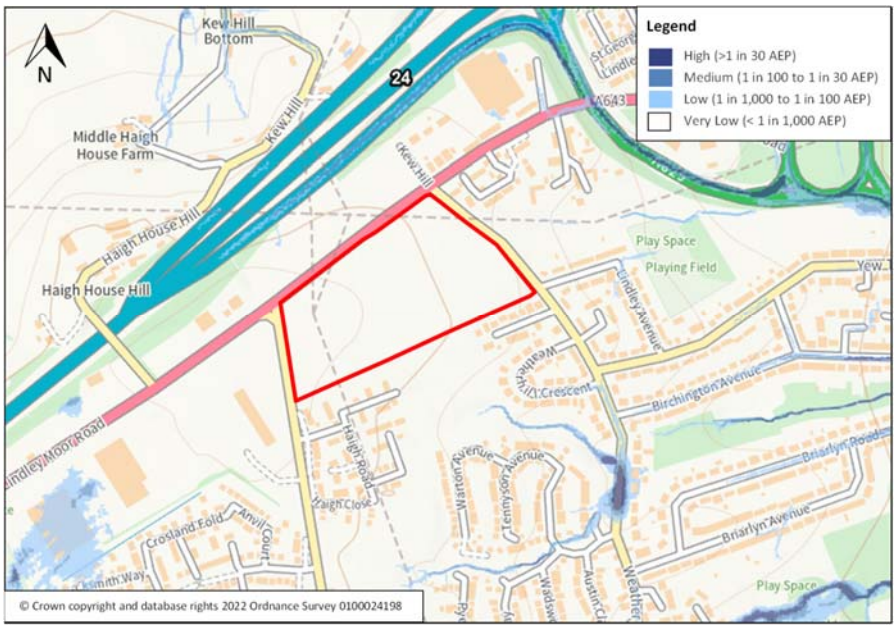


Figure 4: Flood Risk from Surface Water
Source: gov.uk website; Accessed: February 2022

Notwithstanding this, given the historic flooding issues reported by the lead local flood authority outlined in **Section 4.1**, 2D direct rainfall-runoff hydraulic modelling has been undertaken by Weetwood for the 1 in 100 AEP and 1 in 100 AEP event plus climate change events to determine the overland flow routes of surface water and to inform the drainage proposals so that the development proposals will not increase off-site flood risk.

The model outputs are presented in **Appendix D**. The outputs indicate the following:

- The majority of surface water runoff from the site flows in an easterly direction towards Unnamed Watercourse (1)
- Runoff adjacent to the south-eastern boundary of the site flows in a southerly direction along Weatherhill Road away from the site boundary.
- Runoff from the south-west corner of the site flows in a south-easterly direction, following the natural topography of the land to a localised valley that bisects Weatherhill Crescent and Warton Avenue.

No accumulation of surface water on the site is indicated. This is due to the sloping terrain and absence of localised depression.

4.4 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.

4.5 Flood Risk from Groundwater

The JBA Groundwater Flood Risk Indicator map (**Figure 5**) indicates that the site is at 'Negligible' and 'Very Low' risk of flooding from groundwater during a 1 in 100 AEP groundwater flooding event.

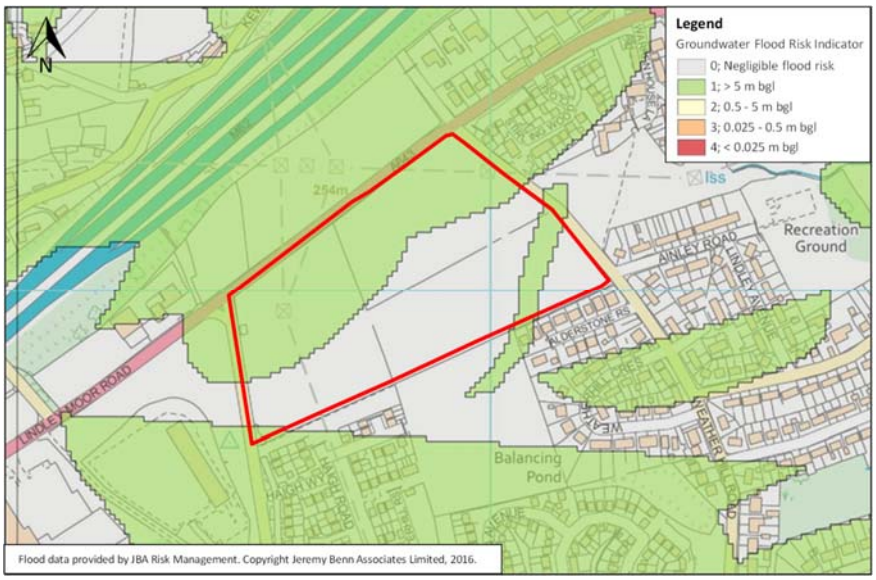


Figure 5: JBA Groundwater Flood Risk Indicator Map
Source: Blue Sky Maps; Accessed: February 2022

4.6 Sequential Test and Exception Test

The site is assessed as being at very low risk of flooding from all known sources. As such, the proposals satisfy the requirements of the sequential test and the exception test need not be applied. Nevertheless, the proposals are still required to meet the requirements for site specific flood risk assessments.

4.7 Flood Risk Mitigation Measures

The risk of flooding to the proposed development is assessed to be very low from all known sources. As such, no specific mitigation measures are required. However, finished floor levels of buildings should be set at a minimum of 0.15 m above adjacent ground levels following reprofiling of the site.

This will, subject to the implementation of an appropriately designed surface water drainage scheme (**Section 6**), enable any potential overland flows to be conveyed safely across the site without affecting property in accordance with the approach promoted by government policy[7].

[7] 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

5 FOUL WATER MANAGEMENT

5.1 Existing Assets

Yorkshire Water public sewer records (**Appendix E**) indicate that there are no wastewater assets location on site. The following wastewater assets are present within the surrounding area:

- A 225 mm diameter public combined sewer is located adjacent to the south-eastern corner of the site in Weatherhill Road and flows in a southerly direction
- A 150 mm diameter public foul water sewer is located approximately 75 m to the east of the site and flows in an easterly direction
- A 150 mm diameter Section 104 foul water sewer is located in Stirling Wood Close and flows into the aforementioned sewer.

5.2 Foul Water Loadings

The anticipated domestic foul flows from the site have been calculated in accordance with British Flows and Loads. The expected total peak flow rate from the development would be 3.9 l/s.

Any commercial food preparation waste will need to pass through suitable traps to capture fats, grease and oils prior to discharge into the proposed foul water system.

5.3 New Connections

Yorkshire Water has advised, by way of a pre-planning sewerage enquiry response (**Appendix F**), that there is existing capacity in the local foul sewerage network to receive and treat domestic foul water from the proposed development and that foul water can discharge without restriction into the 225 mm diameter combined sewer in Weatherhill Road at a point to the south-east of the site.

6 SURFACE WATER MANAGEMENT

6.1 Existing Assets

Yorkshire Water public sewer records (**Appendix E**) indicate that a 150 mm diameter public surface water sewer is located approximately 75 m to the east of the site. The sewer flows from Stirling Wood Close and outfalls into the unnamed watercourse (1).

6.2 Surface Water Drainage at the Existing Site

The site is undeveloped greenfield. Given the sloping nature of the site and ground conditions, surface water runoff would be expected to slowly infiltrate where conditions allow and flow overland in a direction determined by topography, with the majority of the site flowing in an easterly direction.

The greenfield surface water runoff rates for the site, calculated using the ICP SUDS method within MicroDrainage are presented in **Table 1**. Details of the input parameters and the output results are provided in **Appendix G**.

Table 1: Greenfield Runoff Rate

AEP of Rainfall Event	Greenfield Runoff Rate (l/s/ha)	Greenfield Runoff Rate for 6.26 ha Site (l/s)
1 in 1	2.9	18.2
QBAR	3.4	21.3
1 in 30	6.0	37.6
1 in 100	7.1	44.4

6.3 Surface Water Drainage at the Developed Site

6.3.1 Disposal of Surface Water

In accordance with PPG para. 056, 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.

Kirklees Council has advised by way of a pre-application consultation response letter (ref: 2020/20447; 5 December 2020) that the disposal of surface water via infiltration is not viable due to the following reasons:

- Perched water tables within the immediate vicinity of the site
- Reports of flooding in the locality due to rapid runoff and a fast-responding catchment; and
- The site has a 1 in 10 gradient in the eastern portion.

It is subsequently proposed to direct all runoff from the developed site to the Unnamed Watercourse (3) to the eastern boundary of the site, ultimately discharging into Unnamed Watercourse (1). An alternative option is to discharge to Unnamed Watercourse (1) via a connection to the downstream manhole chamber MH2103 located in the field to the east, subject to Yorkshire Water approval.

6.3.2 Peak Flow Control

Kirklees Council LLFA has advised by way of a Planning Consultation Response (ref: 2022/91477, 30 September 2022) that the allowable discharge rate is set to 10.5 l/s. Yorkshire Water has advised (**Appendix H**) that they are satisfied with a proposed discharge rate of 10.5 l/s, subject to a Section 98 or Section 185 agreement.

6.3.3 Volume Control

Where reasonably practicable, for sites which have been previously developed, the runoff volume from the proposed development to any highway drain, sewer or surface water body in the 1 in 100 AEP, 6 hour rainfall event 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.

As outlined within the CIRIA SuDS Manual 2015 extra runoff volumes in extreme events may be managed by releasing all runoff (above the 1 in 1 AEP event) from the site at a maximum rate of 2 l/s/ha or QBAR, whichever is the higher value.

It is proposed to restrict peak discharge rates to 10.5 l/s in up to the 1 in 100 AEP event, including an allowance for climate change, which is approximately 50% less than the QBAR rate for the whole site.

6.3.4 Attenuation Storage

Attenuation storage will be provided to store surface water runoff generated across roofs and hardstanding.

The attenuation storage facilities for the detailed planning extents (access road and Unit P) and the outline planning extents (Units A – N) have been modelled using the Network (**Appendix I**) and Source Control (**Appendix J**) modules of MicroDrainage respectively.

The required storage volumes have been sized to store the 1 in 100 AEP rainfall event including a 30% increase in rainfall intensity to allow for climate change in accordance with local guidance[8].

A preliminary surface water drainage layout is provided in **Appendix K** and a contributing areas plan is provided in **Appendix L**.

Access Road and Unit P (Detailed Planning Application)

Assuming a peak discharge rate of 10.5 l/s, a total storage volume of 2,695.0 m^3 would be required. It should be noted that the storage volume also allows for a nominal discharge rate of 2.5 l/s from specific units within the outline planning extent.

The storage volume serving the access road and Unit P could be accommodated within two pre-cast concrete tanks (1,191.5 m^2 x 1.9 m deep, 2,263.9 m^3 capacity and 350.0 m^2 x 1.5 m deep, 525.0 m^3 capacity) and the proposed pipe and manhole network.

Units A – N (Outline Planning Application)

Assuming a peak discharge rate of 2.5 l/s, the following storage volumes would be required:

- Unit A: 105.0 m^3, utilising a concrete storage tank (105.0 m^2 x 1.0 m deep, 105.0 m^3 capacity)
- Unit C: 425.0 m^3, utilising a concrete storage tank (425.0 m^2 x 1.0 m deep, 425.0 m^3 capacity)
- Unit D-E: 375.0 m^3, utilising a concrete storage tank (375.0 m^2 x 1.0 m deep, 375.0 m^3 capacity)
- Unit F: 450.0 m^3, utilising a concrete storage tank (450.0 m^2 x 1.0 m deep, 450.0 m^3 capacity)
- Unit G: 500.0 m^3, utilising a concrete storage tank (500.0 m^2 x 1.0 m deep, 500.0 m^3 capacity)
- Unit H-N: 800.0 m^3, utilising a concrete storage tank (800.0 m^2 x 1.0 m deep, 800.0 m^3 capacity)

It should be noted that the calculations for the outline planning extents 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.

6.3.5 Exceedance Routes

Flows resulting from rainfall in excess of the 1 in 100 AEP rainfall event including an allowance for climate change will be managed in exceedance routes, as illustrated in **Appendix K**. It is assumed that as the development proposals progress, the design of the site would ensure flood flows are directed towards

[8] Kirklees Council (LLFA) consultation response, 22 February 2023

carriageways, with the site being profiled to ensure that flood flows are directed away from built development.

The introduction of a bund along the southern boundary will ensure any overland flow is intercepted, preventing runoff from the site discharging towards the residential developments to the south.

6.3.6 Pollution Control

Table 26.2 of the CIRIA SuDS Manual and Table G3.1 of the Statutory Standards for SuDS identifies highly frequented lorry approaches to industrial estates, commercial yard and delivery areas, and commercial/industrial roofs as having a high to medium to low pollution hazard level.

Table 26.2 of the CIRIA SuDS Manual 2015 indicates that the pollution hazard indices for total suspended solids, hydrocarbons and metals are 0.80, 0.80 and 0.90, and 0.70, 0.60 and 0.70, and 0.3, 0.2 and 0.05 for highly frequented lorry approaches to industrial estates, commercial yard and delivery areas, and commercial/industrial roofs respectively.

Vegetated filter strips can remove coarse sediments and enables pollutants to be easily seen and trapped early in the treatment train. Table 26.3 of the CIRIA SuDS Manual 2015 indicates that the SuDS mitigation indices for filter strips for total suspended solids, hydrocarbons and metals are 0.40, 0.40 and 0.50 respectively.

Table 26.3 of the CIRIA SuDS Manual indicates that the SuDS mitigation indices for permeable paving for total suspended solids, hydrocarbons and metals are 0.70, 0.60 and 0.70 respectively. As such, the proposed surface water drainage system provides adequate water quality treatment.

The use of catchpit manholes, silt traps in gullies/channel drains and the use of Class 1 bypass separators within each unit will help prevent contaminants discharging into the downstream receptor.

The potential for additional SuDS features to be utilised at the site would be investigated further at the detailed design stage.

6.3.7 Adoption and Maintenance of SuDS

The pipe network, including the attenuation basin, designed in accordance with the Design and Construction Guidance[9], may be adopted by the sewerage undertaker.

Pipe networks and SuDS elements within the curtilage of individual units 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: Maintenance Requirements

Schedule	Required action	Frequency
Permeable Paving		
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.

[9] Design and Construction Guidance for foul and surface water sewers offered for adoption under the Code for adoption agreements for water and sewerage companies operating wholly or mainly in England ("the Code"), Approved Version 2.0, 10 March 2020

Schedule	Required action	Frequency
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosphate 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	
Concrete storage tank		
Regular maintenance	Inspect and identify any areas that are not operating correctly	Monthly for 3 months, then annually
	Remove debris from the catchment surface	Monthly
	Remove sediment from internal forebays	Annually, or as required
Remedial action	Repair inlets/outlets	As required
Monitoring	Inspect catchpit manholes and note rate of sediment accumulation	Monthly in the first year and then annually
	Inspect inlets/outlets to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years, or as required
Filter strip		
Regular maintenance	Remove sediments, litter, surface debris and weeds	Monthly or as required
	Mow amenity grass access paths and verges surrounding the filter strips at 35-60 mm minimum and 75 mm maximum	
	Mow filter strips at 100 mm with 150 mm maximum to filter and control runoff, removing first and last cut in season, and if grass is longer than 150 mm removing cuttings to wildlife piles on site	
Occasional maintenance	Where there is a build-up of silt on the filter strip, i.e. 50 mm or more above the design level, then remove and spread on site	As required
	Undertake when ground is damp in autumn or early spring and transplant turf and overseed to original design levels	
	Spread excavated material on site above SuDS design profile, e.g. top of banks	
Remedial actions	Remove and replace filter material and vegetation above	As required
Flow Control Unit		
Routine maintenance	Remove litter and debris and inspect for sediment accumulation	Six Monthly
	Remove sediment from sump	As necessary – Indicated by system inspections

Schedule	Required action	Frequency
Remedial actions	Replace malfunctioning parts or structures	As required
Monitoring	Inspect for evidence of poor operation	Six Monthly
	Inspect flow control unit and establish appropriate replacement frequencies	Six Monthly
	Inspect sediment accumulation rates and establish appropriate removal frequencies	Monthly during first year of operation, then every six months

7 SUMMARY AND RECOMMENDATIONS

This report has been prepared on behalf of 2SH Developments and relates to the proposed development of land off Lindley Moor Road, Lindley for mixed-uses.

According to the Flood Map for Planning the proposed development is located outside the 1 in 1,000 AEP flood outline and is therefore defined by the NPPF as being situated within flood zone 1.

The site is assessed as not being at risk of flooding from fluvial sources, surface water, reservoirs, canals or other artificial sources and at a very low risk of flooding from groundwater. As such, the proposals satisfy the requirements of the sequential test and the exception test need not be applied.

This report has demonstrated that the proposed development may be completed in accordance with the requirements of planning policy subject to the following:

- Finished floor levels to be set 150 mm above adjacent ground levels
- The detailed drainage design to be submitted to and approved by the local planning authority prior to the commencement of development.

The proposals are not expected to impact flood risk elsewhere.

Yorkshire Water has advised that there is existing capacity in the local foul sewerage network to receive and treat the additional foul flows from the proposed development.

Surface water will discharge to a watercourse located to the east of the site via a public surface water sewer and will be restricted to 10.5 l/s. Attenuation storage will be provided across the site within concrete tanks. Surface water runoff from the developed site can therefore be sustainably managed in accordance with planning policy.

APPENDIX A

Proposed Layout (Partly Illustrative)

N

LINDLEY MOOR ROAD

WEATHERHILL ROAD

WEATHERHILL VIEW

HAIGH ROAD

Castleroyd Road

sUb

Drain

2m footpath formed

new dry stone wall to match existing

road widened to form new access

indicative cycle shelters

3m wide PROW

2.4m high Paladin fence

10No. cycle shelter

Tarmac Carpark and access

2m high acoustic fence

Concrete service yard

new drystone wall relocated to allow an aditional 1.5m to the PRoW

A

C

D

Da

E

F

G

H

I

J

K

L

M

N

P

Area Schedule

		Supermarket		Restaurant		Trade Counter		Warehouse		Office		Industrial			
2020 Cla...		E (a)		E (b)		B8		B8		E (g)		B2			
		sq/m	sq/ft	sq/m	sq/ft	sq/m	sq/ft	sq/m	sq/ft	sq/m	sq/ft	sq/m	sq/ft	Total sq/m	Total sq/ft
A	Outline											525	5651	525	5651
C	Outline			908	9774									908	9774
D	Outline					260	2799							260	2799
Da	Outline					330	3552							330	3552
E	Outline					525	5650							525	5650
F	Outline							2330	25079	242	2605			2572	27684
G	Outline							2615	28147	192	2066			2807	30213
H	Outline							314	3379			157	1689	471	5068
I	Outline							314	3379			157	1689	471	5068
J	Outline							314	3379			157	1689	471	5068
K	Outline							314	3379			157	1689	471	5068
L	Outline							314	3379			157	1689	471	5068
M	Outline							614	6609			232	2498	846	9107
N	Outline							307	3304			614	6609	921	9913
P	Detailed							910	9795	1019	10968	2840	30569	4769	51332
Total				908	9774	1115	12001	8346	89829	1453	15639	4996	53772	16,818	181,015

Proposed Site Plan
1 : 500

Rev	Description	Drawn	Checked	Date
P12	Updated to show revised road layout, cycle parking and PROW accessed to North East boundary	MR		00-02-24
P11	Updated for traffic islands, Unit B and 3m footpath as requested by KMC	MR		27-11-23
P10	Change in traffic island to suit highway department	MR		18-10-23
P9	Change in road radius	MR		26-09-23
P8	Updated to show playground rank and adjacent levels	MR		25-09-23
P7	Updated to show Haigh Road, Weatherhill View	MR		25-09-23
P6	Trade counter BB update	MR		25-09-23
P5	Various updates including roundabout omission	MR		24-08-23
P4	Revised to show change in plots D and E	MR	JW	15-06-23
P3	Revised to show change in unit D and E	MR	JW	07-04-23
P2	Issued for Planning	MR	JW	27-04-22
P1	Revised Plots levels added	JW	MJR	07.24.22

Document Status: **S2**
Purpose of Issue: **FOR PLANNING**

MARTIN WALSH ARCHITECTURAL
Firth Buildings, 99 - 103 Leeds Rd, Dewsbury, WF12 7BU t: 01924 464342
e: info@martinwalsh.co.uk w: www.martinwalsh.co.uk

Project: Proposed Development at Lindley Moor Road, Lindley

Huddersfield

Title: Proposed Site Plan

Client: 2SH Developments

MWA Project	Scale	Original Paper Size	Paper Orientation	Drawn
6194	1 : 500	@A0	LAND	MJR

File Identifier

Project	Originator	Volume	Level	Type	Role	Number	Revision
LMSH -	MWA -	01 -	XX -	DR -	A -	0008	P12

APPENDIX B

Site Investigation Extract

Haigh Huddleston & Associates
Civil & Structural Engineering Consultants
Firth Buildings, 99 - 101 Leeds Road, Dewsbury, WF12 7BU
t 01924 464342 f 01924 450862 e martin@haighhuddleston.co.uk

Phase 2
Geo-environmental Report

ON

PROPOSED BUSINESS PARK

AT

LINDLEY MOOR ROAD, HUDDERSFIELD

FOR

2SH Developments Ltd

APRIL 2022

E21/7768/R002

Haigh Huddleston Associates is the trading name of Haigh Huddleston Associates Limited
Registered Office: Firth Buildings, 99-101 Leeds Road, Dewsbury, WF12 7BU
Registered in England Number 6458196

INDEX

0.0 EXECUTIVE SUMMARY

SITE

The site consists of three grassed fields located to the south of Lindley Moor Road. The western and eastern boundaries are formed by Crosland Road and Weather Hill Road respectively. To the south there is an ongoing residential development.
The fields are delineated by intermittent mature hedges and trees.
There are two metal pylons located on the site. The first is located in the north west of the site and has overhead cables heading to the north and the south east. The second is located in the east of the site and has overhead cables heading to the west and east
At the time of the site investigation works, due to the adverse weather conditions, the ground conditions were noted to be very soft which proved difficult for the heavier plant to navigate.
The site generally falls from the north west to the south east.

HISTORY

There has been no significant development of the site since 1854. From 1854-1955 a Roman Road was indicated in the north west of the site and from 1854-1892 two wells were indicated in the north east of the site.
There has been residential development to the south east of the site from 1948, and to the south west from 2021.

GEOLOGY

The central and south eastern area of the site is shown to be underlain by the Pennine Lower Coal Measures consisting of Mudstone, Siltstone and Sandstone. The north eastern, north western and south eastern corners of the site are underlain by the Elland Flags, 80 Yard Rock and 48 Yard respectively, all consisting of Sandstone.
The trial pits generally proved topsoils overlying clays with a mudstone or sandstone bedrock encountered at 1.2-2.2m below existing ground levels.
The boreholes undertaken proved alternating bands of mudstone, siltstone and sandstone to a depth of 30m. Four of the rotary boreholes recorded a 0.1-0.8m thick unworked coal seam at the base of the black shale at depths of 9.4-27.7m below existing ground levels.

MINING/QUARRYING

The previous archaeological investigation identified a possible quarry adjacent the southern boundary of the site. This was not confirmed during the site investigation.
In TP07 in the south east of the site, a 0.1m thick coal seam was recorded in the clay strata at 0.8-0.9m below existing ground levels. In TP09 adjacent the eastern boundary, a 0.2m thick weathered coal seam and a 0.3m thick very

weak coal seam were encountered at 0.4-0.6 and 2.1-2.4m below existing ground levels. This is likely to be a single seam that split as it outcropped.
In only WS13 in the east of the site a 1.0m thick seam of coal was encountered at 1.0-2.0m below existing ground levels. This is potentially an exaggerated seam thickness from an upturn in the coal seam as it outcrops.
Four of the rotary boreholes recorded a 0.1-0.8m thick unworked coal seam at depths of 9.4-27.7m below existing ground levels. The coal was shallowest adjacent the recorded outcrops crossing the site.
None of the seams encountered showed evidence of being worked. However, due to the shallow nature of the coal adjacent the recorded outcrops, it is considered possible that the coal may have been worked and extracted from the surface through the use of bellpits. It is therefore recommended that a site scrape is undertaken during development to allow a visual inspection of the underlying natural strata to determine the presence of any features

HYDROLOGY

The nearest open surface water feature to the site is an un-named watercourse located 166m east of the site.
During the investigation works, a shallow sandstone culvert was encountered that exits the site through the eastern boundary and appears to discharge towards this open watercourse.

HYDROGEOLOGY

The bedrock underlying the site is classified as a Secondary (A) aquifer.
Groundwater seepage was noted in TP02, TP03, TP06, TP07, TP08 and TP09 at depths of 1.4-2.6m below existing ground levels. TP06 was left open for several hours and the groundwater level rose to within 1.3m of the surface level. Water strikes were recorded in eight of the fourteen boreholes at depths of 1.6-9.0m below ground level.
During the gas monitoring, water levels have been recorded between the surface and 2.70m below ground level.

HAZARDOUS GAS

The development is not in an area requiring radon protection measures.
A maximum carbon dioxide concentration of 4.8% was recorded in R15. No methane has been detected in any of the monitoring stations during the monitoring.
Based on the maximum concentrations and gas flow rates measured to date, the gas regime found on this site can be classified as CS1 by BS 8485:2015

CONTAMINATION

No elevated levels of contaminants were identified in the samples taken from site when compared to the tier 1 trigger levels for commercial land use.

REMEDIATION	Topsoil to be stripped and stockpiled behind protective fencing to prevent cross contamination during development. Watching brief to be undertaken during site strip for evidence of mining features, historical wells in north east of site and anecdotal quarry adjacent southern boundary. Exact location of fault line to be determined by further trial trenching following site strip prior to construction. Possible trace survey of existing land drainage to be undertaken to determine if any diversion works are required to accommodate the proposed development. Any features encountered to be surveyed and reported to all any necessary remediation strategies to be agreed.
FOUNDATIONS	that the commercial units should be constructed on strip/trench fill and pad footings founded entirely onto the mudstone/sandstone strata with ground bearing floor slabs. Due to the steep nature of the site, it is likely that re-levelling works will be required to accommodate the proposed commercial units and parking areas. Consideration may need to be given to piled foundations dependent on the depth to suitable founding material from final proposed finished floor levels.
.	Where shallow coal is encountered within the foundation excavations, the foundations should be extended beneath the coal strata to underlying mudstone/sandstone. The exposed coal face should be sealed off to prevent combustion.
DRAINAGE	Infiltration methods have proved unsuitable for use on site. A discharge rate has been previously agreed with the Local Water Authority and the LLFA through the planning application.

8.0 RESULTS OF THE INVESTIGATION

8.1 GEOTECHNICAL INVESTIGATION

8.1.1 A copy of the trial pit, window sample and borehole logs providing a complete record of strata encountered beneath the proposed development is presented in Appendix B.

8.1.2 The fieldwork generally proved a moderate depth of clays with a mudstone or sandstone bedrock.

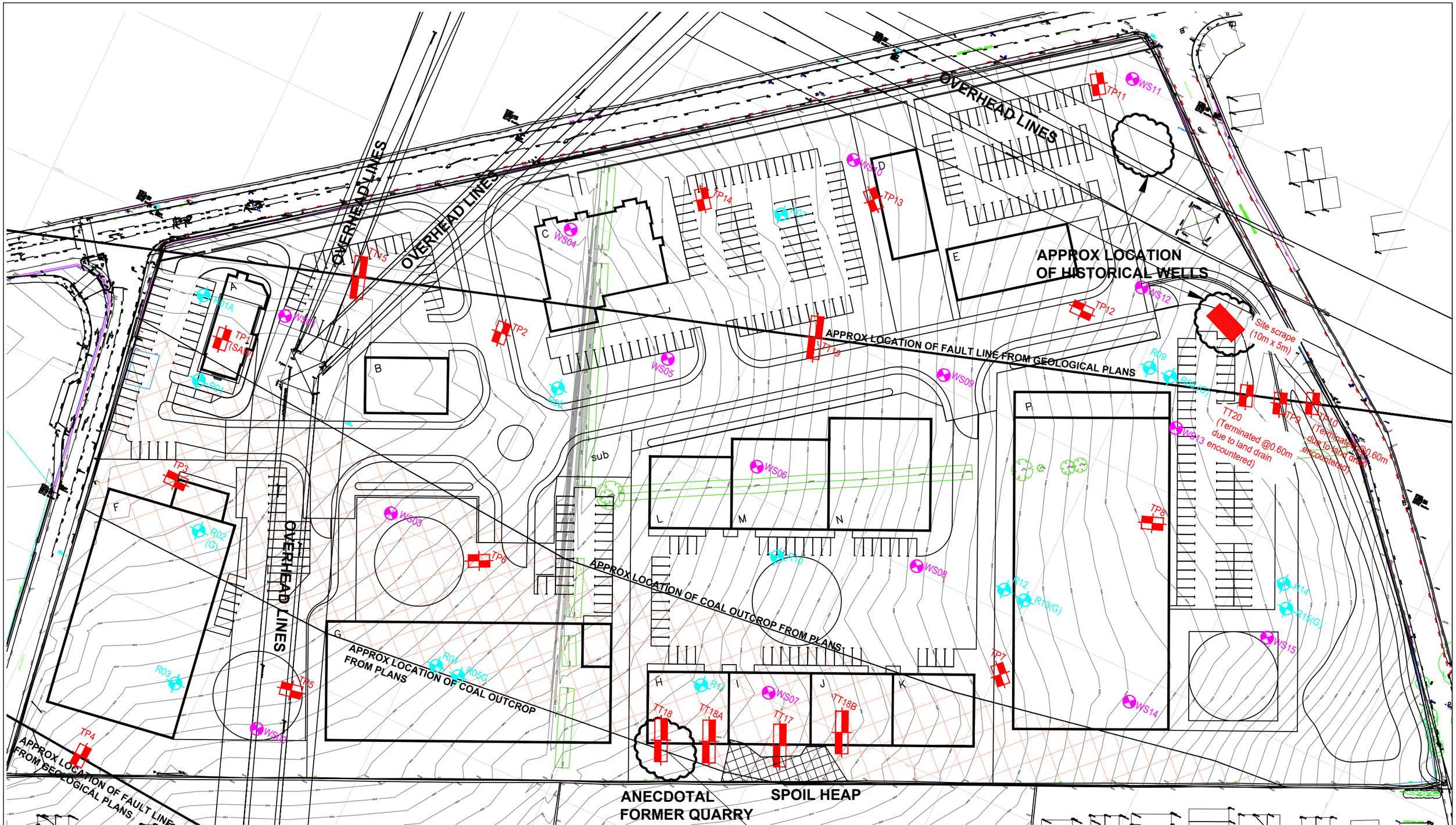
8.1.3 The surface of all the trial pits proved rough grass over 0.2-0.4m of dark brown/grey topsoil.

8.1.4 Underlying the topsoil in all but TP13, there was layer of orange/grey clay with occasional sandstone gravels and cobbles. This varied in thickness from 0.2-1.9m across the site, and was identified as weathered sandstone in TP2. TP10 was undertaken in a depression noted on the eastern boundary and stopped at the base of the topsoil as a shallow stone culvert with water flow was encountered in the clay strata. The culvert was noted to flow eastwards where it left the site.

8.1.5 In TP07 in the south east of the site, a 0.1m thick coal seam was recorded in the clay strata at 0.8-0.9m below existing ground levels. In TP09 adjacent the eastern boundary, a 0.2m thick weathered coal seam and a 0.3m thick very weak coal seam were encountered at 0.4-0.6 and 2.1-2.4m below existing ground levels. This is likely to be a single seam that split as it outcropped.

8.1.6 Beneath the topsoil in TP13, and beneath the clay in TP11, TP12 and TP14 there was a 0.2-1.0m thick layer of weak mudstone excavated as shaley gravels. All four of these trial pits were in the north east of the site.

8.1.7 Beneath the clay in TP02, TP03, TP05, TP07 and TP13 there was a 0.5-1.1m thick layer of weathered light brown sandstone excavated as gravels and cobbles. This was encountered at 0.4-1.3m below existing ground levels. TP05, TP07 and TP13 terminated in this strata at depths of 1.2-1.8m below existing ground levels where the sandstone became hard to excavate.



TRIAL TRENCH LOCATION

TRIAL PIT LOCATION

BOREHOLE LOCATION

WINDOW SAMPLE LOCATION

Rev B Updated to suit site investigation works	11.02.22 JF
Rev A Updated to suit revised planning layout	17.12.21 MD

Haigh Huddleston & Associates

Civil Structural Engineering Consultants

Firth Buildings, 99 - 101 Leeds Rd, Dewsbury, WF12 7BU t 01924 464342 f 01924 450662

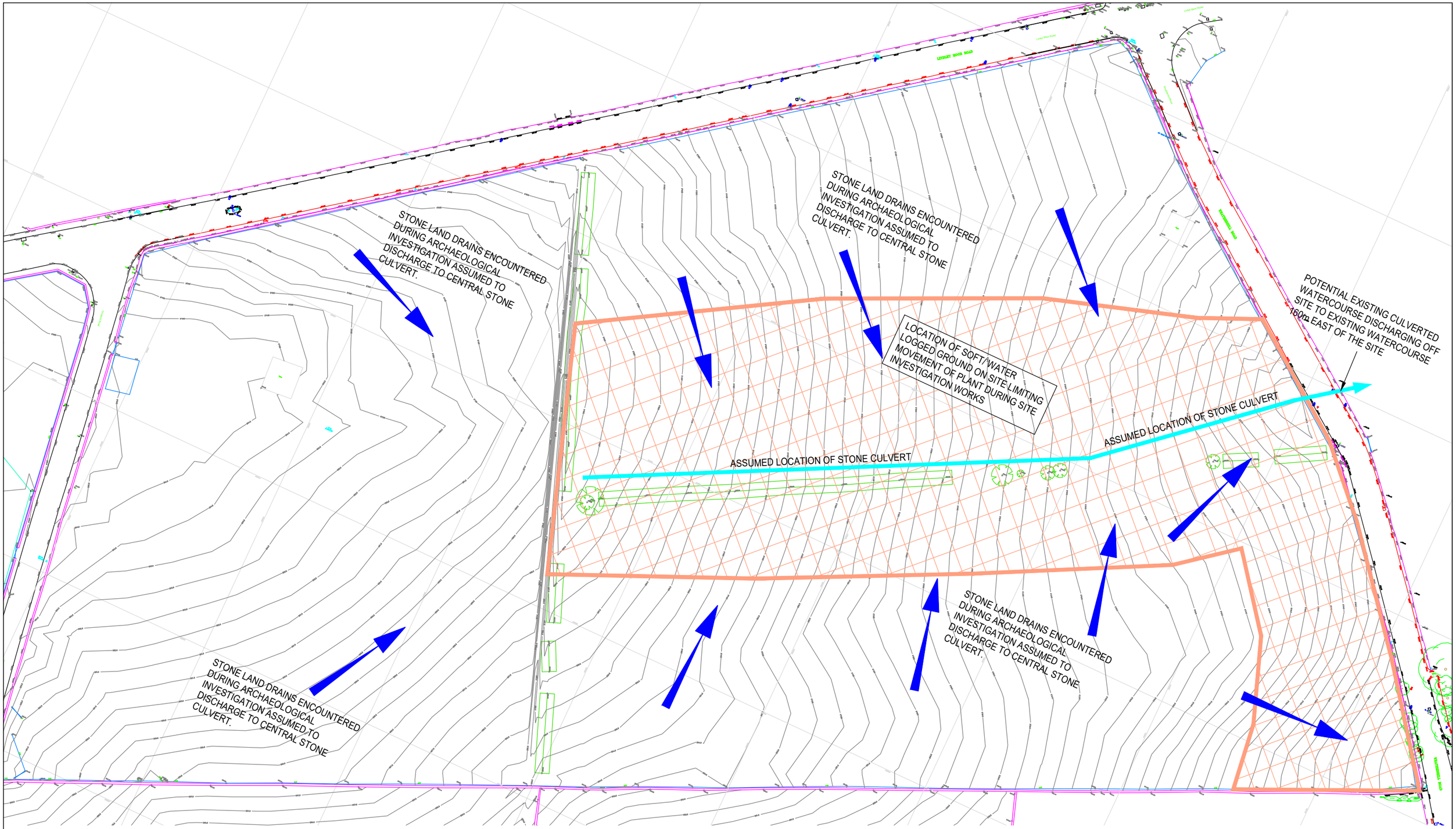
e martin@haighhuddleston.co.uk

Client: 2SH Developments Ltd

Project: Lindley Moor Road, Huddersfield

Detail: Site Investigation Plan

Scale	Dwn	Chkd	Date	Dwg No.
1:1000	MD		Sep'21	E20/7768/03B



KEY:

DIRECTION OF FLOW OF GROUND WATER

LOCATION OF SOFT/ WATER LOGGED GROUND ON SITE LIMITING MOVEMENT OF PLANT DURING SITE INVESTIGATION WORKS

Haigh Huddleston & Associates

Civil Structural Engineering Consultants

Firth Buildings, 99 - 101 Leeds Rd, Dewsbury, WF12 7BU t 01924 464342 f 01924 450662

e martin@haighhuddleston.co.uk

Client	2SH Developments Ltd
Project	Lindley Moor Road, Huddersfield
Detail	GROUND WATER MOVEMENT PLAN

Scale	Dwn	Chkd	Date	Dwg No.
1:1000	JF		Apr'22	E20/7768/200

TRIAL HOLE NO. 10

Haigh Huddleston & Associates
Civil & Structural Engineering Consultants
Firth Buildings, 99 -101 Leeds Road, Dewsbury, WF12 7BU
t 01924 464342 f 01924 450662 e martin@haighhuddleston.co.uk

Client :	**MWA**	**Job No :**	**7768**
Site :	**LINDLEY**	**Date :**	**9 FEBRUARY 2022**

0.0		
	0.4	Rough grass over dark brown topsoil.
0.5	**0.5**	Strong light brown angular sandstone boulders. Land drain encountered.
1.0		Depth to base of land drain = 0.6m.
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation	NO
Sample taken	NO
Sides of excavation remained stable	YES
Level	……..

NOTES:

……

……

APPENDIX C

Topographic Survey

A	Survey Checks, Elec Pylon + Cable positions, adjacent propoerty hts and new junction layout.	HSL		08.04.20
Rev	Description	Drawn	Checked	Date

Document Status :
S0

Purpose of Issue:
FOR INFORMATION

MARTIN WALSH
ARCHITECTURAL

Firth Buildings, 99 - 103 Leeds Rd, Dewsbury, WF12 7BU t: 01924 464342
e: info@martinwalsh.co.uk w: www.martinwalsh.co.uk

Project
Feasibility Schemes at Lindley Moor Road, Lindley Huddersfield

Title
Existing Site Survey

Client
Michael Steel & Co. c/o Scott Hall

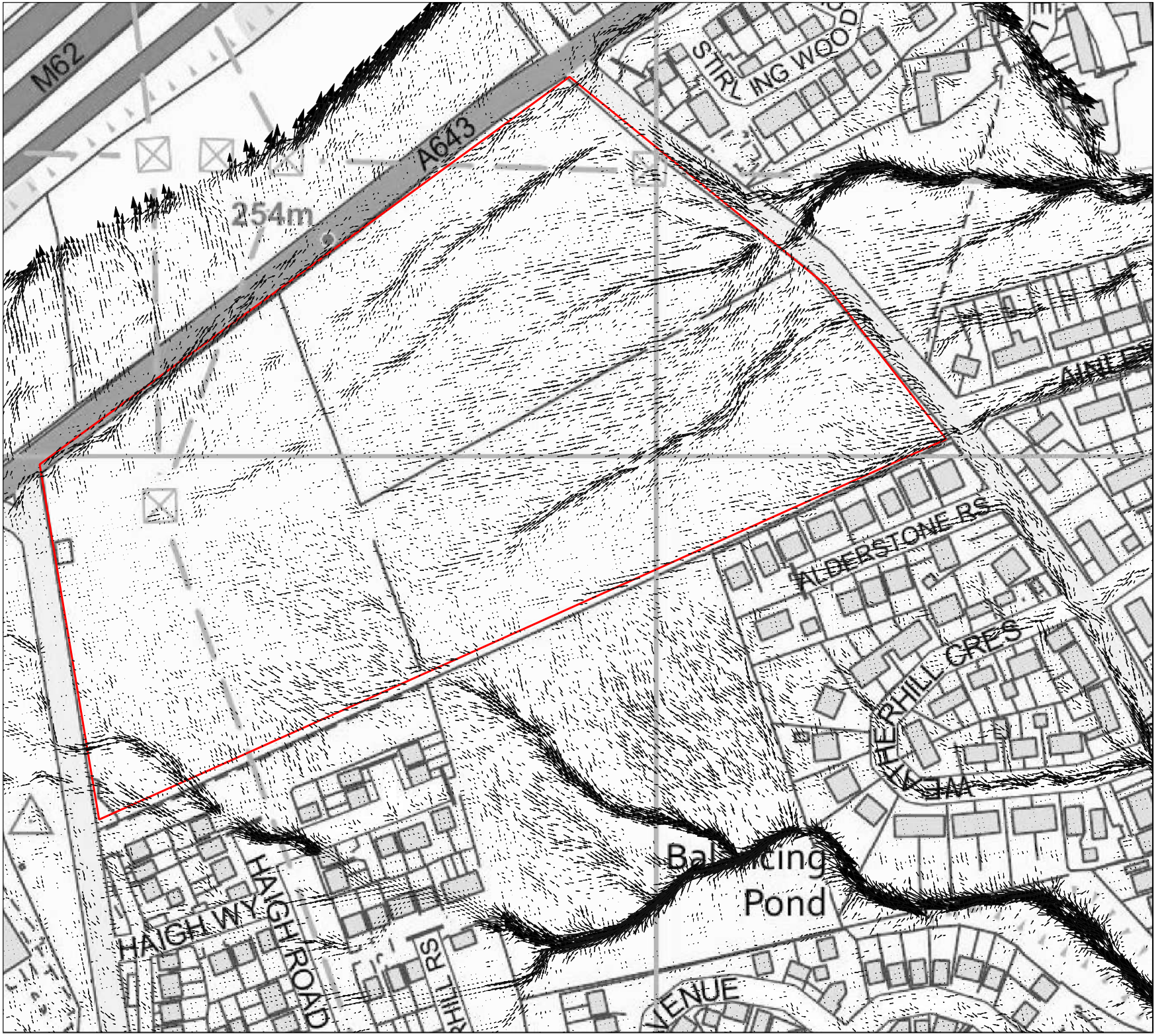
MWA Project Ref	Scale	Original Paper Size	Paper Orientation	Drawn	Checked
6194	1:500	@A1	Landscape	ABC	ABC

File Identifier

Project		Originator		Volume		Level		Type		Role		Number	Revision
SHLM	-	**MWA**	-	**01**	-	**GF**	-	**DR**	-	**A**	-	**0001**	**P1**

APPENDIX D

2D Direct Rainfall Modelling Outputs



Notes:

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Legend

Flow Direction

Weetwood
Development • Planning • Environment
Suite C22
Joseph's Well
Hanover Walk
Leeds
LS3 1AB
T: 0113 244 1377
E: info@weetwood.net
W: www.weetwood.net

Client: **2SH Developments**

Project Title: **Land Off Lindley Moor Road, Lindley, Huddersfield**

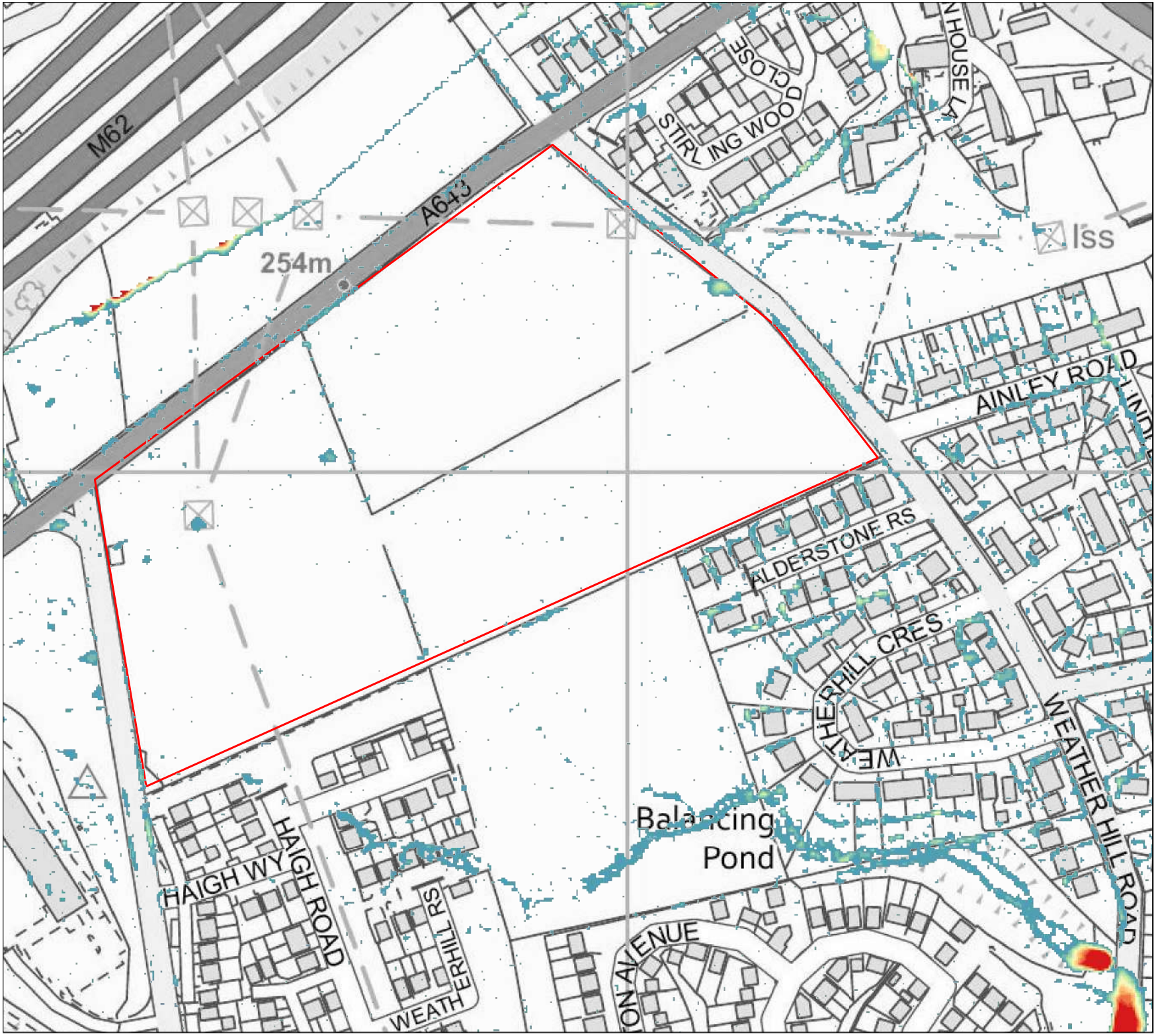
Drawing Title: **Baseline Scenario - Flow Pathways**
1 in 100 plus climate change (40%) AEP

Map Orientation:

Scale: 0 10 20 30 40 m

Drawn:	Checked:	Date:
MN	KB	28 February 2022

Project No:	Drawing No:	Rev:
5474	5474_001_100CC40_vDir	A



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Legend

Depth (m)

- <= 0.04
- 0.04 - 0.07
- 0.07 - 0.10
- 0.10 - 0.13
- 0.13 - 0.15
- 0.15 - 0.18
- 0.18 - 0.21
- 0.21 - 0.24
- 0.24 - 0.27
- 0.27 - 0.30
- 0.30 - 0.33
- 0.33 - 0.36
- 0.36 - 0.38
- 0.38 - 0.41
- 0.41 - 0.44
- 0.44 - 0.47
- > 0.47

Weetwood
Development • Planning • Environment
Suite C22
Joseph's Well
Hanover Walk
Leeds
LS3 1AB
T: 0113 244 1377
E: info@weetwood.net
W: www.weetwood.net

Client: **2SH Developments**

Project Title: **Land Off Lindley Moor Road, Lindley, Huddersfield**

Drawing Title: **Baseline Scenario - Runoff Depths 1 in 30 AEP**

Map Orientation:

Scale: 0 10 20 30 40 m

Drawn:	Checked:	Date:
MN	KB	7 March 2022

Project No:	Drawing No:	Rev:
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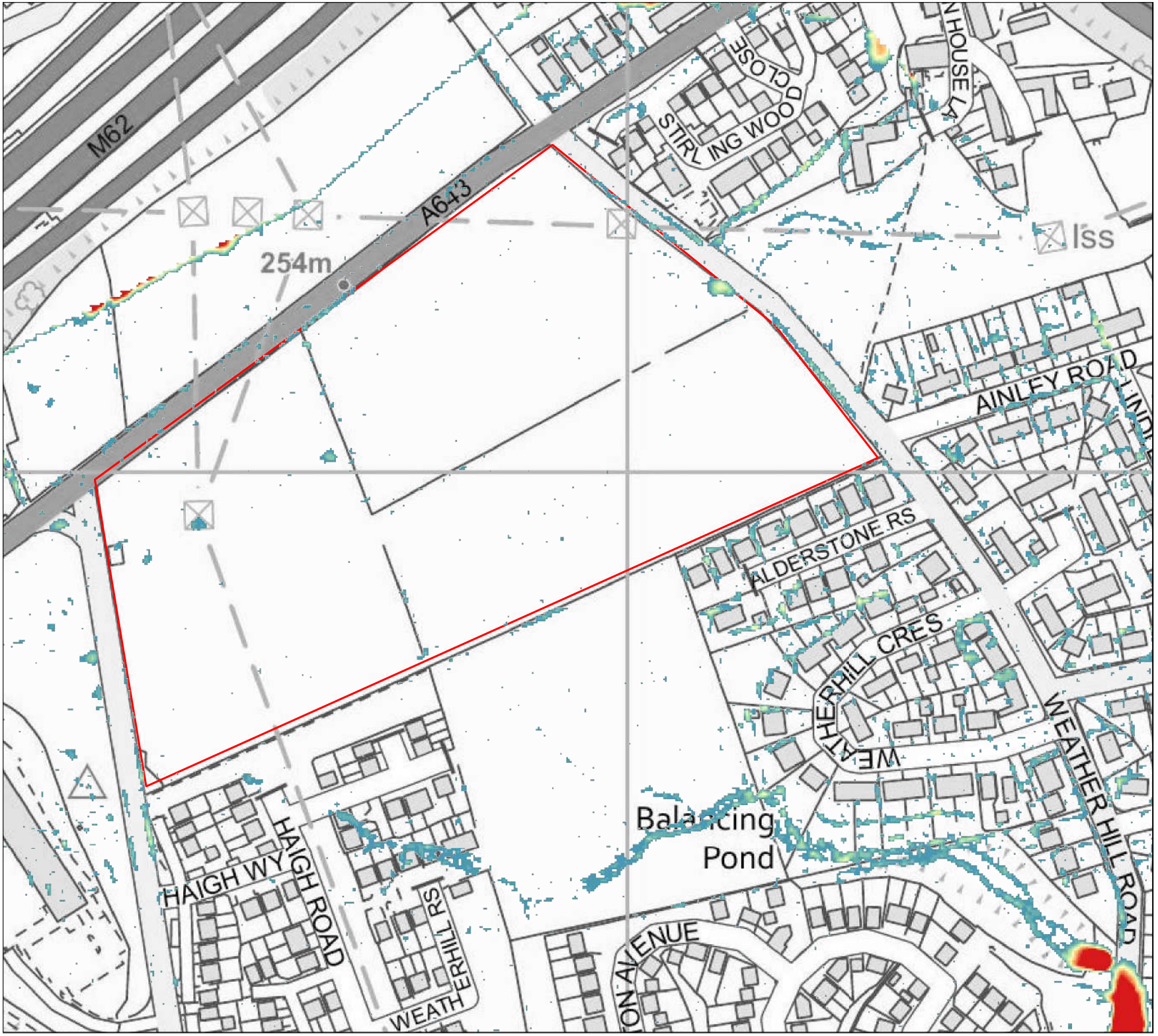

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Depth (m)

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- 0.04 - 0.07
- 0.07 - 0.10
- 0.10 - 0.13
- 0.13 - 0.15
- 0.15 - 0.18
- 0.18 - 0.21
- 0.21 - 0.24
- 0.24 - 0.27
- 0.27 - 0.30
- 0.30 - 0.33
- 0.33 - 0.36
- 0.36 - 0.38
- 0.38 - 0.41
- 0.41 - 0.44
- 0.44 - 0.47
- > 0.47

Weetwood
Development • Planning • Environment
Suite C22
Joseph's Well
Hanover Walk
Leeds
LS3 1AB
T: 0113 244 1377
E: info@weetwood.net
W: www.weetwood.net

Client: **2SH Developments**

Project Title: **Land Off Lindley Moor Road, Lindley, Huddersfield**

Drawing Title: **Baseline Scenario - Runoff Depths 1 in 100 AEP**

Map Orientation:

Scale: 0 10 20 30 40 m

Drawn:	Checked:	Date:
MN	KB	1 March 2022

Project No:	Drawing No:	Rev:
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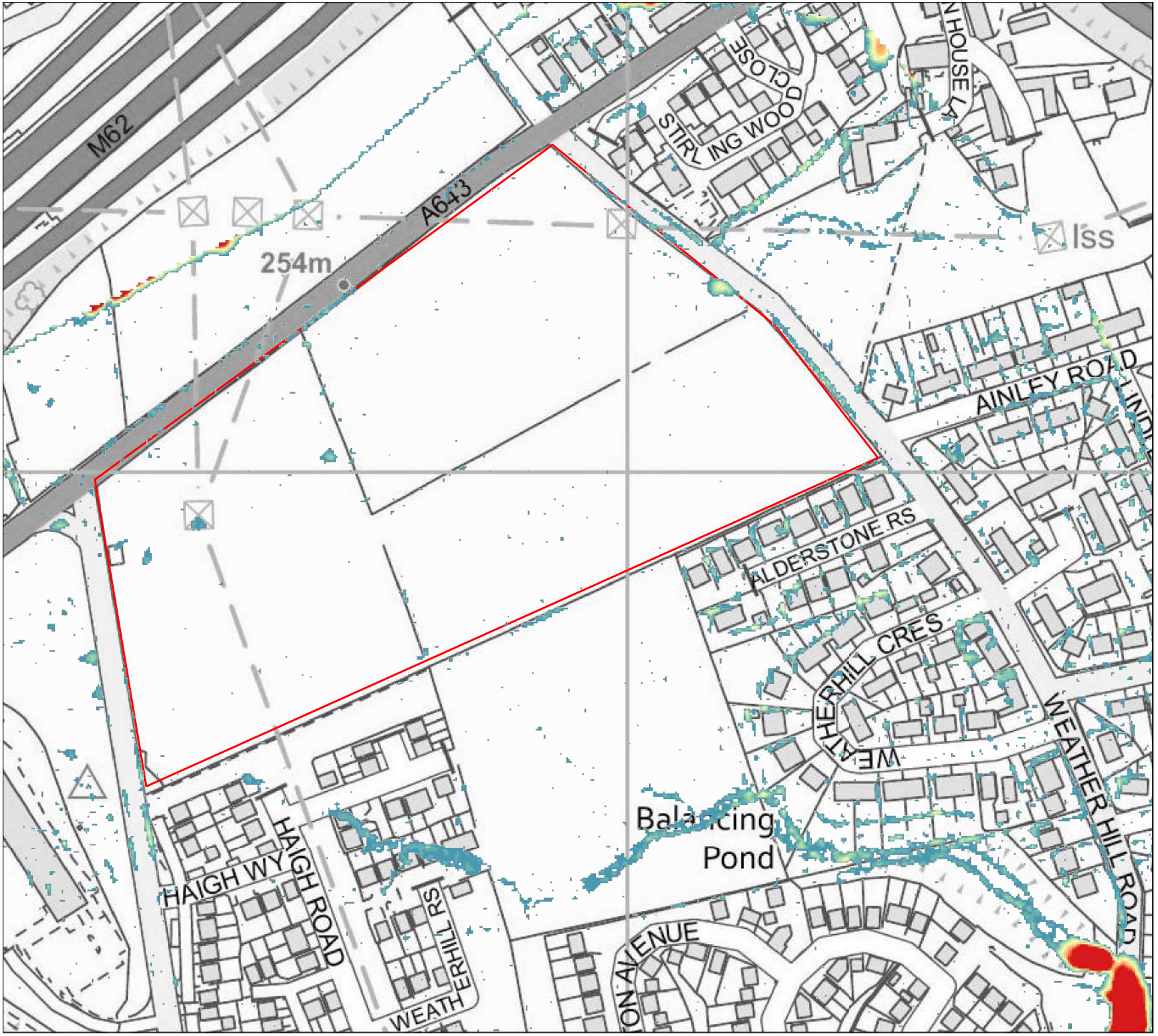

Notes:

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Legend

Depth (m)

- <= 0.04
- 0.04 - 0.07
- 0.07 - 0.10
- 0.10 - 0.13
- 0.13 - 0.15
- 0.15 - 0.18
- 0.18 - 0.21
- 0.21 - 0.24
- 0.24 - 0.27
- 0.27 - 0.30
- 0.30 - 0.33
- 0.33 - 0.36
- 0.36 - 0.38
- 0.38 - 0.41
- 0.41 - 0.44
- 0.44 - 0.47
- > 0.47

Weetwood
Development • Planning • Environment
Suite C22
Joseph's Well
Hanover Walk
Leeds
LS3 1AB
T: 0113 244 1377
E: info@weetwood.net
W: www.weetwood.net

Client: **2SH Developments**

Project Title: **Land Off Lindley Moor Road, Lindley, Huddersfield**

Drawing Title: **Baseline Scenario - Runoff Depths**
1 in 100 plus climate change (40%) AEP

Map Orientation:

Scale: 0 10 20 30 40 m

Drawn:	Checked:	Date:
MN	KB	1 March 2022

Project No:	Drawing No:	Rev:
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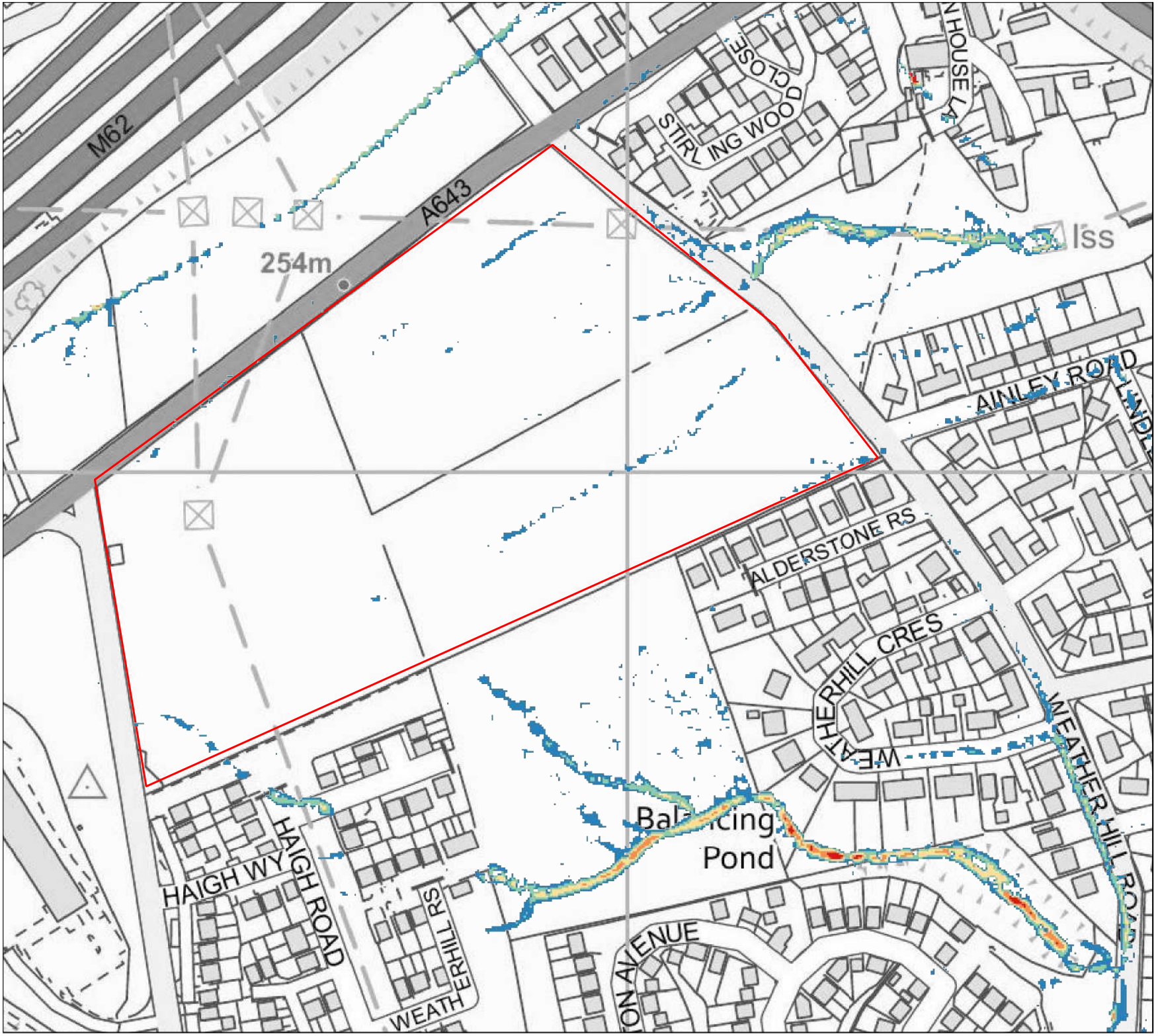

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Legend

Velocity (m/s)

- <= 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- > 0.5

Weetwood
Development • Planning • Environment
Suite C22
Joseph's Well
Hanover Walk
Leeds
LS3 1AB
T: 0113 244 1377
E: info@weetwood.net
W: www.weetwood.net

Client: **2SH Developments**

Project Title: **Land Off Lindley Moor Road, Lindley, Huddersfield**

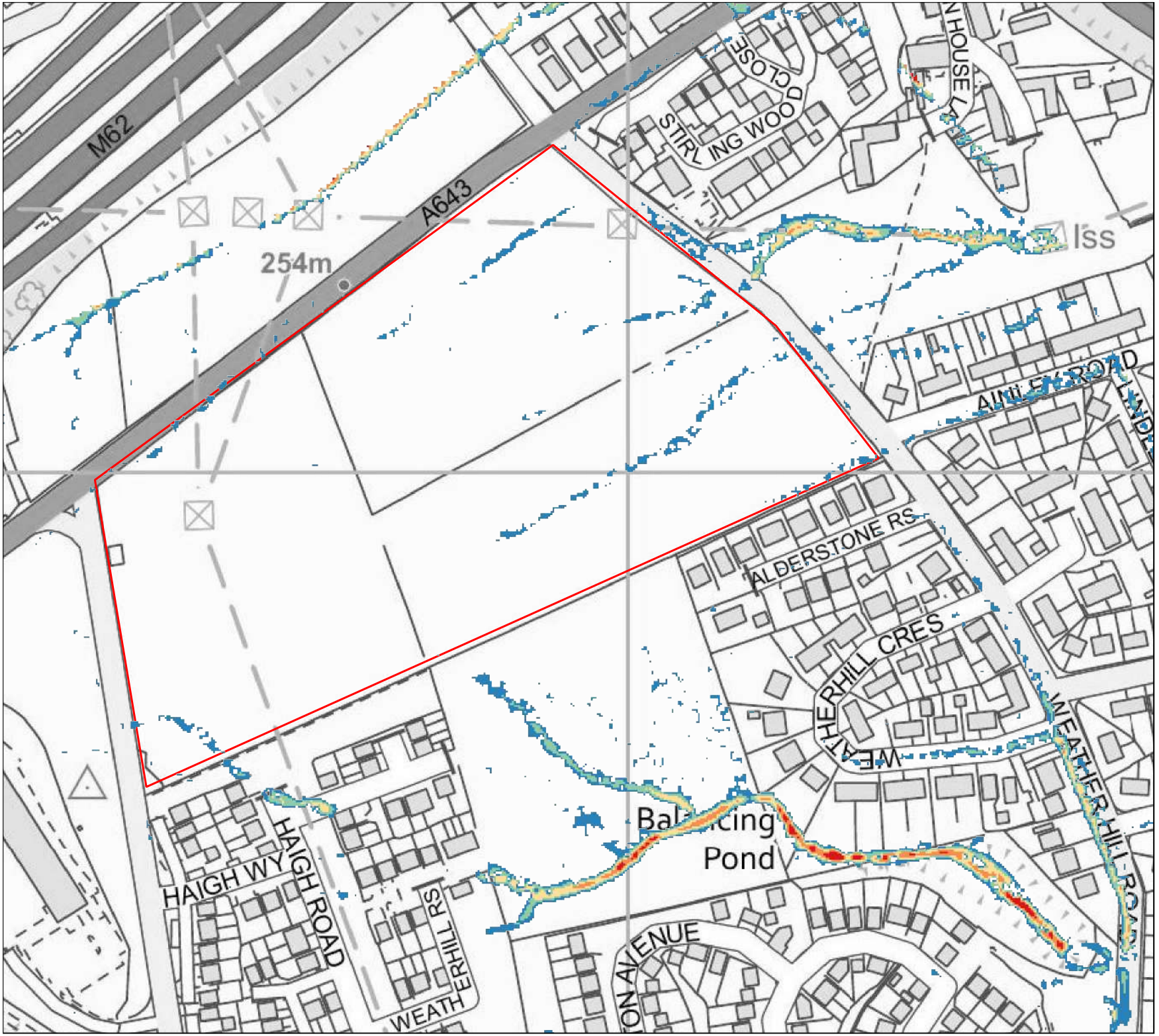
Drawing Title: **Baseline Scenario - Runoff Velocity 1 in 30 AEP**

Map Orientation:

Scale: 0 10 20 30 40 m

Drawn:	Checked:	Date:
MN	KB	07 March 2022

Project No:	Drawing No:	Rev:
5474	5474_001_30yr_v	A



Notes:

1. Do not scale from this drawing.

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Legend

Velocity (m/s)

- <= 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- > 0.5

Weetwood
Development • Planning • Environment
Suite C22
Joseph's Well
Hanover Walk
Leeds
LS3 1AB
T: 0113 244 1377
E: info@weetwood.net
W: www.weetwood.net

Client: **2SH Developments**

Project Title: **Land Off Lindley Moor Road, Lindley, Huddersfield**

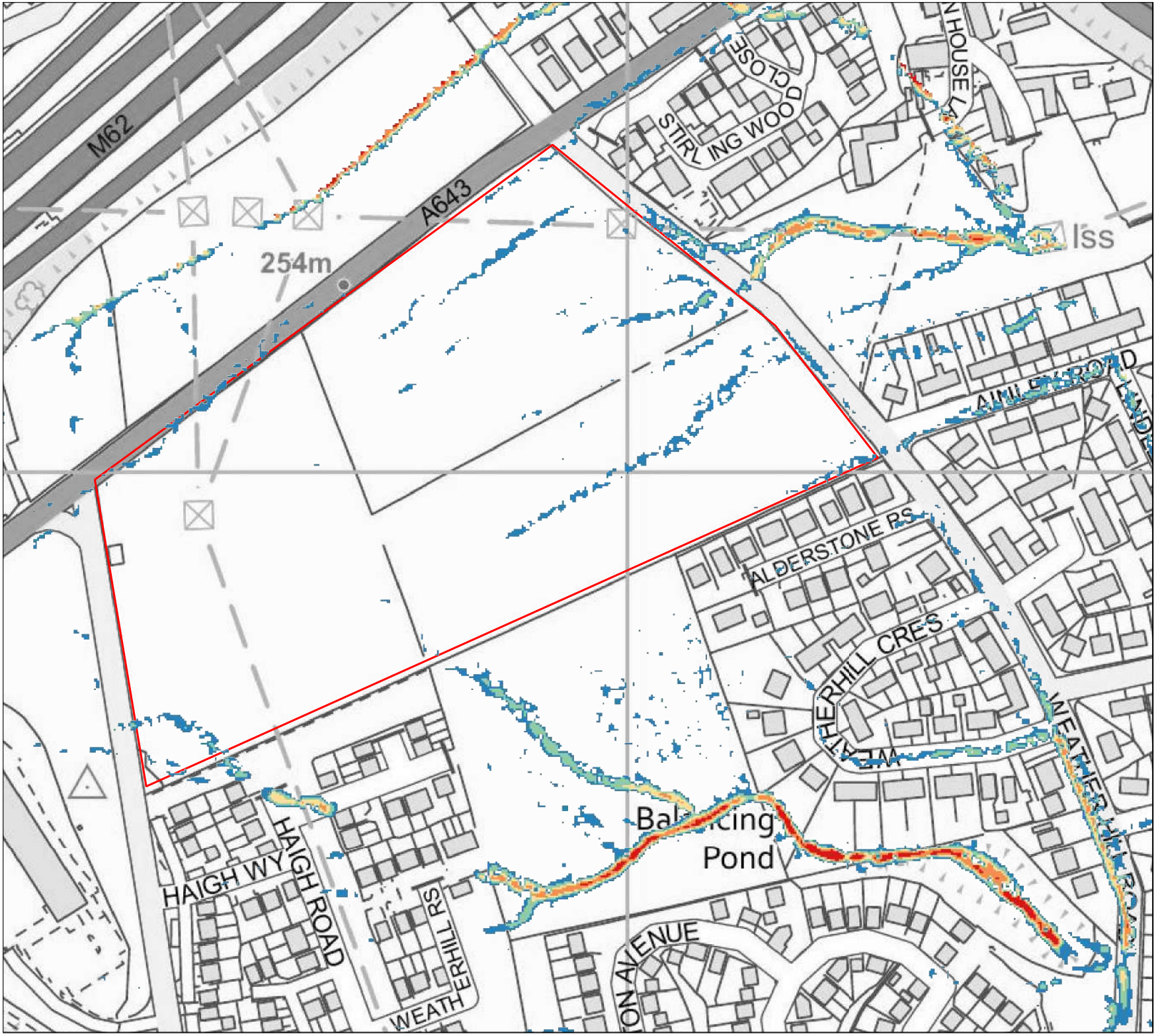
Drawing Title: **Baseline Scenario - Runoff Velocity 1 in 100 AEP**

Map Orientation:

Scale: 0 10 20 30 40 m

Drawn:	Checked:	Date:
MN	KB	07 March 2022

Project No:	Drawing No:	Rev:
5474	5474_001_100_v	A



Notes:

1. Do not scale from this drawing.

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Legend

Velocity (m/s)

- <= 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- > 0.5

Weetwood
Development • Planning • Environment
Suite C22
Joseph's Well
Hanover Walk
Leeds
LS3 1AB
T: 0113 244 1377
E: info@weetwood.net
W: www.weetwood.net

Client: **2SH Developments**

Project Title: **Land Off Lindley Moor Road, Lindley, Huddersfield**

Drawing Title: **Baseline Scenario - Runoff Velocity**
1 in 100 plus climate change (40%) AEP

Map Orientation:

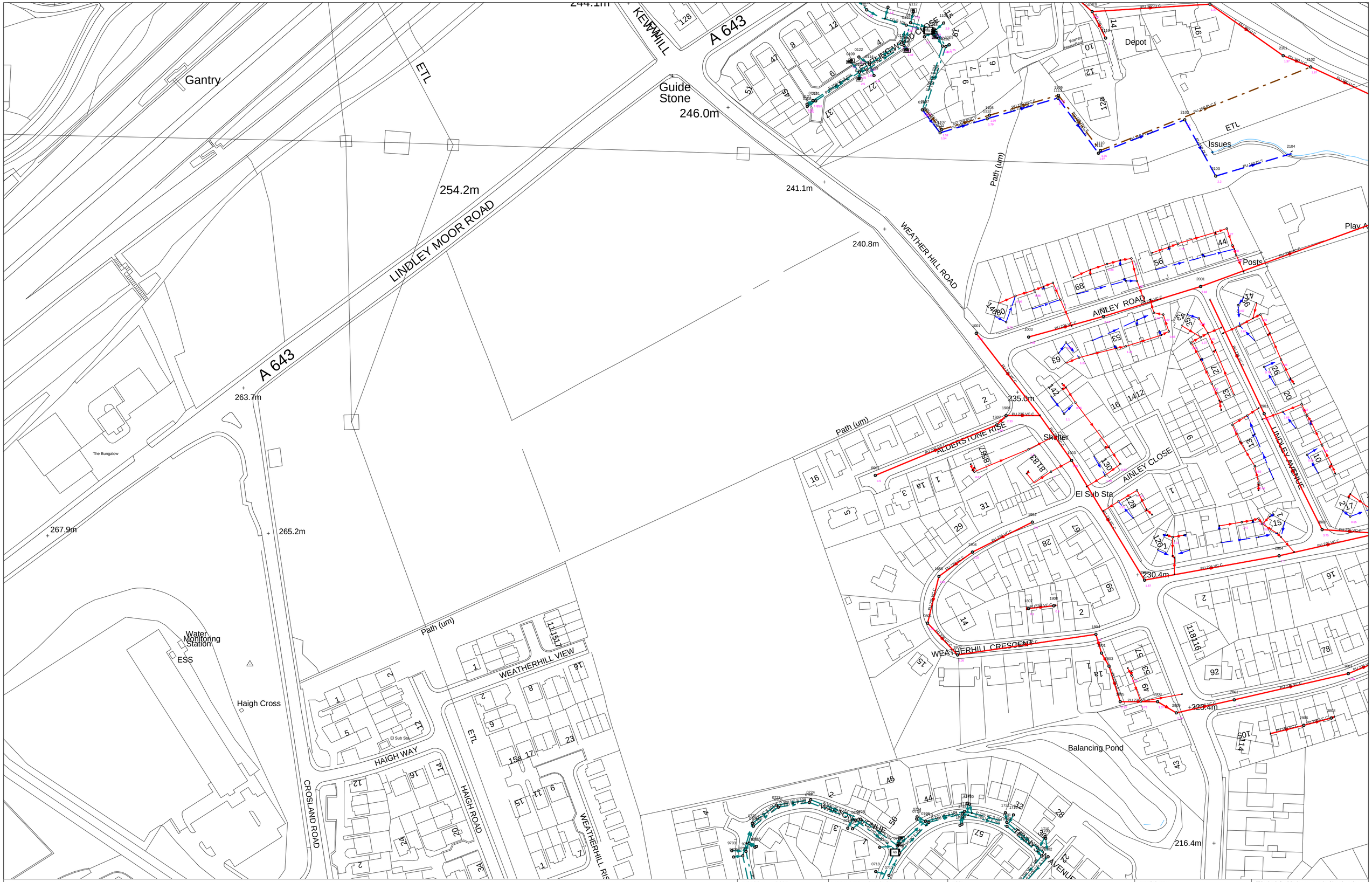
Scale: 0 10 20 30 40 m

Drawn:	Checked:	Date:
MN	KB	07 March 2022

Project No:	Drawing No:	Rev:
5474	5474_001_100CC40_v	A

APPENDIX E

Public Sewer Record



410799 : 418860	Map Name : SE1018NE	Title	Partial Key
YorkshireWater	Yorkshire Water, PO Box 500, Halifax Road, Bradford BD6 2LZ Contact Name : YorMap Advisor C ROBERTS Contact Tel : 87 2582	Notes	Foul Sewer = F Combined Sewer = C Surface Water Sewer = SW Trade Sewer = TD Partially Separate = PS
		(Only) COPYRIGHT STATEMENTS: Reproduced by permission of Ordnance Survey on behalf of HMSO © Crown copyright and database 2014. All rights reserved Ordnance Survey Licence number 100022432	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 : 14/02/2022, 10:10:36
			Date Gen : 14/02/2022, 10:11:03
			Source : Sewer Network Enquiry

UPN: Undefined Originator: C ROBERTS, YorMap, 87 2582

APPENDIX F

Pre-Planning Sewerage Enquiry Response

YorkshireWater

Mr T Brook
Weetwood Services Ltd
22C Josephs Well
Hannover Walk
Leeds
LS3 1AB
tim.brook@weetwood.net

Yorkshire Water Services
Developer Services
Pre-Development Team
PO BOX 52
Bradford
BD3 7AY

Tel: 0345 120 8482
Fax:

Email:
technical.sewerage@yorkshirewater.co.uk

Your Ref:
Our Ref: Y001281

For telephone enquiries ring:
Chris Roberts on 0345 120 8482

14th February 2022

Dear Mr Brook,

Lindley Moor Road, Lindley, Huddersfield, HD3 3TB – Pre-Planning Sewerage Enquiry U541537

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 can discharge to the 225 mm diameter public combined sewer recorded in Weather Hill Road, at a point to the south-east of the site.

Foul water from kitchens and/or food preparation areas of any restaurants and/or canteens etc. must pass through a fat and grease trap of adequate design before any discharge to the public sewer network.

Surface Water

As the proposed site is currently undeveloped no surface water is known to have previously discharged to the public sewer network

As such, the local public sewer network does not have capacity to accept any surface water from the proposed site. If SuDS are not viable, the developer is advised to contact the Environment Agency/local Land Drainage Authority/Internal Drainage Board with a view to establishing a suitable watercourse for discharge.

It is understood that a watercourse is located to the east of the site. This appears to be the obvious place for surface water disposal (if SuDS are not viable).

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.

Surface water run-off from communal parking (greater than 800 sq metres or more than 50 car parking spaces) and hardstanding must pass through an oil, petrol and grit interceptor/separator of adequate design before any discharge to the public sewer network.

Roof water should not pass through the traditional 'stage' or full retention type of interceptor/separator. It is good drainage practice for any interceptor/separator to be located upstream of any on-site balancing, storage or other means of flow attenuation that may be required.

Surface water run-off from areas of vehicular parking and/or hardstanding etc. must pass through an oil, petrol and grit interceptor/separator of adequate design before any discharge to the public sewer network. Roof water should not pass through the traditional 'stage' or full retention type of interceptor/separator.

It is imperative, however that surface water run-off from the forecourt of petrol stations, areas used for the delivery of fuel, areas used for and immediately adjacent to vehicle washing facilities and/or other similar areas where detergent is likely to be used is not discharged to any public surface water sewer network. Surface water from such areas must pass through an oil, petrol and grit interceptor/separator of adequate design before discharge to the public foul or combined sewer network. A trade effluent consent - that may be conditional and, amongst other things, place a restriction on the rate of discharge to public sewer - may be required for such discharges. The developer is advised to contact Yorkshire Water's Industrial Waste Section (telephone 0345 1242424) about any such proposal.

It is good drainage practice for any interceptor/separator to be located upstream of any on-site balancing, storage or other means of flow attenuation that may be required.

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 Code for Adoption under Section 104 of the Water Industry Act 1991.

YorkshireWater

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 Code for Adoption 2021/22, pursuant to an agreement under Section 104 of the Water Industry Act 1991. We are happy to offer pre-development technical advice on any prospective sites that you would like to put forward for for adoption, prior to submission of your adoption application.

An application to enter into a Section 104 agreement must be made in writing prior to any works commencing on site. Please contact our Sewer Adoption, Diversion and Requisition (telephone 0345 120 84 82) or email technical.sewerage@yorkshirewater.co.uk or visit - https://www.yorkshirewater.com/developers/sewerage/sewer-adoptions/ for further information.

Yorkshire Water's Trade Effluent team must be consulted in respect of any proposed trade effluent discharge to the public sewer.

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.

YorkshireWater

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
Development Services Technician

APPENDIX G

Greenfield Runoff Calculations

ICP SUDS Mean Annual Flood

Input

Return Period (years) 1 SAAR (mm) 1200 Urban 0.000
Area (ha) 1.000 Soil 0.300 Region Number Region 3

Results l/s

QBAR Rural 3.4
QBAR Urban 3.4

Q1 year 2.9

Q1 year 2.9
Q30 years 6.0
Q100 years 7.1

APPENDIX H

Correspondence with Yorkshire Water

From:	Robert Illingworth
To:	Tim Brook
Subject:	RE: Lindley Moor Road, Lindley, Huddersfield, HD3 3TB - Formal Planning Ref Consultation Number: Y010595
Date:	17 August 2023 13:56:25
Attachments:	image001.png image003.png image004.png image005.png image006.png image007.png

Hello Tim

Thanks for your email and my apologies for the delay in responding.

The contents of your email are correct. The surface water sewer to serve the development can be privately laid or provided by Yorkshire Water under the terms of Section 98 Water Industry Act 1991. The upsizing of the existing final leg of public surface water sewer (if required) can be by Section 185 agreement or wrapped up in a Section 98 agreement. In either case, riparian consent for the increased rate of discharge will be required. This would be the developers responsibility to secure in principle.

Kind regards

Rob

YorkshireWater
Developer Services

Robert Illingworth
Development Control Senior Engineer
Customer Experience
07790 616 318
yorkshirewater.com/developers

My working days are Tuesday-Friday

From: Tim Brook
Sent: Friday, July 7, 2023 10:02 AM
To: 'planningconsultation@yorkshirewater.co.uk' <planningconsultation@yorkshirewater.co.uk>; 'planning.consultation@yorkshirewater.co.uk' <planning.consultation@yorkshirewater.co.uk>
Subject: RE: Lindley Moor Road, Lindley, Huddersfield, HD3 3TB - Formal Planning Ref Consultation Number: Y010595

Morning,

Further to the email trail below and following a telephone call with Rob yesterday, we understand Yorkshire Water are happy to accept a proposed 10.5 l/s surface water discharge rate into the existing 150 mm diameter public surface water sewer located in the field east of Weatherhill Road.

We note that to accept a 10.5 l/s flow rate, the existing 150 mm diameter pipe may need to be upsized and that this can be achieved under a Section 185 Agreement. However, should our client prefer to pursue a formal Section 98 Sewer Requisition, then the upsizing of the existing public sewer can be done under a Section 98 Agreement.

Please note that our client is yet to enter into a discussion with the third-party landowner as they believe they will demand a significant compensation payment . As we understand, compensation would be due under a Section 98 Agreement to the third-party landowner, but this would be a statutory amount. The focus for our client at this stage is to obtain planning consent.

As mentioned in the call, once planning approval has been granted, our client may then decide to discuss the surface water route with the third-party landowner. Should those discussions not result in a positive outcome, we anticipate that a formal Section 98 application would be submitted.

Can you kindly confirm by return at your earliest convenience that the above is correct.

Kind Regards

Tim

Tim Brook
Technical Director
tim.brook@weetwood.net

Weetwood
Development • Planning • Environment
Park House, Ffordd Byrnwr Gwair, Mold, CH7 1FQ
T 01352 700045 **M** 07707 694370 **W** www.weetwood.net

From: Tim Brook
Sent: Wednesday, June 21, 2023 11:15 AM
To: 'planningconsultation@yorkshirewater.co.uk' <planningconsultation@yorkshirewater.co.uk>
Subject: FW: Lindley Moor Road, Lindley, Huddersfield, HD3 3TB - Formal Planning Ref Consultation Number: Y010595

Our ref: 5474

Morning,

I spoke with Ben last week regarding the above and our request to discharge surface water flows at 10.5 l/s into an existing 150 mm diameter public surface water sewer to the east of our site (please see attached mark-up plan).

Ben indicated that he would need an agreement from your legal team that the increase in allowable discharge rate from 3.5 l/s to 10.5 l/s is acceptable, and that he was hopeful of getting an answer by the end of last week. I have yet to receive a response.

Can you kindly provide an update on this request at your very earliest convenience? The only thing holding up a planning decision on the proposed development is related to an agreement for surface water drainage.

Kind Regards

Tim

Tim Brook
Technical Director
tim.brook@weetwood.net

Weetwood
Development • Planning • Environment
Park House, Ffordd Byrnwr Gwair, Mold, CH7 1FQ
T 01352 700045 **M** 07707 694370 **W** www.weetwood.net

From: Chris Roberts <Chris.Roberts@yorkshirewater.co.uk>
Sent: Thursday, June 1, 2023 12:42 PM
To: Tim Brook <Tim.Brook@weetwood.net>
Subject: Lindley Moor Road, Lindley, Huddersfield, HD3 3TB - Formal Planning Ref Consultation Number: Y010595

Hi Tim,

The PPSE is now expired for this site and I can see it has progressed via a Formal Planning Application which our Formal Planners/Senior Engineer have made comment on in March – See below

****

Mathias Franklin
Head of Planning Services
Kirklees Metropolitan District Council
P.O. Box B93
Civic Centre
Huddersfield
HD1 2JR

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

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

Your Ref: 2022/91477
Our Ref: Y010595

Email: planningconsultation@yorkshirewater.co.uk;

For telephone enquiries ring:
Reuben Thornton; on 0345 120 8482;

3rd March 2023

Dear Sir/Madam,

Land off Lindley Moor Road, Lindley, Huddersfield - Hybrid planning application for erection of an industrial unit for E(g)/B2 /B8 use with associated access, parking, groundworks and landscaping in conjunction with an outline application for mixed use development use class E(a), E(b), E(g), B2 and B8

Thank you for consulting Yorkshire Water regarding the above proposed development. We have the following comments:

Waste Water

If planning permission is to be granted, the following conditions should be attached in order to protect the local aquatic environment and Yorkshire Water infrastructure:

There shall be no piped discharge of surface water from the development prior to the completion of surface water drainage works, details of which will have been submitted to and approved by the Local Planning Authority. If discharge to public sewer is proposed, the information shall include, but not be exclusive to:
i) evidence that other means of surface water drainage have been properly considered and why they have been discounted; and
ii) the means of discharging to the public sewer network at a rate to be agreed by the Local Planning Authority in consultation with the statutory sewerage undertaker.
(To ensure that no surface water discharges take place until proper provision has been made for its disposal)

1.) The submitted Flood Risk and Drainage Assessment prepared by Weetwood, (Rev v1.2) dated January 2023 requires amendments, but if planning permission is granted, the matter can be dealt with via condition.

In summary, the report states that
a.) Foul water will discharge to public combined sewer
b.) Sub-soil conditions do not support the use of soakaways
c.) Surface water will discharge to 150 mm diameter public surface water sewer via storage with restricted discharge of 10.5 litres/second.
This is unacceptable. If the developer wishes to discharge to the public surface water sewer flows should be restricted to 3.5 litres/second.

Yours faithfully

Reuben Thornton
Developer Services Team

****

Your offer to upgrade the network which would be at your cost may be a viable option but you would need to gain agreement via our S98 Team and Formal Planners / Senior Engineer so I will forward it onto the them to review and arrange a call.

Kind Regards

YorkshireWater

Chris Roberts
Pre-Development Technician
Developer Services
Tel: 0345 1 20 84 82

*******Please note we have 10 working days to respond to email enquiries*******

-----Original Message-----

APPENDIX I

Surface Water Attenuation – Detailed Planning Storage Volume Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.312	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	0.000
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.762	4-8	0.620

Total Area Contributing (ha) = 1.382

Total Pipe Volume (m^3) = 89.563

Network Design Table for Storm

- Indicates pipe length does not match coordinates
« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	50.000	2.450	20.4	0.099	5.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.37	257.650	0.099	0.0	0.0	0.0	2.24	39.6	13.4

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S2.000	20.793	2.050	10.1	0.000	5.00	2.5	0.600	o	150	Pipe/Conduit	
S3.000	25.000	0.250	100.0	0.000	5.00	2.5	0.600	o	150	Pipe/Conduit	
S2.001	32.891	2.150	15.3	0.078	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.000	10.637	0.150	70.9	0.036	5.00	2.5	0.600	o	150	Pipe/Conduit	
S4.001	23.586	0.250	94.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S2.002	32.236	0.150	214.9	0.049	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.001	25.711	0.150	171.4	0.044	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	78.397	4.400	17.8	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S5.000	10.000	0.350	28.6	0.000	5.00	2.5	0.600	o	150	Pipe/Conduit	
S1.003	15.032	1.000	15.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S2.000	50.00	5.11	259.550	0.000	2.5	0.0	0.0	3.18	56.2	2.5
S3.000	50.00	5.41	257.750	0.000	2.5	0.0	0.0	1.00	17.8	2.5
S2.001	50.00	5.55	257.350	0.078	5.0	0.0	0.0	4.04	285.6	15.6
S4.000	50.00	5.15	255.750	0.036	2.5	0.0	0.0	1.20	21.1	7.4
S4.001	50.00	5.53	255.600	0.036	2.5	0.0	0.0	1.03	18.3	7.4
S2.002	50.00	6.05	255.200	0.163	7.5	0.0	0.0	1.07	75.5	29.6
S1.001	50.00	6.41	255.050	0.306	7.5	0.0	0.0	1.20	84.7	48.9
S1.002	50.00	6.76	254.900	0.306	7.5	0.0	0.0	3.74	264.5	48.9
S5.000	50.00	5.09	251.000	0.000	2.5	0.0	0.0	1.89	33.4	2.5
S1.003	50.00	6.82	250.500	0.306	10.0	0.0	0.0	4.08	288.1	51.4

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S6.000	13.785	1.400	9.8	0.117	5.00	0.0	0.600	o	300	Pipe/Conduit	
S1.004	12.918	1.050	12.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S7.000	25.754	0.500	51.5	0.000	5.00	2.5	0.600	o	150	Pipe/Conduit	
S1.005	52.832	3.850	13.7	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S8.000	21.500	0.250	86.0	0.000	5.00	2.5	0.600	o	150	Pipe/Conduit	
S1.006	10.215	0.250	40.9	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S9.000	14.161	1.500	9.4	0.155	5.00	0.0	0.600	o	300	Pipe/Conduit	
S1.007	15.920	0.200	79.6	0.014	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.008	15.920	0.250	63.7	0.012	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.009	42.136	2.600	16.2	0.032	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.010	35.195	1.300	27.1	0.027	0.00	0.0	0.600	o	600	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S6.000	50.00	5.05	250.900	0.117	0.0	0.0	0.0	5.04	356.2	15.8
S1.004	50.00	6.87	249.500	0.423	10.0	0.0	0.0	4.51	318.5	67.3
S7.000	50.00	5.31	249.100	0.000	2.5	0.0	0.0	1.40	24.8	2.5
S1.005	50.00	7.03	248.300	0.423	12.5	0.0	0.0	5.51	876.4	69.8
S8.000	50.00	5.33	245.000	0.000	2.5	0.0	0.0	1.08	19.2	2.5
S1.006	50.00	7.08	244.450	0.423	15.0	0.0	0.0	3.19	507.0	72.3
S9.000	50.00	5.05	245.850	0.155	0.0	0.0	0.0	5.15	363.8	21.0
S1.007	50.00	7.20	244.200	0.592	15.0	0.0	0.0	2.28	362.7	95.2
S1.008	50.00	7.30	244.000	0.604	15.0	0.0	0.0	2.55	405.7	96.8
S1.009	49.77	7.42	243.600	0.636	15.0	0.0	0.0	6.07	1715.9	100.7
S1.010	49.39	7.54	241.000	0.663	15.0	0.0	0.0	4.69	1326.8	103.7

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S10.000	37.500	0.300	125.0	0.065	5.00	0.0	0.600	o	300	Pipe/Conduit	
S10.001	10.308	0.100	103.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S10.002	36.250	1.800	20.1	0.115	0.00	0.0	0.600	o	300	Pipe/Conduit	
S11.000	31.000	1.750	17.7	0.111	5.00	0.0	0.600	o	300	Pipe/Conduit	
S10.003	4.000	0.050	80.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S10.004	4.000	0.050	80.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S12.000	94.934	0.450	211.0	0.220	5.00	0.0	0.600	o	300	Pipe/Conduit	
S13.000	95.000	0.550	172.7	0.208	5.00	0.0	0.600	o	300	Pipe/Conduit	
S13.001	49.810	0.300	166.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S12.001	18.000	1.200	15.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S12.002	34.573	1.000	34.6	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S10.005	5.000	0.050	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S10.000	50.00	5.44	243.500	0.065	0.0	0.0	0.0	1.40	99.3	8.8
S10.001	50.00	5.56	243.200	0.065	0.0	0.0	0.0	1.55	109.5	8.8
S10.002	50.00	5.73	243.100	0.180	0.0	0.0	0.0	3.52	248.8	24.4
S11.000	50.00	5.14	243.050	0.111	0.0	0.0	0.0	3.75	265.3	15.0
S10.003	50.00	5.77	241.300	0.291	0.0	0.0	0.0	1.76	124.4	39.4
S10.004	50.00	5.80	241.150	0.291	0.0	0.0	0.0	1.76	124.4	39.4
S12.000	50.00	6.47	243.750	0.220	0.0	0.0	0.0	1.08	76.2	29.8
S13.000	50.00	6.33	244.150	0.208	0.0	0.0	0.0	1.19	84.4	28.2
S13.001	50.00	7.01	243.600	0.208	0.0	0.0	0.0	1.22	86.1	28.2
S12.001	50.00	7.08	243.300	0.428	0.0	0.0	0.0	4.08	288.4	58.0
S12.002	50.00	7.25	241.950	0.428	0.0	0.0	0.0	3.47	551.4	58.0
S10.005	50.00	7.33	240.950	0.719	0.0	0.0	0.0	1.00	17.8«	97.4

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.011	3.282	0.100	32.8	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.012	2.000#	0.050	40.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.013	18.687	1.850	10.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.011	49.33	7.56	239.700	1.382	15.0	0.0	0.0	2.75	194.7«	199.6
S1.012	49.30	7.57	238.100	1.382	15.0	0.0	0.0	3.22	512.5	199.6
S1.013	49.02	7.67	238.000	1.382	15.0	0.0	0.0	3.19	56.4«	199.6

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Ba
S37	259.000	1.350	Open Manhole	1200	S1.000	257.650	150				
S36-FC (A)	264.400	4.850	Open Manhole	1200	S2.000	259.550	150				
S35-FC (F)	260.000	2.250	Open Manhole	1200	S3.000	257.750	150				
S34	263.550	6.200	Open Manhole	1200	S2.001	257.350	300	S2.000	257.500	150	
								S3.000	257.500	150	
S33-FC (G)	258.000	2.250	Open Manhole	1200	S4.000	255.750	150				
S32	259.000	3.400	Open Manhole	1200	S4.001	255.600	150	S4.000	255.600	150	
S31	261.550	6.350	Open Manhole	1200	S2.002	255.200	300	S2.001	255.200	300	
								S4.001	255.350	150	
S30	260.800	5.750	Open Manhole	1200	S1.001	255.050	300	S1.000	255.200	150	
								S2.002	255.050	300	
S29	259.100	4.200	Open Manhole	1200	S1.002	254.900	300	S1.001	254.900	300	
S28-FC (C)	253.000	2.000	Open Manhole	1200	S5.000	251.000	150				
S27	253.500	3.000	Open Manhole	1200	S1.003	250.500	300	S1.002	250.500	300	
								S5.000	250.650	150	
S-FS02	253.000	2.100	Open Manhole	600	S6.000	250.900	300				
S26	252.500	3.000	Open Manhole	1200	S1.004	249.500	300	S1.003	249.500	300	
								S6.000	249.500	300	
S25-FC (H-N)	250.600	1.500	Open Manhole	1200	S7.000	249.100	150				
S24	251.700	3.400	Open Manhole	1500	S1.005	248.300	450	S1.004	248.450	300	
								S7.000	248.600	150	
S23-FC (D-E)	247.000	2.000	Open Manhole	1200	S8.000	245.000	150				
S22	248.300	3.850	Open Manhole	1500	S1.006	244.450	450	S1.005	244.450	450	
								S8.000	244.750	150	
S-FS01	248.000	2.150	Open Manhole	600	S9.000	245.850	300				
S21	247.600	3.400	Open Manhole	1500	S1.007	244.200	450	S1.006	244.200	450	
								S9.000	244.350	300	
S20	246.650	2.650	Open Manhole	1500	S1.008	244.000	450	S1.007	244.000	450	
S19	245.700	2.100	Open Manhole	1500	S1.009	243.600	600	S1.008	243.750	450	
S18	244.000	3.000	Open Manhole	1500	S1.010	241.000	600	S1.009	241.000	600	
S17	245.000	1.500	Open Manhole	1200	S10.000	243.500	300				
S16	245.000	1.800	Open Manhole	1200	S10.001	243.200	300	S10.000	243.200	300	
S15	244.750	1.650	Open Manhole	1200	S10.002	243.100	300	S10.001	243.100	300	

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Ba
S14	244.550	1.500	Open Manhole	1200	S11.000	243.050	300				
S13-TANK (P)	244.650	3.350	Open Manhole	1200	S10.003	241.300	300	S10.002	241.300	300	
								S11.000	241.300	300	
S12-BS	244.400	3.250	Open Manhole	1200	S10.004	241.150	300	S10.003	241.250	300	
S11	245.250	1.500	Open Manhole	1200	S12.000	243.750	300				
S10	245.350	1.200	Open Manhole	600	S13.000	244.150	300				
S9	245.350	1.750	Open Manhole	600	S13.001	243.600	300	S13.000	243.600	300	
S8	245.200	1.900	Open Manhole	1200	S12.001	243.300	300	S12.000	243.300	300	
								S13.001	243.300	300	
S7	244.500	2.550	Open Manhole	1500	S12.002	241.950	450	S12.001	242.100	300	
S6-FC (P)	243.580	2.630	Open Manhole	1500	S10.005	240.950	150	S10.004	241.100	300	
								S12.002	240.950	450	
S5-ORIFICE	244.000	4.300	Open Manhole	1500	S1.011	239.700	300	S1.010	239.700	600	
								S10.005	240.900	150	
S4-TANK	242.000	3.900	Open Manhole	1200	S1.012	238.100	450	S1.011	239.600	300	
S3-FC	241.750	3.750	Open Manhole	1800	S1.013	238.000	150	S1.012	238.050	450	
S2	238.000	1.850	Open Manhole	1200		OUTFALL		S1.013	236.150	150	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S37	410808.426	419043.619	410808.426	419043.619	Required	
S36-FC (A)	410774.120	418952.666	410774.120	418952.666	Required	
S35-FC (F)	410803.393	418938.509	410803.393	418938.509	Required	
S34	410793.050	418961.269	410793.050	418961.269	Required	

Manhole Schedules for Storm

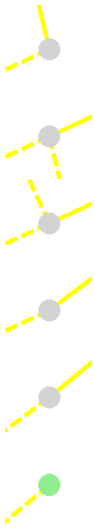
MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S33-FC (G)	410845.927	418951.983	410845.927	418951.983	Required	
S32	410841.527	418961.667	410841.527	418961.667	Required	
S31	410822.591	418975.729	410822.591	418975.729	Required	
S30	410838.569	419003.727	410838.569	419003.727	Required	
S29	410864.129	419000.944	410864.129	419000.944	Required	
S28-FC (C)	410920.649	419056.185	410920.649	419056.185	Required	
S27	410926.678	419048.207	410926.678	419048.207	Required	
S-FS02	410938.573	419043.484	410938.573	419043.484	Required	
S26	410938.671	419057.269	410938.671	419057.269	Required	
S25-FC (H-N)	410964.504	419044.509	410964.504	419044.509	Required	
S24	410948.978	419065.057	410948.978	419065.057	Required	
S23-FC (D-E)	410978.168	419114.061	410978.168	419114.061	Required	
S22	410991.130	419096.908	410991.130	419096.908	Required	
S-FS01	411000.043	419088.926	411000.043	419088.926	Required	

Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S21	410999.280	419103.066	410999.280	419103.066	Required	
S20	411014.687	419107.072	411014.687	419107.072	Required	
S19	411028.414	419099.010	411028.414	419099.010	Required	
S18	411053.817	419065.392	411053.817	419065.392	Required	
S17	411015.739	419093.043	411015.739	419093.043	Required	
S16	411031.442	419058.989	411031.442	419058.989	Required	
S15	411041.570	419060.906	411041.570	419060.906	Required	
S14	411069.730	418999.836	411069.730	418999.836	Required	
S13-TANK (P)	411056.749	419027.988	411056.749	419027.988	Required	
S12-BS	411060.382	419029.663	411060.382	419029.663	Required	
S11	411015.967	419076.388	411015.967	419076.388	Required	
S10	410970.734	419055.530	410970.734	419055.530	Required	
S9	411010.514	418969.260	411010.514	418969.260	Required	
S8	411055.719	418990.177	411055.719	418990.177	Required	

Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S7	411072.065	418997.715	411072.065	418997.715	Required	
S6-FC (P)	411064.014	419031.338	411064.014	419031.338	Required	
S5-ORIFICE	411068.555	419033.431	411068.555	419033.431	Required	
S4-TANK	411071.535	419034.806	411071.535	419034.806	Required	
S3-FC	411088.702	419047.691	411088.702	419047.691	Required	
S2	411103.119	419059.579			No Entry	



PIPELINE SCHEDULES for Storm

Upstream Manhole

- Indicates pipe length does not match coordinates

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	150	S37	259.000	257.650	1.200	Open Manhole	1200
S2.000	o	150	S36-FC (A)	264.400	259.550	4.700	Open Manhole	1200
S3.000	o	150	S35-FC (F)	260.000	257.750	2.100	Open Manhole	1200
S2.001	o	300	S34	263.550	257.350	5.900	Open Manhole	1200
S4.000	o	150	S33-FC (G)	258.000	255.750	2.100	Open Manhole	1200
S4.001	o	150	S32	259.000	255.600	3.250	Open Manhole	1200
S2.002	o	300	S31	261.550	255.200	6.050	Open Manhole	1200
S1.001	o	300	S30	260.800	255.050	5.450	Open Manhole	1200
S1.002	o	300	S29	259.100	254.900	3.900	Open Manhole	1200
S5.000	o	150	S28-FC (C)	253.000	251.000	1.850	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	50.000	20.4	S30	260.800	255.200	5.450	Open Manhole	1200
S2.000	20.793	10.1	S34	263.550	257.500	5.900	Open Manhole	1200
S3.000	25.000	100.0	S34	263.550	257.500	5.900	Open Manhole	1200
S2.001	32.891	15.3	S31	261.550	255.200	6.050	Open Manhole	1200
S4.000	10.637	70.9	S32	259.000	255.600	3.250	Open Manhole	1200
S4.001	23.586	94.3	S31	261.550	255.350	6.050	Open Manhole	1200
S2.002	32.236	214.9	S30	260.800	255.050	5.450	Open Manhole	1200
S1.001	25.711	171.4	S29	259.100	254.900	3.900	Open Manhole	1200
S1.002	78.397	17.8	S27	253.500	250.500	2.700	Open Manhole	1200
S5.000	10.000	28.6	S27	253.500	250.650	2.700	Open Manhole	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.003	o	300	S27	253.500	250.500	2.700	Open Manhole	1200
S6.000	o	300	S-FS02	253.000	250.900	1.800	Open Manhole	600
S1.004	o	300	S26	252.500	249.500	2.700	Open Manhole	1200
S7.000	o	150	S25-FC (H-N)	250.600	249.100	1.350	Open Manhole	1200
S1.005	o	450	S24	251.700	248.300	2.950	Open Manhole	1500
S8.000	o	150	S23-FC (D-E)	247.000	245.000	1.850	Open Manhole	1200
S1.006	o	450	S22	248.300	244.450	3.400	Open Manhole	1500
S9.000	o	300	S-FS01	248.000	245.850	1.850	Open Manhole	600
S1.007	o	450	S21	247.600	244.200	2.950	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.003	15.032	15.0	S26	252.500	249.500	2.700	Open Manhole	1200
S6.000	13.785	9.8	S26	252.500	249.500	2.700	Open Manhole	1200
S1.004	12.918	12.3	S24	251.700	248.450	2.950	Open Manhole	1500
S7.000	25.754	51.5	S24	251.700	248.600	2.950	Open Manhole	1500
S1.005	52.832	13.7	S22	248.300	244.450	3.400	Open Manhole	1500
S8.000	21.500	86.0	S22	248.300	244.750	3.400	Open Manhole	1500
S1.006	10.215	40.9	S21	247.600	244.200	2.950	Open Manhole	1500
S9.000	14.161	9.4	S21	247.600	244.350	2.950	Open Manhole	1500
S1.007	15.920	79.6	S20	246.650	244.000	2.200	Open Manhole	1500

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.008	o	450	S20	246.650	244.000	2.200	Open Manhole	1500
S1.009	o	600	S19	245.700	243.600	1.500	Open Manhole	1500
S1.010	o	600	S18	244.000	241.000	2.400	Open Manhole	1500
S10.000	o	300	S17	245.000	243.500	1.200	Open Manhole	1200
S10.001	o	300	S16	245.000	243.200	1.500	Open Manhole	1200
S10.002	o	300	S15	244.750	243.100	1.350	Open Manhole	1200
S11.000	o	300	S14	244.550	243.050	1.200	Open Manhole	1200
S10.003	o	300	S13-TANK (P)	244.650	241.300	3.050	Open Manhole	1200
S10.004	o	300	S12-BS	244.400	241.150	2.950	Open Manhole	1200
S12.000	o	300	S11	245.250	243.750	1.200	Open Manhole	1200
S13.000	o	300	S10	245.350	244.150	0.900	Open Manhole	600
S13.001	o	300	S9	245.350	243.600	1.450	Open Manhole	600

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.008	15.920	63.7	S19	245.700	243.750	1.500	Open Manhole	1500
S1.009	42.136	16.2	S18	244.000	241.000	2.400	Open Manhole	1500
S1.010	35.195	27.1	S5-ORIFICE	244.000	239.700	3.700	Open Manhole	1500
S10.000	37.500	125.0	S16	245.000	243.200	1.500	Open Manhole	1200
S10.001	10.308	103.1	S15	244.750	243.100	1.350	Open Manhole	1200
S10.002	36.250	20.1	S13-TANK (P)	244.650	241.300	3.050	Open Manhole	1200
S11.000	31.000	17.7	S13-TANK (P)	244.650	241.300	3.050	Open Manhole	1200
S10.003	4.000	80.0	S12-BS	244.400	241.250	2.850	Open Manhole	1200
S10.004	4.000	80.0	S6-FC (P)	243.580	241.100	2.180	Open Manhole	1500
S12.000	94.934	211.0	S8	245.200	243.300	1.600	Open Manhole	1200
S13.000	95.000	172.7	S9	245.350	243.600	1.450	Open Manhole	600
S13.001	49.810	166.0	S8	245.200	243.300	1.600	Open Manhole	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S12.001	o	300	S8	245.200	243.300	1.600	Open Manhole	1200
S12.002	o	450	S7	244.500	241.950	2.100	Open Manhole	1500
S10.005	o	150	S6-FC (P)	243.580	240.950	2.480	Open Manhole	1500
S1.011	o	300	S5-ORIFICE	244.000	239.700	4.000	Open Manhole	1500
S1.012	o	450	S4-TANK	242.000	238.100	3.450	Open Manhole	1200
S1.013	o	150	S3-FC	241.750	238.000	3.600	Open Manhole	1800

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S12.001	18.000	15.0	S7	244.500	242.100	2.100	Open Manhole	1500
S12.002	34.573	34.6	S6-FC (P)	243.580	240.950	2.180	Open Manhole	1500
S10.005	5.000	100.0	S5-ORIFICE	244.000	240.900	2.950	Open Manhole	1500
S1.011	3.282	32.8	S4-TANK	242.000	239.600	2.100	Open Manhole	1200
S1.012	2.000#	40.0	S3-FC	241.750	238.050	3.250	Open Manhole	1800
S1.013	18.687	10.1	S2	238.000	236.150	1.700	Open Manhole	1200

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.099	0.099	0.099
2.000	-	-	100	0.000	0.000	0.000
3.000	-	-	100	0.000	0.000	0.000
2.001	-	-	100	0.078	0.078	0.078
4.000	-	-	100	0.036	0.036	0.036
4.001	-	-	100	0.000	0.000	0.000
2.002	-	-	100	0.049	0.049	0.049
1.001	-	-	100	0.044	0.044	0.044
1.002	-	-	100	0.000	0.000	0.000
5.000	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
6.000	-	-	100	0.117	0.117	0.117
1.004	-	-	100	0.000	0.000	0.000
7.000	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.000	0.000	0.000
8.000	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
9.000	-	-	100	0.155	0.155	0.155
1.007	-	-	100	0.014	0.014	0.014
1.008	-	-	100	0.012	0.012	0.012
1.009	-	-	100	0.032	0.032	0.032
1.010	-	-	100	0.027	0.027	0.027
10.000	-	-	100	0.065	0.065	0.065
10.001	-	-	100	0.000	0.000	0.000
10.002	-	-	100	0.115	0.115	0.115
11.000	-	-	100	0.111	0.111	0.111
10.003	-	-	100	0.000	0.000	0.000
10.004	-	-	100	0.000	0.000	0.000
12.000	-	-	100	0.220	0.220	0.220
13.000	-	-	100	0.208	0.208	0.208
13.001	-	-	100	0.000	0.000	0.000
12.001	-	-	100	0.000	0.000	0.000
12.002	-	-	100	0.000	0.000	0.000
10.005	-	-	100	0.000	0.000	0.000
1.011	-	-	100	0.000	0.000	0.000
1.012	-	-	100	0.000	0.000	0.000
1.013	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				1.382	1.382	1.382

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.013	S2	238.000	236.150	0.000	1200	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0	Number of Offline Controls 0	Number of Time/Area Diagrams 0
Number of Online Controls 3	Number of Storage Structures 2	Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.312		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S6-FC (P), DS/PN: S10.005, Volume (m³): 10.1

Unit Reference	MD-SHE-0075-2500-1000-2500
Design Head (m)	1.000
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	240.950
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.5	Kick-Flo®	0.627	2.0
Flush-Flo™	0.307	2.5	Mean Flow over Head Range	-	2.2

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	2.1	1.200	2.7	3.000	4.1	7.000	6.2
0.200	2.4	1.400	2.9	3.500	4.5	7.500	6.4
0.300	2.5	1.600	3.1	4.000	4.7	8.000	6.6
0.400	2.5	1.800	3.3	4.500	5.0	8.500	6.8
0.500	2.4	2.000	3.4	5.000	5.3	9.000	7.0
0.600	2.1	2.200	3.6	5.500	5.5	9.500	7.1
0.800	2.3	2.400	3.7	6.000	5.7		
1.000	2.5	2.600	3.9	6.500	6.0		

Orifice Manhole: S5-ORIFICE, DS/PN: S1.011, Volume (m³): 17.2

Diameter (m) 0.250 Discharge Coefficient 0.600 Invert Level (m) 239.700

Hydro-Brake® Optimum Manhole: S3-FC, DS/PN: S1.013, Volume (m³): 9.6

Unit Reference	MD-SHE-0136-1050-1900-1050
Design Head (m)	1.900
Design Flow (l/s)	10.5
Flush-Flo™	Calculated

Hydro-Brake® Optimum Manhole: S3-FC, DS/PN: S1.013, Volume (m³): 9.6

Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	136
Invert Level (m)	238.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.900	10.5	Kick-Flo®	1.151	8.3
Flush-Flo™	0.559	10.5	Mean Flow over Head Range	-	9.2

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	4.9	1.200	8.5	3.000	13.0	7.000	19.5
0.200	8.9	1.400	9.1	3.500	14.0	7.500	20.2
0.300	9.8	1.600	9.7	4.000	14.9	8.000	20.8
0.400	10.3	1.800	10.2	4.500	15.8	8.500	21.4
0.500	10.5	2.000	10.8	5.000	16.6	9.000	22.0
0.600	10.5	2.200	11.3	5.500	17.4	9.500	22.6
0.800	10.2	2.400	11.7	6.000	18.1		
1.000	9.5	2.600	12.2	6.500	18.8		

Storage Structures for Storm

Tank or Pond Manhole: S13-TANK (P), DS/PN: S10.003

Invert Level (m) 241.300

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	350.0	1.500	350.0	1.501	0.0

Tank or Pond Manhole: S4-TANK, DS/PN: S1.012

Invert Level (m) 238.100

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1191.5	1.900	1191.5	1.901	0.0

Volume Summary (Static)

Length Calculations based on True Length

Pipe Number	USMH Name	Manhole Volume (m³)	Pipe Volume (m³)	Storage Structure Volume (m³)	Total Volume (m³)
S1.000	S37	1.527	0.862	0.000	2.389
S2.000	S36-FC (A)	5.485	0.346	0.000	5.831
S3.000	S35-FC (F)	2.545	0.421	0.000	2.965
S2.001	S34	7.012	2.240	0.000	9.252
S4.000	S33-FC (G)	2.545	0.167	0.000	2.711
S4.001	S32	3.845	0.396	0.000	4.241
S2.002	S31	7.182	2.194	0.000	9.375
S1.001	S30	6.503	1.733	0.000	8.236
S1.002	S29	4.750	5.457	0.000	10.207
S5.000	S28-FC (C)	2.262	0.156	0.000	2.417
S1.003	S27	3.393	0.978	0.000	4.371
S6.000	S-FS02	0.594	0.911	0.000	1.505
S1.004	S26	3.393	0.818	0.000	4.211
S7.000	S25-FC (H-N)	1.696	0.431	0.000	2.128
S1.005	S24	6.008	8.164	0.000	14.172
S8.000	S23-FC (D-E)	2.262	0.356	0.000	2.618
S1.006	S22	6.804	1.386	0.000	8.190
S9.000	S-FS01	0.608	0.927	0.000	1.535
S1.007	S21	6.008	2.293	0.000	8.302
S1.008	S20	4.683	2.293	0.000	6.976
S1.009	S19	3.711	11.490	0.000	15.201
S1.010	S18	5.301	9.527	0.000	14.828
S10.000	S17	1.696	2.566	0.000	4.262
S10.001	S16	2.036	0.644	0.000	2.680
S10.002	S15	1.866	2.478	0.000	4.344
S11.000	S14	1.696	2.106	0.000	3.803
S10.003	S13-TANK (P)	3.789	0.198	525.117	529.103
S10.004	S12-BS	3.676	0.187	0.000	3.863
S12.000	S11	1.696	6.626	0.000	8.322
S13.000	S10	0.339	6.673	0.000	7.012
S13.001	S9	0.495	3.457	0.000	3.952
S12.001	S8	2.149	1.177	0.000	3.326
S12.002	S7	4.506	5.260	0.000	9.766
S10.005	S6-FC (P)	4.648	0.062	0.000	4.709
S1.011	S5-ORIFICE	7.599	0.137	0.000	7.735
S1.012	S4-TANK	4.411	0.080	2264.247	2268.737
S1.013	S3-FC	9.543	0.304	0.000	9.846
Total		138.261	85.497	2789.364	3013.123

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 3 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.312
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 2, 30, 100
Climate Change (%)	0, 0, 0, 30

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
S1.000	S37	15 minute 1 year Winter I+0%	259.000	257.708	-0.092	0.000	0.31
S2.000	S36-FC (A)	15 minute 1 year Summer I+0%	264.400	259.571	-0.129	0.000	0.05
S3.000	S35-FC (F)	15 minute 1 year Summer I+0%	260.000	257.788	-0.112	0.000	0.15
S2.001	S34	15 minute 1 year Winter I+0%	263.550	257.393	-0.257	0.000	0.05
S4.000	S33-FC (G)	15 minute 1 year Winter I+0%	258.000	255.813	-0.087	0.000	0.36
S4.001	S32	15 minute 1 year Winter I+0%	259.000	255.666	-0.084	0.000	0.40
S2.002	S31	15 minute 1 year Winter I+0%	261.550	255.325	-0.175	0.000	0.36
S1.001	S30	15 minute 1 year Winter I+0%	260.800	255.207	-0.143	0.000	0.54
S1.002	S29	15 minute 1 year Winter I+0%	259.100	254.980	-0.220	0.000	0.16
S5.000	S28-FC (C)	15 minute 1 year Summer I+0%	253.000	251.029	-0.121	0.000	0.08
S1.003	S27	15 minute 1 year Winter I+0%	253.500	250.585	-0.215	0.000	0.18
S6.000	S-FS02	15 minute 1 year Winter I+0%	253.000	250.942	-0.258	0.000	0.05
S1.004	S26	15 minute 1 year Winter I+0%	252.500	249.595	-0.205	0.000	0.22

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow (l/s)	Maximum Vol (m^3)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	S37		0.060		11.9	OK
S2.000	S36-FC (A)		0.018		2.5	OK
S3.000	S35-FC (F)		0.038		2.5	OK
S2.001	S34		0.043		13.1	OK
S4.000	S33-FC (G)		0.065		6.9	OK
S4.001	S32		0.090		6.9	OK
S2.002	S31		0.161		24.8	OK
S1.001	S30		0.714		40.7	OK
S1.002	S29		0.190		40.7	OK
S5.000	S28-FC (C)		0.027		2.5	OK
S1.003	S27		0.103		43.3	OK
S6.000	S-FS02		0.011		14.3	OK
S1.004	S26		0.120		55.3	OK

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S7.000	S25-FC (H-N)	15 minute 1 year Summer I+0%	250.600	249.132	-0.118	0.000
S1.005	S24	15 minute 1 year Winter I+0%	251.700	248.380	-0.370	0.000
S8.000	S23-FC (D-E)	15 minute 1 year Summer I+0%	247.000	245.037	-0.113	0.000
S1.006	S22	15 minute 1 year Winter I+0%	248.300	244.591	-0.309	0.000
S9.000	S-FS01	15 minute 1 year Winter I+0%	248.000	245.899	-0.251	0.000
S1.007	S21	15 minute 1 year Winter I+0%	247.600	244.373	-0.277	0.000
S1.008	S20	15 minute 1 year Winter I+0%	246.650	244.163	-0.287	0.000
S1.009	S19	15 minute 1 year Winter I+0%	245.700	243.692	-0.508	0.000
S1.010	S18	15 minute 1 year Winter I+0%	244.000	241.110	-0.490	0.000
S10.000	S17	15 minute 1 year Winter I+0%	245.000	243.559	-0.241	0.000
S10.001	S16	15 minute 1 year Winter I+0%	245.000	243.263	-0.237	0.000
S10.002	S15	15 minute 1 year Winter I+0%	244.750	243.159	-0.241	0.000
S11.000	S14	15 minute 1 year Winter I+0%	244.550	243.096	-0.254	0.000
S10.003	S13-TANK (P)	600 minute 1 year Winter I+0%	244.650	241.570	-0.030	0.000
S10.004	S12-BS	15 minute 1 year Winter I+0%	244.400	241.637	0.187	0.000
S12.000	S11	15 minute 1 year Winter I+0%	245.250	243.875	-0.175	0.000
S13.000	S10	15 minute 1 year Winter I+0%	245.350	244.265	-0.185	0.000
S13.001	S9	15 minute 1 year Winter I+0%	245.350	243.710	-0.190	0.000
S12.001	S8	15 minute 1 year Winter I+0%	245.200	243.388	-0.212	0.000
S12.002	S7	15 minute 1 year Winter I+0%	244.500	242.044	-0.356	0.000
S10.005	S6-FC (P)	15 minute 1 year Winter I+0%	243.580	241.688	0.588	0.000
S1.011	S5-ORIFICE	15 minute 1 year Winter I+0%	244.000	240.291	0.291	0.000
S1.012	S4-TANK	1440 minute 1 year Winter I+0%	242.000	239.274	0.724	0.000
S1.013	S3-FC	1440 minute 1 year Winter I+0%	241.750	239.287	1.137	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S7.000	S25-FC (H-N)	0.11		0.031		2.5	OK
S1.005	S24	0.07		0.133		58.1	OK
S8.000	S23-FC (D-E)	0.14		0.036		2.5	OK
S1.006	S22	0.22		0.278		60.8	OK
S9.000	S-FS01	0.06		0.012		18.9	OK
S1.007	S21	0.31		0.447		78.2	OK
S1.008	S20	0.28		0.554		79.9	OK
S1.009	S19	0.06		0.153		83.0	OK
S1.010	S18	0.08		0.210		85.5	OK
S10.000	S17	0.08		0.062		7.7	OK
S10.001	S16	0.10		0.126		7.8	OK
S10.002	S15	0.09		0.103		19.5	OK

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S11.000	S14	0.06		0.046		13.5	OK
S10.003	S13-TANK (P)	0.05		95.033		2.9	OK
S10.004	S12-BS	0.05		0.741		2.8	SURCHARGED
S12.000	S11	0.33		0.136		24.3	OK
S13.000	S10	0.29		0.031		23.4	OK
S13.001	S9	0.28		0.205		23.0	OK
S12.001	S8	0.19		0.359		47.1	OK
S12.002	S7	0.10		0.157		47.1	OK
S10.005	S6-FC (P)	0.18		4.154		2.5	SURCHARGED
S1.011	S5-ORIFICE	1.04		3.133		82.1	SURCHARGED
S1.012	S4-TANK	0.07		1400.570		11.7	SURCHARGED
S1.013	S3-FC	0.20		3.342		10.5	SURCHARGED

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 3 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.312
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 2, 30, 100
Climate Change (%)	0, 0, 0, 30

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
S1.000	S37	15 minute 2 year Winter I+0%	259.000	257.717	-0.083	0.000	0.40
S2.000	S36-FC (A)	15 minute 2 year Summer I+0%	264.400	259.571	-0.129	0.000	0.05
S3.000	S35-FC (F)	15 minute 2 year Summer I+0%	260.000	257.788	-0.112	0.000	0.15
S2.001	S34	15 minute 2 year Winter I+0%	263.550	257.397	-0.253	0.000	0.06
S4.000	S33-FC (G)	15 minute 2 year Winter I+0%	258.000	255.819	-0.081	0.000	0.43
S4.001	S32	15 minute 2 year Winter I+0%	259.000	255.673	-0.077	0.000	0.47
S2.002	S31	15 minute 2 year Winter I+0%	261.550	255.339	-0.161	0.000	0.43
S1.001	S30	15 minute 2 year Winter I+0%	260.800	255.230	-0.120	0.000	0.66
S1.002	S29	15 minute 2 year Winter I+0%	259.100	254.991	-0.209	0.000	0.20
S5.000	S28-FC (C)	15 minute 2 year Summer I+0%	253.000	251.029	-0.121	0.000	0.08
S1.003	S27	15 minute 2 year Winter I+0%	253.500	250.595	-0.205	0.000	0.22
S6.000	S-FS02	15 minute 2 year Winter I+0%	253.000	250.949	-0.251	0.000	0.06
S1.004	S26	15 minute 2 year Winter I+0%	252.500	249.607	-0.193	0.000	0.27

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow (l/s)	Maximum Vol (m^3)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	S37		0.070		15.4	OK
S2.000	S36-FC (A)		0.018		2.5	OK
S3.000	S35-FC (F)		0.038		2.5	OK
S2.001	S34		0.048		15.4	OK
S4.000	S33-FC (G)		0.072		8.2	OK
S4.001	S32		0.100		8.2	OK
S2.002	S31		0.185		29.9	OK
S1.001	S30		0.897		50.3	OK
S1.002	S29		0.216		50.4	OK
S5.000	S28-FC (C)		0.027		2.5	OK
S1.003	S27		0.115		53.0	OK
S6.000	S-FS02		0.012		18.5	OK
S1.004	S26		0.136		68.5	OK

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S7.000	S25-FC (H-N)	15 minute 2 year Summer I+0%	250.600	249.132	-0.118	0.000
S1.005	S24	15 minute 2 year Winter I+0%	251.700	248.391	-0.359	0.000
S8.000	S23-FC (D-E)	15 minute 2 year Summer I+0%	247.000	245.037	-0.113	0.000
S1.006	S22	15 minute 2 year Winter I+0%	248.300	244.607	-0.293	0.000
S9.000	S-FS01	15 minute 2 year Winter I+0%	248.000	245.907	-0.243	0.000
S1.007	S21	15 minute 2 year Winter I+0%	247.600	244.395	-0.255	0.000
S1.008	S20	15 minute 2 year Winter I+0%	246.650	244.184	-0.266	0.000
S1.009	S19	15 minute 2 year Winter I+0%	245.700	243.704	-0.496	0.000
S1.010	S18	15 minute 2 year Winter I+0%	244.000	241.124	-0.476	0.000
S10.000	S17	15 minute 2 year Winter I+0%	245.000	243.567	-0.233	0.000
S10.001	S16	15 minute 2 year Winter I+0%	245.000	243.271	-0.229	0.000
S10.002	S15	15 minute 2 year Winter I+0%	244.750	243.167	-0.233	0.000
S11.000	S14	15 minute 2 year Winter I+0%	244.550	243.103	-0.247	0.000
S10.003	S13-TANK (P)	600 minute 2 year Winter I+0%	244.650	241.656	0.056	0.000
S10.004	S12-BS	600 minute 2 year Winter I+0%	244.400	241.656	0.206	0.000
S12.000	S11	15 minute 2 year Winter I+0%	245.250	243.895	-0.155	0.000
S13.000	S10	15 minute 2 year Winter I+0%	245.350	244.283	-0.167	0.000
S13.001	S9	15 minute 2 year Winter I+0%	245.350	243.727	-0.173	0.000
S12.001	S8	15 minute 2 year Winter I+0%	245.200	243.401	-0.199	0.000
S12.002	S7	15 minute 2 year Winter I+0%	244.500	242.055	-0.345	0.000
S10.005	S6-FC (P)	15 minute 2 year Summer I+0%	243.580	241.715	0.615	0.000
S1.011	S5-ORIFICE	15 minute 2 year Winter I+0%	244.000	240.499	0.499	0.000
S1.012	S4-TANK	1440 minute 2 year Winter I+0%	242.000	239.348	0.798	0.000
S1.013	S3-FC	1440 minute 2 year Winter I+0%	241.750	239.357	1.207	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S7.000	S25-FC (H-N)	0.11		0.031		2.5	OK
S1.005	S24	0.09		0.152		71.3	OK
S8.000	S23-FC (D-E)	0.14		0.036		2.5	OK
S1.006	S22	0.26		0.314		74.1	OK
S9.000	S-FS01	0.08		0.015		24.5	OK
S1.007	S21	0.38		0.521		96.6	OK
S1.008	S20	0.35		0.662		98.7	OK
S1.009	S19	0.07		0.175		102.8	OK
S1.010	S18	0.10		0.247		106.2	OK
S10.000	S17	0.11		0.070		10.0	OK
S10.001	S16	0.13		0.144		10.1	OK
S10.002	S15	0.11		0.118		25.3	OK

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Maximum Vol (m^3)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S11.000	S14	0.07		0.055		17.5	OK
S10.003	S13-TANK (P)	0.05		125.443		2.9	SURCHARGED
S10.004	S12-BS	0.04		0.764		2.7	SURCHARGED
S12.000	S11	0.43		0.159		31.5	OK
S13.000	S10	0.37		0.036		30.3	OK
S13.001	S9	0.37		0.314		29.6	OK
S12.001	S8	0.25		0.411		60.9	OK
S12.002	S7	0.13		0.178		60.8	OK
S10.005	S6-FC (P)	0.18		4.344		2.5	SURCHARGED
S1.011	S5-ORIFICE	1.27		5.025		100.6	SURCHARGED
S1.012	S4-TANK	0.07		1488.076		11.6	SURCHARGED
S1.013	S3-FC	0.20		3.521		10.5	SURCHARGED

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 3 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.312
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 2, 30, 100
Climate Change (%)	0, 0, 0, 30

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
S1.000	S37	15 minute 30 year Winter I+0%	259.000	257.749	-0.051	0.000	0.75
S2.000	S36-FC (A)	15 minute 30 year Summer I+0%	264.400	259.571	-0.129	0.000	0.05
S3.000	S35-FC (F)	15 minute 30 year Summer I+0%	260.000	257.788	-0.112	0.000	0.15
S2.001	S34	15 minute 30 year Winter I+0%	263.550	257.417	-0.233	0.000	0.11
S4.000	S33-FC (G)	15 minute 30 year Winter I+0%	258.000	255.843	-0.057	0.000	0.70
S4.001	S32	15 minute 30 year Winter I+0%	259.000	255.699	-0.051	0.000	0.76
S2.002	S31	15 minute 30 year Winter I+0%	261.550	255.527	0.027	0.000	0.79
S1.001	S30	15 minute 30 year Winter I+0%	260.800	255.426	0.076	0.000	1.25
S1.002	S29	15 minute 30 year Winter I+0%	259.100	255.027	-0.173	0.000	0.37
S5.000	S28-FC (C)	15 minute 30 year Summer I+0%	253.000	251.029	-0.121	0.000	0.08
S1.003	S27	15 minute 30 year Winter I+0%	253.500	250.633	-0.167	0.000	0.40
S6.000	S-FS02	15 minute 30 year Winter I+0%	253.000	250.969	-0.231	0.000	0.12
S1.004	S26	15 minute 30 year Winter I+0%	252.500	249.652	-0.148	0.000	0.49

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow (l/s)	Maximum Vol (m³)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	S37		0.107		29.0	OK
S2.000	S36-FC (A)		0.018		2.5	OK
S3.000	S35-FC (F)		0.038		2.5	OK
S2.001	S34		0.070		29.9	OK
S4.000	S33-FC (G)		0.100		13.2	OK
S4.001	S32		0.139		13.1	OK
S2.002	S31		0.696		54.7	SURCHARGED
S1.001	S30		2.508		94.9	SURCHARGED
S1.002	S29		0.400		94.5	OK
S5.000	S28-FC (C)		0.027		2.5	OK
S1.003	S27		0.177		97.4	OK
S6.000	S-FS02		0.018		34.9	OK
S1.004	S26		0.224		126.8	OK

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)
S7.000	S25-FC (H-N)	15 minute 30 year Summer I+0%	250.600	249.132	-0.118	0.000
S1.005	S24	15 minute 30 year Winter I+0%	251.700	248.422	-0.328	0.000
S8.000	S23-FC (D-E)	15 minute 30 year Summer I+0%	247.000	245.037	-0.113	0.000
S1.006	S22	15 minute 30 year Winter I+0%	248.300	244.668	-0.232	0.000
S9.000	S-FS01	15 minute 30 year Winter I+0%	248.000	245.928	-0.222	0.000
S1.007	S21	15 minute 30 year Winter I+0%	247.600	244.482	-0.168	0.000
S1.008	S20	15 minute 30 year Winter I+0%	246.650	244.262	-0.188	0.000
S1.009	S19	15 minute 30 year Winter I+0%	245.700	243.742	-0.458	0.000
S1.010	S18	15 minute 30 year Winter I+0%	244.000	241.846	0.246	0.000
S10.000	S17	15 minute 30 year Winter I+0%	245.000	243.593	-0.207	0.000
S10.001	S16	15 minute 30 year Winter I+0%	245.000	243.300	-0.200	0.000
S10.002	S15	15 minute 30 year Winter I+0%	244.750	243.200	-0.200	0.000
S11.000	S14	15 minute 30 year Winter I+0%	244.550	243.124	-0.226	0.000
S10.003	S13-TANK (P)	720 minute 30 year Winter I+0%	244.650	242.054	0.454	0.000
S10.004	S12-BS	720 minute 30 year Winter I+0%	244.400	242.053	0.603	0.000
S12.000	S11	15 minute 30 year Winter I+0%	245.250	243.972	-0.078	0.000
S13.000	S10	15 minute 30 year Winter I+0%	245.350	244.348	-0.102	0.000
S13.001	S9	15 minute 30 year Winter I+0%	245.350	243.787	-0.113	0.000
S12.001	S8	15 minute 30 year Winter I+0%	245.200	243.444	-0.156	0.000
S12.002	S7	15 minute 30 year Winter I+0%	244.500	242.098	-0.302	0.000
S10.005	S6-FC (P)	720 minute 30 year Winter I+0%	243.580	242.053	0.953	0.000
S1.011	S5-ORIFICE	15 minute 30 year Winter I+0%	244.000	241.514	1.514	0.000
S1.012	S4-TANK	1440 minute 30 year Winter I+0%	242.000	239.603	1.053	0.000
S1.013	S3-FC	1440 minute 30 year Winter I+0%	241.750	239.614	1.464	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Maximum Vol (m^3)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S7.000	S25-FC (H-N)	0.11		0.031		2.5	OK
S1.005	S24	0.16		0.207		130.0	OK
S8.000	S23-FC (D-E)	0.14		0.036		2.5	OK
S1.006	S22	0.47		0.469		132.9	OK
S9.000	S-FS01	0.15		0.021		46.3	OK
S1.007	S21	0.70		0.941		175.3	OK
S1.008	S20	0.64		1.198		179.0	OK
S1.009	S19	0.13		0.246		185.8	OK
S1.010	S18	0.16		3.877		177.0	SURCHARGED
S10.000	S17	0.21		0.100		18.9	OK
S10.001	S16	0.24		0.206		19.1	OK
S10.002	S15	0.24		0.181		54.7	OK

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S11.000	S14	0.14		0.078		33.1	OK
S10.003	S13-TANK (P)	0.04		266.219		2.5	SURCHARGED
S10.004	S12-BS	0.04		1.214		2.5	SURCHARGED
S12.000	S11	0.81		0.245		59.6	OK
S13.000	S10	0.70		0.055		57.2	OK
S13.001	S9	0.69		0.697		56.1	OK
S12.001	S8	0.46		0.981		115.2	OK
S12.002	S7	0.24		0.253		114.9	OK
S10.005	S6-FC (P)	0.19		6.624		2.6	SURCHARGED
S1.011	S5-ORIFICE	2.05		12.753		162.5	SURCHARGED
S1.012	S4-TANK	0.07		1792.423		11.7	SURCHARGED
S1.013	S3-FC	0.20		4.175		10.5	SURCHARGED

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 3 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.312
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 2, 30, 100
Climate Change (%)	0, 0, 0, 30

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
S1.000	S37	15 minute 100 year Winter I+30%	259.000	258.764	0.964	0.000	1.11
S2.000	S36-FC (A)	15 minute 100 year Summer I+30%	264.400	259.571	-0.129	0.000	0.05
S3.000	S35-FC (F)	15 minute 100 year Summer I+30%	260.000	257.788	-0.112	0.000	0.15
S2.001	S34	15 minute 100 year Winter I+30%	263.550	257.435	-0.215	0.000	0.18
S4.000	S33-FC (G)	15 minute 100 year Winter I+30%	258.000	256.348	0.448	0.000	0.97
S4.001	S32	15 minute 100 year Winter I+30%	259.000	256.195	0.445	0.000	1.18
S2.002	S31	15 minute 100 year Winter I+30%	261.550	255.953	0.453	0.000	1.18
S1.001	S30	15 minute 100 year Winter I+30%	260.800	255.730	0.380	0.000	1.88
S1.002	S29	15 minute 100 year Winter I+30%	259.100	255.061	-0.139	0.000	0.56
S5.000	S28-FC (C)	15 minute 100 year Summer I+30%	253.000	251.029	-0.121	0.000	0.08
S1.003	S27	15 minute 100 year Winter I+30%	253.500	250.668	-0.132	0.000	0.60
S6.000	S-FS02	15 minute 100 year Winter I+30%	253.000	250.991	-0.209	0.000	0.20
S1.004	S26	15 minute 100 year Winter I+30%	252.500	249.701	-0.099	0.000	0.77

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow (l/s)	Maximum Vol (m³)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	S37		1.254		42.8	FLOOD RISK
S2.000	S36-FC (A)		0.018		2.5	OK
S3.000	S35-FC (F)		0.038		2.5	OK
S2.001	S34		0.091		46.7	OK
S4.000	S33-FC (G)		0.671		18.4	SURCHARGED
S4.001	S32		0.834		20.5	SURCHARGED
S2.002	S31		1.865		81.7	SURCHARGED
S1.001	S30		3.116		142.8	SURCHARGED
S1.002	S29		0.627		142.1	OK
S5.000	S28-FC (C)		0.027		2.5	OK
S1.003	S27		0.241		145.0	OK
S6.000	S-FS02		0.024		58.6	OK
S1.004	S26		0.319		196.9	OK

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S7.000	S25-FC (H-N)	15 minute 100 year Summer I+30%	250.600	249.132	-0.118	0.000
S1.005	S24	15 minute 100 year Winter I+30%	251.700	248.453	-0.297	0.000
S8.000	S23-FC (D-E)	15 minute 100 year Summer I+30%	247.000	245.037	-0.113	0.000
S1.006	S22	15 minute 100 year Winter I+30%	248.300	244.815	-0.085	0.000
S9.000	S-FS01	15 minute 100 year Winter I+30%	248.000	245.953	-0.197	0.000
S1.007	S21	15 minute 100 year Winter I+30%	247.600	244.683	0.033	0.000
S1.008	S20	15 minute 100 year Winter I+30%	246.650	244.369	-0.081	0.000
S1.009	S19	15 minute 100 year Winter I+30%	245.700	244.157	-0.043	0.000
S1.010	S18	15 minute 100 year Winter I+30%	244.000	243.823	2.223	0.000
S10.000	S17	15 minute 100 year Winter I+30%	245.000	243.624	-0.176	0.000
S10.001	S16	15 minute 100 year Winter I+30%	245.000	243.333	-0.167	0.000
S10.002	S15	15 minute 100 year Winter I+30%	244.750	243.233	-0.167	0.000
S11.000	S14	15 minute 100 year Winter I+30%	244.550	243.148	-0.202	0.000
S10.003	S13-TANK (P)	960 minute 100 year Winter I+30%	244.650	242.722	1.122	0.000
S10.004	S12-BS	960 minute 100 year Winter I+30%	244.400	242.721	1.271	0.000
S12.000	S11	15 minute 100 year Winter I+30%	245.250	244.584	0.534	0.000
S13.000	S10	15 minute 100 year Winter I+30%	245.350	244.794	0.344	0.000
S13.001	S9	15 minute 100 year Winter I+30%	245.350	243.957	0.057	0.000
S12.001	S8	15 minute 100 year Winter I+30%	245.200	243.520	-0.080	0.000
S12.002	S7	15 minute 100 year Winter I+30%	244.500	242.914	0.514	0.000
S10.005	S6-FC (P)	960 minute 100 year Winter I+30%	243.580	242.721	1.621	0.000
S1.011	S5-ORIFICE	15 minute 100 year Winter I+30%	244.000	243.454	3.454	0.000
S1.012	S4-TANK	1440 minute 100 year Winter I+30%	242.000	239.877	1.327	0.000
S1.013	S3-FC	1440 minute 100 year Winter I+30%	241.750	239.887	1.737	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S7.000	S25-FC (H-N)	0.11		0.031		2.5	OK
S1.005	S24	0.25		0.263		198.3	OK
S8.000	S23-FC (D-E)	0.14		0.036		2.5	OK
S1.006	S22	0.73		0.967		204.6	OK
S9.000	S-FS01	0.26		0.028		77.7	OK
S1.007	S21	1.10		2.074		277.4	SURCHARGED
S1.008	S20	1.00		2.031		281.4	OK
S1.009	S19	0.20		2.424		292.3	OK
S1.010	S18	0.22		15.967		247.1	FLOOD RISK
S10.000	S17	0.35		0.134		31.7	OK
S10.001	S16	0.41		0.370		32.1	OK
S10.002	S15	0.40		0.291		91.5	OK

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Maximum Vol (m^3)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S11.000	S14	0.23		0.105		55.6	OK
S10.003	S13-TANK (P)	0.05		502.492		3.2	SURCHARGED
S10.004	S12-BS	0.05		1.970		3.2	SURCHARGED
S12.000	S11	1.35		0.937		99.9	SURCHARGED
S13.000	S10	1.17		0.181		95.3	SURCHARGED
S13.001	S9	1.10		2.551		88.8	SURCHARGED
S12.001	S8	0.73		2.226		180.5	OK
S12.002	S7	0.37		2.341		176.5	SURCHARGED
S10.005	S6-FC (P)	0.23		8.568		3.2	SURCHARGED
S1.011	S5-ORIFICE	3.02		16.215		239.4	SURCHARGED
S1.012	S4-TANK	0.07		2118.835		11.7	SURCHARGED
S1.013	S3-FC	0.20		4.869		10.5	SURCHARGED

APPENDIX J

Surface Water Attenuation – Outline Planning Storage Volume Calculations

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	259.928	0.378	2.5	39.7	O K
30 min Summer	260.059	0.509	2.5	53.4	O K
60 min Summer	260.198	0.648	2.5	68.0	O K
120 min Summer	260.321	0.771	2.5	81.0	O K
180 min Summer	260.369	0.819	2.5	86.0	O K
240 min Summer	260.383	0.833	2.5	87.5	O K
360 min Summer	260.385	0.835	2.5	87.7	O K
480 min Summer	260.376	0.826	2.5	86.7	O K
600 min Summer	260.362	0.812	2.5	85.3	O K
720 min Summer	260.346	0.796	2.5	83.6	O K
960 min Summer	260.310	0.760	2.5	79.8	O K
1440 min Summer	260.231	0.681	2.5	71.5	O K
2160 min Summer	260.089	0.539	2.5	56.6	O K
2880 min Summer	259.970	0.420	2.5	44.1	O K
4320 min Summer	259.807	0.257	2.5	27.0	O K
5760 min Summer	259.719	0.169	2.4	17.8	O K
7200 min Summer	259.672	0.122	2.2	12.8	O K
8640 min Summer	259.647	0.097	2.0	10.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	111.165	0.0	41.2	18
30 min Summer	76.210	0.0	56.5	33
60 min Summer	49.937	0.0	74.4	62
120 min Summer	31.554	0.0	94.0	122
180 min Summer	23.716	0.0	106.0	182
240 min Summer	19.196	0.0	114.4	240
360 min Summer	14.282	0.0	127.7	314
480 min Summer	11.554	0.0	137.8	380
600 min Summer	9.792	0.0	145.9	444
720 min Summer	8.549	0.0	152.9	512
960 min Summer	6.892	0.0	164.3	652
1440 min Summer	5.076	0.0	181.5	926
2160 min Summer	3.728	0.0	200.2	1316
2880 min Summer	2.991	0.0	214.1	1672
4320 min Summer	2.187	0.0	234.8	2376
5760 min Summer	1.753	0.0	251.1	3048
7200 min Summer	1.477	0.0	264.4	3744
8640 min Summer	1.284	0.0	275.9	4408

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
10080 min Summer	259.636	0.086	1.8	9.0	O K
15 min Winter	259.975	0.425	2.5	44.6	O K
30 min Winter	260.124	0.574	2.5	60.3	O K
60 min Winter	260.282	0.732	2.5	76.9	O K
120 min Winter	260.425	0.875	2.5	91.9	O K
180 min Winter	260.485	0.935	2.5	98.2	O K
240 min Winter	260.507	0.957	2.5	100.5	O K
360 min Winter	260.517	0.967	2.5	101.5	O K
480 min Winter	260.501	0.951	2.5	99.9	O K
600 min Winter	260.484	0.934	2.5	98.1	O K
720 min Winter	260.462	0.912	2.5	95.7	O K
960 min Winter	260.408	0.858	2.5	90.1	O K
1440 min Winter	260.288	0.738	2.5	77.5	O K
2160 min Winter	260.065	0.515	2.5	54.1	O K
2880 min Winter	259.893	0.343	2.5	36.0	O K
4320 min Winter	259.711	0.161	2.3	16.9	O K
5760 min Winter	259.647	0.097	2.0	10.2	O K
7200 min Winter	259.631	0.081	1.7	8.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.141	0.0	285.9	5136
15 min Winter	111.165	0.0	46.1	18
30 min Winter	76.210	0.0	63.3	33
60 min Winter	49.937	0.0	83.3	62
120 min Winter	31.554	0.0	105.3	120
180 min Winter	23.716	0.0	118.8	178
240 min Winter	19.196	0.0	128.2	234
360 min Winter	14.282	0.0	143.0	342
480 min Winter	11.554	0.0	154.3	396
600 min Winter	9.792	0.0	163.5	468
720 min Winter	8.549	0.0	171.3	546
960 min Winter	6.892	0.0	184.1	702
1440 min Winter	5.076	0.0	203.3	1010
2160 min Winter	3.728	0.0	224.3	1404
2880 min Winter	2.991	0.0	239.8	1732
4320 min Winter	2.187	0.0	263.0	2376
5760 min Winter	1.753	0.0	281.2	2944
7200 min Winter	1.477	0.0	296.2	3672

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
8640 min Winter	259.621	0.071	1.5	7.4	O K
10080 min Winter	259.614	0.064	1.3	6.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Winter	1.284	0.0	309.0	4400
10080 min Winter	1.141	0.0	320.3	5136

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	0.312	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.199

Time (mins) From:	To:	Area (ha)
0	4	0.199

Model Details

Storage is Online Cover Level (m) 264.400

Tank or Pond Structure

Invert Level (m) 259.550

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	105.0	1.000	105.0	1.001	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0075-2500-1000-2500
Design Head (m)	1.000
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	259.550
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.5	Kick-Flo®	0.627	2.0
Flush-Flo™	0.307	2.5	Mean Flow over Head Range	-	2.2

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	2.1	1.200	2.7	3.000	4.1	7.000	6.2
0.200	2.4	1.400	2.9	3.500	4.5	7.500	6.4
0.300	2.5	1.600	3.1	4.000	4.7	8.000	6.6
0.400	2.5	1.800	3.3	4.500	5.0	8.500	6.8
0.500	2.4	2.000	3.4	5.000	5.3	9.000	7.0
0.600	2.1	2.200	3.6	5.500	5.5	9.500	7.1
0.800	2.3	2.400	3.7	6.000	5.7		
1.000	2.5	2.600	3.9	6.500	6.0		

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	251.272	0.272	2.5	115.6	O K
30 min Summer	251.371	0.371	2.5	157.6	O K
60 min Summer	251.481	0.481	2.5	204.2	O K
120 min Summer	251.596	0.596	2.5	253.4	O K
180 min Summer	251.662	0.662	2.5	281.3	O K
240 min Summer	251.703	0.703	2.5	298.6	O K
360 min Summer	251.759	0.759	2.5	322.7	O K
480 min Summer	251.794	0.794	2.5	337.3	O K
600 min Summer	251.815	0.815	2.5	346.6	O K
720 min Summer	251.829	0.829	2.5	352.3	O K
960 min Summer	251.840	0.840	2.5	357.0	O K
1440 min Summer	251.832	0.832	2.5	353.6	O K
2160 min Summer	251.807	0.807	2.5	343.1	O K
2880 min Summer	251.777	0.777	2.5	330.4	O K
4320 min Summer	251.713	0.713	2.5	303.0	O K
5760 min Summer	251.647	0.647	2.5	275.0	O K
7200 min Summer	251.571	0.571	2.5	242.7	O K
8640 min Summer	251.504	0.504	2.5	214.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	111.165	0.0	110.4	19
30 min Summer	76.210	0.0	150.8	34
60 min Summer	49.937	0.0	207.2	64
120 min Summer	31.554	0.0	261.6	124
180 min Summer	23.716	0.0	294.1	184
240 min Summer	19.196	0.0	316.4	242
360 min Summer	14.282	0.0	349.7	362
480 min Summer	11.554	0.0	370.5	482
600 min Summer	9.792	0.0	379.5	602
720 min Summer	8.549	0.0	379.6	722
960 min Summer	6.892	0.0	373.6	960
1440 min Summer	5.076	0.0	357.0	1254
2160 min Summer	3.728	0.0	562.7	1640
2880 min Summer	2.991	0.0	600.3	2044
4320 min Summer	2.187	0.0	641.7	2892
5760 min Summer	1.753	0.0	709.2	3696
7200 min Summer	1.477	0.0	746.9	4472
8640 min Summer	1.284	0.0	778.9	5192

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
10080 min Summer	251.445	0.445	2.5	189.0	O K
15 min Winter	251.305	0.305	2.5	129.6	O K
30 min Winter	251.416	0.416	2.5	176.8	O K
60 min Winter	251.540	0.540	2.5	229.4	O K
120 min Winter	251.672	0.672	2.5	285.6	O K
180 min Winter	251.746	0.746	2.5	317.0	O K
240 min Winter	251.792	0.792	2.5	336.8	O K
360 min Winter	251.858	0.858	2.5	364.8	O K
480 min Winter	251.900	0.900	2.5	382.5	O K
600 min Winter	251.927	0.927	2.5	394.2	O K
720 min Winter	251.946	0.946	2.5	401.9	O K
960 min Winter	251.965	0.965	2.5	409.9	O K
1440 min Winter	251.964	0.964	2.5	409.5	O K
2160 min Winter	251.929	0.929	2.5	394.8	O K
2880 min Winter	251.890	0.890	2.5	378.1	O K
4320 min Winter	251.797	0.797	2.5	338.6	O K
5760 min Winter	251.699	0.699	2.5	297.1	O K
7200 min Winter	251.582	0.582	2.5	247.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.141	0.0	806.2	5952
15 min Winter	111.165	0.0	123.7	19
30 min Winter	76.210	0.0	167.7	33
60 min Winter	49.937	0.0	232.0	62
120 min Winter	31.554	0.0	292.3	122
180 min Winter	23.716	0.0	327.9	180
240 min Winter	19.196	0.0	351.3	240
360 min Winter	14.282	0.0	380.8	356
480 min Winter	11.554	0.0	387.4	472
600 min Winter	9.792	0.0	386.1	590
720 min Winter	8.549	0.0	383.3	702
960 min Winter	6.892	0.0	376.7	930
1440 min Winter	5.076	0.0	364.1	1358
2160 min Winter	3.728	0.0	629.4	1712
2880 min Winter	2.991	0.0	669.8	2188
4320 min Winter	2.187	0.0	676.6	3112
5760 min Winter	1.753	0.0	794.4	4032
7200 min Winter	1.477	0.0	836.6	4832

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
8640 min Winter	251.474	0.474	2.5	201.6	O K
10080 min Winter	251.387	0.387	2.5	164.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Winter	1.284	0.0	872.7	5536
10080 min Winter	1.141	0.0	903.6	6248

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	0.312	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.563

Time (mins) From:	To:	Area (ha)
0	4	0.563

Model Details

Storage is Online Cover Level (m) 253.000

Tank or Pond Structure

Invert Level (m) 251.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	425.0	1.000	425.0	1.001	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0075-2500-1000-2500
Design Head (m)	1.000
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	251.000
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.5	Kick-Flo®	0.627	2.0
Flush-Flo™	0.307	2.5	Mean Flow over Head Range	-	2.2

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	2.1	1.200	2.7	3.000	4.1	7.000	6.2
0.200	2.4	1.400	2.9	3.500	4.5	7.500	6.4
0.300	2.5	1.600	3.1	4.000	4.7	8.000	6.6
0.400	2.5	1.800	3.3	4.500	5.0	8.500	6.8
0.500	2.4	2.000	3.4	5.000	5.3	9.000	7.0
0.600	2.1	2.200	3.6	5.500	5.5	9.500	7.1
0.800	2.3	2.400	3.7	6.000	5.7		
1.000	2.5	2.600	3.9	6.500	6.0		

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	245.283	0.283	2.5	106.2	O K
30 min Summer	245.386	0.386	2.5	144.7	O K
60 min Summer	245.500	0.500	2.5	187.4	O K
120 min Summer	245.619	0.619	2.5	232.2	O K
180 min Summer	245.686	0.686	2.5	257.2	O K
240 min Summer	245.727	0.727	2.5	272.5	O K
360 min Summer	245.782	0.782	2.5	293.4	O K
480 min Summer	245.815	0.815	2.5	305.6	O K
600 min Summer	245.834	0.834	2.5	312.9	O K
720 min Summer	245.845	0.845	2.5	317.0	O K
960 min Summer	245.851	0.851	2.5	319.1	O K
1440 min Summer	245.838	0.838	2.5	314.4	O K
2160 min Summer	245.809	0.809	2.5	303.2	O K
2880 min Summer	245.774	0.774	2.5	290.4	O K
4320 min Summer	245.701	0.701	2.5	263.0	O K
5760 min Summer	245.624	0.624	2.5	233.9	O K
7200 min Summer	245.540	0.540	2.5	202.4	O K
8640 min Summer	245.469	0.469	2.5	175.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	111.165	0.0	102.8	19
30 min Summer	76.210	0.0	140.8	34
60 min Summer	49.937	0.0	191.3	64
120 min Summer	31.554	0.0	241.7	124
180 min Summer	23.716	0.0	272.1	182
240 min Summer	19.196	0.0	293.2	242
360 min Summer	14.282	0.0	325.7	362
480 min Summer	11.554	0.0	348.8	482
600 min Summer	9.792	0.0	365.2	602
720 min Summer	8.549	0.0	374.7	720
960 min Summer	6.892	0.0	375.1	960
1440 min Summer	5.076	0.0	359.8	1200
2160 min Summer	3.728	0.0	518.8	1580
2880 min Summer	2.991	0.0	554.1	1992
4320 min Summer	2.187	0.0	602.8	2852
5760 min Summer	1.753	0.0	652.8	3688
7200 min Summer	1.477	0.0	687.4	4392
8640 min Summer	1.284	0.0	716.9	5104

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
10080 min Summer	245.407	0.407	2.5	152.7	O K
15 min Winter	245.318	0.318	2.5	119.1	O K
30 min Winter	245.433	0.433	2.5	162.4	O K
60 min Winter	245.561	0.561	2.5	210.6	O K
120 min Winter	245.698	0.698	2.5	261.7	O K
180 min Winter	245.773	0.773	2.5	289.9	O K
240 min Winter	245.820	0.820	2.5	307.5	O K
360 min Winter	245.886	0.886	2.5	332.1	O K
480 min Winter	245.925	0.925	2.5	347.1	O K
600 min Winter	245.951	0.951	2.5	356.6	O K
720 min Winter	245.967	0.967	2.5	362.6	O K
960 min Winter	245.981	0.981	2.5	367.7	O K
1440 min Winter	245.969	0.969	2.5	363.5	O K
2160 min Winter	245.929	0.929	2.5	348.5	O K
2880 min Winter	245.882	0.882	2.5	330.8	O K
4320 min Winter	245.775	0.775	2.5	290.6	O K
5760 min Winter	245.662	0.662	2.5	248.1	O K
7200 min Winter	245.525	0.525	2.5	196.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.141	0.0	742.2	5848
15 min Winter	111.165	0.0	115.2	19
30 min Winter	76.210	0.0	157.0	33
60 min Winter	49.937	0.0	214.3	62
120 min Winter	31.554	0.0	270.4	122
180 min Winter	23.716	0.0	304.0	180
240 min Winter	19.196	0.0	327.0	240
360 min Winter	14.282	0.0	361.1	356
480 min Winter	11.554	0.0	380.8	472
600 min Winter	9.792	0.0	386.5	588
720 min Winter	8.549	0.0	385.7	700
960 min Winter	6.892	0.0	380.2	924
1440 min Winter	5.076	0.0	366.5	1342
2160 min Winter	3.728	0.0	580.7	1668
2880 min Winter	2.991	0.0	619.8	2136
4320 min Winter	2.187	0.0	663.5	3068
5760 min Winter	1.753	0.0	731.2	3984
7200 min Winter	1.477	0.0	770.0	4688

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
8640 min Winter	245.418	0.418	2.5	156.6	O K
10080 min Winter	245.332	0.332	2.5	124.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Winter	1.284	0.0	803.2	5440
10080 min Winter	1.141	0.0	831.8	6056

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	0.312	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.518

Time (mins) From:	To:	Area (ha)
0	4	0.518

Model Details

Storage is Online Cover Level (m) 247.000

Tank or Pond Structure

Invert Level (m) 245.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	375.0	1.000	375.0	1.001	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0075-2500-1000-2500
Design Head (m)	1.000
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	245.000
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.5	Kick-Flo®	0.627	2.0
Flush-Flo™	0.307	2.5	Mean Flow over Head Range	-	2.2

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	2.1	1.200	2.7	3.000	4.1	7.000	6.2
0.200	2.4	1.400	2.9	3.500	4.5	7.500	6.4
0.300	2.5	1.600	3.1	4.000	4.7	8.000	6.6
0.400	2.5	1.800	3.3	4.500	5.0	8.500	6.8
0.500	2.4	2.000	3.4	5.000	5.3	9.000	7.0
0.600	2.1	2.200	3.6	5.500	5.5	9.500	7.1
0.800	2.3	2.400	3.7	6.000	5.7		
1.000	2.5	2.600	3.9	6.500	6.0		

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	258.269	0.269	2.5	121.2	O K
30 min Summer	258.367	0.367	2.5	165.3	O K
60 min Summer	258.476	0.476	2.5	214.4	O K
120 min Summer	258.592	0.592	2.5	266.2	O K
180 min Summer	258.657	0.657	2.5	295.7	O K
240 min Summer	258.698	0.698	2.5	314.2	O K
360 min Summer	258.756	0.756	2.5	340.1	O K
480 min Summer	258.791	0.791	2.5	356.1	O K
600 min Summer	258.814	0.814	2.5	366.5	O K
720 min Summer	258.829	0.829	2.5	373.1	O K
960 min Summer	258.843	0.843	2.5	379.3	O K
1440 min Summer	258.838	0.838	2.5	377.0	O K
2160 min Summer	258.815	0.815	2.5	366.8	O K
2880 min Summer	258.787	0.787	2.5	354.3	O K
4320 min Summer	258.727	0.727	2.5	327.0	O K
5760 min Summer	258.665	0.665	2.5	299.4	O K
7200 min Summer	258.595	0.595	2.5	268.0	O K
8640 min Summer	258.529	0.529	2.5	237.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	111.165	0.0	115.0	19
30 min Summer	76.210	0.0	156.7	34
60 min Summer	49.937	0.0	216.7	64
120 min Summer	31.554	0.0	273.5	124
180 min Summer	23.716	0.0	307.2	184
240 min Summer	19.196	0.0	330.0	242
360 min Summer	14.282	0.0	362.6	362
480 min Summer	11.554	0.0	379.2	482
600 min Summer	9.792	0.0	381.9	602
720 min Summer	8.549	0.0	379.8	722
960 min Summer	6.892	0.0	372.4	960
1440 min Summer	5.076	0.0	356.0	1310
2160 min Summer	3.728	0.0	588.8	1668
2880 min Summer	2.991	0.0	627.3	2072
4320 min Summer	2.187	0.0	652.4	2896
5760 min Summer	1.753	0.0	743.1	3744
7200 min Summer	1.477	0.0	782.6	4536
8640 min Summer	1.284	0.0	816.1	5272

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
10080 min Summer	258.470	0.470	2.5	211.4	O K
15 min Winter	258.302	0.302	2.5	135.9	O K
30 min Winter	258.412	0.412	2.5	185.4	O K
60 min Winter	258.535	0.535	2.5	240.7	O K
120 min Winter	258.666	0.666	2.5	299.9	O K
180 min Winter	258.740	0.740	2.5	333.1	O K
240 min Winter	258.787	0.787	2.5	354.2	O K
360 min Winter	258.854	0.854	2.5	384.3	O K
480 min Winter	258.897	0.897	2.5	403.5	O K
600 min Winter	258.925	0.925	2.5	416.4	O K
720 min Winter	258.945	0.945	2.5	425.2	O K
960 min Winter	258.966	0.966	2.5	434.9	O K
1440 min Winter	258.970	0.970	2.5	436.6	O K
2160 min Winter	258.938	0.938	2.5	422.2	O K
2880 min Winter	258.903	0.903	2.5	406.2	O K
4320 min Winter	258.816	0.816	2.5	367.1	O K
5760 min Winter	258.725	0.725	2.5	326.3	O K
7200 min Winter	258.624	0.624	2.5	280.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.141	0.0	844.6	5960
15 min Winter	111.165	0.0	128.9	19
30 min Winter	76.210	0.0	173.8	33
60 min Winter	49.937	0.0	242.7	64
120 min Winter	31.554	0.0	305.3	122
180 min Winter	23.716	0.0	341.6	180
240 min Winter	19.196	0.0	364.5	240
360 min Winter	14.282	0.0	386.9	356
480 min Winter	11.554	0.0	387.8	474
600 min Winter	9.792	0.0	385.2	590
720 min Winter	8.549	0.0	381.9	704
960 min Winter	6.892	0.0	375.3	932
1440 min Winter	5.076	0.0	364.0	1370
2160 min Winter	3.728	0.0	658.0	1732
2880 min Winter	2.991	0.0	697.5	2192
4320 min Winter	2.187	0.0	679.4	3116
5760 min Winter	1.753	0.0	832.3	4040
7200 min Winter	1.477	0.0	876.5	4968

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
8640 min Winter	258.512	0.512	2.5	230.2	O K
10080 min Winter	258.423	0.423	2.5	190.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Winter	1.284	0.0	914.3	5624
10080 min Winter	1.141	0.0	946.7	6352

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	0.312	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.590

Time (mins) From:	To:	Area (ha)
0	4	0.590

Model Details

Storage is Online Cover Level (m) 260.000

Tank or Pond Structure

Invert Level (m) 258.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	450.0	1.000	450.0	1.001	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0075-2500-1000-2500
Design Head (m)	1.000
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	258.000
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.5	Kick-Flo®	0.627	2.0
Flush-Flo™	0.307	2.5	Mean Flow over Head Range	-	2.2

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	2.1	1.200	2.7	3.000	4.1	7.000	6.2
0.200	2.4	1.400	2.9	3.500	4.5	7.500	6.4
0.300	2.5	1.600	3.1	4.000	4.7	8.000	6.6
0.400	2.5	1.800	3.3	4.500	5.0	8.500	6.8
0.500	2.4	2.000	3.4	5.000	5.3	9.000	7.0
0.600	2.1	2.200	3.6	5.500	5.5	9.500	7.1
0.800	2.3	2.400	3.7	6.000	5.7		
1.000	2.5	2.600	3.9	6.500	6.0		

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	256.007	0.257	2.5	128.6	O K
30 min Summer	256.101	0.351	2.5	175.3	O K
60 min Summer	256.205	0.455	2.5	227.5	O K
120 min Summer	256.315	0.565	2.5	282.7	O K
180 min Summer	256.379	0.629	2.5	314.3	O K
240 min Summer	256.419	0.669	2.5	334.5	O K
360 min Summer	256.476	0.726	2.5	363.1	O K
480 min Summer	256.512	0.762	2.5	381.1	O K
600 min Summer	256.536	0.786	2.5	393.0	O K
720 min Summer	256.552	0.802	2.5	401.1	O K
960 min Summer	256.569	0.819	2.5	409.4	O K
1440 min Summer	256.569	0.819	2.5	409.5	O K
2160 min Summer	256.550	0.800	2.5	399.9	O K
2880 min Summer	256.525	0.775	2.5	387.5	O K
4320 min Summer	256.470	0.720	2.5	360.2	O K
5760 min Summer	256.415	0.665	2.5	332.3	O K
7200 min Summer	256.352	0.602	2.5	300.9	O K
8640 min Summer	256.290	0.540	2.5	270.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	111.165	0.0	120.3	19
30 min Summer	76.210	0.0	163.3	34
60 min Summer	49.937	0.0	228.6	64
120 min Summer	31.554	0.0	288.2	124
180 min Summer	23.716	0.0	323.2	184
240 min Summer	19.196	0.0	346.2	242
360 min Summer	14.282	0.0	375.7	362
480 min Summer	11.554	0.0	383.8	482
600 min Summer	9.792	0.0	382.0	602
720 min Summer	8.549	0.0	378.3	722
960 min Summer	6.892	0.0	369.7	960
1440 min Summer	5.076	0.0	353.0	1370
2160 min Summer	3.728	0.0	621.6	1712
2880 min Summer	2.991	0.0	660.0	2104
4320 min Summer	2.187	0.0	655.1	2940
5760 min Summer	1.753	0.0	786.8	3800
7200 min Summer	1.477	0.0	828.6	4544
8640 min Summer	1.284	0.0	864.1	5280

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
10080 min Summer	256.236	0.486	2.5	242.9	O K
15 min Winter	256.038	0.288	2.5	144.1	O K
30 min Winter	256.143	0.393	2.5	196.7	O K
60 min Winter	256.261	0.511	2.5	255.4	O K
120 min Winter	256.387	0.637	2.5	318.4	O K
180 min Winter	256.458	0.708	2.5	354.2	O K
240 min Winter	256.504	0.754	2.5	377.1	O K
360 min Winter	256.570	0.820	2.5	410.0	O K
480 min Winter	256.613	0.863	2.5	431.3	O K
600 min Winter	256.642	0.892	2.5	446.0	O K
720 min Winter	256.663	0.913	2.5	456.3	O K
960 min Winter	256.687	0.937	2.5	468.4	O K
1440 min Winter	256.697	0.947	2.5	473.6	O K
2160 min Winter	256.671	0.921	2.5	460.3	O K
2880 min Winter	256.640	0.890	2.5	445.0	O K
4320 min Winter	256.564	0.814	2.5	406.8	O K
5760 min Winter	256.482	0.732	2.5	366.1	O K
7200 min Winter	256.394	0.644	2.5	322.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.141	0.0	894.2	6056
15 min Winter	111.165	0.0	134.7	19
30 min Winter	76.210	0.0	180.3	33
60 min Winter	49.937	0.0	256.0	64
120 min Winter	31.554	0.0	321.3	122
180 min Winter	23.716	0.0	357.6	180
240 min Winter	19.196	0.0	378.0	240
360 min Winter	14.282	0.0	388.7	358
480 min Winter	11.554	0.0	386.3	474
600 min Winter	9.792	0.0	382.4	590
720 min Winter	8.549	0.0	378.6	706
960 min Winter	6.892	0.0	371.7	934
1440 min Winter	5.076	0.0	361.1	1372
2160 min Winter	3.728	0.0	692.7	1944
2880 min Winter	2.991	0.0	723.6	2220
4320 min Winter	2.187	0.0	678.3	3156
5760 min Winter	1.753	0.0	881.3	4096
7200 min Winter	1.477	0.0	927.9	5040

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
8640 min Winter	256.290	0.540	2.5	269.8	O K
10080 min Winter	256.204	0.454	2.5	227.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Winter	1.284	0.0	968.0	5712
10080 min Winter	1.141	0.0	1002.3	6448

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	0.312	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.625

Time (mins) From:	To:	Area (ha)
0	4	0.625

Model Details

Storage is Online Cover Level (m) 258.000

Tank or Pond Structure

Invert Level (m) 255.750

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	500.0	1.000	500.0	1.001	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0075-2500-1000-2500
Design Head (m)	1.000
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	255.750
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.5	Kick-Flo®	0.627	2.0
Flush-Flo™	0.307	2.5	Mean Flow over Head Range	-	2.2

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	2.1	1.200	2.7	3.000	4.1	7.000	6.2
0.200	2.4	1.400	2.9	3.500	4.5	7.500	6.4
0.300	2.5	1.600	3.1	4.000	4.7	8.000	6.6
0.400	2.5	1.800	3.3	4.500	5.0	8.500	6.8
0.500	2.4	2.000	3.4	5.000	5.3	9.000	7.0
0.600	2.1	2.200	3.6	5.500	5.5	9.500	7.1
0.800	2.3	2.400	3.7	6.000	5.7		
1.000	2.5	2.600	3.9	6.500	6.0		

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	249.340	0.240	2.5	192.0	O K
30 min Summer	249.428	0.328	2.5	262.4	O K
60 min Summer	249.527	0.427	2.5	341.8	O K
120 min Summer	249.634	0.534	2.5	427.3	O K
180 min Summer	249.696	0.596	2.5	477.2	O K
240 min Summer	249.738	0.638	2.5	510.5	O K
360 min Summer	249.800	0.700	2.5	559.9	O K
480 min Summer	249.842	0.742	2.5	593.5	O K
600 min Summer	249.873	0.773	2.5	618.1	O K
720 min Summer	249.896	0.796	2.5	636.8	O K
960 min Summer	249.928	0.828	2.5	662.5	O K
1440 min Summer	249.958	0.858	2.5	686.8	O K
2160 min Summer	249.962	0.862	2.5	689.8	O K
2880 min Summer	249.950	0.850	2.5	679.9	O K
4320 min Summer	249.918	0.818	2.5	654.6	O K
5760 min Summer	249.886	0.786	2.5	628.4	O K
7200 min Summer	249.853	0.753	2.5	602.2	O K
8640 min Summer	249.820	0.720	2.5	575.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	111.165	0.0	162.0	23
30 min Summer	76.210	0.0	200.4	38
60 min Summer	49.937	0.0	327.3	68
120 min Summer	31.554	0.0	394.2	126
180 min Summer	23.716	0.0	405.6	186
240 min Summer	19.196	0.0	400.5	246
360 min Summer	14.282	0.0	387.4	366
480 min Summer	11.554	0.0	377.7	486
600 min Summer	9.792	0.0	370.5	604
720 min Summer	8.549	0.0	365.0	724
960 min Summer	6.892	0.0	357.2	964
1440 min Summer	5.076	0.0	351.2	1442
2160 min Summer	3.728	0.0	743.0	2144
2880 min Summer	2.991	0.0	717.9	2476
4320 min Summer	2.187	0.0	665.9	3240
5760 min Summer	1.753	0.0	1165.4	4040
7200 min Summer	1.477	0.0	1222.4	4896
8640 min Summer	1.284	0.0	1260.3	5712

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
10080 min Summer	249.786	0.686	2.5	549.0	O K
15 min Winter	249.369	0.269	2.5	215.2	O K
30 min Winter	249.468	0.368	2.5	294.3	O K
60 min Winter	249.579	0.479	2.5	383.6	O K
120 min Winter	249.700	0.600	2.5	480.3	O K
180 min Winter	249.771	0.671	2.5	537.1	O K
240 min Winter	249.818	0.718	2.5	574.6	O K
360 min Winter	249.888	0.788	2.5	630.6	O K
480 min Winter	249.937	0.837	2.5	669.3	O K
600 min Winter	249.973	0.873	2.5	698.1	O K
720 min Winter	250.000	0.900	2.5	720.3	O K
960 min Winter	250.040	0.940	2.5	751.6	O K
1440 min Winter	250.080	0.980	2.5	784.3	O K
2160 min Winter	250.095	0.995	2.5	796.3	O K
2880 min Winter	250.084	0.984	2.5	787.3	O K
4320 min Winter	250.041	0.941	2.5	753.1	O K
5760 min Winter	249.997	0.897	2.5	718.0	O K
7200 min Winter	249.950	0.850	2.5	679.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.141	0.0	1243.6	6552
15 min Winter	111.165	0.0	178.0	23
30 min Winter	76.210	0.0	206.9	37
60 min Winter	49.937	0.0	362.1	66
120 min Winter	31.554	0.0	407.0	126
180 min Winter	23.716	0.0	398.8	184
240 min Winter	19.196	0.0	390.7	244
360 min Winter	14.282	0.0	379.1	360
480 min Winter	11.554	0.0	372.4	478
600 min Winter	9.792	0.0	368.5	596
720 min Winter	8.549	0.0	366.5	712
960 min Winter	6.892	0.0	367.4	946
1440 min Winter	5.076	0.0	371.0	1402
2160 min Winter	3.728	0.0	751.9	2076
2880 min Winter	2.991	0.0	733.0	2708
4320 min Winter	2.187	0.0	703.3	3380
5760 min Winter	1.753	0.0	1302.2	4328
7200 min Winter	1.477	0.0	1358.3	5264

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
8640 min Winter	249.901	0.801	2.5	640.5	O K
10080 min Winter	249.851	0.751	2.5	600.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Winter	1.284	0.0	1351.1	6216
10080 min Winter	1.141	0.0	1287.7	7064

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	0.312	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.931

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.500	4	8	0.431

Model Details

Storage is Online Cover Level (m) 251.000

Tank or Pond Structure

Invert Level (m) 249.100

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	800.0	1.000	800.0	1.001	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0075-2500-1000-2500
Design Head (m)	1.000
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	249.100
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

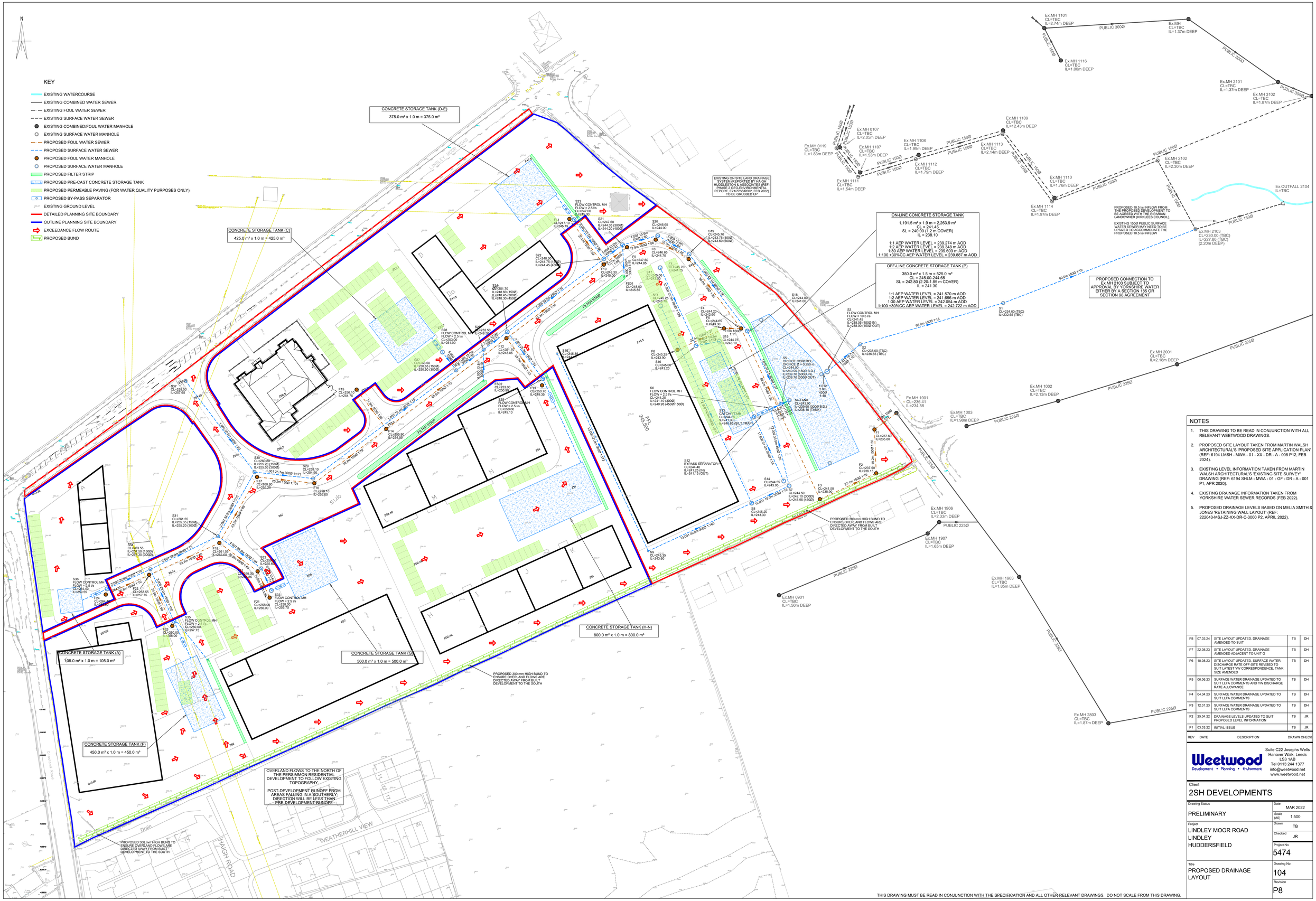
Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.5	Kick-Flo®	0.627	2.0
Flush-Flo™	0.307	2.5	Mean Flow over Head Range	-	2.2

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	2.1	1.200	2.7	3.000	4.1	7.000	6.2
0.200	2.4	1.400	2.9	3.500	4.5	7.500	6.4
0.300	2.5	1.600	3.1	4.000	4.7	8.000	6.6
0.400	2.5	1.800	3.3	4.500	5.0	8.500	6.8
0.500	2.4	2.000	3.4	5.000	5.3	9.000	7.0
0.600	2.1	2.200	3.6	5.500	5.5	9.500	7.1
0.800	2.3	2.400	3.7	6.000	5.7		
1.000	2.5	2.600	3.9	6.500	6.0		

APPENDIX K

Preliminary Drainage Layout



NOTES

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT WEETWOOD DRAWINGS.
2. PROPOSED SITE LAYOUT TAKEN FROM MARTIN WALSH ARCHITECTURAL'S 'PROPOSED SITE APPLICATION PLAN' (REF: 6194 LMSH - MWA - 01 - XX - DR - A - 008 P12, FEB 2024).
3. EXISTING LEVEL INFORMATION TAKEN FROM MARTIN WALSH ARCHITECTURAL'S 'EXISTING SITE SURVEY' DRAWING (REF: 6194 SHLM - MWA - 01 - GF - DR - A - 001 P1, APR 2020).
4. EXISTING DRAINAGE INFORMATION TAKEN FROM YORKSHIRE WATER SEWER RECORDS (FEB 2022).
5. PROPOSED DRAINAGE LEVELS BASED ON MELIA SMITH & JONES 'RETAINING WALL LAYOUT' (REF: 222043-MSJ-ZZ-XX-DR-C-3000 P2, APRIL 2022).

REV	DATE	DESCRIPTION	DRAWN	CHECK
P8	07.03.24	SITE LAYOUT UPDATED. DRAINAGE AMENDED TO SUIT.	TB	DH
P7	22.08.23	SITE LAYOUT UPDATED. DRAINAGE AMENDED ADJACENT TO UNIT G	TB	DH
P6	18.08.23	SITE LAYOUT UPDATED. SURFACE WATER DISCHARGE RATE OFF-SITE REVISED TO SUIT LATEST YW CORRESPONDENCE, TANK SIZE AMENDED	TB	DH
P5	06.06.23	SURFACE WATER DRAINAGE UPDATED TO SUIT LLFA COMMENTS AND YW DISCHARGE RATE ALLOWANCE	TB	DH
P4	04.04.23	SURFACE WATER DRAINAGE UPDATED TO SUIT LLFA COMMENTS	TB	DH
P3	12.01.23	SURFACE WATER DRAINAGE UPDATED TO SUIT LLFA COMMENTS	TB	DH
P2	25.04.22	DRAINAGE LEVELS UPDATED TO SUIT PROPOSED LEVEL INFORMATION	TB	JR
P1	03.03.22	INITIAL ISSUE	TB	JR

Weetwood
Development • Planning • Environment
Suite C22 Josephs Wells
Hanover Walk, Leeds
LS3 1AB
Tel 0113 244 1377
info@weetwood.net
www.weetwood.net

Client
2SH DEVELOPMENTS

Drawing Status: PRELIMINARY	Date: MAR 2022
	Scale (A0): 1:500
Project: LINDLEY MOOR ROAD LINDLEY HUDDERSFIELD	Drawn: TB
	Checked: JR
	Project No: 5474
Title: PROPOSED DRAINAGE LAYOUT	Drawing No: 104
	Revision: P8

THIS DRAWING MUST BE READ IN CONJUNCTION WITH THE SPECIFICATION AND ALL OTHER RELEVANT DRAWINGS. DO NOT SCALE FROM THIS DRAWING.

APPENDIX L

Contributing Areas Plan

N

CONTRIBUTING AREA KEY

- S1.000 (0.099 ha)
- S2.000 (0.000 ha + 2.5 l/s)
- S3.000 (0.000 ha + 2.5 l/s)
- S2.001 (0.078 ha)
- S4.000 (0.036 ha + 2.5 l/s)
- S2.002 (0.049 ha)
- S1.001 (0.044 ha)
- S1.002 (0.00 ha)
- S5.000 (0.000 ha + 2.5 l/s)
- S6.000 (0.117 ha)
- S7.000 (0.000 ha + 2.5 l/s)
- S8.000 (0.000 ha + 2.5 l/s)
- S9.000 (0.155 ha)
- S1.007 (0.014 ha)
- S1.008 (0.012 ha)
- S1.009 (0.032 ha)
- S1.010 (0.027 ha)
- S10.000 (0.065 ha)
- S10.002 (0.115 ha)
- S11.000 (0.111 ha)
- S12.000 (0.220 ha)
- S13.000 (0.208 ha)
- OUTLINE PLANNING EXTENT
- DETAILED PLANNING SITE BOUNDARY
- OUTLINE PLANNING SITE BOUNDARY

PROPOSED IMPERMEABLE AREA
A = 0.221 ha
A = 0.221 x 0.9 (90%) = 0.199 ha

PROPOSED IMPERMEABLE AREA
C = 0.626 ha
C = 0.626 x 0.9 (90%) = 0.563 ha

PROPOSED IMPERMEABLE AREA
D-F = 0.575 ha
D-F = 0.575 x 0.9 (90%) = 0.518 ha

PROPOSED IMPERMEABLE AREA
F = 0.656 ha
F = 0.656 x 0.9 (90%) = 0.590 ha

PROPOSED IMPERMEABLE AREA
G = 0.694 ha
G = 0.694 x 0.9 (90%) = 0.625 ha

PROPOSED IMPERMEABLE AREA
H-N = 1.034 ha
H-N = 1.034 x 0.9 (90%) = 0.931 ha

LINDLEY MOOR ROAD
WEATHERHILL ROAD
WEATHERHILL VIEW
HAIGH ROAD
Cinderhills Road
Drain

NOTES

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

REV	DATE	DESCRIPTION	DRAWN	CHECK
P4	07.03.24	AREAS AMENDED TO SUIT REVISED SITE LAYOUT	TB	DH
P3	22.08.23	AREAS AMENDED TO SUIT REVISED SITE LAYOUT	TB	DH
P2	18.08.23	AREAS AMENDED TO SUIT REVISED SITE LAYOUT	TB	DH
P1	04.04.23	INITIAL ISSUE	TB	DH

Weetwood
Development • Planning • Environment
Suite C22 Josephs Wells
Hanover Walk, Leeds
LS3 1AB
Tel 0113 244 1377
info@weetwood.net
www.weetwood.net

Client
2SH DEVELOPMENTS

Drawing Status
PRELIMINARY

Project
LINDLEY MOOR ROAD
LINDLEY
HUDDERSFIELD

Title
CONTRIBUTING AREAS PLAN

Date: APR 2023
Scale (A0): 1:500
Drawn: TB
Checked: DH
Project No: 5474
Drawing No: 110
Revision: P4

THIS DRAWING MUST BE READ IN CONJUNCTION WITH THE SPECIFICATION AND ALL OTHER RELEVANT DRAWINGS. DO NOT SCALE FROM THIS DRAWING.

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