



CONSULTING ENGINEERS LTD

FLOOD RISK ASSESSMENT

LOWER BLACUP FARM,
CLECKHEATON

On Behalf of

NEWETT HOMES



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1.0 INTRODUCTION

- 1.1 Newett Homes is proposing to develop a parcel of land located at Lower Blacup Farm, Cleckheaton with new residential dwellings. As part of the viability of the site and to supplement a planning application, it was decided that a Flood Risk Assessment Report should be undertaken.
- 1.2 It is within the general development strategy of the country for development in areas where there is a risk of flooding to be assessed to avoid unnecessary increase in the requirement for flood defence. Under the National Planning Policy Framework (NPPF) and the Planning Practice Guidance (PPG), consultation is required with the Environment Agency, Water Authority, Lead Local Flood Authority and Internal Drainage Board and a Flood Risk Assessment Report should be prepared considering the development proposals and make recommendations for any flood mitigation measures.
- 1.3 OEC has been appointed to carry out an assessment of the site, implement appropriate consultations and prepare a Flood Risk Assessment Report, in accordance with NPPF, to satisfy the requirements of the Planning Authority.
- 1.4 The consultations and walkover survey have been undertaken in June and July 2024.
- 1.5 This report is based on the interpretation and assessment of data provided by third parties. Whilst every effort has been taken to ensure this information is accurate and up-to-date, OEC cannot guarantee the accuracy of third party data and the findings of this report may change if the data is amended or updated after the date of consultation.

2.0 EXISTING SITE

General

2.1 The site is a rectangular shaped piece of land equating to an area of approximately 2.37ha. The site is located on the south western outskirts of Cleckheaton and is situated at Ordnance Survey Grid Reference SE 186 248.

2.2 A site location plan is presented in Appendix A.

Current Use

2.3 The site is greenfield with the field to the north used as a paddock, and the southern fields used for the grazing of cows.

Boundaries

2.4 The site is bound by a mix of timber post and wire fencing, with the southern part of the site divided into three separate parcels. Lower Blacup access track split the site into two, that leads to the existing farm and residential buildings that are located centrally along the western boundary. Adjacent to the western boundary and beyond the existing buildings is agricultural farm land. Situated to the east and south are existing densely populated residential areas, with a commercial area to the north.

Topography and Vegetation

2.5 The site has a prominent fall in a northerly direction, with levels in the south-west corner at a high point of 129.50m A.O.D, dropping to a low point in the north-eastern corner of 90.46m A.O.D.

2.6 The majority of the site is grassland with sporadic vegetation in the form of mature trees, bushes and shrubs located around the site. Extensive mature vegetation in the form of trees, bushes and shrubs run along the entirety of the northern boundary and Lower Blacup access track that crosses the site.

- 2.7 A topographical survey is presented in Appendix B, with site photographs presented in Appendix C.

Existing Drainage

- 2.8 There is no obvious positive drainage system on the site, although land drainage may be present. Surface water run-off clearly discharges in a northerly direction following the natural topography of the site.
- 2.9 The nearest watercourse to the site is Blacup Beck and is located along the northern boundary. Access to the watercourse was not possible as it was overgrown.
- 2.10 The nearest river to the site is the River Spen, located approximately 1.20km in an easterly direction, from the site boundary at its nearest location.

Geology and Hydrogeology

- 2.11 The Geological Survey Maps of Great Britain available on the BGS website indicates that the site is underlain by the Clifton Rock – Sandstone Formation and the Pennine Lower Coal Measures Formation - Mudstone, Siltstone and Sandstone.
- 2.12 The Environment Agency website designates the bedrock under the site as a Secondary A Aquifer. This is a permeable strata capable of supporting water supplies at a local rather than strategic scale and in some cases forming an important source of base flow to rivers.
- 2.13 The Environment Agency website shows that the site does not lie within a Groundwater Source Protection Zone.

3.0 ENVIRONMENT AGENCY CONSULTATION

3.1 The Environment Agency Flood Map, which shows area of land that could flood from rivers or the sea and are shaded blue are presented in Appendix D. These areas do not take into account defences as water can overtop or can fail in extreme conditions. The EA flood zone classifications are defined as:-

3.1.1 Flood Zone 1 - 'Low Probability' is assessed as having a less than 1 in 1,000 annual probability of river or sea flooding in any year (less than 0.1%).

3.1.2 Flood Zone 2 - 'Medium Probability' is assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding in any year (1% - 0.1%) and between a 1 in 200 and 1 in 1,000 annual probability of flooding from the sea (0.5% - 0.1%).

3.1.3 Flood Zone 3 - 'High Probability' is assessed as having a 1 in 100 or greater annual probability of river flooding in any year (greater than 1%) and a 1 in 200 chance or greater annual probability of flooding from the sea (less than 0.5%).

3.2 The EA flood map for planning shows that the majority of the site is located within Flood Zone 1, and land immediately adjacent to the watercourse as being Flood Zone 2. Development is to be restricted to Flood Zone 1, therefore, has a low risk of fluvial flooding.

3.3 The flood map for surface water, which shows areas where surface water only would be expected to flow or pond in England & Wales, is also presented in Appendix D. All land in England and Wales will be within 'one' of a possible 'four' categories. The four categories shown on the map are:-

3.3.1 High - This area has a chance of flooding greater than 1 in 30 in any given year (annual probability of flooding 3.3%).

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- 3.3.2 Medium - This area has a chance of flooding between 1 in 100 (1%) and 1 in 30 (3.3%) in any given year.
 - 3.3.3 Low - This area has a chance of flooding between 1 in 1000 (0.1%) and 1 in 100 (1%) in any given year.
 - 3.3.4 Very low - This area has a chance of flooding of less than 1 in 1000 (0.1%) in any given year.
- 3.4 The proposed development is shown to be within a very low risk area for surface water flooding, with no flood routes from third party land affecting the site.

4.0 WATER AUTHORITY CONSULTATION

- 4.1 A consultation was requested from Yorkshire Water (YW), who are the Water Authority for this area, and a copy of their response, reference V538261, dated 12 July 2024, is presented in Appendix E for reference purposes.
- 4.2 As of October 2011 and the private to public sewer transfer, there are many unchartered Yorkshire Water assets currently not shown on their records.
- 4.3 There is a 450mm diameter public combined sewer recorded crossing the site. No buildings or other obstructions are to be erected within 6 (six) metres either side of the sewer centre-line, or trees planted within 5 (five) metres of this public sewer. It may not be acceptable to raise or lower ground levels over the sewer, nor to restrict access to the manholes.
- 4.4 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.
- 4.5 Foul water domestic waste can discharge to the 450mm diameter public combined sewer recorded crossing the site.
- 4.6 In respect of surface water, reference is made to Requirement H3 of Building Regulations 2000 and Sustainable Drainage Systems. This establishes a hierarchy of surface water disposal. Consideration should firstly be given to discharge to soakaways, infiltration and watercourse, in that priority order, before connection to sewer will be considered.
- 4.7 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.
- 4.8 It is understood that a watercourse (Blacup Beck) is located to the north of the site. This appears to be the obvious place for surface water disposal (if SuDS are not viable).

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- 4.9 Restrictions on surface water disposal from the site may be imposed by other parties. It is strongly advised to seek advice/comments from the Environment Agency/Land Drainage Authority, with regards to surface water disposal from the site.

5.0 LEAD LOCAL FLOOD AUTHORITY CONSULTATION

- 5.1 A consultation was requested from Kirklees Council (KC) who are the Lead Local Flood Authority (LLFA) for this area, and a copy of their response dated 27 June 2024 is presented in Appendix F.
- 5.2 The majority of the site is located in Flood Zone 1, with land immediately adjacent to Blacup Beck in Flood Zone 2 and 3. The LLFA expect a sequential approach to avoid the higher floods zones. The location of the SuDS basin will need looking at in relation to the flood zones, using topographical survey data in relation to flood levels.
- 5.3 There are no reports of flooding to the council on the site or in the immediate vicinity. However, this does not mean that flooding has not occurred.
- 5.4 The site is quite steep in places (1 in 8) which gives concern to re-emergence if looking at using soakaways. The BGS data for the northern sections class the site as a 4 rating (serious constraints on the use of infiltration techniques).
- 5.5 A connection to watercourse based on 5 l/s/ha for the developed area only is required. Large areas of open space should be discounted. As Blacup Beck is a suitable outfall, sewers are discounted as an option for surface water disposal. SuDS should be considered for water quality improvements.
- 5.6 Flood routing needs to be factored into the design, and the layout should accommodate overland flows in blockage scenarios and exceedance events. Ashbourne View should be protected and overland flows must move south to north and void curtilage.
- 5.7 Climate change is 45% with no allowance for urban creep. The LLFA accept default run-off co-efficient whilst the 1 in 100 + 45% climate change event is accommodated. Yorkshire Water or equivalent NAV may expect a Cv of 1.0.
- 5.8 The LLFA expect the developer to enter into a Section 106 Agreement to set up a management company to cover two aspects of drainage.

- 1) The management of the watercourse (Blacup Beck) within the redline boundary.
- 2) The SuDS system for the period from construction to formal adoption.

5.9 There is an obligation for the LPA to ensure maintenance and management of SuDS for the lifetime of the site. Whilst this aspect of the agreement can be terminated at the time of adoption of assets by the Water Authority, there is no guarantee this will happen so the residents must be protected by organising a management company to take on this responsibility. The principle can be set up in the Section 106 Agreement, with a method statement including an itinerary and schedule of tasks to be added after detailed design is submitted.

6.0 INTERNAL DRAINAGE BOARD CONSULTATION

- 6.1 The proposed development site is not located within an Internal Drainage Board catchment.

7.0 MATERIAL CONSIDERATION IN RESPECT OF NPPF AND PPG

Flood Classification

7.1 The Environment Agency flood map has identified that the majority of the site falls within land assessed as having less than a 1 in 1,000 annual probability of river or sea flooding in any year (less than 0.1%). In accordance with Table 1 of the PPG, the site falls within Flood Zone 1 "low probability".

7.2 As the development is to be restricted to Flood Zone 1, all uses of the land are appropriate within this zone, but an assessment of the effect of surface water run-off will need to be incorporated in any Flood Risk Assessment.

End Use

7.3 The development proposal is for the construction of residential development on the site, and a copy of the proposed layout is presented in Appendix G for reference purposes.

7.4 When applying Table 2 of the PPG, the flood risk vulnerability classification shows that the proposed end use will fall into a "more vulnerable" classification.

Sequential & Exception Test

7.5 As set out in the NPPF, the aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding (Zone 1), but adds that where there are **no reasonably available sites in Flood Zone 1, LPA's should take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2 and 3, applying the Exception Test, if required.**

- 7.6 The sequential test does not apply to the development site, as confirmed by paragraph 172 of the NPPF which states that: “Where planning applications come forward on sites allocated in the development plan through the sequential test, applicants need not apply the sequential test again”. During the plan-making process, Kirklees Council undertook a sequential test in respect of the proposed allocated site within the Kirklees Publication Draft Local Plan Technical Paper: Flood Risk (November 2016), which concluded that there are no reasonably available sites in lower flood risk areas.
- 7.7 Paragraph 172 of the NPPF states “the exception test may need to be reapplied if relevant aspects of the proposal had not been considered when the test was applied at the plan-making stage, or if more recent information about existing or potential flood risk should be taken into account”. The Exception Test was applied during the plan-making stage where the Council confirmed the exception test does not apply to the allocated site, as per the Kirklees Publication Draft Local Plan Technical Paper: Flood Risk (November 2016).

Flood Sources

- 7.8 The risk of flooding to the site from all current and future potential sources of flooding has been assessed as follows: -

7.9 Flooding from Rivers (Fluvial)

The nearest river to the site is the River Spen, located approximately 1.20km in an easterly direction, from the site boundary at its nearest location. Due to the topography of the site being elevated substantially above the river, flooding from this source is considered to be low risk.

7.10 Flooding from Local Watercourses (Fluvial)

The nearest watercourse to the site is Blacup Beck and is located adjacent to the northern boundary. Whilst no flood level information is available, by comparing the flood map with the topographical survey we can determine that the approximate 1 in 1,000 year flood level is 91.50m A.O.D. Therefore, whilst flooding from this source will need to be considered as part of the development, due to the topography of the site being elevated above the watercourse, flooding from this source is considered to be low risk.

7.11 Flooding from the Sea (Tidal/Coastal)

The site is not located near enough to the sea to cause a problem of flooding from this source.

7.12 Flooding from Land (Surface Water)

The EA surface water flood map shows the site to have a very low risk of surface water flooding, with no flood routes from third party land affecting the site. Therefore, although flooding from this source is considered low risk, it should still be considered as part of the proposed development.

7.13 Flooding from Groundwater

The Geological Survey Maps of Great Britain available on the BGS website indicates that the site is underlain by the Clifton Rock – Sandstone Formation and the Pennine Lower Coal Measures Formation - Mudstone, Siltstone and Sandstone. Whilst sandstone could be fractured, therefore, allowing ground water to potentially rise, the steep topography of the site and surrounding area would suggest that the ground water level would remain below the surface level. Therefore, whilst flooding from this source is considered to be low risk it should still be considered.

7.14 Flooding from Sewer

Existing public sewers are recorded within the vicinity of the site and there will also be a new drainage system introduced for the proposed development. It is possible that any blockage of these sewers will result in flooding from the lowest cover level of manholes or gullies and this will need to be considered as part of any proposed development. Flooding from this source is considered to be low risk.

7.15 Flooding from Reservoirs, Canals or Artificial Sources

The Environment Agency produce maps which show the expected inundation area should a reservoir fail and release its capacity. It should be noted, however, that reservoir flooding is extremely unlikely to happen and there has been no loss of life in the UK from reservoir flooding since 1925. The proposed development site is shown to be outside of the maximum extent of reservoir flooding.

- 7.16 There are no canals or other artificial sources within the vicinity of the proposed development site that would pose a risk of flooding on site, therefore, the risk from this source is deemed to be negligible.
- 7.17 Table 1.0 below, summarises the findings of the detailed assessment and explanations of the flood risk issues on the site.

Table 1.0 – Degree of risk from each source of flooding

FLOOD SOURCE	RISK
River (Fluvial)	Low
Watercourse (Fluvial)	Low
Sea (Tidal/Coastal)	Negligible
Land (Surface Water)	Low
Groundwater	Low
Sewer	Low
Other – Reservoir	Negligible
Other - Canals	Negligible

Climate Change

- 7.18 The NPPF and PPG has indicated that the Global sea level will continue to rise, depending on greenhouse gas emissions, and the sensitivity of the climate system and there will be an increase in rainfall across the country.
- 7.19 United Kingdom climate change guidance was revised in July 2021 for peak river flows and in February 2016 for peak rainfall intensities. With regards to peak river flows, a regionalised approach has now been adopted to climate change impacts, based upon management catchments of the river basin district of the proposed development site and the flood risk vulnerability classification.

- 7.20 The proposed development site is situated within the Aire and Calder Management **Catchment, which, based on the “central allowance” climate change scenario, could** see peak river flows increase by 23% by the 2080s. As the site is located in Flood Zone 1, an increase of 23% in river flow is deemed unlikely to affect the proposed development site.
- 7.21 In accordance with the revised climate change data, the published figures show that, for an expected life of greater than 50 years for any new development, the anticipated increase in rainfall could be up to 45%, subject to the location within the country and the drainage system should be designed in accordance with this requirement. The Kirklees Council flood risk requirements for managing on/off-site flood risk from fluvial flooding is to assess the development using a 45% allowance for climate change for the 1 in 100 year event, with no allowance for urban creep.
- 7.22 Due to the topography of the land and surrounding area, overland run-off from adjoining land is unlikely to be an issue. Therefore, any run-off from outside the site will be insignificant and, on this basis, only rainfall falling within the site boundaries will need to be considered in respect of climate change.

Flood Mitigation

- 7.23 As the site falls within Flood Zone 1, flood mitigation measures are only required in the event of a catastrophic storm, overland run-off or blockage of the existing or proposed drainage system. The following precautionary flood mitigation measures are, therefore, recommended:-
- 7.23.1 The finished floor levels (FFL) to the properties shall be raised a minimum of 600mm above the 1 in 1,000 year approximate flood level of 91.50m A.O.D. ($91.50 + 0.6 = 92.10\text{m}$), or 150mm above existing ground level, whichever is the greater.
- 7.23.2 Properties shall be designed without any basements and ground floors shall comprise solid concrete slabs or beam and block with screed construction.

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- 7.23.3 Incoming electricity supplies shall be raised above ground floor level and ground floor electric sockets shall be served by loops from upper level.
 - 7.23.4 In the unlikely event of flooding of the site, it would be appropriate to design external levels with falls to non-critical areas, such as landscape, where the water can pond without causing flooding to buildings.
 - 7.23.5 If any water issues are found on the site, or boundary levels result in flow of water into the site, these shall be accommodated by introducing "cut-off" drains to direct the flow around the development and into the watercourse.

Emergency Egress During Times of Flood

- 7.24 It is a requirement under the PPG that occupants should be able to egress any building during times of flood, without being trapped by flood conditions.
- 7.25 As the site falls within Flood Zone 1, no special mitigation measures are required for emergency egress during times of flood.

8.0 EXISTING AND PROPOSED DRAINAGE

Sustainable Drainage

- 8.1 In order to comply with the requirements of NPPF, it will be necessary to consider aspects of Sustainable Drainage techniques for the new development. The Geological Survey Maps of Great Britain available on the BGS website indicates that the site is underlain by the Clifton Rock – Sandstone Formation, and the Pennine Lower Coal Measures Formation - Mudstone, Siltstone and Sandstone. Considering the anticipated geology beneath the site, in conjunction with the topography, it is anticipated that the site is unsuitable for the disposal of surface water using infiltration techniques and a positive drainage system to watercourse will be required for surface water drainage disposal. It will be necessary to carry out appropriate infiltration tests in accordance **with BRE Digest 365 'Soakaway Design' prior to construction on site and the results** presented in a report for the approval of the Planning Authority. However, for the purpose of this report, a positive drainage system to watercourse or sewer will be required for surface water drainage.

Drainage

- 8.2 It is a requirement to ensure that surface water run-off from any proposed development has negligible consequence on downstream areas either in sewer capacity or discharge to watercourse.

Existing Surface Water Run-Off

- 8.3 The site is greenfield and, therefore, in accordance with current guidelines and Regulations, indicative surface water calculations have been undertaken using the IH124 method of calculating greenfield run-off rates. The calculations are presented in Appendix H.
- 8.4 It is unusual to use the IH124 method for calculating greenfield run-off rates with an area less than 50ha. The Interim Code of Practice recommends that the IH124 method is applied with 50ha and the resulting discharge is linearly interpolated for the required.

- 8.5 For the proposed developed area of approximately 1.90ha, the existing greenfield runoff rates have been linearly interpolated with the results presented in Table 2.0 below.

Table 2.0 – Existing greenfield runoff rates

Storm Event	Discharge Rate
1 year	8.87 l/s
Q _{BAR}	10.32 l/s
30 year	18.13 l/s
100 year	21.46 l/s

- 8.6 Based on the above, it is usual for the proposed discharge rate for the site to be restricted to no greater than 10.3 l/s (Q_{Bar}). However, the LLFA has advised it shall be restricted to no greater than 5 l/s/ha, therefore, the restricted discharge rate will be 9.5 l/s.

Proposed Surface Water Drainage

- 8.7 Consideration of the proposed drainage should firstly be given to infiltration techniques (to ground). Therefore, it will be necessary to carry out appropriate infiltration tests **in accordance with BRE Digest 365 'Soakaway Design' prior to construction on site** and the results presented in a report for the approval of the Planning Authority. However, as the use of infiltration techniques is considered to be unviable, it will be necessary to provide a positive drainage system to watercourse or sewer.
- 8.8 Blacup watercourse is located along the northern boundary, therefore, this would be the obvious place for the disposal of surface water.
- 8.9 The proposed layout, presented in Appendix G, has been assessed as having an impermeable area of approximately 1.14ha. Indicative calculations have been carried out using the WinDES Source Control Computer Program. The proposed surface water sewer system should be designed to accommodate the 1 in 30 year storm event without flooding and a 1 in 100 year storm plus climate change event should be retained within the site in an area that does cause flooding to properties or third parties.

- 8.10 Restricting the discharge rate to no greater than 9.5 l/s, on site storage of 430.4m³ will need to be provided for a 1 in 30 year storm. This can be achieved by several methods, including oversized pipes and underground tanks. The drainage system will also need to accommodate the 1 in 100 year plus 45% climate change event without causing flooding or property or third-party land. In the event that levels dictate that the 1 in 100 year plus climate change flood water will flow off site, an additional or larger storage facility will be required. Therefore, on site storage would increase to 936.6m³. The indicative surface water calculations are presented in Appendix I. However, detailed calculations and proposals will need to be prepared and submitted to the Planning Authority for approval prior to construction.

Consents

- 8.11 The discharge of surface water to watercourse and/or the introduction of headwalls or works to the watercourse will require the consent of the LLFA by submitting an Application for Consent to Work Within a Watercourse.
- 8.12 There will be a requirement for a 7m strip to be provided from the top of the watercourse banking where no development can take place and access arrangements will need to be agreed for future improvements or maintenance.
- 8.13 The discharge of foul or surface water to sewer and/or the introduction of manholes or works to a public sewer will require the consent of the Water Authority.

Proposed Foul Water Drainage

- 8.14 Foul water domestic waste can discharge to the 450mm diameter public combined sewer recorded crossing the site.

9.0 CONCLUSION

9.1 The site will be restricted to Flood Zone 1 and the Sequential Test is not applicable. However, in order to accommodate the possibilities of flood from a catastrophic storm, overland run-off or blockage of the existing or proposed drainage system, the following precautionary flood mitigation measures are recommended: -

9.1.1 The finished floor levels (FFL) to the properties shall be raised a minimum of 600mm above the 1 in 1,000 year approximate flood level of 91.50m A.O.D. ($91.50 + 0.6 = 92.10\text{m}$), or 150mm above existing ground level, whichever is the greater.

9.1.2 Properties shall be designed without any basements and ground floors shall comprise solid concrete slabs or beam and block with screed construction.

9.1.3 Incoming electricity supplies shall be raised above ground floor level and ground floor electric sockets shall be served by loops from upper level.

9.1.4 In the unlikely event of flooding of the site, it would be appropriate to design external levels with falls to non-critical areas, such as landscape, where the water can pond without causing flooding to buildings.

9.1.5 If any water issues are found on the site, or boundary levels result in flow of water into the site, these shall be accommodated by introducing "cut-off" drains to direct the flow around the development and into the watercourse.

9.2 A 45% increase in rainfall shall be incorporated into any new positive drainage system to satisfy the requirements of climate change.

9.3 Sustainable Drainage Systems of infiltration techniques are considered to be unsuitable on this particular site due to the geological parameters of the natural soils. However, it will be necessary to carry out appropriate infiltration tests in accordance with BRE **Digest 365 'Soakaway Design' prior to construction on site and** the results presented in a report for the approval of the Planning Authority.

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- 9.4 The proposed surface water drainage system shall be restricted to the agreed discharge rate with appropriate attenuation for a 1 in 100 year storm plus climate change event incorporated into the design, prior to discharge to watercourse. The detailed design and calculations shall be submitted to the Planning Authority for approval prior to construction on the development site
 - 9.5 The discharge of foul or surface water to sewer and/or the introduction of manholes or works to a public sewer will require the consent of the Water Authority.
 - 9.6 The discharge of surface water to watercourse and/or the introduction of headwalls or works to the watercourse will require the consent of the LLFA by submitting an Application for Consent to Work Within a Watercourse.
 - 9.7 There will be a requirement for a 7m strip to be provided from the top of the watercourse banking where no development can take place and access arrangements will need to be agreed for future improvements or maintenance.
 - 9.8 Foul water domestic waste can discharge to the 450mm diameter public combined sewer recorded crossing the site.
 - 9.9 No special mitigation measures are required for emergency egress during times of flood.
 - 9.10 Subject to compliance with the above, the proposed development can satisfy the requirements of the National Planning Policy Framework and the Planning Practice Guidance in relation to flood risk.

A P P E N D I X A: SITE LOCATION PLAN



NEWETT HOMES

LOWER BLACCUP FARM, CLECKHEATON

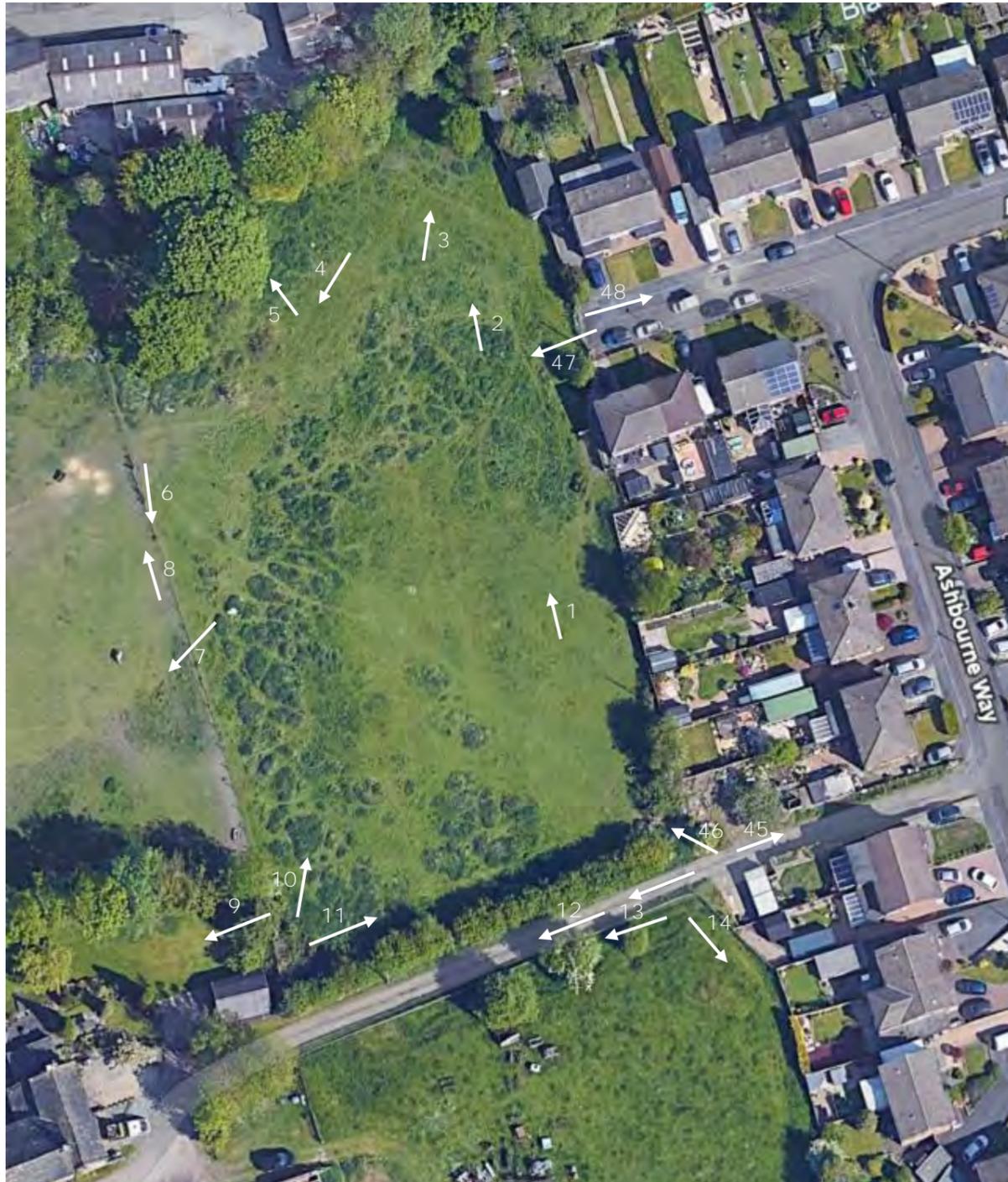
SITE LOCATION PLAN



GRID REFERENCE: SE 186 248

A P P E N D I X B: SITE PHOTOGRAPHS

NEWETT HOMES
ASHBOURNE DRIVE, CLECKHEATON
PHOTOGRAPH KEY PLAN





Photograph 1



Photograph 2



Photograph 3



Photograph 4



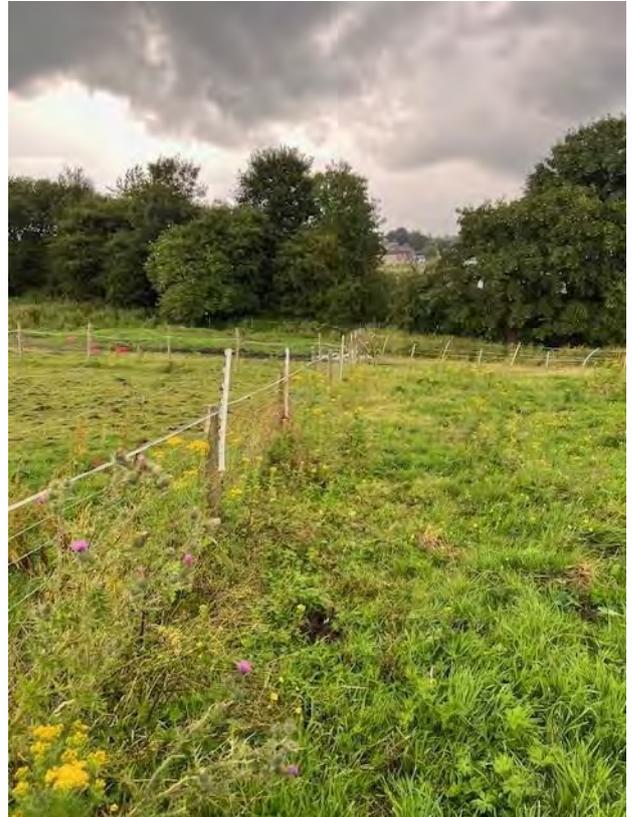
Photograph 5



Photograph 6



Photograph 7



Photograph 8



Photograph 9



Photograph 10



Photograph 11



Photograph 12



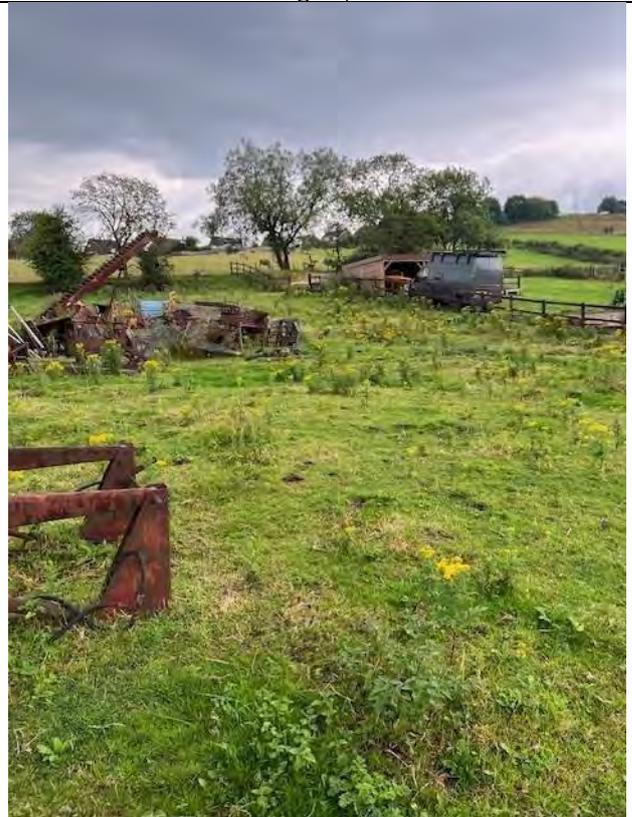
Photograph 13



Photograph 14



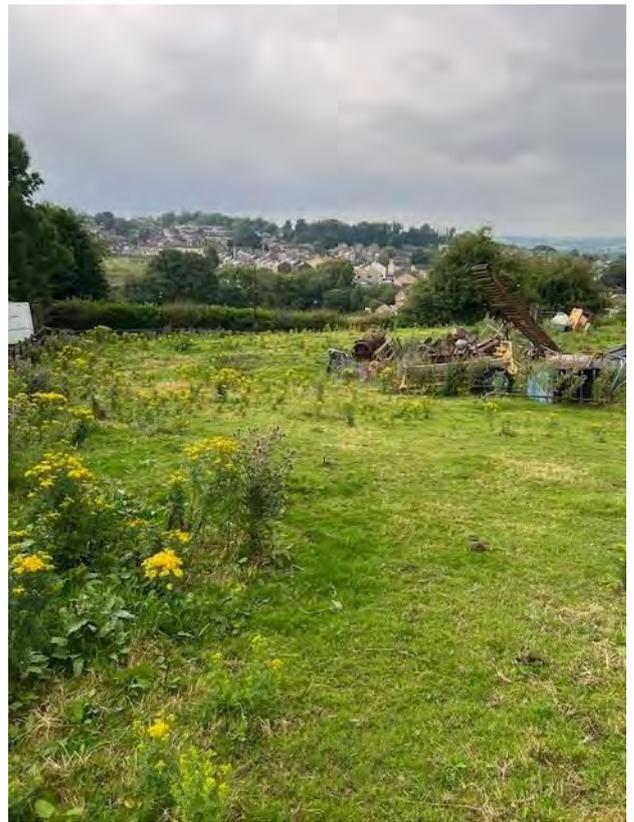
Photograph 15



Photograph 16



Photograph 17



Photograph 18



Photograph 19



Photograph 20



Photograph 21



Photograph 22



Photograph 23



Photograph 24



Photograph 25



Photograph 26



Photograph 27



Photograph 28



Photograph 29



Photograph 30



Photograph 31



Photograph 32



Photograph 33



Photograph 34



Photograph 35



Photograph 36



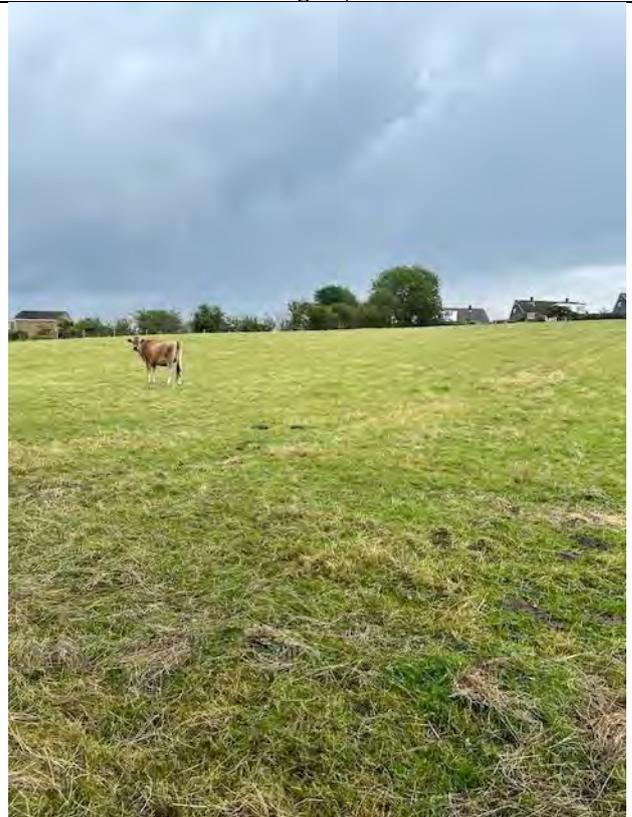
Photograph 37



Photograph 38



Photograph 39



Photograph 40



Photograph 41



Photograph 42



Photograph 43



Photograph 44



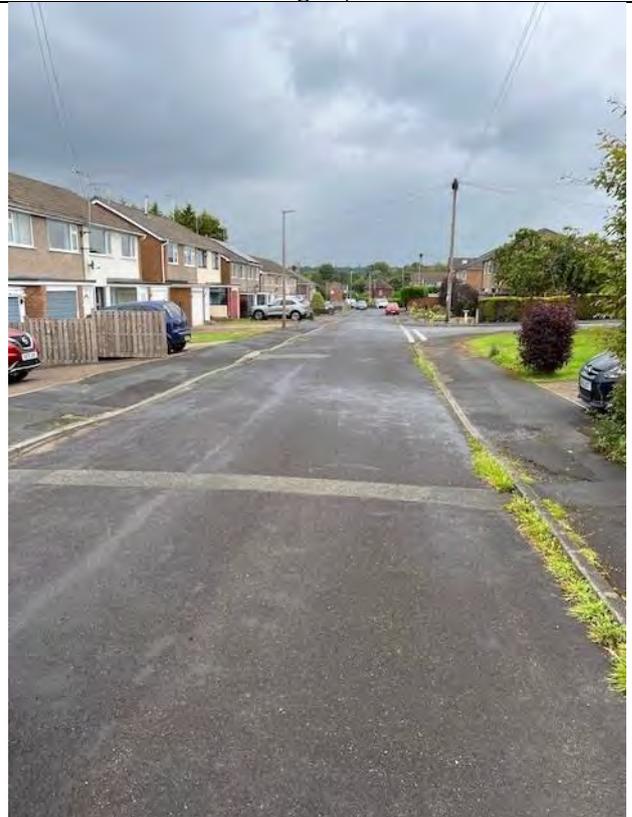
Photograph 45



Photograph 46



Photograph 47



Photograph 48

A P P E N D I X C: TOPOGRAPHICAL SURVEY



A P P E N D I X D: ENVIRONMENT AGENCY CONSULTATION



Surface water

- Extent
- High risk
More than 3.3% chance each year
- Medium risk
Between 1% and 3.3% chance each year
- Low risk
Between 0.1% and 1% chance each year
- Depth
- Velocity

Flood map for planning

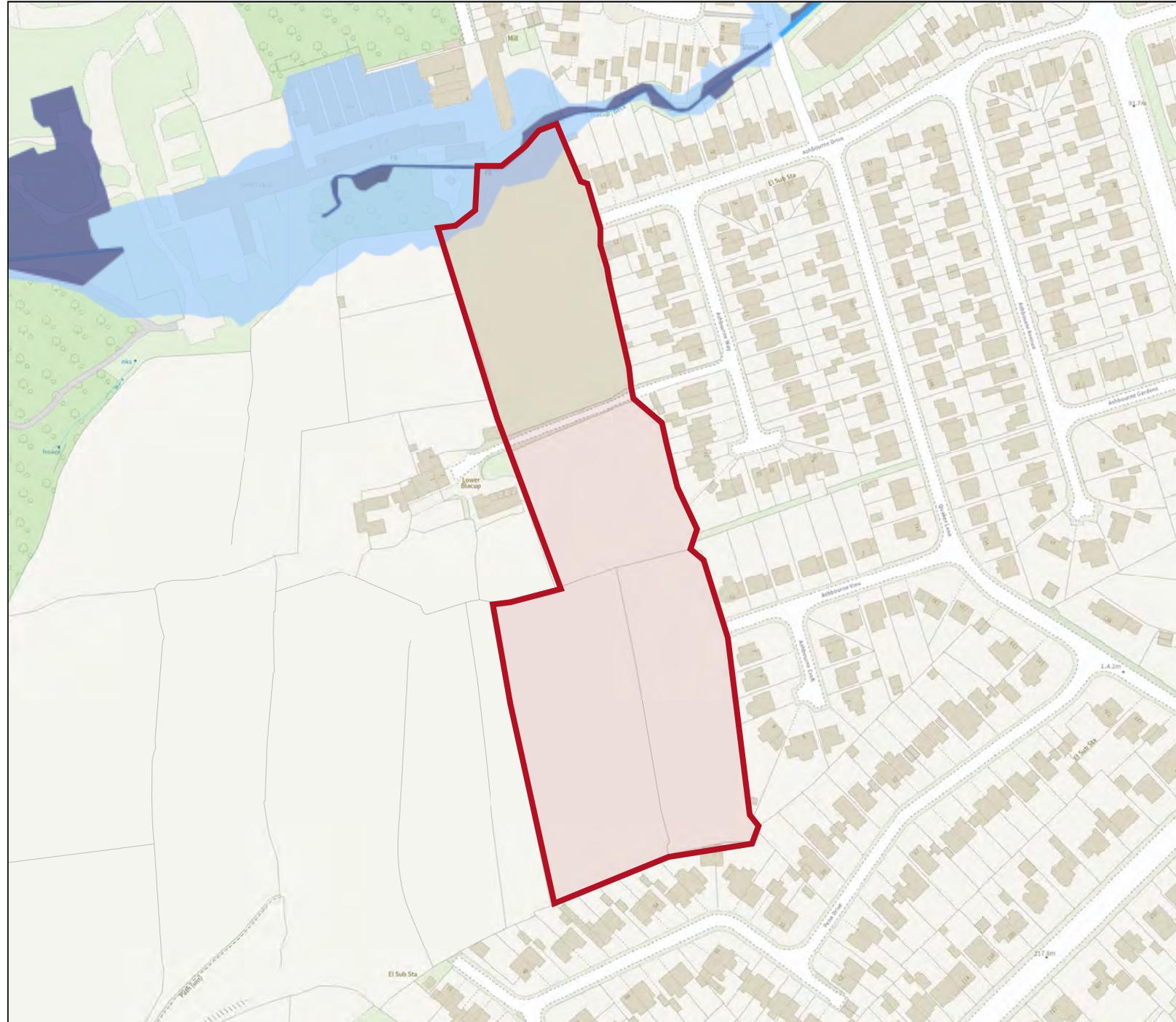
Your reference
<Unspecified>

Location (easting/northing)
418610/424788

Scale
1:2500

Created
2 Aug 2024 9:49

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



A P P E N D I X E: WATER AUTHORITY CONSULTATION

Mr W Walker
OEC Consulting Engineers
Unit 8 Clarke Hall Farm
Aberford Road
Wakefield
West Yorkshire
WF1 4AL

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

Tel: 0345 120 8482

Your Ref:
Our Ref: A003046

Email:
technical.sewerage@yorkshirewater.co.uk

For telephone enquiries ring:
Chris Roberts on 0345 120 8482

12th July 2024

Dear Mr Walker,

Lower Blacup Farm, Ashbourne Drive, Cleckheaton, BD19 5HZ. – Pre-planning Enquiry V538261

Thank you for your recent enquiry. Our charge of £195.00 plus VAT will be added to your account with us, reference OEC005. You will receive an invoice for your account in due course.

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:

Existing Infrastructure

There is a 450 mm diameter public combined water sewer recorded crossing the site. No buildings, or other obstructions, are to be erected within 6 (six) metres is required at each side of the sewer centre-line, no trees planted within 5 (five) metres of this public sewer. It may not be acceptable to raise or lower ground levels over the sewer, nor to restrict access to the manholes on the sewer. If you wish to have this sewer diverted under Section 185 of the Water Industry Act 1991 an application should be made in writing. To discuss this matter, please telephone 0345 120 84 82.

Foul Water

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 domestic waste can discharge to the 450 mm diameter public combined sewer recorded crossing the site.

This permission is not an acceptance in respect to any planning conditions imposed under the Grant of Planning Permission.

Surface Water

The developer's attention is drawn to Requirement H3 of the Building Regulations 2010. This establishes a preferred hierarchy for surface water disposal. Consideration should firstly be given to discharge to soakaway, infiltration system and watercourse in that priority order.

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

It is understood that a watercourse is located to the north of the site. This appears to be the obvious place for surface water disposal (if SuDS are not viable). Please note Yorkshire Water cannot provide plans of culverted watercourses or highway drains. To obtain plans please contact the Lead Local Flood Authority for more details.

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 - <https://www.yorkshirewater.com/developers/sewerage/sewerage-connections/>

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. 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 2024/25, 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 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.

The site is within an area that may be affected by river, coastal or estuarine flooding. We would advise you to contact the Environment Agency for details.

All the above comments are based upon the information and records available at the present time and is subject to formal planning approval agreement. The information contained in this letter together with that shown on any extract from the Statutory Sewer Map that may be enclosed is believed to be correct and is supplied in good faith.

Please note that capacity in the public sewer network is not reserved for specific future development. It is used up on a 'first come, first served' basis. You should visit the site and establish



YorkshireWater

the line and level of any public sewers affecting your proposals before the commencement of any design work.

Yours sincerely



YorkshireWater

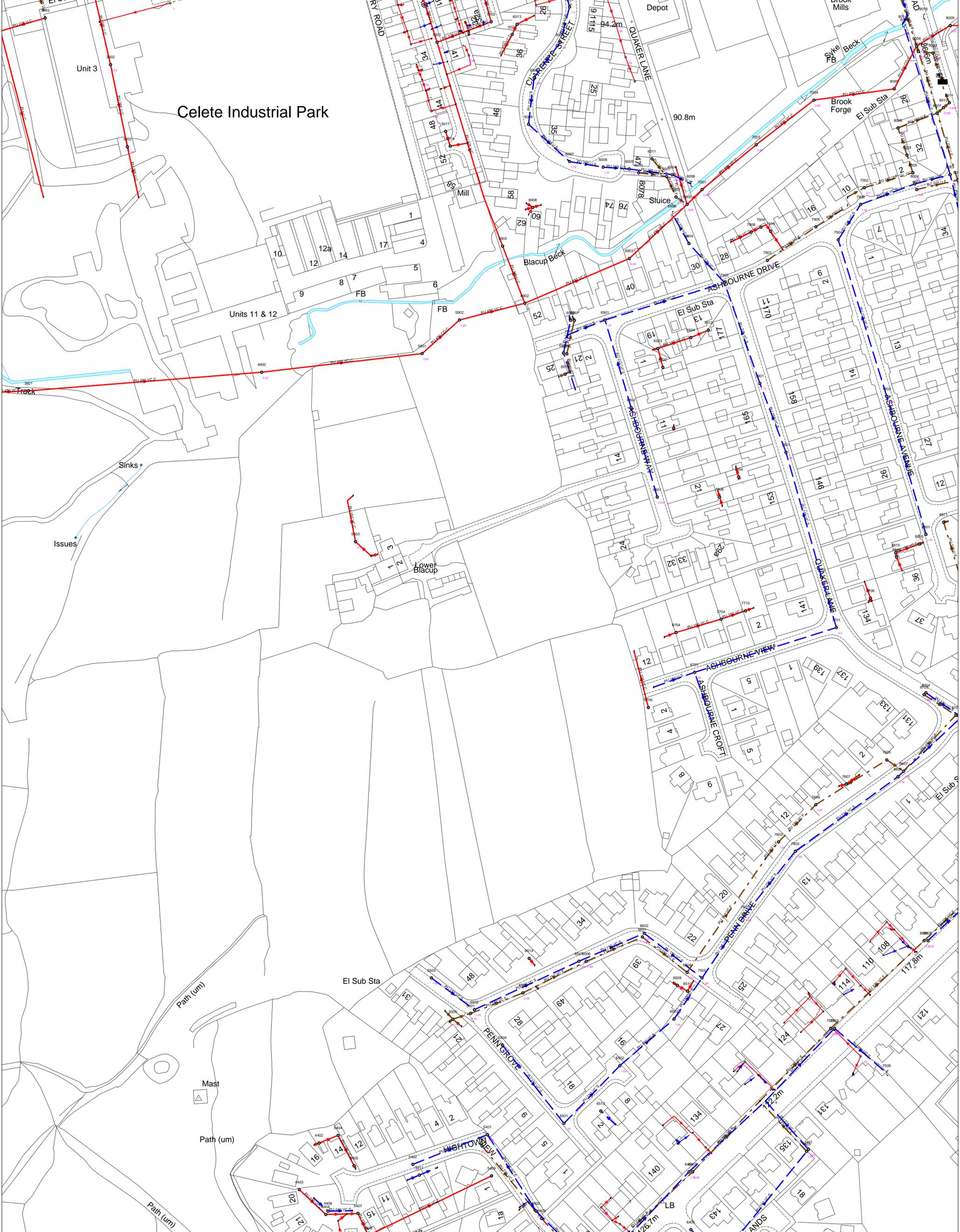
Chris Roberts

Town Planning
Land & Property

Email – Chris.Roberts@Yorkshirewater.co.uk

[My normal working hours are between 8am-4.30pm](#)

Celete Industrial Park



418512 : 424684	Map Name : SE1824SW	Title
 <p>Yorkshire Water, PO Box 500, Halifax Road, Bradford BD6 2LZ Contact Name : YorMap Advisor C ROBERTS Contact Tel : 87 2582</p>		<p>Notes</p> <p>Partial Key</p> <ul style="list-style-type: none"> Foul Sewer = F Combined Sewer = C Surface Water Sewer = SW Trade Sewer = TD Partially Separate = PS
Date Req : 12/07/2024, 11:02:49		Date Gen : 12/07/2024, 11:05:58
Source : Sewer Network Enquiry		

A P P E N D I X F : LLFA CONSULTATION

From: [Paul Farndale](#)
To: [Wayne Walker](#)
Subject: RE: 159.004 - Ashbourne Drive, Cleckheaton - Consultation
Date: 27 June 2024 13:21:50

Hello Wayne,

Fine thanks.

Majority of the site is in flood zone 1 with part of the northern section being in flood zone 2/3 adjacent to Blacup Beck. We expect a sequential approach here and development to avoid the higher flood risk zones. It looks like this has been done but please look at the Suds basin in relation to the flood zones in your FRA, using local topographical data in relation to flood levels given by the EA. The site is over 1ha so will need a formal flood risk assessment.

Surface water flooding mimics that of the main river.

There are no reports of flooding to the Council on the site or in the immediate vicinity. However, given that the site is greenfield, this does not mean flooding has not occurred. The public are more likely to report flooding around properties and public highways.

The site is quite steep in places (1 in 8) which gives concern to re-emergence if looking at using soakaways. Also note the BGS data for northern sections classes the site as a 4 rating (serious constraints on the use of infiltration techniques).

A connection to watercourse base on 5l/s/ha for the developed area only is required. Large areas of open space should be discounted from this calculation. As Blacup Beck is available, sewers are discounted as an option for surface water discharges. SUDS should be considered for water quality improvements.

Flood routing needs to be factored into the design. As the site slopes south to north, we expect the layout to accommodate overland flows in blockage scenarios and exceedance events. Ashbourne View should be protected, and overland flows most move south to north and avoid curtilage. If a drainage easement is required between this section and the north, then overground flow can be designed to go through this protected area and continue using road network and open space as opposed to property curtilage to create a free pathway to Blacup Beck. The indicative layout suggests that the low spots on the extended Ashbourne View would affect housing in terms of flood risk. The layout or an appropriate cut and fill design must be changed.

Until further notice climate change is 45% but no allowance for urban creep is

required. We can accept default run off co-efficient whilst the 1 in 100 + 45% cc is accommodated. Please note that Yorkshire Water or an equivalent NAV may expect a Cv of 1.0

We expect the developer to enter into a section 106 agreement (Town and Country Planning Act 1990) to set up a management company to cover two aspects of drainage. The first is management of the watercourse (Blacup Beck) within the red line boundary. Second is for the SUDS system for the period from construction to formal adoption. This is because there is an obligation for the LPA to ensure maintenance and management of SUDS for the lifetime of the site. Whilst this aspect of the agreement can be terminated at the time of adoption of assets by Yorkshire Water or NAV equivalent, there is no guarantee this will happen so the residents must be protected by organising a management company to take on this responsibility. The principle can be set up in the section 106 agreement, with a method statement including an itinerary and schedule of task to be added after detailed design is submitted.

Kind regards,

Paul Farndale
Team Leader (Acting)
Flood Management & Drainage (LLFA)
Kirklees Council



[Website](#) | [News](#) | [Email Updates](#) | [Facebook](#) | [Twitter](#)

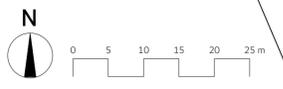
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A P P E N D I X G : PROPOSED LAYOUT

PROPOSED SALES ARENA

ACCOMMODATION SCHEDULE												
Market Units												
HouseType	Bed		NDS	M(2)	M(3)	Storey Height	SQFT	SQM	Number	Total SQFT	2 Bed %	
MALT A	Maltby	1	Maisonette	Y	-	Y	1	651	60	2	1302	
MALT B	Maltby	1	Maisonette	Y	-	Y	1	651	60	2	1302	
Total									4	2604	6%	
HouseType	Bed		NDS	M(2)	M(3)	Storey Height	SQFT	SQM	Number	Total SQFT	3 Bed %	
MALT C	Maltby	2	Maisonette	Y	Y	-	1	794	74	2	1588	
MALT D	Maltby	2	Maisonette	Y	Y	-	1	794	74	2	1588	
Total									4	3176	6%	
HouseType	Bed		NDS	M(2)	M(3)	Storey Height	SQFT	SQM	Number	Total SQFT	3 Bed %	
DAL	Dalton	3	Semi	Y	Y	-	2	908	84	8	7264	
SAX	Saxton	3	Detached	Y	Y	-	2	939	87	2	1878	
SAX	Saxton	3	Semi	Y	Y	-	2	939	87	2	1878	
GRA	Grassington	3	Semi	Y	Y	-	2.5	969	90	16	15504	
FEW	Fewston	3	Semi	Y	-	-	3	1145	106	4	4580	
SCO	Scotton	3	Semi	Y	-	-	3	1188	110	8	9504	
Total									40	46608	60%	
HouseType	Bed		NDS	M(2)	M(3)	Storey Height	SQFT	SQM	Number	Total SQFT	4 Bed %	
LED	Ledsham	4	Detached	Y	Y	-	2.5	1138	106	4	4552	
LED	Ledsham	4	Semi	Y	Y	-	2.5	1138	106	2	2276	
MAL	Malham	4	Detached integral	Y	Y	-	2	1227	114	4	4908	
ADD	Addingham	4	Detached	Y	Y	-	2	1258	117	3	3774	
HAL	Halsham	4	Detached integral	Y	Y	-	2	1417	132	5	7085	
MID	Middleham	4	Detached	Y	-	-	3	1566	145	1	1566	
Total									19	24161	28%	
GRAND TOTAL:									67	79549		
GROSS DEVELOPMENT AREA:									5.86627	ACRES	2.37 HECTARES	
NET DEVELOPMENT AREA:									4.25012	ACRES	1.72 HECTARES	
SQ FT / NET DEVELOPMENT ACRE:									16599	SQ FT		
NET DEVELOPMENT AREA DENSITY:									38.95	DPH		

- Key
- Site boundary
 - Proposed housing
 - Existing footpath / public right of way
 - Proposed new footpaths
 - Existing landscaping
 - Proposed landscaping
 - Main road
 - Existing trees / hedges removed
 - Existing services
 - Potential retaining wall
 - Potential 6m drainage easement
 - Sheds (cycle storage)
 - Bin Storage
 - Bin Collection Point
 - Sales Area



Drawing Title **Planning Layout**

Site **Lower Blacup Farm, Cleckheaton**

Scale 1:500 @A1 Date 29/04/24

Drawn VB Checked MC

Drawing No. Z168.002 Rev. A

Thorpe Arch Grange
Walton Road
Thorp Arch
LS23 7BA

01937 543599
www.newetthomes.co.uk



A P P E N D I X H : INDICATIVE GREENFIELD RUN-OFF RATE
CALCULATIONS

Clarke Hall Farm
Aberford Road, Wakefield
WF1 4AL



Date 06/08/2024 07:27
File

Designed by Office_User
Checked by

Innovyze Source Control 2020.1.3

IH 124 Mean Annual Flood

Input

Return Period (years)	1	Soil	0.450
Area (ha)	50.000	Urban	0.000
SAAR (mm)	839	Region Number	Region 3

Results 1/s

QBAR Rural 271.5
QBAR Urban 271.5

Q1 year 233.5

Q1 year 233.5
Q2 years 256.2
Q5 years 339.4
Q10 years 393.7
Q20 years 445.9
Q25 years 463.2
Q30 years 477.2
Q50 years 514.2
Q100 years 564.7
Q200 years 640.8
Q250 years 665.2
Q1000 years 825.4

A P P E N D I X I: INDICATIVE SURFACE WATER DRAINAGE CALCULATIONS

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	100.202	0.202	9.2	189.2	O K
30 min Summer	100.266	0.266	9.5	249.5	O K
60 min Summer	100.333	0.333	9.5	311.8	O K
120 min Summer	100.396	0.396	9.5	371.0	O K
180 min Summer	100.426	0.426	9.5	399.4	O K
240 min Summer	100.442	0.442	9.5	414.0	O K
360 min Summer	100.454	0.454	9.5	425.4	O K
480 min Summer	100.459	0.459	9.5	429.7	O K
600 min Summer	100.459	0.459	9.5	430.4	O K
720 min Summer	100.458	0.458	9.5	428.7	O K
960 min Summer	100.449	0.449	9.5	420.7	O K
1440 min Summer	100.421	0.421	9.5	394.8	O K
2160 min Summer	100.373	0.373	9.5	349.3	O K
2880 min Summer	100.326	0.326	9.5	305.6	O K
4320 min Summer	100.250	0.250	9.4	234.3	O K
5760 min Summer	100.198	0.198	9.2	185.2	O K
7200 min Summer	100.164	0.164	8.9	153.5	O K
8640 min Summer	100.147	0.147	8.3	137.3	O K
10080 min Summer	100.134	0.134	7.6	125.6	O K
15 min Winter	100.202	0.202	9.2	189.3	O K
30 min Winter	100.266	0.266	9.5	249.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	68.300	0.0	179.0	18
30 min Summer	45.644	0.0	243.0	33
60 min Summer	29.238	0.0	324.9	62
120 min Summer	18.183	0.0	405.6	122
180 min Summer	13.616	0.0	456.2	182
240 min Summer	11.032	0.0	493.3	240
360 min Summer	8.184	0.0	549.3	336
480 min Summer	6.617	0.0	592.4	392
600 min Summer	5.608	0.0	627.6	454
720 min Summer	4.896	0.0	657.5	520
960 min Summer	3.950	0.0	706.9	656
1440 min Summer	2.914	0.0	780.8	924
2160 min Summer	2.147	0.0	875.5	1324
2880 min Summer	1.727	0.0	938.4	1704
4320 min Summer	1.269	0.0	1030.4	2424
5760 min Summer	1.019	0.0	1112.0	3112
7200 min Summer	0.860	0.0	1171.6	3816
8640 min Summer	0.748	0.0	1222.5	4496
10080 min Summer	0.666	0.0	1264.7	5152
15 min Winter	68.300	0.0	179.0	18
30 min Winter	45.644	0.0	243.1	33

OEC Consulting Engineers Ltd		Page 1
Clarke Hall Farm Aberford Road, Wakefield WF1 4AL	Lower Blacup Farm, Cleckheaton Newett Homes 100yr + 45% Calcs	
Date 06/08/2024 10:50 File 159.004 30yr - 9.5ls.SRCX	Designed by A.Bottomley Checked by W.Walker	
Innovyze	Source Control 2020.1.3	

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
60 min Winter	100.333	0.333	9.5	311.8	O K
120 min Winter	100.396	0.396	9.5	370.8	O K
180 min Winter	100.426	0.426	9.5	399.1	O K
240 min Winter	100.442	0.442	9.5	413.9	O K
360 min Winter	100.454	0.454	9.5	425.5	O K
480 min Winter	100.454	0.454	9.5	425.2	O K
600 min Winter	100.452	0.452	9.5	423.5	O K
720 min Winter	100.447	0.447	9.5	418.7	O K
960 min Winter	100.430	0.430	9.5	403.0	O K
1440 min Winter	100.384	0.384	9.5	360.2	O K
2160 min Winter	100.312	0.312	9.5	292.1	O K
2880 min Winter	100.249	0.249	9.4	233.5	O K
4320 min Winter	100.167	0.167	9.0	156.6	O K
5760 min Winter	100.137	0.137	7.7	128.4	O K
7200 min Winter	100.120	0.120	6.7	112.6	O K
8640 min Winter	100.109	0.109	5.9	102.4	O K
10080 min Winter	100.101	0.101	5.2	95.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
60 min Winter	29.238	0.0	324.9	62
120 min Winter	18.183	0.0	405.6	120
180 min Winter	13.616	0.0	456.3	178
240 min Winter	11.032	0.0	493.3	234
360 min Winter	8.184	0.0	549.4	342
480 min Winter	6.617	0.0	592.5	432
600 min Winter	5.608	0.0	627.7	470
720 min Winter	4.896	0.0	657.6	548
960 min Winter	3.950	0.0	707.1	700
1440 min Winter	2.914	0.0	781.2	994
2160 min Winter	2.147	0.0	875.5	1388
2880 min Winter	1.727	0.0	938.5	1760
4320 min Winter	1.269	0.0	1030.7	2420
5760 min Winter	1.019	0.0	1112.1	3064
7200 min Winter	0.860	0.0	1171.7	3752
8640 min Winter	0.748	0.0	1222.7	4496
10080 min Winter	0.666	0.0	1265.5	5240

Clarke Hall Farm Aberford Road, Wakefield WF1 4AL	Lower Blacup Farm, Cleckheaton Newett Homes 100yr + 45% Calcs	
Date 06/08/2024 10:50 File 159.004 30yr - 9.5ls.SRCX	Designed by A.Bottomley Checked by W.Walker	
Innovyze		Source Control 2020.1.3

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.342	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.140

Time (mins)	Area
From:	To: (ha)
0	4 1.140

OEC Consulting Engineers Ltd		Page 3
Clarke Hall Farm Aberford Road, Wakefield WF1 4AL	Lower Blacup Farm, Cleckheaton Newett Homes 100yr + 45% Calcs	
Date 06/08/2024 10:50 File 159.004 30yr - 9.5ls.SRCX	Designed by A.Bottomley Checked by W.Walker	
Innovyze	Source Control 2020.1.3	

Model Details

Storage is Online Cover Level (m) 105.000

Tank or Pond Structure

Invert Level (m) 100.000

Depth (m)	Area (m ²)						
0.000	937.0	0.700	937.0	1.400	937.0	2.100	937.0
0.100	937.0	0.800	937.0	1.500	937.0	2.200	937.0
0.200	937.0	0.900	937.0	1.600	937.0	2.300	937.0
0.300	937.0	1.000	937.0	1.700	937.0	2.400	937.0
0.400	937.0	1.100	937.0	1.800	937.0	2.500	937.0
0.500	937.0	1.200	937.0	1.900	937.0		
0.600	937.0	1.300	937.0	2.000	937.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0142-9500-1000-9500
 Design Head (m) 1.000
 Design Flow (l/s) 9.5
 Flush-Flo™ Calculated
 Objective Minimise upstream storage
 Application Surface
 Sump Available Yes
 Diameter (mm) 142
 Invert Level (m) 100.000
 Minimum Outlet Pipe Diameter (mm) 225
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	9.5
Flush-Flo™	0.305	9.5
Kick-Flo®	0.675	7.9
Mean Flow over Head Range	-	8.2

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)						
0.100	5.1	1.200	10.4	3.000	16.0	7.000	24.0
0.200	9.2	1.400	11.1	3.500	17.2	7.500	24.8
0.300	9.5	1.600	11.9	4.000	18.3	8.000	25.6
0.400	9.4	1.800	12.5	4.500	19.4	8.500	26.3
0.500	9.2	2.000	13.2	5.000	20.4	9.000	27.1
0.600	8.7	2.200	13.8	5.500	21.4	9.500	27.8
0.800	8.6	2.400	14.4	6.000	22.3		
1.000	9.5	2.600	14.9	6.500	23.1		

Clarke Hall Farm Aberford Road, Wakefield WF1 4AL	Lower Blacup Farm, Cleckheaton Newett Homes 100yr + 45% Calcs
Date 06/08/2024 10:43 File 159.004 100yr + 45% - 9...	Designed by A.Bottomley Checked by W.Walker
Innovyze Source Control 2020.1.3	



Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	100.382	0.382	9.5	358.3	O K
30 min Summer	100.513	0.513	9.5	480.3	O K
60 min Summer	100.652	0.652	9.5	611.2	O K
120 min Summer	100.793	0.793	9.5	742.9	O K
180 min Summer	100.866	0.866	9.5	811.7	O K
240 min Summer	100.909	0.909	9.5	852.1	O K
360 min Summer	100.959	0.959	9.5	898.8	O K
480 min Summer	100.983	0.983	9.5	921.5	O K
600 min Summer	100.993	0.993	9.5	930.0	O K
720 min Summer	100.992	0.992	9.5	929.4	O K
960 min Summer	100.983	0.983	9.5	920.7	O K
1440 min Summer	100.954	0.954	9.5	893.6	O K
2160 min Summer	100.900	0.900	9.5	843.6	O K
2880 min Summer	100.843	0.843	9.5	790.1	O K
4320 min Summer	100.728	0.728	9.5	682.3	O K
5760 min Summer	100.597	0.597	9.5	559.4	O K
7200 min Summer	100.488	0.488	9.5	456.9	O K
8640 min Summer	100.399	0.399	9.5	373.5	O K
10080 min Summer	100.328	0.328	9.5	307.2	O K
15 min Winter	100.382	0.382	9.5	358.3	O K
30 min Winter	100.513	0.513	9.5	480.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	128.043	0.0	345.0	19
30 min Summer	86.421	0.0	467.4	34
60 min Summer	55.699	0.0	624.3	64
120 min Summer	34.661	0.0	777.5	124
180 min Summer	25.866	0.0	870.2	182
240 min Summer	20.860	0.0	935.3	242
360 min Summer	15.370	0.0	1032.6	362
480 min Summer	12.368	0.0	1106.3	480
600 min Summer	10.440	0.0	1165.2	600
720 min Summer	9.085	0.0	1214.1	712
960 min Summer	7.289	0.0	1290.3	816
1440 min Summer	5.333	0.0	1369.4	1068
2160 min Summer	3.893	0.0	1589.4	1472
2880 min Summer	3.110	0.0	1691.7	1900
4320 min Summer	2.261	0.0	1840.8	2724
5760 min Summer	1.802	0.0	1968.2	3464
7200 min Summer	1.510	0.0	2061.4	4184
8640 min Summer	1.309	0.0	2141.7	4920
10080 min Summer	1.159	0.0	2209.1	5552
15 min Winter	128.043	0.0	345.0	19
30 min Winter	86.421	0.0	467.4	33

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Clarke Hall Farm Aberford Road, Wakefield WF1 4AL	Lower Blacup Farm, Cleckheaton Newett Homes 100yr + 45% Calcs	
Date 06/08/2024 10:43 File 159.004 100yr + 45% - 9...	Designed by A.Bottomley Checked by W.Walker	
Innovyze	Source Control 2020.1.3	

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
60 min Winter	100.652	0.652	9.5	611.0	O K
120 min Winter	100.793	0.793	9.5	742.8	O K
180 min Winter	100.867	0.867	9.5	812.0	O K
240 min Winter	100.910	0.910	9.5	852.7	O K
360 min Winter	100.961	0.961	9.5	900.6	O K
480 min Winter	100.987	0.987	9.5	924.9	O K
600 min Winter	100.998	0.998	9.5	935.1	O K
720 min Winter	101.000	1.000	9.5	936.6	O K
960 min Winter	100.986	0.986	9.5	924.0	O K
1440 min Winter	100.946	0.946	9.5	886.2	O K
2160 min Winter	100.869	0.869	9.5	814.7	O K
2880 min Winter	100.783	0.783	9.5	734.1	O K
4320 min Winter	100.581	0.581	9.5	544.6	O K
5760 min Winter	100.411	0.411	9.5	384.9	O K
7200 min Winter	100.287	0.287	9.5	268.5	O K
8640 min Winter	100.207	0.207	9.3	194.1	O K
10080 min Winter	100.162	0.162	8.9	151.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
60 min Winter	55.699	0.0	624.3	62
120 min Winter	34.661	0.0	777.5	122
180 min Winter	25.866	0.0	870.2	180
240 min Winter	20.860	0.0	935.3	238
360 min Winter	15.370	0.0	1032.6	354
480 min Winter	12.368	0.0	1106.3	468
600 min Winter	10.440	0.0	1165.3	578
720 min Winter	9.085	0.0	1214.1	688
960 min Winter	7.289	0.0	1290.6	894
1440 min Winter	5.333	0.0	1372.0	1112
2160 min Winter	3.893	0.0	1589.5	1580
2880 min Winter	3.110	0.0	1691.9	2044
4320 min Winter	2.261	0.0	1842.8	2856
5760 min Winter	1.802	0.0	1968.2	3576
7200 min Winter	1.510	0.0	2061.5	4184
8640 min Winter	1.309	0.0	2142.0	4832
10080 min Winter	1.159	0.0	2210.0	5344

Clarke Hall Farm Aberford Road, Wakefield WF1 4AL	Lower Blacup Farm, Cleckheaton Newett Homes 100yr + 45% Calcs	
Date 06/08/2024 10:43 File 159.004 100yr + 45% - 9...	Designed by A.Bottomley Checked by W.Walker	
Innovyze	Source Control 2020.1.3	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.342	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+45

Time Area Diagram

Total Area (ha) 1.140

Time (mins)	Area
From:	To: (ha)
0	4 1.140

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Clarke Hall Farm Aberford Road, Wakefield WF1 4AL	Lower Blacup Farm, Cleckheaton Newett Homes 100yr + 45% Calcs	
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Model Details

Storage is Online Cover Level (m) 105.000

Tank or Pond Structure

Invert Level (m) 100.000

Depth (m)	Area (m ²)						
0.000	937.0	0.700	937.0	1.400	937.0	2.100	937.0
0.100	937.0	0.800	937.0	1.500	937.0	2.200	937.0
0.200	937.0	0.900	937.0	1.600	937.0	2.300	937.0
0.300	937.0	1.000	937.0	1.700	937.0	2.400	937.0
0.400	937.0	1.100	937.0	1.800	937.0	2.500	937.0
0.500	937.0	1.200	937.0	1.900	937.0		
0.600	937.0	1.300	937.0	2.000	937.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0142-9500-1000-9500
Design Head (m)	1.000
Design Flow (l/s)	9.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	142
Invert Level (m)	100.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	9.5
Flush-Flo™	0.305	9.5
Kick-Flo®	0.675	7.9
Mean Flow over Head Range	-	8.2

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)						
0.100	5.1	1.200	10.4	3.000	16.0	7.000	24.0
0.200	9.2	1.400	11.1	3.500	17.2	7.500	24.8
0.300	9.5	1.600	11.9	4.000	18.3	8.000	25.6
0.400	9.4	1.800	12.5	4.500	19.4	8.500	26.3
0.500	9.2	2.000	13.2	5.000	20.4	9.000	27.1
0.600	8.7	2.200	13.8	5.500	21.4	9.500	27.8
0.800	8.6	2.400	14.4	6.000	22.3		
1.000	9.5	2.600	14.9	6.500	23.1		