



ODYSSEY

DEVELOPING JOURNEYS

**LAND OFF REEDS LANE, SAYERS
COMMON**

**FLOOD RISK ASSESSMENT
AND DRAINAGE STRATEGY**



LAND OFF OF REEDS LANE, SAYERS COMMON
FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY
ON BEHALF OF ANTLER HOMES

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22-258-009A Preliminary Drainage Strategy

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1.0 INTRODUCTION

1.1 *General*

1.1.1 Odyssey has been commissioned by Antler Homes to provide flood risk and drainage advice, incorporating a surface water and foul drainage strategy, in support of a planning application for residential development at Sayers Common.

1.1.2 The development comprises an initial proposal of 27 dwellings. The proposed site layout is presented in **Appendix A**.

1.1.3 This report sets out the main flood risks to the site and those that may arise as a result of the development. It also demonstrates the principles of surface water and foul water management at the site.

1.1.4 The report comprises the following elements:

- **Section 2.0** reviews the existing site conditions including the geology, hydrology and existing drainage regime of the site.
- **Section 3.0** provides a description of the development proposals.
- **Section 4.0** summarises relevant planning policy.
- **Section 5.0** assesses the flood risk to the site.
- **Section 6.0** presents the surface water drainage strategy.
- **Section 7.0** presents the foul drainage strategy.
- **Section 8.0** summarises and concludes this FRA.



2.0 EXISTING SITE CONDITIONS

2.1 *Location*

2.1.1 The site is located approximately 4.6 kilometres (km) north-west of Hassocks railway station. The site is currently mostly undeveloped greenfield land. There are existing buildings, and a parking area on the western part of the site. The site is bounded by residential units and Reeds Lane to the north, residential and commercial units to the north-west and east, and greenfield land to the south and south-west.

2.1.2 The Ordnance Survey (OS) grid reference for the centre of the site is 526501E, 118019N, and the nearest postcode for the site is BN6 9GB. A site location plan is presented in **Appendix A** alongside the proposed layout.

2.2 *Topography*

2.2.1 A topographical survey was completed in July 2020 by The Survey Association. The highest point of the site is located in the east with an elevation of 20.17 metres Above Ordnance Datum (m AOD). The site falls to the south-west and north-west with the lowest elevation of 17.12m AOD recorded at the northern boundary of the site. The topographical survey is presented in **Appendix B**.

2.3 *Geology and Hydrogeology*

2.3.1 British Geological Survey (BGS) online mapping (accessed March 2025) indicates the site is underlain by a bedrock of Weald Clay Formation (mudstone) with no superficial deposits recorded. The BGS online mapping is presented in **Appendix C**.

2.3.2 Environment Agency (EA) online mapping indicates the nearest 'Main River' is the Herrings Stream, situated approximately 1.2 kilometres (km) north-east of the site boundary at its nearest point. It is noted there is an ordinary watercourse flowing across the southern section of the site.

2.3.3 BGS hydrogeology mapping shows the site lies within the Wealden Group, described as "*rocks with essentially no groundwater*", and summarised as having "*very small yields of often poor quality water have been obtained from subordinate sandstones and limestones*".

2.3.4 Groundwater mapping published by the EA indicates the site is not located within a Groundwater Source Protection Zone (SPZ). Nevertheless, the development would adhere to the



EA's "Approach to Groundwater Protection" to ensure that groundwater quality is maintained and improved where possible across the site.

2.4 Existing Drainage Regime

2.4.1 According to Southern Water sewer records, a public surface water sewer network is present 250m north-east of the site, serving the residential area of Berrylands Farm. A short network is also present near properties on Osborn Close to the north of the site. The Southern Water sewer records are presented in **Appendix D**. It has been confirmed there is a highway drain along Reeds Lane.

2.4.2 The Southern Water sewer records show the presence of a public foul sewer network along Reeds Lane to the north of the site and the B2118 to the east of the site, serving the neighbouring residential units. A foul pumping station is also present north-east of the site at the junction between Reeds Lane and the B2118.

2.4.3 As the developable area for this site is less than 50ha, the Institute of Hydrology (IoH) Report 124 Flood Estimation for Smaller Catchments (1994) method is suitable to estimate greenfield peak flow rates (50ha is used in the formula and the flow rate is linearly interpolated based on the ratio of the development area). This methodology is approved in the Construction Industry Research and Information Association (CIRIA) C753 The SuDS Manual; the parameters used are presented in **Table 2.1**.

Table 2.1: SuDS Parameters

Parameter	Value	Unit
SAAR	811	Millimetres (mm)
Soil Index	0.450	-
Region	7	-
Urban	0.000	-

2.4.4 **Table 2.2** summarises the greenfield discharge rates for the total proposed impermeable area (0.635ha). Supporting calculations are provided in **Appendix E**.



Table 2.2: Greenfield Surface Water Discharge Rates

Return Period	Existing Greenfield Discharge Rates from Site (litres per second (l/s))	Existing Greenfield Discharge Rates per Hectare (l/s/ha)
QBAR	3.3	5.3
Q1	2.8	4.5
Q30	7.5	11.8
Q100	10.6	16.7



3.0 PROPOSED DEVELOPMENT

3.1.1 The development comprises an initial proposal of 27 dwellings. The proposed site layout is presented in **Appendix A**.



4.0 PLANNING POLICY

4.1 *Flood and Water Management Act (2010)*

4.1.1 The Flood and Water Management Act (FWMA) received royal assent on 8th April 2010. It was intended to implement Sir Michael Pitt's recommendations following the widespread summer floods of 2007. Guidance and information notes are published online by the Department for Environment, Food and Rural Affairs (Defra) to address a range of aspects concerning the Act.

4.1.2 The FWMA encourages the use of Sustainable Drainage Systems (SuDS) on development sites by removing the automatic right to connect to sewers.

4.1.3 The development proposals for the site considered by this report should adhere to the FWMA through the provision of SuDS as a fundamental component of the surface water drainage strategy.

4.2 *National Planning Policy Framework (2024)*

4.2.1 The National Planning Policy Framework (NPPF) sets out the Government's planning policies, and how these policies should be applied. Planning Practice Guidance (PPG) is available online and provides additional guidance to the NPPF, as well as providing links to relevant detailed documents. **Section 4.3** provides further detail on the PPG.

4.2.2 Paragraph 170 of the NPPF states *"Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere."*

4.2.3 Paragraph 172 of the NPPF states *"All plans should apply a sequential, risk-based approach to the location of development – taking into account all sources of flood risk and the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property."*

4.2.4 Paragraph 181 of the NPPF states *"When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:*



- *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;*
- *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;*
- *it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;*
- *any residual risk can be safely managed; and*
- *safe access and escape routes are included where appropriate, as part of an agreed emergency plan.”*

4.2.5 In accordance with the NPPF, a site-specific FRA is required for sites within the following categories:

- In Flood Zone 1, all proposals involving:
 - Sites of one hectare or more.
 - Land which has been identified by the EA as having critical drainage problems.
 - Land identified in a strategic flood risk assessment (SFRA) as being at increased flood risk in the future.
 - Land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.
- All proposals for development in Flood Zones 2 and 3.

4.3 Planning Practice Guidance (2022)

4.3.1 The PPG provides additional direction to the NPPF, with details provided in each section of the document on how to conform to the NPPF.

4.3.2 All land in England is classified as falling into one of three main flood zones, with the zones referring to the probability of river or sea flooding, ignoring the existence of defences. The PPG identifies and describes the EA flood zones as:

- Flood Zone 1: Low probability – land assessed as having less than a 1 in 1,000 annual probability of river or sea flooding (<0.1% Annual Exceedance Probability (AEP)).
- Flood Zone 2: Medium probability – land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river or sea flooding (1% - 0.1% AEP).
- Flood Zone 3: High probability – land assessed as having a 1 in 100 or greater annual probability of river flooding (≥1% AEP), or a 1 in 200 or greater annual probability of sea flooding (≥0.5% AEP).



- Flood Zone 3b: The Functional Floodplain – land where water has to flow or be stored in times of flood (as identified by the LPAs in the SFRA).

4.3.3 The current PPG sets out the following drainage hierarchy that the discharge of surface water runoff should adhere to:

- Into the ground (infiltration).
- To a surface water body.
- To a surface water sewer, highway drain, or another drainage system.
- To a combined sewer.

4.4 *West Sussex County Council Local Lead Flood Authority Policy for the Management of Surface Water*

4.4.1 The West Sussex County Council Local Lead Flood Authority (LLFA) Policy for the Management of Surface Water sets out ten SuDS policies.

4.4.2 LLFA Policy one regards following the drainage hierarchy and states:

1. *“Surface runoff not collected for use must be discharged according to the following discharge hierarchy:*
 - *to ground,*
 - *to a surface water body,*
 - *to a surface water sewer, highway drain, or another drainage system, or*
 - *to a combined sewer where there are absolutely no other options, and only where agreed in advance with the relevant sewerage undertaker.*
2. *The selection of a discharge point should be clearly demonstrated and evidenced.”*

4.4.3 LLFA Policy two regards managing flood risk through design and states:

1. *“The drainage scheme proposed is to:*
 - a. *protect people and property on the development site from flooding; and,*
 - b. *avoid creating any additional flood risk outside of the development in any part of the catchment, either upstream or downstream.*
2. *Any drainage scheme must manage all sources of surface water, including exceedance flows and surface flows from offsite, provide for emergency ingress and egress and ensure adequate connectivity.*



3. *For large sites where development is to be phased, there will need to be a strategic site surface water management system that allows different parts of the site to be developed at different times while ensuring that each of the design criteria can be met.”*

4.4.4 LLFA Policy three regards managing mimicking natural flows and drainage flow paths and states:

1. *“Drainage schemes should be designed to match greenfield discharge rates and follow natural drainage routes as far as possible; pumps should therefore not form part of drainage schemes.*
2. *Greenfield runoff should be calculated from FEH or a similar approved method. SAAR and any other rainfall data used in run-off storage calculations should be based upon FEH rainfall values.”*

4.4.5 LLFA Policy four regards reducing existing flood risk and states:

1. *“New development should be designed to take full account of any existing flood risk, irrespective of the source of flooding.*
2. *Where a site or its immediate surroundings have been identified to be at flood risk, all opportunities to reduce the identified risk should be investigated at an early stage and subsequently incorporated at the detailed design stage”*

4.4.6 LLFA Policy five regards reducing maximising resilience and states:

1. *“The design of the drainage system must account for the likely impacts of climate change and changes in impermeable area over the design life of the development. Appropriate allowances should be applied in each case.*
2. *A sustainable drainage approach which considers control of surface runoff at the surface and at source is preferred and should be explored prior to other design solutions.*
3. *Culverting an existing watercourse should only be considered if there is no feasible alternative.”*

4.4.7 LLFA Policy six regards designing to be maintainable and states:

1. *“No building is to be occupied until a Verification Report pertaining to the surface water drainage system, carried out by a Chartered Engineer, has been submitted to the Local Planning Authority which demonstrates the suitable operation of the drainage system such that flood risk is appropriately managed, as approved by the Lead Local Flood*



Authority. The Report shall contain information and evidence (including photographs) of earthworks; details and locations of inlets, outlets and control structures; extent of planting; details of materials utilised in construction including subsoil, topsoil, aggregate and membrane liners; full as built drawings; and topographical survey of 'as constructed' features.

2. *The Verification Report should also include an indication of the adopting or maintaining authority or organisation and may require inclusion within a register of drainage features."*

4.4.8 LLFA Policy seven regards safeguarding water quality and states:

1. *"When designing a surface water management scheme, full consideration should be given to the system's capacity to remove pollutants and to the cleanliness of the water being discharged from the site, irrespective of the receiving system.*
2. *Interception of small rainfall events should be incorporated into the design of the drainage system."*

4.4.9 LLFA Policy eight regards design for amenity and multifunctionality and states:

"Drainage design should from the outset consider opportunities for inclusion of amenity and biodiversity objectives and thus provide multi-functional use of open space with appropriate design for drainage measures within the public realm."

4.4.10 LLFA Policy nine regards enhancing biodiversity and states:

"Drainage design should from the outset consider opportunities for biodiversity enhancement, through optimising the scope for surface systems, consideration of connectivity to adjacent water bodies or natural habitats, and appropriate planting specification."

4.4.11 LLFA Policy ten regards links to wider landscape objectives and states:

"Drainage design should from the outset consider opportunities to contribute to the wider landscape and ensure proposals are coherent with the surrounding landscape character area."



4.5 *Mid-Sussex District Plan (2014-2031)*

4.5.1 Policy DP41 of the Mid-Sussex District Plan states, *“Proposals for development will need to follow a sequential risk-based approach, ensure development is safe across its lifetime and not increase the risk of flooding elsewhere.”*

4.5.2 Policy DP41 states *“proposals for development should seek to reduce the risk of flooding by achieving a reduction from existing run-off rates.*

Sustainable Drainage Systems (SuDS) should be implemented in all new developments of 10 dwellings or more, or equivalent non-residential or mixed development unless demonstrated to be inappropriate, to avoid any increase in flood risk and protect surface and ground water quality. Arrangements for the long term maintenance and management of SuDS should also be identified.

SuDS should be sensitively designed and located to promote improved biodiversity, an enhanced landscape and good quality spaces that improve public amenities in the area, where possible.”

4.5.3 The preferred hierarchy of managing surface water drainage from any development is:

- 1) *“Infiltration Measures*
- 2) *Attenuation and discharge to watercourses; and if these cannot be met,*
- 3) *Discharge to surface water only sewers.”*



5.0 SOURCES OF FLOOD RISK

5.1 *Fluvial Flooding*

5.1.1 Fluvial flooding is caused by flows in rivers or streams exceeding the capacity of the river channel and spilling into the floodplain. Fluvial flooding can also occur on designated floodplain land after a period of heavy rainfall.

5.1.2 The EA Flood Map for Planning (accessed March 2025) shows the site is entirely located within Flood Zone 1; land assessed as having “*less than a 1 in 1,000 annual probability of river or sea flooding (<0.1% Annual Exceedance Probability (AEP))*”. The flood risk vulnerability classification of residential dwellings is deemed as ‘more vulnerable’. In accordance with the Planning Practice Guidance (PPG), development of this nature in Flood Zone 1 is acceptable. The EA Flood Map for Planning mapping is presented in **Appendix F**.

5.1.3 The risk of flooding from fluvial sources is considered to be very low.

5.2 *Surface Water Flooding*

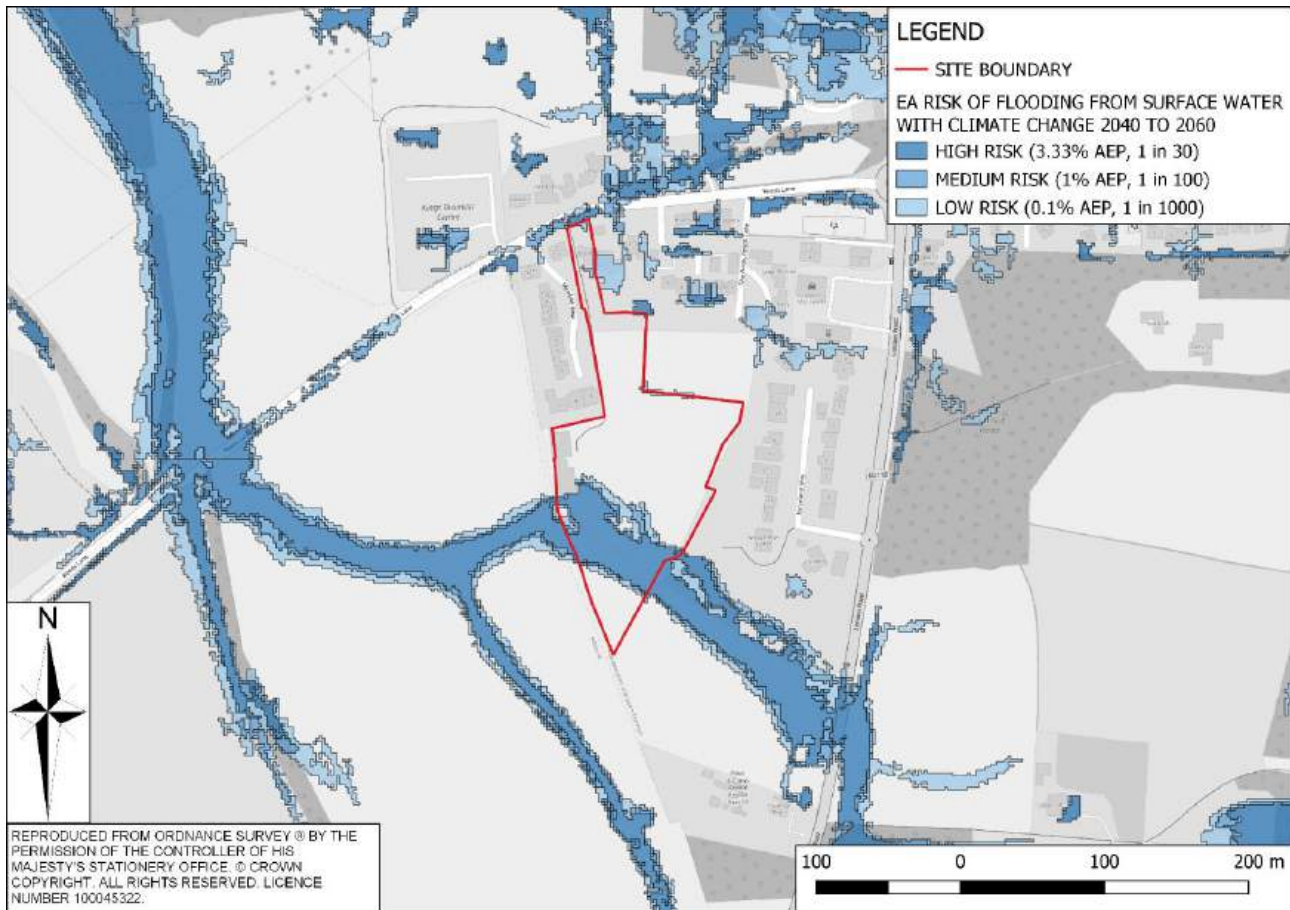
5.2.1 Surface water (pluvial) flooding is caused by rainfall levels exceeding the natural infiltration properties of the surrounding soils. Flooding can occur where there is a lack of a formalised drainage system, or as a result of a poorly designed or maintained sewer system. Flooding can also occur owing to the absence of a natural method of drainage such as watercourses or ditches, or where soil infiltration rates are low. Flooding often results in ponding of water at low points or when surface water flow routes are blocked by an obstruction.

5.2.2 The EA Risk of Flooding from Surface Water (RoFSW) mapping shows the site is at ‘very low’, ‘low’, ‘medium’, and ‘high’ risk of surface water flooding, in association with the ordinary watercourse to the south of the site.

5.2.3 The EA Risk of Surface Water Flooding (RoSWF) mapping is shown in **Figure 5.1**.

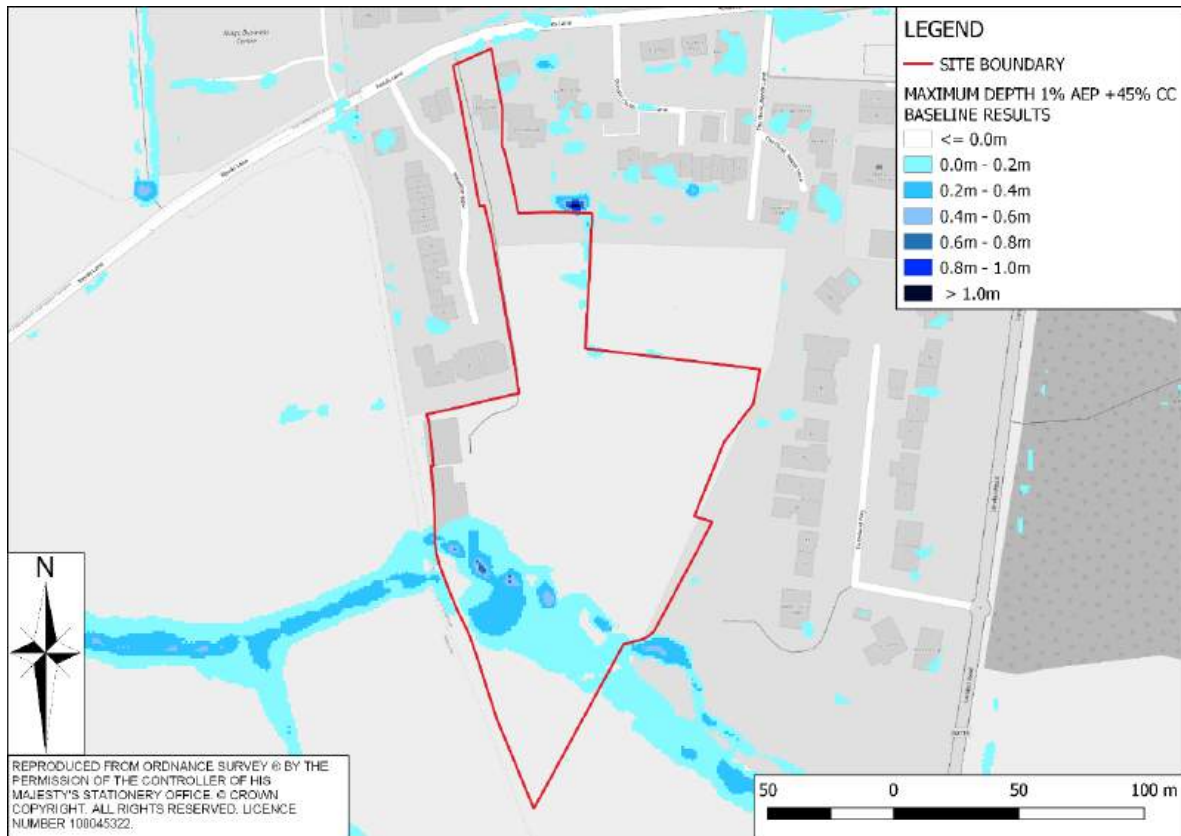


Figure 5.1: EA Risk of Surface Water Flooding Mapping with Climate Change 2040 to 2060



5.2.4 Detailed 2D pluvial flood modelling was undertaken using TUFLOW software suite. The full pluvial model report is presented in **Appendix G**. The model utilised accurate on-site topographical survey data and Flood Estimation Handbook (FEH) rainfall data, and as such it provides a more accurate representation of pluvial flood risk compared to the national EA RoFSW dataset.

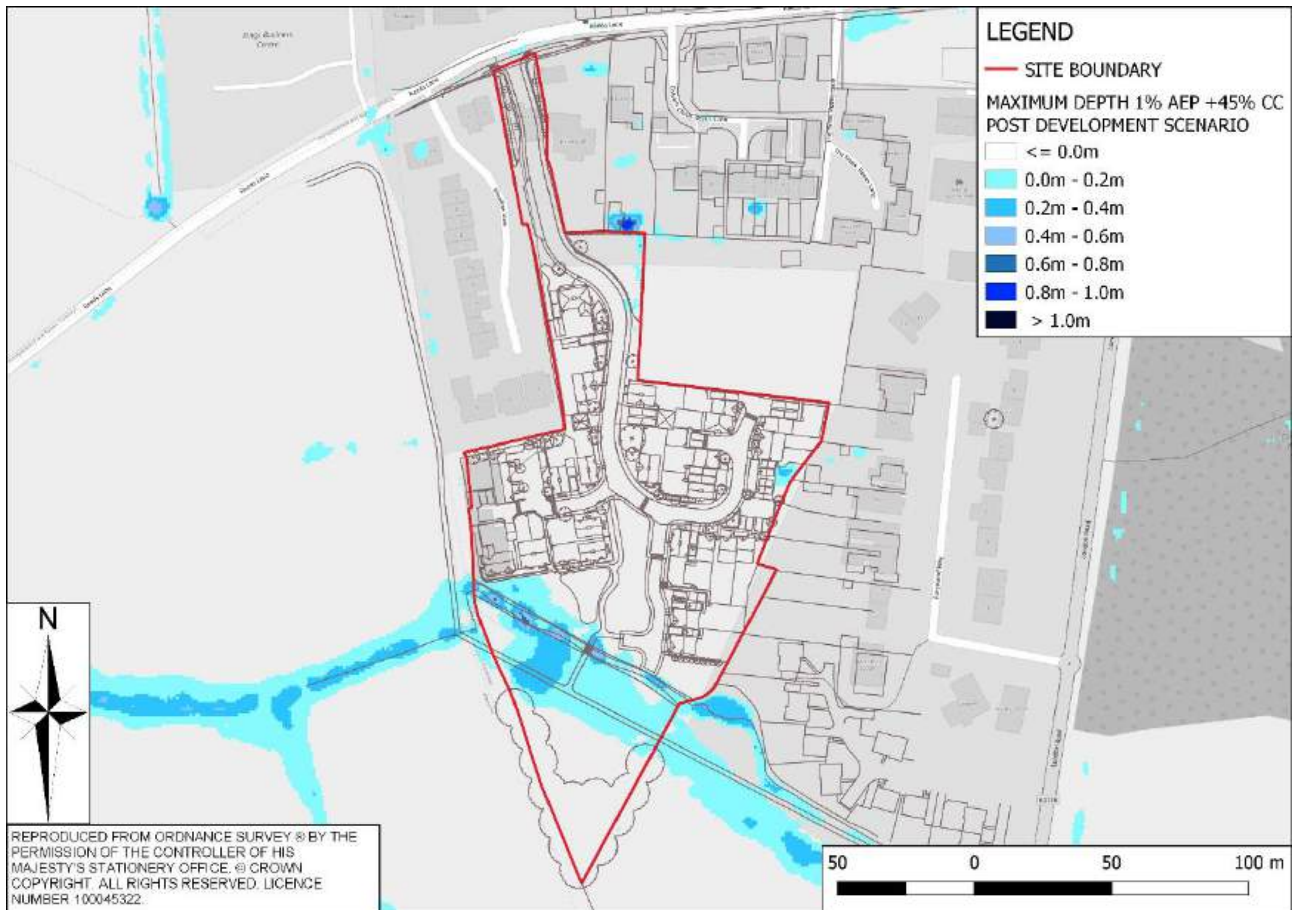
5.2.5 The pluvial model assessed the pre-development and post-development scenarios for a number of events including the 1 in 100 year with 45% climate change allowance. The modelled baseline pluvial floodplain, during a 1 in 100 year with 45% climate change allowance event, is presented in **Figure 5.2** and shows that the baseline flood extent for the 1 in 100 year event with climate change would impact on the proposed dwellings.

**Figure 5.2: Baseline 1 in 100 Year Plus 45% Climate Change Peak Flood Depths**

5.2.6 It is proposed that the areas, where the baseline flood extents would affect the dwellings and the pumping station, would be raised to demonstrate that the dwellings would be safe from flooding. The level changes on site do not increase flood risk offsite and this is supported by the modelling. The modelled post-development pluvial floodplain for the 1 in 100 year with 45% climate change allowance event with the proposed ground raising is presented in **Figure 5.3**.



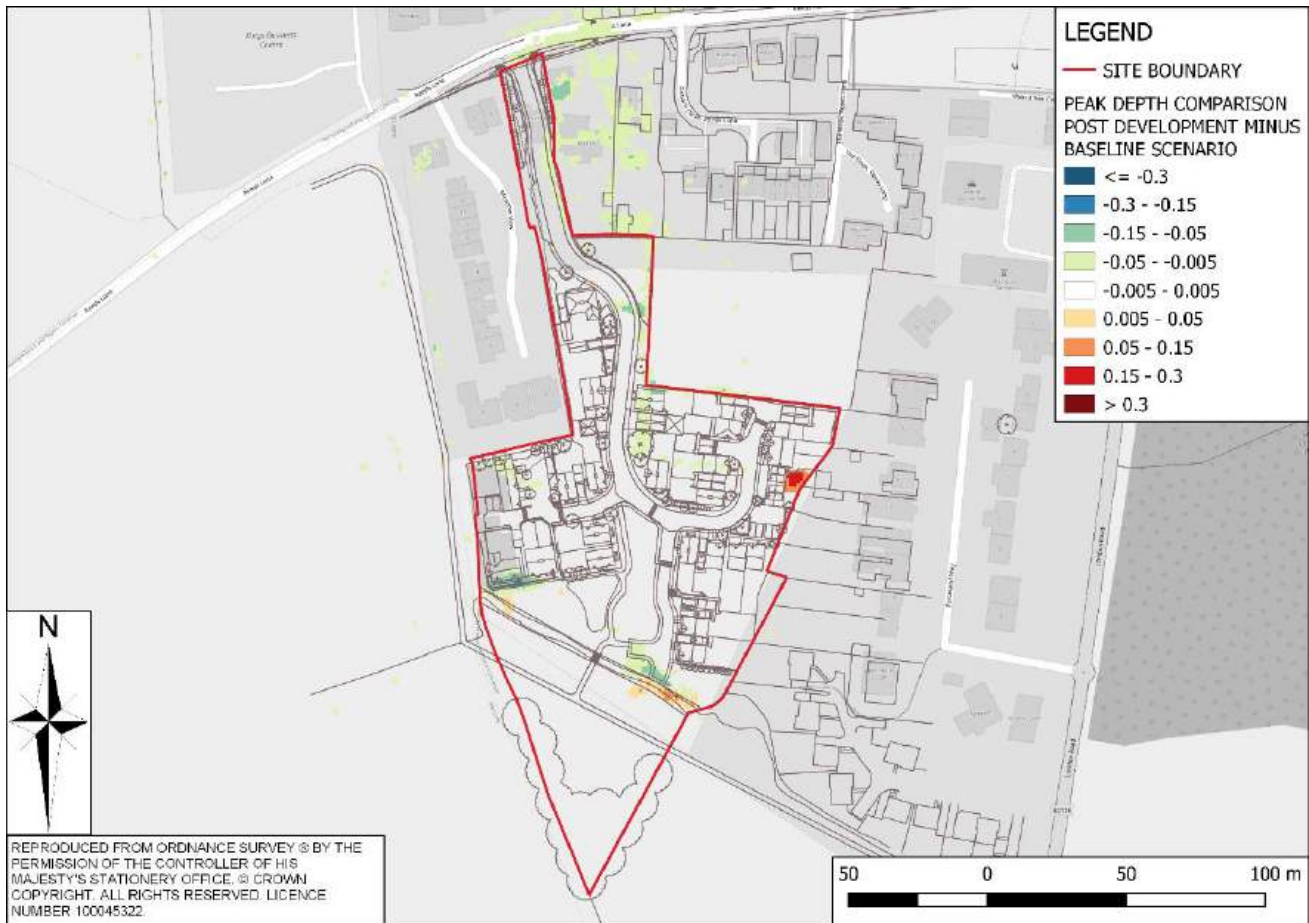
Figure 5.3: Post-Development 1 in 100 Year Plus 45% Climate Change Peak Flood Depths



5.2.7 **Figure 5.4** shows the difference in flooding between the baseline and the post development with the ground raising, for the 1 in 100 year storm event including climate change. The figure shows that the changes to the extents of flooding in the post development scenario are contained within the site boundary and do not increase flood risk offsite. As a result, flood compensation storage would not be required on or off site.



Figure 5.4: Post-Development 1 in 100 Year Plus 45% Climate Change Flood Depths Comparison



5.2.8 Therefore, the modelling has shown that all dwellings would be located outside of the pluvial flood extents.

5.2.9 The risk of flooding from surface water is considered to be low.

5.3 Groundwater Flooding

5.3.1 Groundwater flooding is caused by the emergence of water originating from sub-surface permeable strata. A groundwater flood event results from a rise in groundwater level sufficient for the water table to intersect the ground surface and inundate low lying land. Periods of prolonged rainfall may also be a cause of groundwater flooding, with aquifers and soils becoming saturated.

5.3.2 The West Sussex Lead Local Flood Authority Draft Local Flood Risk Management Strategy (LFRMS) (2021 – 2026) Groundwater Flood Risk Map shows the site is within an area of 'very low'



risk of groundwater flooding in the 1 in 100-year (1% AEP) event. The Groundwater Flood Risk Map is presented in **Appendix F**.

5.3.3 The risk of flooding from groundwater is considered to be very low.

5.4 Sewer Flooding

5.4.1 Flooding can occur owing to the failure of existing foul or surface water drainage infrastructure. If flows within the drainage system exceed the designed capacity or foreign matter causes blockages, overflow to the surface can occur, leading to flooding.

5.4.2 The West Sussex LFRMS and Mid Sussex District Council Level 1 SFRA do not mention Sayers Commons as an area known to experience sewer flooding and no sewer flooding mapping is available.

5.4.3 The risk of sewer flooding is considered to be low.

5.5 Flooding from Artificial Sources

5.5.1 Failure and overtopping of reservoirs and navigable water bodies, and failure of water mains, constitute the primary means of flooding from artificial sources.

5.5.2 The EA Flood Risk from Reservoirs mapping indicates the site is not located within the maximum extent of flooding from reservoirs. The EA Flood Risk from Reservoirs mapping is presented in **Appendix F**.

5.5.3 The risk of flooding from artificial sources is considered to be very low.



6.0 SURFACE WATER DRAINAGE STRATEGY

6.1 *Surface Water Drainage Strategy Requirements*

6.1.1 Any surface water drainage strategy must demonstrate the proposed development would be drained in a sustainable manner, commensurate with local and national policy. The NPPF requires that flood risk to land and property is not increased as a result of new development.

6.2 *Proposed Surface Water Drainage Strategy*

6.2.1 The indicative surface water drainage strategy described below is detailed in **Drawing 22-258-009A**.

6.2.2 As set out in **Section 4.3**, the drainage hierarchy states the most-preferred option for discharging surface water is “*into the ground (infiltration)*”. According to BGS maps, the underlying clay geology is not suitable for infiltrating SuDS features. Infiltration testing and groundwater monitoring would be carried out during a later stage of the planning process to determine the viability of using infiltration, and the drainage design would be updated accordingly.

6.2.3 The second most-preferred option in the drainage hierarchy is “*to a surface water body*”. An ordinary watercourse runs through the south of the proposed site.

6.2.4 It is proposed that surface water generated by the proposed development would be attenuated using permeable paving and attenuation tanks in the roads and parking areas, and a detention basin located at the topographical low point in the south of the site, prior to discharging into the ordinary watercourse. The northern part of the site falls away from the ditch on site; this area would be attenuated using permeable paving, prior to discharging to the highway drain along Reeds Lane, subject to agreement with the relevant parties.

6.2.5 The attenuation features would be designed to attenuate surface water flows from all rainfall events up to and including the 1 in 100 year plus 45% climate change design storm, in line with the latest guidance. A CV value of 1 in line with Mid Sussex requirements has been used.

6.2.6 Surface water discharge from the site would be controlled through the use of orifices to achieve lower discharge rates, however only positioned downstream of permeable paving where risk of blockage is reduced by the natural filtration provided by the permeable paving, and also using vortex control devices.



6.2.7 The discharge of surface water would be restricted to the Total Qbar rate for all storm events up to and including the 1 in 100 year plus 45% climate change design storm. As there are two outfalls, the discharge rates total Qbar but are split proportionately. The northern part of the site would discharge at a rate of 0.5l/s and the southern part at a discharge rate of 2.7l/s.

6.2.8 The drainage strategy has been modelled with a surcharged outfall on the southern outfall, and the supporting calculations show that the volume of storage provided is appropriate. The Causeway Flow calculations, which use the most up to date rainfall data available, are presented in **Appendix E**,

6.2.9 Exceedance flows would be considered. The exceedance flows would be routed within the roads, and the proposed site levels would be designed to ensure any flows would be diverted around the new dwellings.

6.3 Water Quality

6.3.1 The “pollution hazard indices for different land use classifications” table has been extracted from CIRIA C753 The SuDS Manual, and applied to the development proposals, as shown in **Table 6.1**.

Table 6.1: Pollution Hazard Indices

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Individual property driveways, residential car parks, low traffic roads (e.g. cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (e.g. schools, offices) i.e. less than 300 traffic movements per day	Low	0.5	0.4	0.4

6.3.2 Attenuating SuDS features would provide treatment for the surface water runoff from the site. The SuDS mitigation indices have been calculated in **Table 6.2**, in accordance with the guidance contained in the SuDS Manual.

**Table 7.2: SuDS Mitigation Indices**

Type of SuDS Component	Mitigation Indices		
	TSS	Metals	Hydrocarbons
Permeable Paving	0.7	0.6	0.7
Detention Basin	0.5	0.5	0.6

6.3.3 **Table 6.2** demonstrates that the permeable paving and basin on their own would provide a sufficient level of surface water runoff treatment prior to discharging to the watercourse or highway drain. The surface water would, in the southern part, flow through both the permeable paving and the basin, therefore undergoing additional treatment and resulting in improved water quality. The area draining through permeable paving to the highway drain would be treated sufficiently through the permeable paving.

6.4 SuDS Maintenance Requirements

6.4.1 Maintenance of the drainage system and SuDS features would be carried out in accordance with the manufacturer guidance and through an approved maintenance management plan to minimise the residual flood risk of drainage system blockage.

6.4.2 Maintenance would be the responsibility of the developer to assign, however the “*operation and maintenance requirements for permeable paving*”, “*operation and maintenance requirements for detention basins*” and “*operation and maintenance requirements for attenuation storage tanks*” tables have been extracted from The SuDS Manual and are presented in **Appendix H**.



7.0 FOUL DRAINAGE STRATEGY

7.1 *General*

7.1.1 It is proposed the foul drainage strategy would be designed to connect by gravity into a private foul pumping station located in the south-east corner of the site. The new connection would be subject to approval by Southern Water.

7.1.2 The foul drainage strategy is presented on **Drawing 22-258-009A**.

7.1.3 Southern Water has a duty to improve its network to cater for proposed developments. This is funded via increased infrastructure charges to developers. Should there be a requirement for offsite improvement works, Southern Water would programme these works with due regard to the build programme of the proposed development.



8.0 SUMMARY AND CONCLUSIONS

8.1 *General*

8.1.1 Odyssey has been commissioned by Antler Homes to provide flood risk and drainage advice, incorporating a surface water and foul drainage strategy, in support of a planning application for residential development at Sayers Common.

8.1.2 The EA Risk of Flooding from Surface Water (RoFSW) mapping shows the site is at 'very low', 'low', 'medium', and 'high' risk of surface water flooding, in association with the ordinary watercourse to the south of the site.

8.1.3 Detailed 2D pluvial flood modelling was undertaken using TUFLOW software suite to assess the baseline flood extents for a number of events including the 1 in 100 year with 45% climate change allowance and shows that the baseline flood extent for the 1 in 100 year event with climate change would impact on the proposed dwellings.

8.1.4 It is proposed that the areas, where the baseline flood extents would affect the dwellings and the pumping station, would be raised to demonstrate that they would be safe from flooding, and compensatory flood plain would be provided on site. Post development modelling incorporating the raised ground showed that the displaced flood extents are contained within the site boundary without increasing flood risk off site. As a result, it is demonstrated that the required flood compensation storage is provided on site and further flood compensation storage would not be required off site.

8.1.5 Risks of flooding from groundwater, sewers and artificial sources are considered to be low or very low.

8.1.6 It is proposed that surface water generated by the proposed development would be attenuated using permeable paving and attenuation tanks in the roads and parking areas, and a detention basin located at the topographical low point in the south of the site, prior to discharging into the ordinary watercourse. The northern part of the site falls away from the ditch on site; this area would be attenuated using permeable paving, prior to discharging to the highway drain along Reeds Lane.

8.1.7 The attenuation features would be designed to attenuate surface water flows from all rainfall events up to and including the 1 in 100 year plus 45% climate change design storm, in line with the latest guidance. A CV value of 1 in line with Mid Sussex requirements has been used.



8.1.8 Surface water discharge from the site would be controlled through the use of orifices to achieve lower discharge rates, however only positioned downstream of permeable paving where risk of blockage is reduced by the natural filtration provided by the permeable paving, and also through the use of vortex control devices.

8.1.9 The discharge of surface water would be restricted to the Total Qbar rate for all storm events up to and including the 1 in 100 year plus 45% climate change design storm.

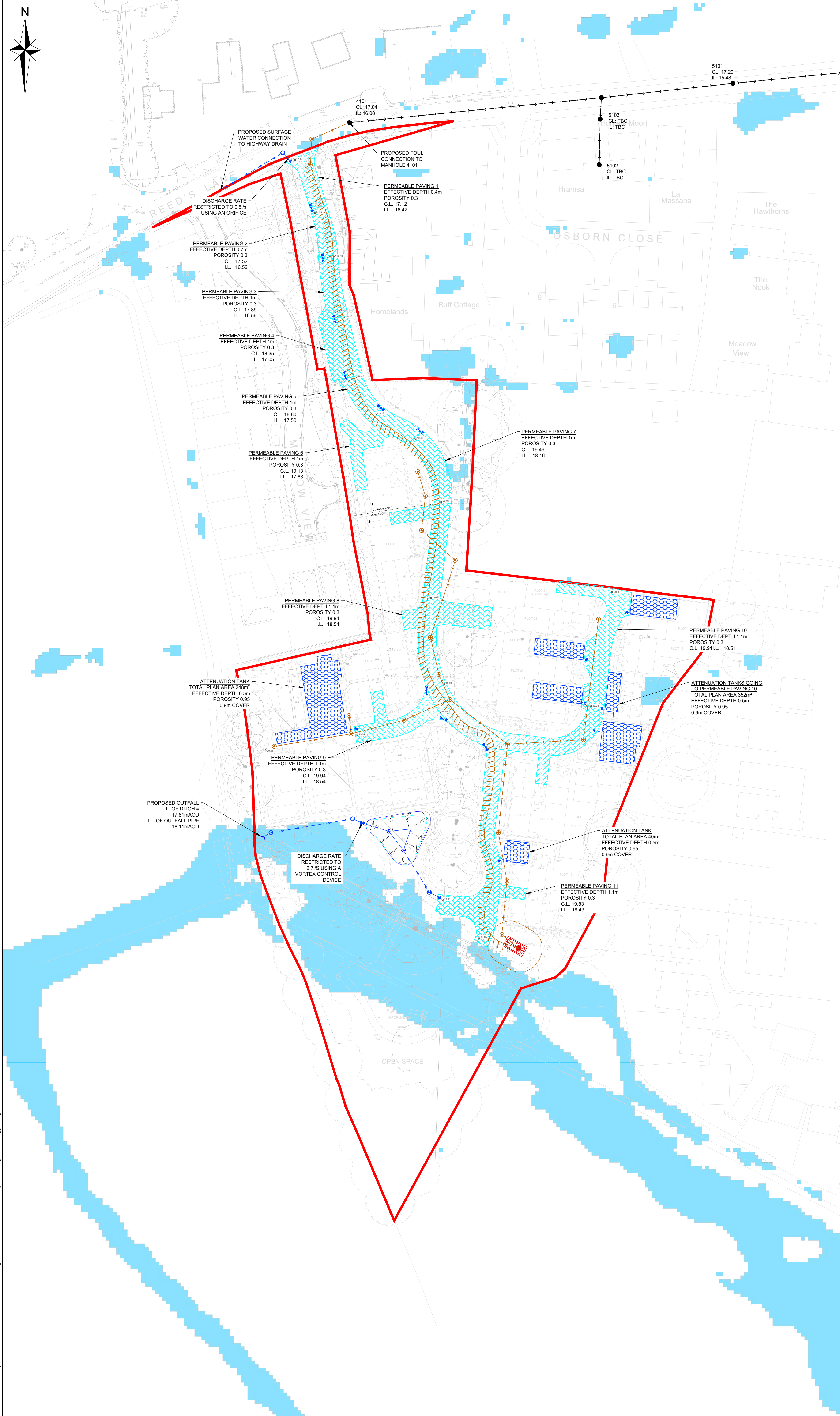
8.1.10 The drainage strategy has been modelled with a surcharged outfall on the southern outfall, and the supporting calculations show that the volume of storage provided is appropriate.

8.1.11 It is proposed the foul drainage strategy would be designed to connect by gravity into a private foul pumping station located in the south-east corner of the site. The new connection would be subject to approval by Southern Water.

8.1.12 A pre-planning enquiry has been submitted with Southern Water using a conservative peak pumped rate of 6l/s to reflect a reasonable flow rate that can be achieved by a pumping station, although the flow would not be continuous. A response has not yet been received.

8.1.13 There are no significant flood risks to the development. The proposed development would not be located within the existing surface water flood risk extents.

DRAWING



- NOTES
- DO NOT SCALE FROM THIS DRAWING. WORK FROM FIGURED DIMENSIONS ONLY.
 - ALL DIMENSIONS SHOWN ON THIS DRAWING ARE IN METRES UNLESS OTHERWISE SPECIFIED.
 - THE TOPOGRAPHICAL SURVEY IS BASED ON 3D SERVICES (SOUTH EAST) DRAWING REF. 20/071/01 AND 20/071/02, DATED 06/07/20.
 - THE SITE LAYOUT HAS BEEN PROVIDED BY ANTLER HOMES. DRAWING REF. AH291 - PL.03F, DATED 11.03.25.
 - THE DRAINAGE STRATEGY IS PRELIMINARY AND WOULD BE SUBJECT TO CHANGE AT DETAILED DESIGN STAGE.
 - THE DRAINAGE STRATEGY IS SUBJECT TO A LEVELS STRATEGY TO FACILITATE ATTENUATION STORAGE.
 - PROPOSED CONNECTION TO EXISTING HIGHWAY DRAIN SUBJECT TO APPROVAL BY RELEVANT AUTHORITY.
 - PLUVIAL MODELLING UNDERTAKEN BY ODYSSEY. THE PLUVIAL MODELLING REPORT IS APPENDED TO THE FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY REPORT (REFERENCE 22-258-05).

LEGEND:

- SITE BOUNDARY
- PROPOSED BASIN
- PROPOSED SURFACE WATER PIPEWORK
- PROPOSED PERMEABLE PAVING
- PROPOSED HEADWALL
- PROPOSED DIFFUSER UNIT
- PROPOSED VORTEX FLOW CONTROL DEVICE
- PROPOSED FOUL SEWER PIPE AND MANHOLE
- PROPOSED FOUL WATER RISING MAIN
- PROPOSED ATTENUATION TANK
- MODELLED 1 IN 100 YEAR PLUS CLIMATE CHANGE PLUVIAL FLOODING EXTENTS
- EXISTING FOUL WATER PIPE AND MANHOLE
- CATCHPIT CHAMBER WITH ORIFICE PLATE
- PROPOSED PRIVATE PUMPING STATION WITH 5m BUFFER TO DWELLINGS
- PROPOSED SPOT LEVELS
- DRAINAGE CATCHMENT CUT LINE

A AMENDED FOR NEW SITE LAYOUT		JW	GG	GG	21.03.25
Rev	Amendments	Drn	Chk	App	Date

ODYSSEY

Tuscany House
White Hart Lane
Basingstoke
Hampshire RG21 4AF

Telephone: 01256 331144
Fax: 01256 331134
E: info@odysseyconsult.co.uk
W: www.odysseyconsult.co.uk

Job Title

LAND OFF OF REEDS LANE,
SAYERS COMMON

Drawing Title

PRELIMINARY DRAINAGE
STRATEGY

Client

ANTLER HOMES

Scale	1:500 @A1	Date	SEPT 23	Designed	JW
Drawn	JW	Checked	GG	Approved	GG
Job No	22-258	Drawing No	22-258-009	Rev	A

APPENDIX A

Site Location Plan and Proposed Site Layout



key plan (if applicable)

notes

revision	date	prepared	description
----------	------	----------	-------------



Knightway House
Park Street
Bagshot
Surrey
GU19 5AQ
T : 01276 538941
www.antlerhomes.co.uk

project
CHESEPEAKE, REEDS LANE, SAYERS
COMMON, WEST SUSSEX. BN6 9GB

drawing
SITE LOCATION PLAN

date	scale	drawn
21.08.23	1:1250 @ A3	MJ

drawing number	revision
AH291 - PL.01	-

notes

LEGEND

- EXISTING TREE RETAINED
- ROOT PROTECTION AREA
- EXISTING TREES TO BE REMOVED
- INDICATIVE NEW TREE PLANTING
- AFFORDABLE HOUSING



- F 11.03.25 MJ REVISED FOLLOWING RECEIPT OF TRAFFIC SURVEY DATA
- E 10.03.25 MJ INDICATIVE PLAY EQUIPMENT SHOWN TO OPEN SPACE
- D 20.02.25 MJ ALLOCATION OF CHIMNEYS RATIONALISED
- C 21.02.25 MJ REVISED TO REFLECT COMMENTS RECEIVED FROM HIGHWAYS CONSULTANTS
- B 20.01.25 MJ PLOT 6 RE - LOCATED OUTSIDE OF FLOOD PLAN
- A 24.01.25 MJ PLOTS 5 TO 10 REVISED

revision	date	prepared	checked



ANTLER HOMES

Knighway House
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T : 01276 538941
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project
LAND TO THE REAR OD CHESEPEAKE,
REEDS LANE, SAYERS COMMON

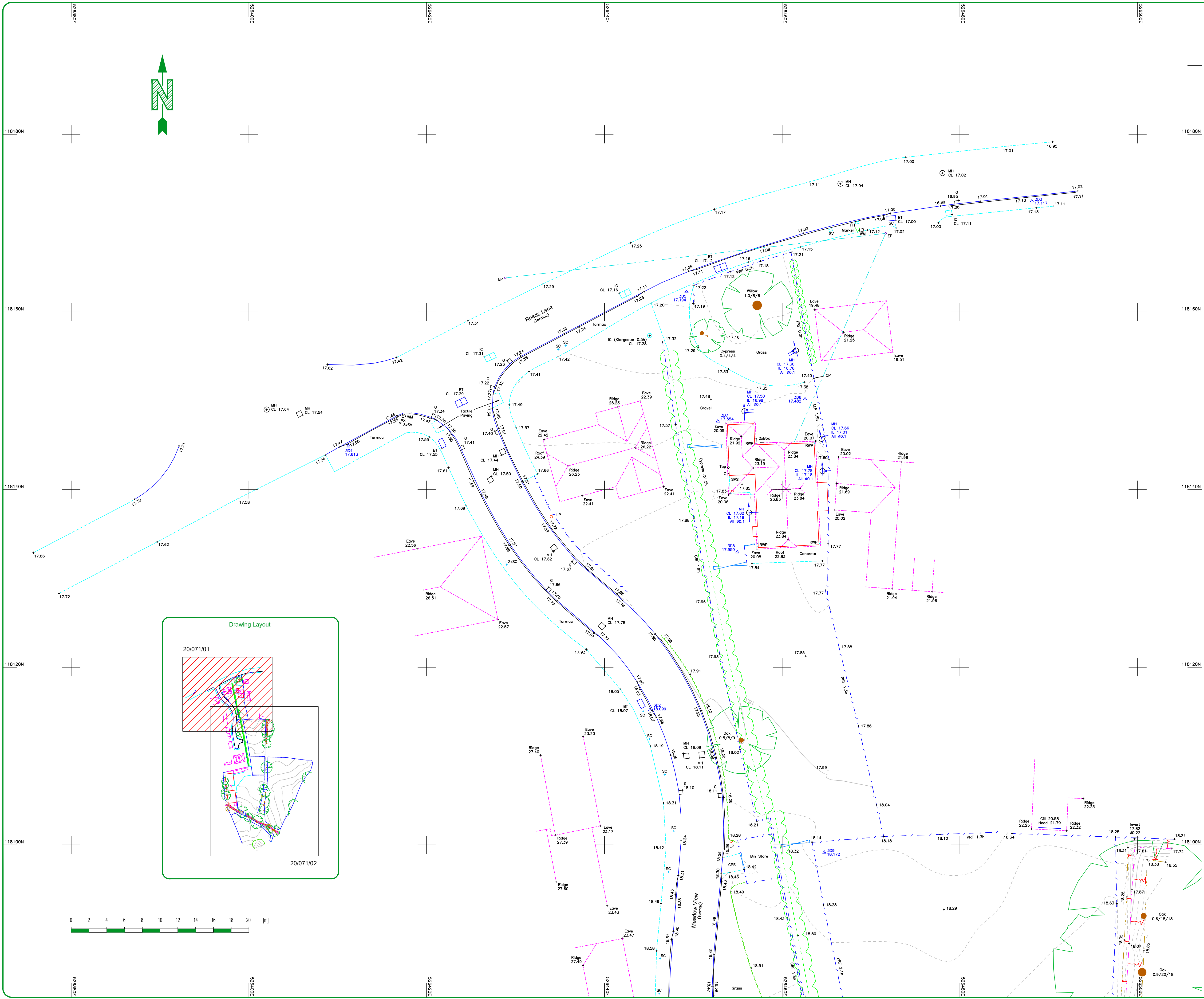
drawing
SITE LAYOUT PLAN

date	scale	drawn
07.11.24	1:500 @ A1	MJ

drawing number	revision
AH291 - PL.03	F

APPENDIX B

Topographical Survey



Survey Station Coordinates			
Station	Easting	Northing	Level
3D1	526466.551	118081.625	18.990
3D2	526465.115	118116.185	18.099
3D3	526488.093	118172.465	17.117
3D4	526411.205	118144.852	17.613
3D5	526440.236	118162.261	17.104
3D6	526462.572	118150.187	17.482
3D7	526452.757	118147.696	17.554
3D8	526454.957	118132.961	17.950
3D9	526464.742	118099.162	18.172
3D10	526474.648	118019.250	19.352
3D11	526494.839	117992.680	18.507
3D12	526520.257	118006.362	19.624
3D13	526743.916	117920.937	19.114
3D14	526446.544	117963.768	18.901
3D15	526467.071	117953.301	18.721
3D16	526467.757	117996.846	19.293
GPS1	526511.696	117955.632	19.627

LEGEND

Building

Glass Roof
(Greenhouse)

Open Sided
Buildings

Survey Station

Banks

Spot Levels
(Metres)

Steps Up

Tree
0.4/8/12
(Dia) (Dia) (Metres)

Leaning Tree

Hedges

Canopy Line
(Width Drawn To Scale)

Fences

Sapling

ABBREVIATIONS (WHERE APPLICABLE)

BOLLARD

BRITISH TELECOM BOX

BRITISH TELECOM IC

CABLE TELEVISION BOX

CABLE TELEVISION IC

CONCRETE

CHANGE POINT

CONCRETE PAVING SLABS

COVER LEVEL

DAMP PROOF COURSE

ELECTRICITY POLE

EARTH ROAD

FLOWER BED

FINISHED FLOOR LEVEL

FIRE HYDRANT

GAS VALVE

GUILLY

INSPECTION COVER

INVERT LEVEL

PIPE INVERT LEVEL

KERO OUTLET

LAMP POST

BTB

CTB

TV

CONC

CP

CPS

CL

DPC

EP

ER

FB

FRL

FH

GV

G

IC

IL

INV

INO

KO

LP

LETTER BOX

MANHOLE

MARKER

NOTICE BOARD

OVERHEAD CABLES

PARKING METER

RODDING EYE

ROAD NAME PLATE

ROAD SIGN

RAINWATER PIPE

STOP COOK

STRUCTURAL SLAB LEVEL

STOP VALVE

TELEPHONE CALL BOX

TRAFFIC LIGHTS

TOP OF WALL

TELEGRAPH POLE

UNKNOWN

UNABLE TO LIFT

VENT PIPE

WATER METER

WASH OUT

LB

MH

MKR

NB

OHC

PM

RE

RNP

RS

RWP

SC

SSL

SV

TCS

TL

TOW

TP

UNK

UTL

VP

WM

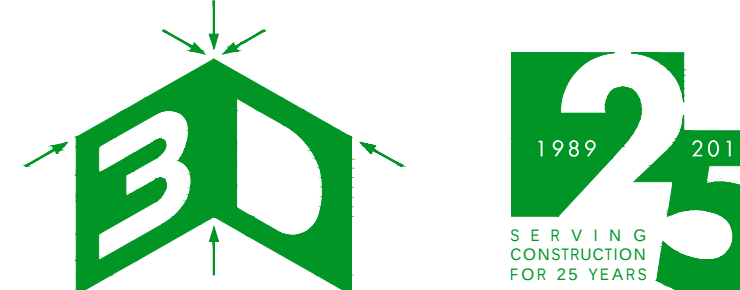
WO

DATUM USED : ALL LEVELS BASED ON OS DATUM.
HORIZONTAL GRID IS BASED ON OS
COORDINATES. ALL INFORMATION
CREATED BY GPS DATA.

FOR USERS OF THIS DRAWING IN DIGITAL FORMAT:
THIS DRAWING HAS BEEN SURVEYED TO A DEGREE OF ACCURACY COMMENSURATE WITH THE
SCALE INDICATED IN THE TITLE PANEL AND ANY DIMENSIONS EXTRACTED SHOULD BE TREATED
AS SUCH.

Revisions		
Date	Revision	Amendment

3D Services (South East) Ltd
Unit 5 Coopers Place, Combe Lane, Wormley, Surrey GU8 5SZ
Tel: 01428 684144 · Fax: 01428 685522 · surveys@3dservices.co.uk



Member of

THE SURVEY
ASSOCIATION

Client

ANTLER HOMES

Surveyed

Drawn

Checked

Date

RMC

CSG

RMC

06/07/20

Project

CHESEPEKE, SAYERS COMMON

Title

DETAIL SURVEY
Sheet 1 of 2

Job No

20/071

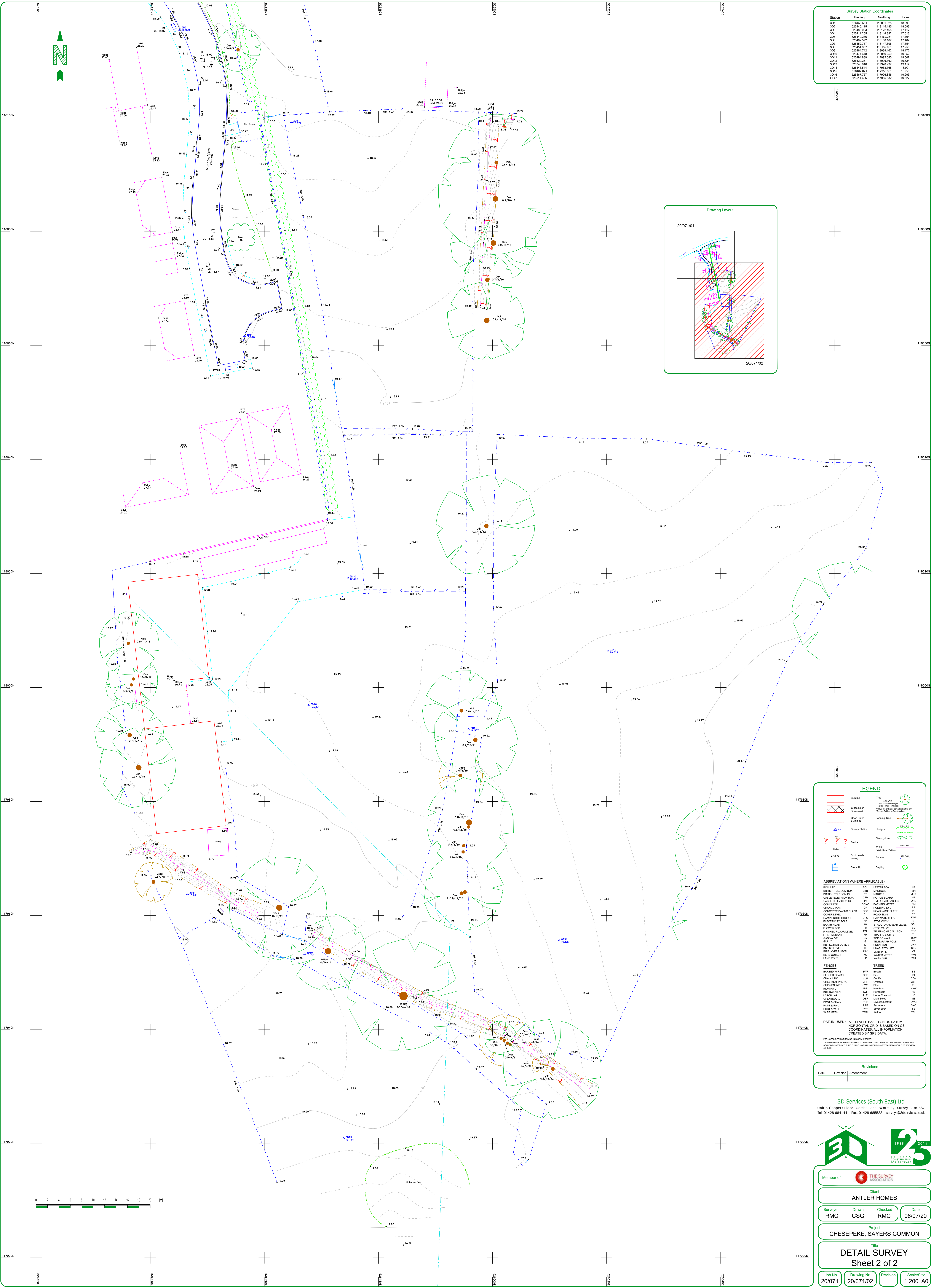
Drawing No

20/071/01

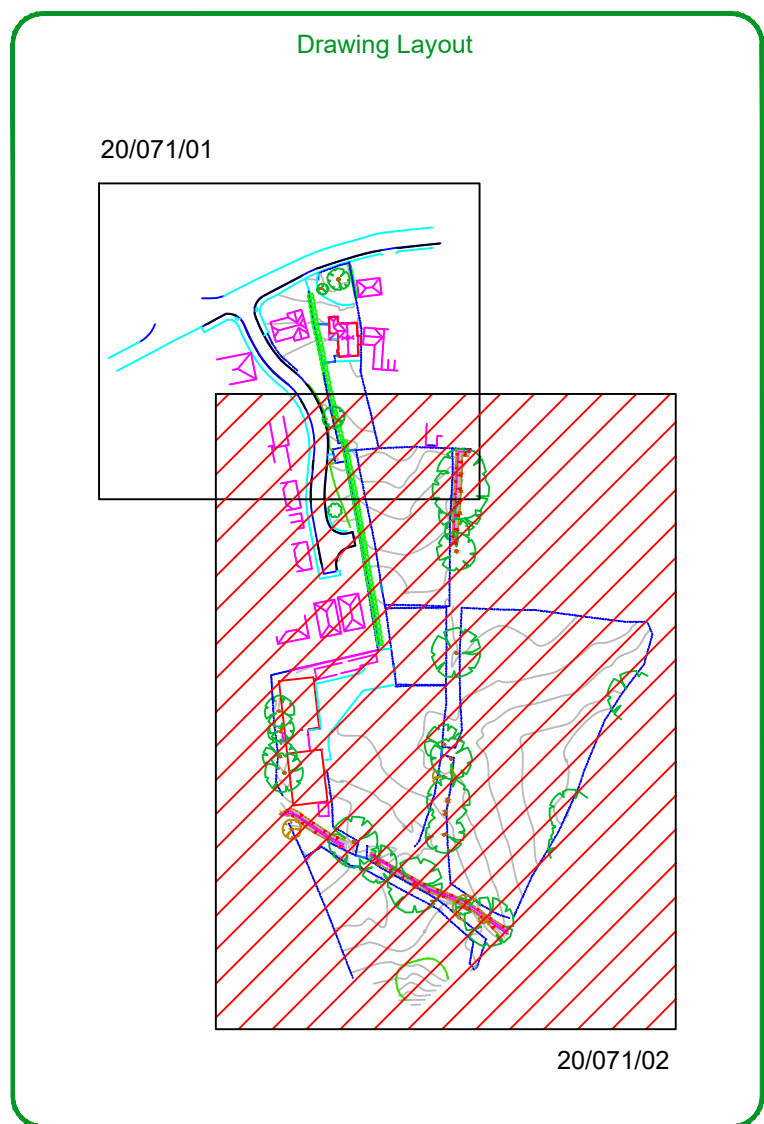
Revision

Scale/Size

1:200 A1



Survey Station Coordinates		
Station	Easting	Northing
301	526456.951	118061.625
302	526445.115	118115.185
303	526488.093	118172.465
304	526411.205	118144.882
305	526462.235	118162.201
306	526462.272	118165.187
307	526462.757	118167.696
308	526464.957	118172.891
309	526464.752	118099.162
310	526474.648	118019.200
311	526484.839	117992.580
312	526502.257	117992.802
313	526743.915	117920.937
314	526464.544	117903.708
315	526467.071	117983.301
316	526467.727	117986.646
GPS1	526511.696	117955.632



LEGEND

Building

Roof

Open Sided Building

Survey Station

Spot Levels (photo)

Steps Up

Tree

Hedges

Carriageway

Walls (Walls shown To Scale)

Fences

Sloping

Abbreviations (Where Applicable)

BRILLIANT TELECOM BOX

BT

CABLE TELEVISION BOX

CTB

CABLE TELEVISION IC

CONCRETE

CONCRETE PAVING SLABS

CPS

DAMP PROOF COURSE

DPC

ELECTRICITY POLE

ER

EARTH ROAD

FLUNDER BED

FLL

FIRE HYDRANT

FI

GAS VALVE

GV

GULLY

G

INSPECTION COVER

IC

PAVING LEVEL

PL

PIPE INVERT LEVEL

PI

PIPE OUTLET

PO

POST & RAIL

PR

DAMP PROOF

DP

LETTER BOX

MANHOLE

MARKER

NOTICE BOARD

OVERHEAD CABLES

PANORAMIC METER

RAIL

ROAD NAME PLATE

RNP

ROAD

RHS

RANWATER PIPE

RWP

STOP COCK

SV

STRUCTURAL SLAB LEVEL

SSL

TELEPHONE CALL BOX

TGB

TOP OF WALL

TP

TELEGRAPH POLE

TR

UNKNOWN

UNL

UNRAIL TO LEFT

UL

VENT PIPE

VP

WATER METER

WM

WASH OUT

WO

Revisions

Date	Revision	Amendment

3D Services (South East) Ltd

Unit 5 Coopers Place, Combe Lane, Wormley, Surrey GU8 5SZ

Tel: 01428 684144 - Fax: 01428 685522 - surveys@3dservices.co.uk

Member of

Client

ANTLER HOMES

Surveyed

RMC

Drawn

CSG

Checked

RMC

Date

06/07/20

Project

CHESEPEKE, SAYERS COMMON

Title

DETAIL SURVEY

Sheet 2 of 2

Job No

20/071

Drawing No

20/071/02

Revision

Scale/Size

1:200 A0

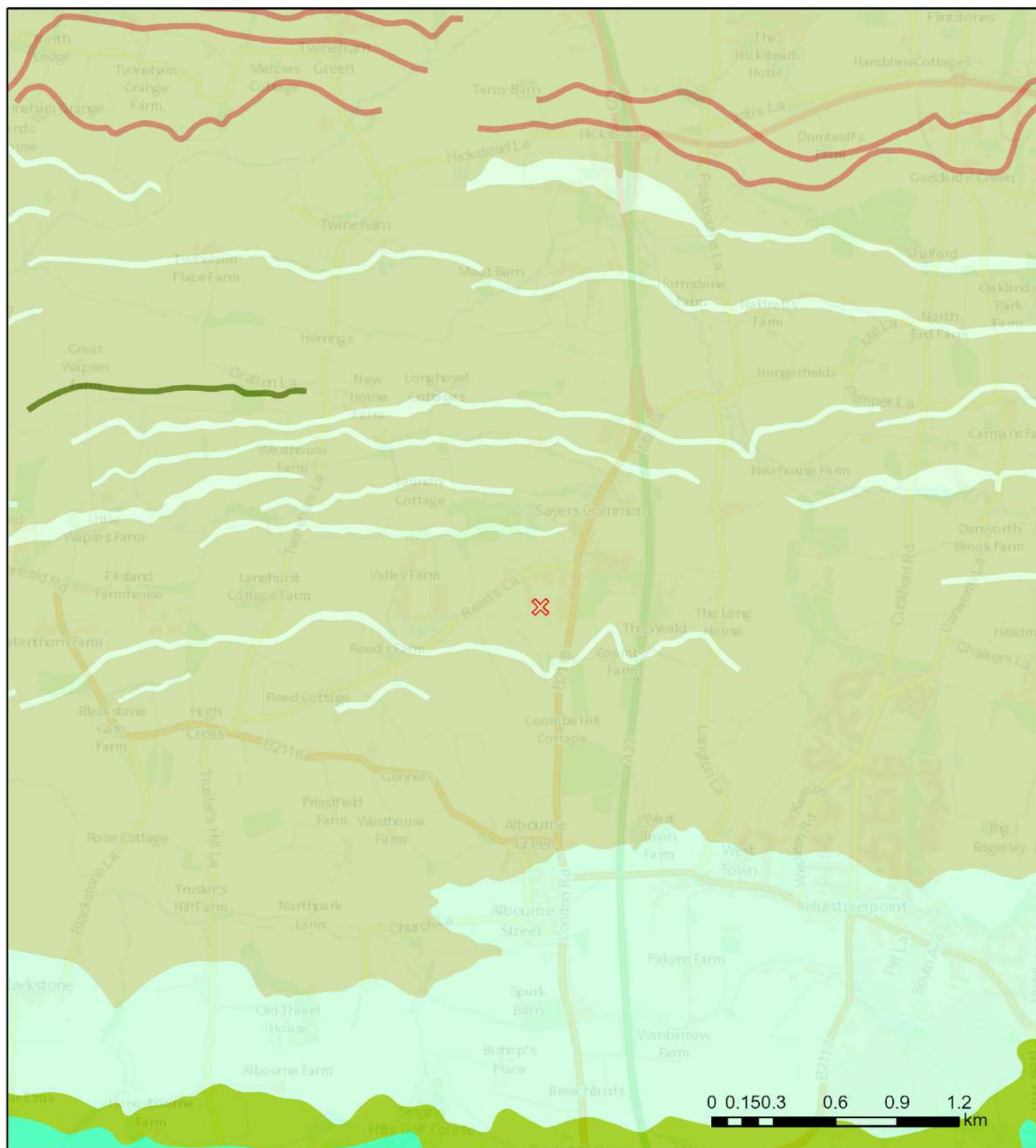
APPENDIX C

British Geological Survey Mapping

Bedrock



British
Geological
Survey



Contains OS data © Crown Copyright and database right 2020

GeolIndex Onshore Data Sources: NERC, Natural England, English Heritage and Ordnance Survey

Map Key

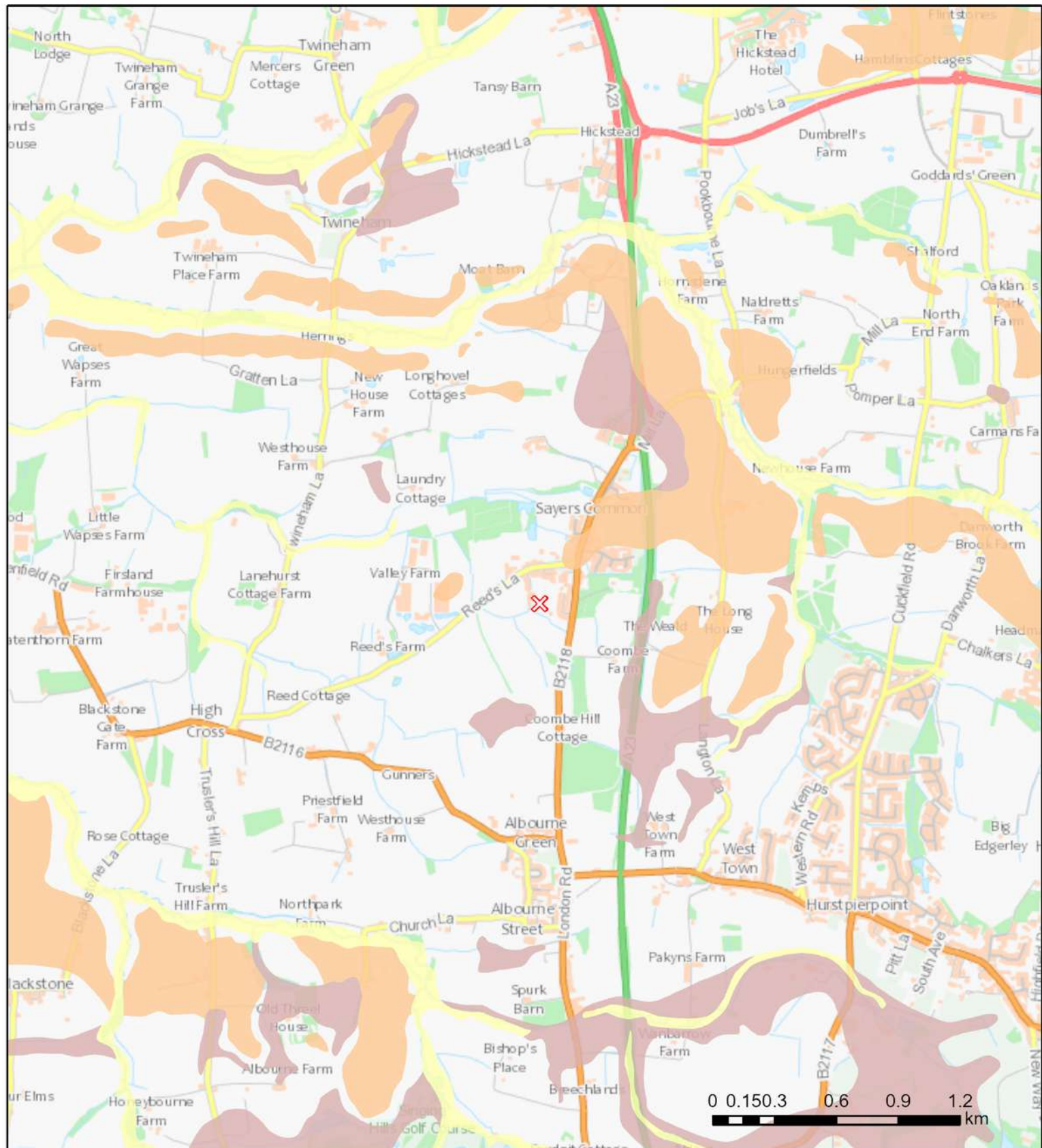
Bedrock geology 1:50,000 scale

	<u>HORSHAM STONE MEMBER - SANDSTONE</u>
	<u>WEALD CLAY FORMATION - SANDSTONE</u>
	<u>LOWER GREENSAND GROUP - SANDSTONE, SILTY</u>
	<u>GAULT FORMATION - MUDSTONE</u>
	<u>WEALD CLAY FORMATION - MUDSTONE</u>
	<u>WEALD CLAY FORMATION - CLAY-IRONSTONE</u>
	<u>FOLKESTONE FORMATION - SANDSTONE</u>
	<u>WEALD CLAY FORMATION - LIMESTONE</u>

Superficial Deposits



British
Geological
Survey



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GeolIndex Onshore Data Sources: NERC, Natural England, English Heritage and Ordnance Survey

Map Key

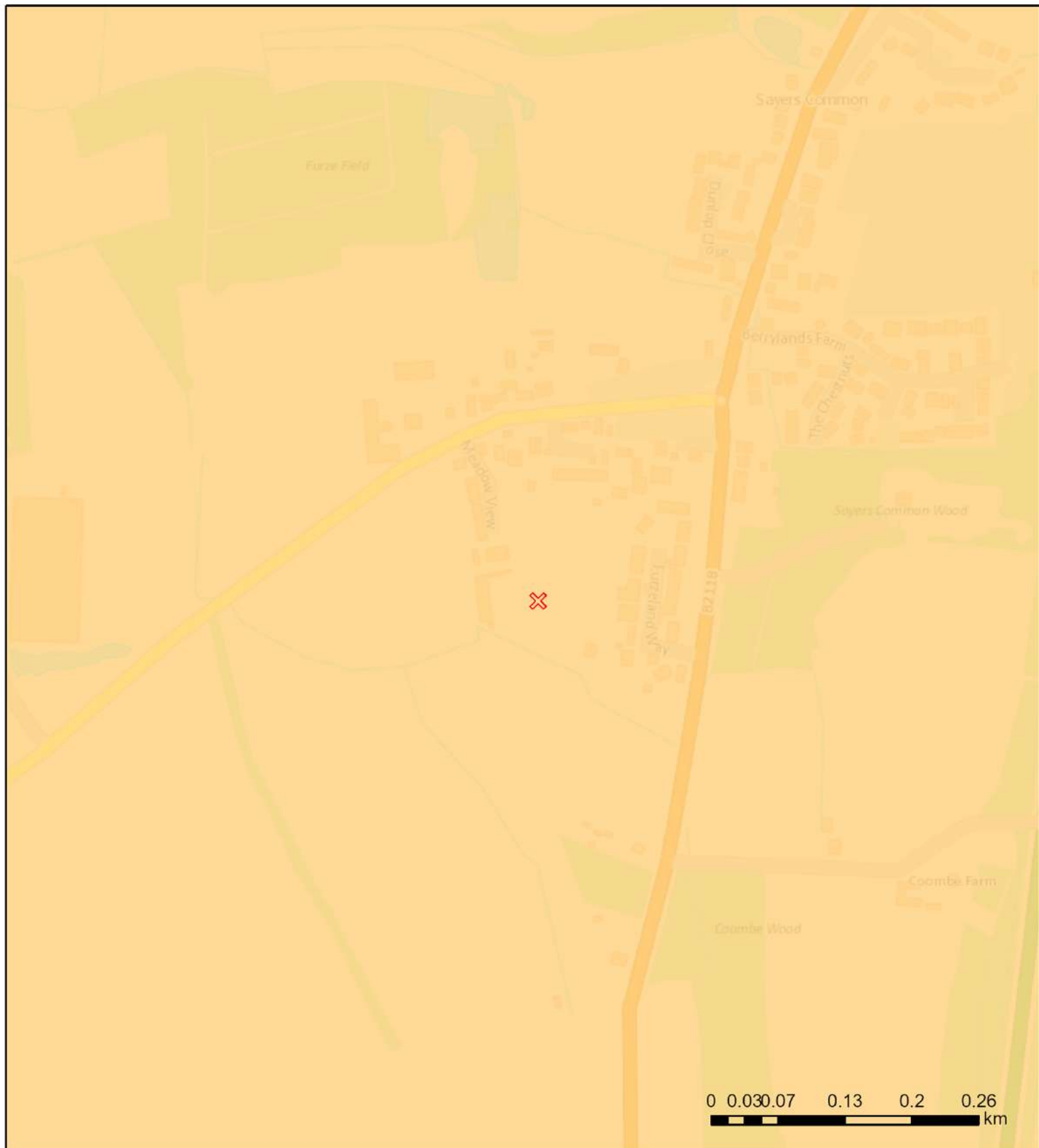
Superficial deposits 1:50,000 scale

-  [ALLUVIUM - CLAY, SILT, SAND AND PEAT](#)
-  [ALLUVIUM - CLAY, SILT, SAND AND GRAVEL](#)
-  [HEAD - CLAY, SILT, SAND AND GRAVEL](#)
-  [RIVER TERRACE DEPOSITS, 1 TO 2 \(ADUR\) - SAND AND GRAVEL](#)
-  [RIVER TERRACE DEPOSITS, 2 \(ADUR\) - SAND AND GRAVEL](#)
-  [RIVER TERRACE DEPOSITS, 2 TO 3 \(ADUR\) - SAND AND GRAVEL](#)
-  [RIVER TERRACE DEPOSITS, 3 \(ADUR\) - SAND AND GRAVEL](#)

Hydrogeology



British
Geological
Survey



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GeoIndex Onshore Data Sources: NERC, Natural England, English Heritage and Ordnance Survey

Map Key

Hydrogeology 1:625,000 scale

Aquifers with significant intergranular flow

-  Highly productive aquifer
-  Moderately productive aquifer
-  Low productivity aquifer

Aquifers in which flow is virtually all through fractures and other discontinuities

-  Highly productive aquifer
-  Moderately productive aquifer
-  Low productivity aquifer
-  Rocks with essentially no groundwater

APPENDIX D

Southern Water Sewer Records



(c) Crown copyright and database rights 2022 Ordnance Survey 100031673
Data updated: 27/10/22

Scale: 1:1250
Map Centre: 526537.117990

Date: 25/11/22
Our Ref: 1013417 - 1

Wastewater Plan A2
Powered by digidat

szalaki@odysseyconsult.co.uk	
22-258 Sayers Common	



The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2022 Ordnance Survey 100031673. This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.

APPENDIX E

Greenfield Runoff Rates and Causeway Flow Calculations

Odyssey		Page 1
Elizabeth House 39 York Road London SE1 7NQ	22-258 Sayers Common Greenfield Runoff Rates	
Date 18/03/2025 File	Designed by JW Checked by NM	
XP Solutions Source Control 2020.1.3		

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	0.635	Urban	0.000
SAAR (mm)	811	Region Number	Region 7

Results l/s

QBAR Rural	3.3
QBAR Urban	3.3
Q100 years	10.6
Q1 year	2.8
Q30 years	7.5
Q100 years	10.6

©1982-2020 Innovyze

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
Carpark 7	0.019	5.00	19.461		-39.647	85.901	1.300
Car Park 7 Orifice			19.461		-43.067	87.930	1.463
Carpark 6	0.035	5.00	19.134		-48.660	91.114	1.300
Car Park 6 Orifice			19.134		-51.213	93.349	1.479
Carpark 5	0.011	5.00	18.796		-56.374	100.924	1.300
Car Park 5 orifice			18.796		-58.532	104.803	1.525
Carpark 4	0.018	5.00	18.346		-60.768	116.244	1.300
Car Park 4 Orifice			18.346	1200	-62.499	119.067	1.531
Carpark 3	0.016	5.00	17.885		-64.775	132.754	1.300
Car Park 3 Orifice			17.885	1200	-65.206	138.005	1.332
Car Park 2	0.012	5.00	17.521		-67.678	151.908	1.000
Car Park 2 Orifice			17.521		-68.089	154.225	1.051
Carpark 1	0.013	5.00	17.120		-72.016	164.592	0.700
Car Park 1 Orifice			17.120	1200	-73.498	166.718	0.730
5			17.120	1200	-74.847	169.463	0.760
Outfall to Highway Drain			17.120	1200	-94.183	158.276	0.841
Carpark 8	0.084	5.00	19.943		-38.436	25.576	1.400
Car Park 8 Orifice			19.943	1200	-35.920	16.501	1.403
Tank Upstream of Car Park 9		5.00	19.937		-62.089	7.930	1.370
Carpark 9	0.130	5.00	19.937		-44.436	5.899	1.400
Car Park 9 Orifice			19.937	1200	-38.108	7.670	1.415
Tank Upstream of Carpark 10		5.00	19.908		-14.957	13.881	1.370
Carpark 10	0.200	5.00	19.908		-23.846	7.168	1.400
Car Park 10 Orifice			19.908	1200	-19.439	0.993	1.440
Tank upstream of Carpark 11		5.00	19.828		-3.664	-8.590	1.370
Carpark 11	0.100	5.00	19.828		-16.048	-8.851	1.400
Car Park 11 Hydrobrake			19.828	1350	-18.462	-13.192	1.430
3			19.260	1350	-26.351	-21.542	0.892
Basin			19.260	1350	-43.904	-29.674	0.933
Basin Hydrobrake			19.260	2100	-54.956	-20.139	0.963
Outfall to ditch			18.690	1200	-83.815	-25.187	0.580

Links (Input)

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	Carpark 7	Car Park 7 Orifice	5.000	0.600	18.161	17.998	0.163	30.7	225	5.04	50.0
1.001	Car Park 7 Orifice	Carpark 6	5.000	0.600	17.998	17.834	0.164	30.5	225	5.07	50.0
1.002	Carpark 6	Car Park 6 Orifice	5.000	0.600	17.834	17.655	0.179	27.9	225	5.10	50.0
1.003	Car Park 6 Orifice	Carpark 5	5.000	0.600	17.655	17.496	0.159	31.4	225	5.14	50.0
1.004	Carpark 5	Car Park 5 orifice	5.000	0.600	17.496	17.271	0.225	22.2	225	5.17	50.0
1.005	Car Park 5 orifice	Carpark 4	5.000	0.600	17.271	17.046	0.225	22.2	225	5.20	50.0
1.006	Carpark 4	Car Park 4 Orifice	5.000	0.600	17.046	16.815	0.231	21.6	225	5.23	50.0
1.007	Car Park 4 Orifice	Carpark 3	5.000	0.600	16.815	16.585	0.230	21.7	225	5.26	50.0
1.008	Carpark 3	Car Park 3 Orifice	5.000	0.600	16.585	16.553	0.032	156.3	225	5.34	50.0
1.009	Car Park 3 Orifice	Car Park 2	5.000	0.600	16.553	16.521	0.032	156.3	225	5.42	50.0
1.010	Car Park 2	Car Park 2 Orifice	5.000	0.600	16.521	16.470	0.051	98.0	225	5.48	50.0
1.011	Car Park 2 Orifice	Carpark 1	5.000	0.600	16.470	16.420	0.050	100.0	225	5.54	50.0
1.012	Carpark 1	Car Park 1 Orifice	5.000	0.600	16.420	16.390	0.030	166.7	225	5.63	50.0
1.013	Car Park 1 Orifice	5	5.000	0.600	16.390	16.360	0.030	167.0	225	5.71	50.0
1.014	5	Outfall to Highway Drain	13.610	0.600	16.360	16.279	0.081	167.0	225	5.93	50.0
2.000	Carpark 8	Car Park 8 Orifice	5.000	0.600	18.543	18.540	0.003	1666.7	225	5.27	50.0
2.001	Car Park 8 Orifice	Carpark 9	5.000	0.600	18.540	18.537	0.003	1666.7	225	5.53	50.0
3.000	Tank Upstream of Car Park 9	Carpark 9	5.000	0.600	18.567	18.537	0.030	166.7	225	5.08	50.0
2.002	Carpark 9	Car Park 9 Orifice	5.000	0.600	18.537	18.522	0.015	333.3	225	5.65	50.0
2.003	Car Park 9 Orifice	Carpark 10	5.000	0.600	18.522	18.508	0.014	357.1	225	5.77	50.0
4.000	Tank Upstream of Carpark 10	Carpark 10	5.000	0.600	18.538	18.508	0.030	166.7	225	5.08	50.0
2.004	Carpark 10	Car Park 10 Orifice	5.000	0.600	18.508	18.468	0.040	125.0	225	5.85	50.0
2.005	Car Park 10 Orifice	Carpark 11	5.000	0.600	18.468	18.428	0.040	125.0	225	5.92	50.0
5.000	Tank upstream of Carpark 11	Carpark 11	5.000	0.600	18.458	18.428	0.030	166.7	225	5.08	50.0
2.006	Carpark 11	Car Park 11 Hydrobrake	5.000	0.600	18.428	18.398	0.030	167.0	225	6.00	50.0
2.007	Car Park 11 Hydrobrake	3	5.000	0.600	18.398	18.368	0.030	167.0	225	6.08	50.0
2.008	3	Basin	6.897	0.600	18.368	18.327	0.041	168.2	225	6.20	50.0
2.009	Basin	Basin Hydrobrake	5.000	0.600	18.327	18.297	0.030	167.0	225	6.28	50.0
2.010	Basin Hydrobrake	Outfall to ditch	31.300	0.600	18.297	18.110	0.187	167.4	225	6.80	50.0

Simulation Settings

Rainfall Methodology	FEH-22	Winter CV	1.000	Drain Down Time (mins)	2880	Check Discharge Rate(s)	x
Rainfall Events	Singular	Analysis Speed	Normal	Additional Storage (m ³ /ha)	0.0	Check Discharge Volume	x
Summer CV	1.000	Skip Steady State	x	Starting Level (m)			

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	45	0	0

Node Outfall to ditch Surcharged Outfall

Overrides Design Area	x	Depression Storage Area (m ²)	0	Evapo-transpiration (mm/day)	0
Overrides Design Additional Inflow	x	Depression Storage Depth (mm)	0		
Applies to All storms					

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
0	0.740	210	0.740	420	0.740	630	0.740	840	0.740	1050	0.740	1260	0.740	1470	0.740
15	0.740	225	0.740	435	0.740	645	0.740	855	0.740	1065	0.740	1275	0.740	1485	0.740
30	0.740	240	0.740	450	0.740	660	0.740	870	0.740	1080	0.740	1290	0.740	1500	0.740
45	0.740	255	0.740	465	0.740	675	0.740	885	0.740	1095	0.740	1305	0.740	1515	0.740
60	0.740	270	0.740	480	0.740	690	0.740	900	0.740	1110	0.740	1320	0.740	1530	0.740
75	0.740	285	0.740	495	0.740	705	0.740	915	0.740	1125	0.740	1335	0.740	1545	0.740
90	0.740	300	0.740	510	0.740	720	0.740	930	0.740	1140	0.740	1350	0.740	1560	0.740
105	0.740	315	0.740	525	0.740	735	0.740	945	0.740	1155	0.740	1365	0.740	1575	0.740
120	0.740	330	0.740	540	0.740	750	0.740	960	0.740	1170	0.740	1380	0.740	1590	0.740
135	0.740	345	0.740	555	0.740	765	0.740	975	0.740	1185	0.740	1395	0.740	1605	0.740
150	0.740	360	0.740	570	0.740	780	0.740	990	0.740	1200	0.740	1410	0.740	1620	0.740
165	0.740	375	0.740	585	0.740	795	0.740	1005	0.740	1215	0.740	1425	0.740	1635	0.740
180	0.740	390	0.740	600	0.740	810	0.740	1020	0.740	1230	0.740	1440	0.740	1650	0.740
195	0.740	405	0.740	615	0.740	825	0.740	1035	0.740	1245	0.740	1455	0.740	1665	0.740

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
1890	0.740	2400	0.740	2910	0.740	3420	0.740	3930	0.740	4440	0.740	4950	0.740	5460	0.740
1905	0.740	2415	0.740	2925	0.740	3435	0.740	3945	0.740	4455	0.740	4965	0.740	5475	0.740
1920	0.740	2430	0.740	2940	0.740	3450	0.740	3960	0.740	4470	0.740	4980	0.740	5490	0.740
1935	0.740	2445	0.740	2955	0.740	3465	0.740	3975	0.740	4485	0.740	4995	0.740	5505	0.740
1950	0.740	2460	0.740	2970	0.740	3480	0.740	3990	0.740	4500	0.740	5010	0.740	5520	0.740
1965	0.740	2475	0.740	2985	0.740	3495	0.740	4005	0.740	4515	0.740	5025	0.740	5535	0.740
1980	0.740	2490	0.740	3000	0.740	3510	0.740	4020	0.740	4530	0.740	5040	0.740	5550	0.740
1995	0.740	2505	0.740	3015	0.740	3525	0.740	4035	0.740	4545	0.740	5055	0.740	5565	0.740
2010	0.740	2520	0.740	3030	0.740	3540	0.740	4050	0.740	4560	0.740	5070	0.740	5580	0.740
2025	0.740	2535	0.740	3045	0.740	3555	0.740	4065	0.740	4575	0.740	5085	0.740	5595	0.740
2040	0.740	2550	0.740	3060	0.740	3570	0.740	4080	0.740	4590	0.740	5100	0.740	5610	0.740
2055	0.740	2565	0.740	3075	0.740	3585	0.740	4095	0.740	4605	0.740	5115	0.740	5625	0.740
2070	0.740	2580	0.740	3090	0.740	3600	0.740	4110	0.740	4620	0.740	5130	0.740	5640	0.740
2085	0.740	2595	0.740	3105	0.740	3615	0.740	4125	0.740	4635	0.740	5145	0.740	5655	0.740
2100	0.740	2610	0.740	3120	0.740	3630	0.740	4140	0.740	4650	0.740	5160	0.740	5670	0.740
2115	0.740	2625	0.740	3135	0.740	3645	0.740	4155	0.740	4665	0.740	5175	0.740	5685	0.740
2130	0.740	2640	0.740	3150	0.740	3660	0.740	4170	0.740	4680	0.740	5190	0.740	5700	0.740
2145	0.740	2655	0.740	3165	0.740	3675	0.740	4185	0.740	4695	0.740	5205	0.740	5715	0.740
2160	0.740	2670	0.740	3180	0.740	3690	0.740	4200	0.740	4710	0.740	5220	0.740	5730	0.740
2175	0.740	2685	0.740	3195	0.740	3705	0.740	4215	0.740	4725	0.740	5235	0.740	5745	0.740
2190	0.740	2700	0.740	3210	0.740	3720	0.740	4230	0.740	4740	0.740	5250	0.740	5760	0.740
2205	0.740	2715	0.740	3225	0.740	3735	0.740	4245	0.740	4755	0.740	5265	0.740	5775	0.740
2220	0.740	2730	0.740	3240	0.740	3750	0.740	4260	0.740	4770	0.740	5280	0.740	5790	0.740
2235	0.740	2745	0.740	3255	0.740	3765	0.740	4275	0.740	4785	0.740	5295	0.740	5805	0.740
2250	0.740	2760	0.740	3270	0.740	3780	0.740	4290	0.740	4800	0.740	5310	0.740	5820	0.740
2265	0.740	2775	0.740	3285	0.740	3795	0.740	4305	0.740	4815	0.740	5325	0.740	5835	0.740
2280	0.740	2790	0.740	3300	0.740	3810	0.740	4320	0.740	4830	0.740	5340	0.740	5850	0.740
2295	0.740	2805	0.740	3315	0.740	3825	0.740	4335	0.740	4845	0.740	5355	0.740	5865	0.740
2310	0.740	2820	0.740	3330	0.740	3840	0.740	4350	0.740	4860	0.740	5370	0.740	5880	0.740
2325	0.740	2835	0.740	3345	0.740	3855	0.740	4365	0.740	4875	0.740	5385	0.740	5895	0.740
2340	0.740	2850	0.740	3360	0.740	3870	0.740	4380	0.740	4890	0.740	5400	0.740	5910	0.740
2355	0.740	2865	0.740	3375	0.740	3885	0.740	4395	0.740	4905	0.740	5415	0.740	5925	0.740
2370	0.740	2880	0.740	3390	0.740	3900	0.740	4410	0.740	4920	0.740	5430	0.740	5940	0.740
2385	0.740	2895	0.740	3405	0.740	3915	0.740	4425	0.740	4935	0.740	5445	0.740	5955	0.740

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
6480	0.740	6885	0.740	7290	0.740	7695	0.740	8100	0.740	8505	0.740	8910	0.740	9315	0.740
6495	0.740	6900	0.740	7305	0.740	7710	0.740	8115	0.740	8520	0.740	8925	0.740	9330	0.740
6510	0.740	6915	0.740	7320	0.740	7725	0.740	8130	0.740	8535	0.740	8940	0.740	9345	0.740
6525	0.740	6930	0.740	7335	0.740	7740	0.740	8145	0.740	8550	0.740	8955	0.740	9360	0.740
6540	0.740	6945	0.740	7350	0.740	7755	0.740	8160	0.740	8565	0.740	8970	0.740	9375	0.740
6555	0.740	6960	0.740	7365	0.740	7770	0.740	8175	0.740	8580	0.740	8985	0.740	9390	0.740
6570	0.740	6975	0.740	7380	0.740	7785	0.740	8190	0.740	8595	0.740	9000	0.740	9405	0.740
6585	0.740	6990	0.740	7395	0.740	7800	0.740	8205	0.740	8610	0.740	9015	0.740	9420	0.740
6600	0.740	7005	0.740	7410	0.740	7815	0.740	8220	0.740	8625	0.740	9030	0.740	9435	0.740
6615	0.740	7020	0.740	7425	0.740	7830	0.740	8235	0.740	8640	0.740	9045	0.740	9450	0.740
6630	0.740	7035	0.740	7440	0.740	7845	0.740	8250	0.740	8655	0.740	9060	0.740	9465	0.740
6645	0.740	7050	0.740	7455	0.740	7860	0.740	8265	0.740	8670	0.740	9075	0.740	9480	0.740
6660	0.740	7065	0.740	7470	0.740	7875	0.740	8280	0.740	8685	0.740	9090	0.740	9495	0.740
6675	0.740	7080	0.740	7485	0.740	7890	0.740	8295	0.740	8700	0.740	9105	0.740	9510	0.740
6690	0.740	7095	0.740	7500	0.740	7905	0.740	8310	0.740	8715	0.740	9120	0.740	9525	0.740
6705	0.740	7110	0.740	7515	0.740	7920	0.740	8325	0.740	8730	0.740	9135	0.740	9540	0.740
6720	0.740	7125	0.740	7530	0.740	7935	0.740	8340	0.740	8745	0.740	9150	0.740	9555	0.740
6735	0.740	7140	0.740	7545	0.740	7950	0.740	8355	0.740	8760	0.740	9165	0.740	9570	0.740
6750	0.740	7155	0.740	7560	0.740	7965	0.740	8370	0.740	8775	0.740	9180	0.740	9585	0.740
6765	0.740	7170	0.740	7575	0.740	7980	0.740	8385	0.740	8790	0.740	9195	0.740	9600	0.740
6780	0.740	7185	0.740	7590	0.740	7995	0.740	8400	0.740	8805	0.740	9210	0.740	9615	1.040
6795	0.740	7200	0.740	7605	0.740	8010	0.740	8415	0.740	8820	0.740	9225	0.740	9630	1.040
6810	0.740	7215	0.740	7620	0.740	8025	0.740	8430	0.740	8835	0.740	9240	0.740	9645	1.040
6825	0.740	7230	0.740	7635	0.740	8040	0.740	8445	0.740	8850	0.740	9255	0.740	9660	1.040
6840	0.740	7245	0.740	7650	0.740	8055	0.740	8460	0.740	8865	0.740	9270	0.740	9675	1.040
6855	0.740	7260	0.740	7665	0.740	8070	0.740	8475	0.740	8880	0.740	9285	0.740	9690	1.040
6870	0.740	7275	0.740	7680	0.740	8085	0.740	8490	0.740	8895	0.740	9300	0.740	9705	1.040

Node Car Park 1 Orifice Online Orifice Control

Flap Valve	x	Invert Level (m)	16.390	Design Flow (l/s)		Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Depth (m)	0.430	Diameter (m)	0.020		

Node Car Park 2 Orifice Online Orifice Control

Flap Valve	x	Replaces Downstream Link	x	Diameter (m)	0.012
Downstream Link	1.011	Invert Level (m)	16.470	Discharge Coefficient	0.600

Node Car Park 3 Orifice Online Orifice Control

Flap Valve	x	Invert Level (m)	16.553	Design Flow (l/s)	1.0	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Depth (m)	0.450	Diameter (m)	0.011		

Node Car Park 4 Orifice Online Orifice Control

Flap Valve	x	Invert Level (m)	16.815	Design Flow (l/s)	1.0	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Depth (m)	0.430	Diameter (m)	0.010		

Node Car Park 5 orifice Online Orifice Control

Flap Valve	x	Replaces Downstream Link	x	Diameter (m)	0.010
Downstream Link	1.005	Invert Level (m)	17.271	Discharge Coefficient	0.600

Node Car Park 6 Orifice Online Orifice Control

Flap Valve	x	Replaces Downstream Link	x	Diameter (m)	0.011
Downstream Link	1.003	Invert Level (m)	17.655	Discharge Coefficient	0.600

Node Car Park 7 Orifice Online Orifice Control

Flap Valve	x	Replaces Downstream Link	x	Diameter (m)	0.008
Downstream Link	1.001	Invert Level (m)	17.998	Discharge Coefficient	0.600

Node Car Park 8 Orifice Online Orifice Control

Flap Valve	x	Invert Level (m)	18.540	Design Flow (l/s)	1.0	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Depth (m)	0.800	Diameter (m)	0.023		

Node Car Park 9 Orifice Online Orifice Control

Flap Valve	x	Invert Level (m)	18.522	Design Flow (l/s)	1.0	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Depth (m)	0.600	Diameter (m)	0.070		

Node Car Park 10 Orifice Online Orifice Control

Flap Valve	x	Replaces Downstream Link	✓	Design Depth (m)	0.600	Diameter (m)	0.095
Downstream Link	2.005	Invert Level (m)	18.468	Design Flow (l/s)	1.0	Discharge Coefficient	0.600

Node Car Park 11 Hydrobrake Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	18.398	Product Number	CTL-SHE-0076-2700-1130-2700
Design Depth (m)	1.130	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.7	Min Node Diameter (mm)	1200

Node Basin Hydrobrake Online Hydro-Brake® Control

Flap Valve	✓	Objective	(HE) Minimise upstream storage
Downstream Link	2.010	Sump Available	✓
Replaces Downstream Link	✓	Product Number	CTL-SHE-0079-2700-0960-2700
Invert Level (m)	18.297	Min Outlet Diameter (m)	0.100
Design Depth (m)	0.960	Min Node Diameter (mm)	1200
Design Flow (l/s)	2.7		

Node Carpark 1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	5.260	Depth (m)
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	16.420	Length (m)	15.370	Inf Depth (m)
Safety Factor	2.0	Time to half empty (mins)	344	Slope (1:X)	300.0	

Node Car Park 2 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	5.060	Depth (m)
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	16.521	Length (m)	13.950	Inf Depth (m)
Safety Factor	2.0	Time to half empty (mins)		Slope (1:X)	350.0	

Node Carpark 3 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	5.800	Depth (m)
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	16.585	Length (m)	17.630	Inf Depth (m)
Safety Factor	2.0	Time to half empty (mins)		Slope (1:X)	250.0	

Node Carpark 4 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	8.420	Depth (m)
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	17.046	Length (m)	17.260	Inf Depth (m)
Safety Factor	2.0	Time to half empty (mins)		Slope (1:X)	250.0	

Node Carpark 5 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	5.770	Depth (m)
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	17.496	Length (m)	12.950	Inf Depth (m)
Safety Factor	2.0	Time to half empty (mins)		Slope (1:X)	500.0	

Node Carpark 6 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	6.640	Depth (m)
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	17.834	Length (m)	26.040	Inf Depth (m)
Safety Factor	2.0	Time to half empty (mins)		Slope (1:X)	500.0	

Node Carpark 7 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	5.470	Depth (m)
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	18.161	Length (m)	21.160	Inf Depth (m)
Safety Factor	2.0	Time to half empty (mins)		Slope (1:X)	130.0	

Node Carpark 8 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	6.640	Depth (m)	1.100
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	18.543	Length (m)	64.420	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	3840	Slope (1:X)	750.0		

Node Tank Upstream of Car Park 9 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	18.567
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	248.0	248.0	0.500	248.0	275.9	0.501	0.0	275.9	1.300	0.0	275.9

Node Carpark 9 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	6.420	Depth (m)	1.100
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	18.537	Length (m)	24.380	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)		Slope (1:X)	750.0		

Node Tank Upstream of Carpark 10 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	18.538
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	352.0	352.0	0.500	352.0	385.3	0.501	0.0	385.3	1.300	0.0	385.3

Node Carpark 10 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	7.030	Depth (m)	1.100
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	18.508	Length (m)	82.340	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)		Slope (1:X)	750.0		

Node Tank upstream of Carpark 11 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	18.458
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	40.0	40.0	0.500	40.0	51.2	0.501	0.0	51.2	1.300	0.0	51.2

Node Carpark 11 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	5.860	Depth (m)	1.100
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	18.428	Length (m)	59.490	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)		Slope (1:X)	750.0		

Node Basin Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	18.327
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	18.2	18.2	0.930	153.7	156.5

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +45% CC 15 minute summer	514.800	145.671	100 year +45% CC 180 minute summer	109.820	28.261
100 year +45% CC 15 minute winter	361.263	145.671	100 year +45% CC 180 minute winter	71.386	28.261
100 year +45% CC 30 minute summer	345.538	97.775	100 year +45% CC 240 minute summer	86.572	22.878
100 year +45% CC 30 minute winter	242.483	97.775	100 year +45% CC 240 minute winter	57.517	22.878
100 year +45% CC 60 minute summer	237.115	62.663	100 year +45% CC 360 minute summer	65.859	16.948
100 year +45% CC 60 minute winter	157.534	62.663	100 year +45% CC 360 minute winter	42.810	16.948
100 year +45% CC 120 minute summer	143.747	37.988	100 year +45% CC 480 minute summer	51.747	13.675
100 year +45% CC 120 minute winter	95.502	37.988	100 year +45% CC 480 minute winter	34.379	13.675

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +45% CC 600 minute summer	42.264	11.560	100 year +45% CC 2880 minute winter	8.613	3.435
100 year +45% CC 600 minute winter	28.878	11.560	100 year +45% CC 4320 minute summer	9.637	2.520
100 year +45% CC 720 minute summer	37.558	10.066	100 year +45% CC 4320 minute winter	6.346	2.520
100 year +45% CC 720 minute winter	25.241	10.066	100 year +45% CC 5760 minute summer	7.952	2.036
100 year +45% CC 960 minute summer	30.631	8.066	100 year +45% CC 5760 minute winter	5.147	2.036
100 year +45% CC 960 minute winter	20.291	8.066	100 year +45% CC 7200 minute summer	6.812	1.738
100 year +45% CC 1440 minute summer	21.973	5.889	100 year +45% CC 7200 minute winter	4.397	1.738
100 year +45% CC 1440 minute winter	14.767	5.889	100 year +45% CC 8640 minute summer	6.015	1.535
100 year +45% CC 2160 minute summer	15.531	4.292	100 year +45% CC 8640 minute winter	3.882	1.535
100 year +45% CC 2160 minute winter	10.701	4.292	100 year +45% CC 10080 minute summer	5.436	1.387
100 year +45% CC 2880 minute summer	12.815	3.435	100 year +45% CC 10080 minute winter	3.509	1.387

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 98.46%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2880 minute summer	Carpark 7	2880	18.868	0.707	0.7	21.7172	0.0000	SURCHARGED
2880 minute summer	Car Park 7 Orifice	2880	18.868	0.870	0.1	0.0000	0.0000	SURCHARGED
2160 minute winter	Carpark 6	2100	18.661	0.827	1.1	41.4825	0.0000	SURCHARGED
2160 minute winter	Car Park 6 Orifice	2100	18.661	1.006	0.2	0.0000	0.0000	SURCHARGED
10080 minute winter	Carpark 5	8940	18.347	0.851	0.2	18.7809	0.0000	SURCHARGED
10080 minute winter	Car Park 5 orifice	8940	18.347	1.076	0.2	0.0000	0.0000	SURCHARGED
10080 minute winter	Carpark 4	7440	17.938	0.892	0.3	37.3869	0.0000	SURCHARGED
10080 minute winter	Car Park 4 Orifice	7440	17.938	1.123	0.2	1.2704	0.0000	SURCHARGED
10080 minute winter	Carpark 3	7320	17.530	0.945	0.3	27.8920	0.0000	SURCHARGED
10080 minute winter	Car Park 3 Orifice	7320	17.530	0.977	0.2	1.1046	0.0000	SURCHARGED
2880 minute summer	Car Park 2	2340	17.149	0.628	0.5	12.8771	0.0000	SURCHARGED
2880 minute summer	Car Park 2 Orifice	2340	17.149	0.679	0.2	0.0000	0.0000	SURCHARGED
360 minute summer	Carpark 1	264	16.761	0.341	2.4	7.6273	0.0000	SURCHARGED
360 minute summer	Car Park 1 Orifice	264	16.761	0.371	0.5	0.4196	0.0000	SURCHARGED
360 minute summer	5	264	16.378	0.018	0.5	0.0202	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
2880 minute summer	Carpark 7	1.000	Car Park 7 Orifice	0.1	0.008	0.001	0.1989	
2880 minute summer	Car Park 7 Orifice	1.001	Carpark 6	0.1	0.214	0.001	0.1989	
2160 minute winter	Carpark 6	1.002	Car Park 6 Orifice	0.2	0.025	0.002	0.1989	
2160 minute winter	Car Park 6 Orifice	1.003	Carpark 5	0.2	0.361	0.002	0.1989	
10080 minute winter	Carpark 5	1.004	Car Park 5 orifice	0.2	0.040	0.001	0.1989	
10080 minute winter	Car Park 5 orifice	1.005	Carpark 4	0.1	0.433	0.001	0.1989	
10080 minute winter	Carpark 4	1.006	Car Park 4 Orifice	0.2	0.065	0.001	0.1989	
10080 minute winter	Car Park 4 Orifice	Orifice	Carpark 3	0.2				
10080 minute winter	Carpark 3	1.008	Car Park 3 Orifice	0.2	0.084	0.004	0.1989	
10080 minute winter	Car Park 3 Orifice	Orifice	Car Park 2	0.2				
2880 minute summer	Car Park 2	1.010	Car Park 2 Orifice	0.2	0.037	0.004	0.1989	
2880 minute summer	Car Park 2 Orifice	1.011	Carpark 1	0.3	0.217	0.006	0.1940	
360 minute summer	Carpark 1	1.012	Car Park 1 Orifice	0.5	0.119	0.013	0.1989	
360 minute summer	Car Park 1 Orifice	Orifice	5	0.5				
360 minute summer	5	1.014	Outfall to Highway Drain	0.5	0.350	0.013	0.0195	45.6

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 98.46%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute summer	Outfall to Highway Drain	264	16.296	0.017	0.5	0.0000	0.0000	OK
10080 minute summer	Carpark 8	6480	19.462	0.919	1.3	112.4784	0.0000	SURCHARGED
10080 minute summer	Car Park 8 Orifice	6480	19.462	0.922	0.5	1.0433	0.0000	SURCHARGED
10080 minute summer	Tank Upstream of Car Park 9	6180	19.394	0.827	1.5	117.9178	0.0000	SURCHARGED
10080 minute summer	Carpark 9	6180	19.394	0.857	2.3	39.4759	0.0000	SURCHARGED
10080 minute summer	Car Park 9 Orifice	6180	19.394	0.872	1.5	0.0000	0.0000	SURCHARGED
10080 minute summer	Tank Upstream of Carpark 10	6180	19.385	0.847	1.8	167.3672	0.0000	SURCHARGED
10080 minute summer	Carpark 10	6180	19.385	0.877	4.2	142.7768	0.0000	SURCHARGED
10080 minute summer	Car Park 10 Orifice	6180	19.385	0.917	2.3	1.0371	0.0000	SURCHARGED
10080 minute summer	Tank upstream of Carpark 11	6180	19.373	0.915	0.2	19.0190	0.0000	SURCHARGED
10080 minute summer	Carpark 11	6180	19.373	0.945	3.6	94.4629	0.0000	SURCHARGED
10080 minute summer	Car Park 11 Hydrobrake	6180	19.373	0.975	2.7	1.3947	0.0000	SURCHARGED
10080 minute summer	3	6900	19.040	0.672	2.7	0.9609	0.0000	FLOOD RISK
10080 minute summer	Basin	6900	19.039	0.712	2.7	50.9347	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
10080 minute summer	Carpark 8	2.000	Car Park 8 Orifice	0.5	0.051	0.040	0.1989	
10080 minute summer	Car Park 8 Orifice	Orifice	Carpark 9	0.5				
10080 minute summer	Tank Upstream of Car Park 9	3.000	Carpark 9	-1.5	-0.090	-0.037	0.1989	
10080 minute summer	Carpark 9	2.002	Car Park 9 Orifice	1.5	0.194	0.051	0.1989	
10080 minute summer	Car Park 9 Orifice	Orifice	Carpark 10	1.4				
10080 minute summer	Tank Upstream of Carpark 10	4.000	Carpark 10	-1.8	-0.155	-0.044	0.1989	
10080 minute summer	Carpark 10	2.004	Car Park 10 Orifice	2.3	0.298	0.049	0.1989	
10080 minute summer	Car Park 10 Orifice	Orifice	Carpark 11	2.3				
10080 minute summer	Tank upstream of Carpark 11	5.000	Carpark 11	-0.2	-0.080	-0.005	0.1989	
10080 minute summer	Carpark 11	2.006	Car Park 11 Hydrobrake	2.7	0.203	0.066	0.1989	
10080 minute summer	Car Park 11 Hydrobrake	Hydro-Brake®	3	2.7				
10080 minute summer	3	2.008	Basin	2.7	0.181	0.067	0.2743	
10080 minute summer	Basin	2.009	Basin Hydrobrake	2.6	0.066	0.065	0.1989	

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 98.46%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
10080 minute summer	Basin Hydrobrake	6900	19.039	0.742	2.6	2.5702	0.0000	FLOOD RISK
7200 minute summer	Outfall to ditch	9660	19.150	1.040	2.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
10080 minute summer	Basin Hydrobrake	Hydro-Brake®	Outfall to ditch	2.6				653.7

APPENDIX F

Flood Mapping

Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
526502/118016

Created
14 Mar 2025 10:56

Your selected location is in flood zone 1, an area with a low probability of flooding.

You will need to do a flood risk assessment if your site is **any of the following:**

- bigger than 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

Notes

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

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

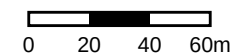
Flood risk data is covered by the Open Government Licence **which** sets out the terms and conditions for using government data. <https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2024 OS AC0000807064. <https://flood-map-for-planning.service.gov.uk/os-terms>



Created
14 Mar 2025 10:56

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



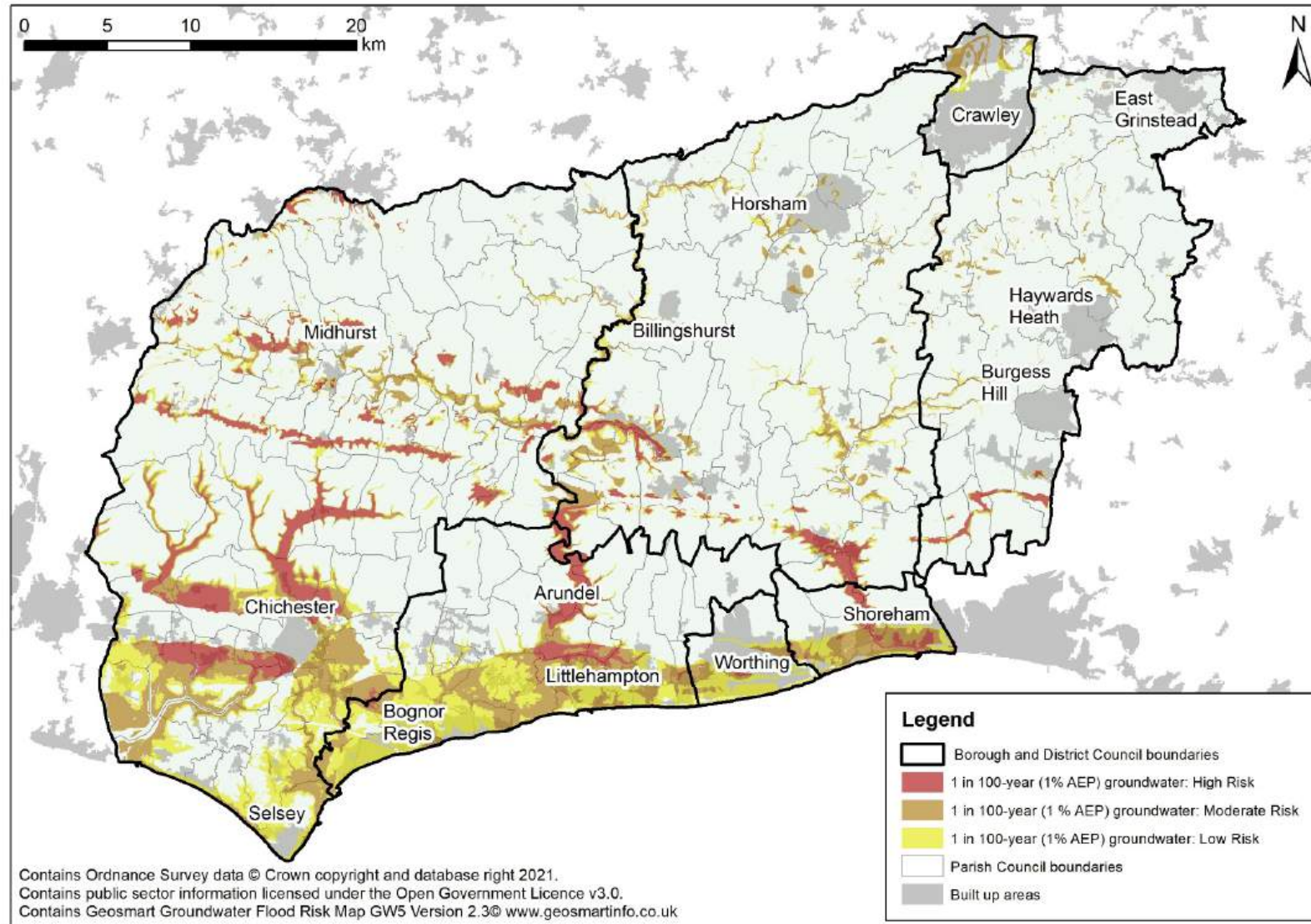
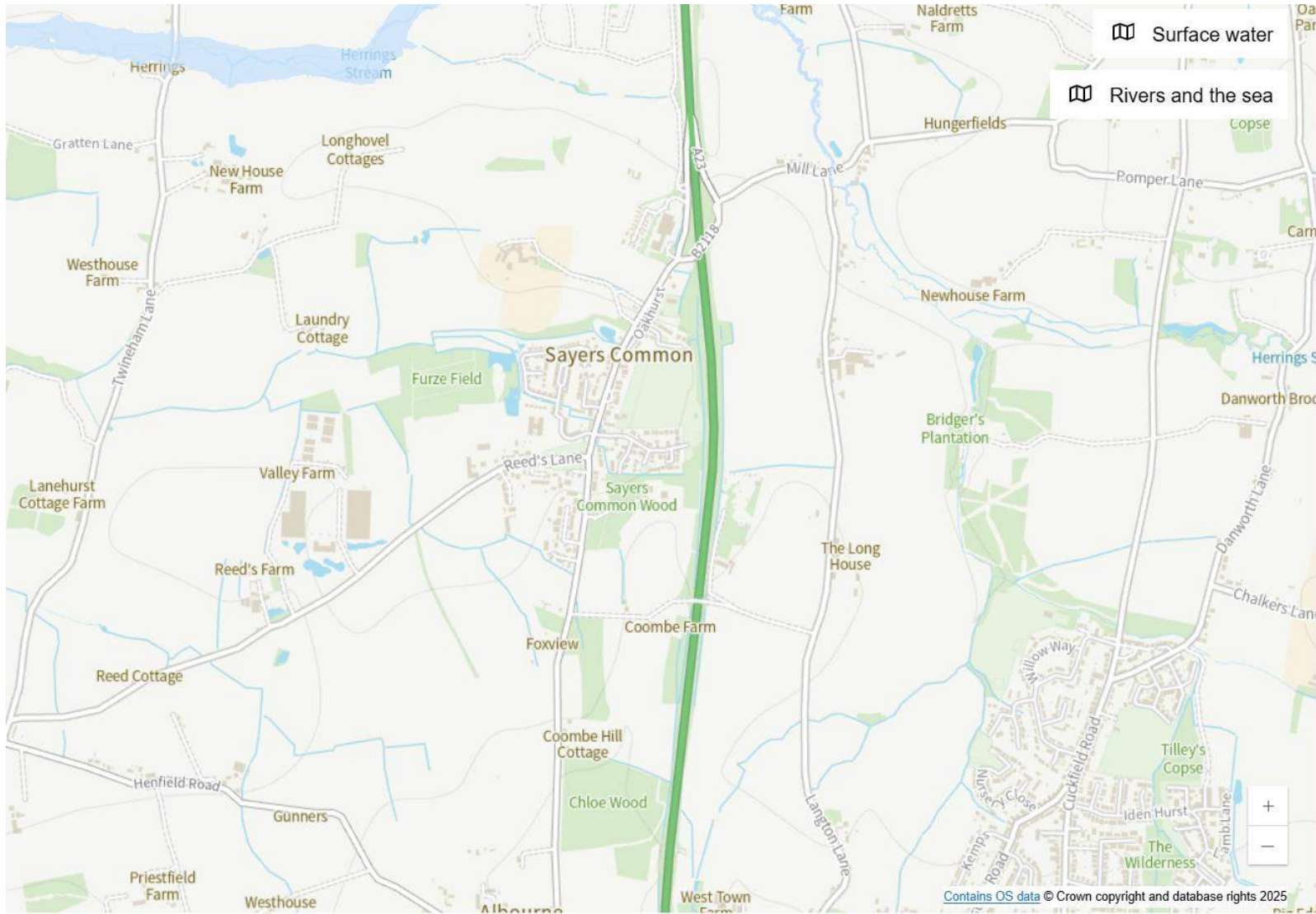


Figure 3-4: Flood risk from groundwater, based on the Groundwater Flood Risk Map



Reservoirs map

- ☐ Extent
- When river levels are normal
 - When there is also flooding from rivers

Map details

- ☒ Show flooding

APPENDIX G

Pluvial Flood Modelling Report



ODYSSEY

DEVELOPING JOURNEYS

**LAND OFF REEDS LANE, SAYERS
COMMON**

PLUVIAL FLOOD MODELLING STUDY



LAND OFF REEDS LANE, SAYERS COMMON

**PLUVIAL FLOOD MODELLING STUDY
ON BEHALF OF ANTLER HOMES**

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March 2025



DOCUMENT CONTROL SHEET

Project Name Land off Reeds Lane, Sayers Common

Project No. 22-258

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Figure 6.4 Peak Flood Depth for 0.1% AEP Event – Baseline Scenario

Figure 6.5 Risk of Flooding from Surface Water Classification

Figure 6.6 Comparison of Baseline Model 1% AEP Event to EA RoFSW 1% AEP

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Figure 6.8 Pre-Development and Post-Development Peak Depth Comparison

APPENDICES

Appendix A Survey Data: Topographical Survey

Appendix B Model Files



1.0 INTRODUCTION

1.1 *Appointment and Brief*

1.1.1 Odyssey has been commissioned by Antler Homes to undertake a site-specific hydraulic modelling assessment, in support of Local Plan Representations for residential development at Land off Reeds Lane, Sayers Common.

1.1.2 The proposed development comprises an initial proposal of 27 dwellings.

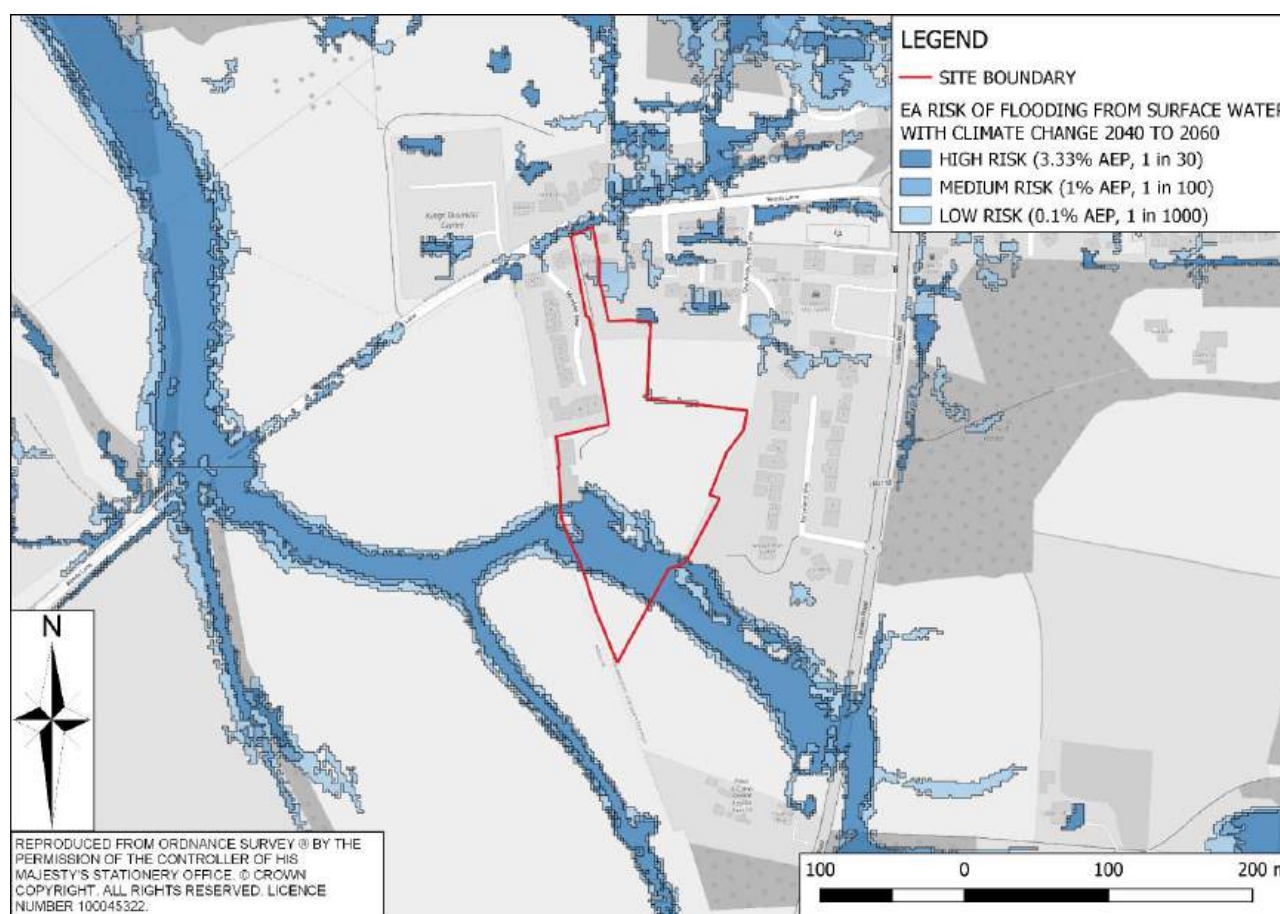
1.1.3 According to the current Environment Agency (EA) Risk of Flooding from Surface Water (RoFSW) map, parts of the site are subject to a 'low' to 'high' risk of pluvial flooding (0.1% and 3.33% Annual Exceedance Probability (AEP), respectively). Since the RoFSW mapping was undertaken to inform a national database, the modelling does not take into consideration detailed site-specific topographical survey or allow for investigation of proposed scenarios. Therefore, it was necessary to carry out direct rainfall hydraulic modelling of the catchments draining into the site in order to quantify the risk from overland flows, and to determine flood levels and the resulting flood extents.

1.1.4 This hydraulic modelling study has been planned and conducted in accordance with the EA Computational Modelling to Assess Flood and Coastal Risk guidance document dated 27 October 2010.

1.1.5 This modelling report has been prepared in accordance with the National Planning Policy Framework (NPPF), updated in December 2024, and its Planning Practice Guidance (PPG), updated in August 2022, and summarises the modelling methodology and outputs derived for the pre-development (i.e. baseline) and post-development scenarios.

1.2 *Site Description*

1.2.1 The site is located south of Reeds Lane, which runs from Sayers Common to the east to the hamlet of High Cross to the west. The national grid reference for the site is 526501E, 118019N. **Figure 1.1** shows the site location and the EA Flood RoFSW classifications. **Table 1.1** summarises the site description.

**Figure 1.1: Site Location Plan and EA RoFSW Climate Change 2040 to 2060****Table 1.1: Site Description Summary**

Site National Grid Reference:	The Ordnance Survey (OS) grid reference at the centre of the site is 526501E, 118019N.
Site area:	The total site area is 1.66ha.
Current Use:	The Site currently comprises mostly undeveloped greenfield land. There are existing buildings and hardstanding on the western part of the Site.
Wider setting:	The Site is bounded by residential units and Reed's Lane to the north, residential and commercial units to the north-west and east, and greenfield land to the south and south-west.
Existing water bodies:	The nearest 'Main River' is the Herrings Stream, situated approximately 1.2km north-east of the Site boundary at its nearest point. It is noted there is an ordinary watercourse flowing across the southern section of the Site.
Existing flood defences:	There are no known formal flood defences currently protecting the site.



1.3 *Scope of Works*

1.3.1 In accordance with the assessment criteria found in the NPPF and PPG, the purpose of this modelling report is to:

- Identify and quantify the pluvial flood risk associated with the overland flow generated by the local catchment; and
- Inform the design of the masterplan layout for the proposed development.

1.3.2 The modelling study has been carried out to establish the flood levels and floodplain extents for the following design events:

- 3.3% AEP (Annual Exceedance Probability) storm event (1 in 30 year);
- 1% AEP storm event (1 in 100 year);
- 1% AEP storm event plus 45% climate change (CC) (1 in 100 year + 45%CC); and,
- 0.1% AEP storm event (1 in 1000 year).

1.4 *Project Assumptions and Limitations*

1.4.1 Odyssey's hydraulic modelling is based on best practice and current guidance at the time of undertaking the project.

1.4.2 The representation of any complex system by a model requires a number of assumptions to be made. Coefficients can have significant impact on model results. Although best practice guidance has been adopted for this modelling study, it has been based on the interpretation and assessment of data provided by third parties. Odyssey cannot be held responsible for the accuracy of third-party data, and the conclusions and findings of this report may change if the data is amended or updated after the date of consultation.

1.4.3 The conclusions of this modelling report are based on the data gathered for the purpose of the project, and therefore are limited in their accuracy in proportion to the validity of the dataset. The data gathered in turn has been based on an agreed scope of works. Odyssey cannot guarantee that the data used is the best available at the time of the modelling, but it is the best available data that could be gathered within the scope of the agreed instruction.



2.0 INPUT DATA

2.1 Data Availability

2.1.1 Multiple sources of information have been used in the development of the hydraulic model. **Table 2.1** provides the data sources used in this modelling study.

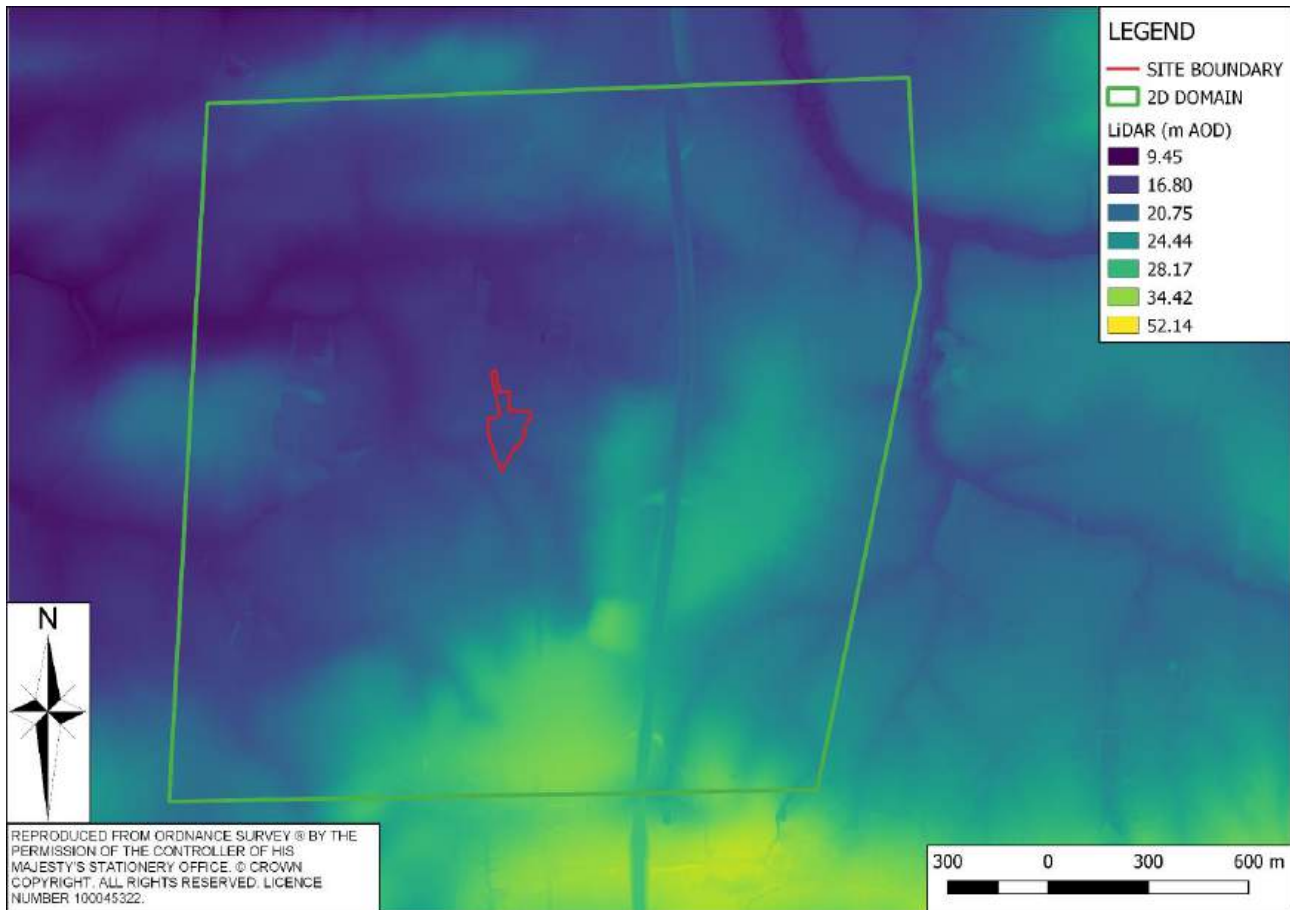
Table 2.1: Data Availability

Dataset	Source	Date	Use	Quality ¹
LiDAR (Light Detection and Ranging)	Environment Agency LiDAR	Flown in 2020 (1 metre (m) resolution). Downloaded July 2024.	Forms the basis of ground level data for the two-dimensional (2D) component of the hydraulic model.	1-2
Site Topographical Survey	Sunshine Survey Limited	Surveyed April 2021.	Provides ground level data within the site for the 2D model.	1
Site Topographical Survey	3D Services (South East) Limited	Surveyed July 2020	Provides ground level data within the site for the 2D model.	1
Base Mapping	OS Open Data	Accessed July 2024	Used to identify watercourses in the vicinity of the site and create material layers.	1
Catchment Data	FEH (Flood Estimation Handbook) Webservice	Downloaded July 2024	Catchment descriptors used for the hydrological calculations.	1

2.2 LiDAR

2.2.1 The most recent 1m resolution Digital Terrain Model (DTM) composite LiDAR data was downloaded from the EA survey open data website. The LiDAR data shows that ground elevations vary across the model from 11.5 metres above Ordnance Datum (mAOD) to 44.0 mAOD. Site specific levels vary between 17.2m AOD to 21.1m AOD. **Figure 2.1** shows the extent of LiDAR data used in the model.

¹ Data quality scoring taken from Multi-Coloured Manual (Flood Hazard Research Centre, 2005) – 1 = best possible, 2 = data with known deficiencies, 3 = gross assumptions, 4 = heroic assumptions

**Figure 2.1: LiDAR Data**

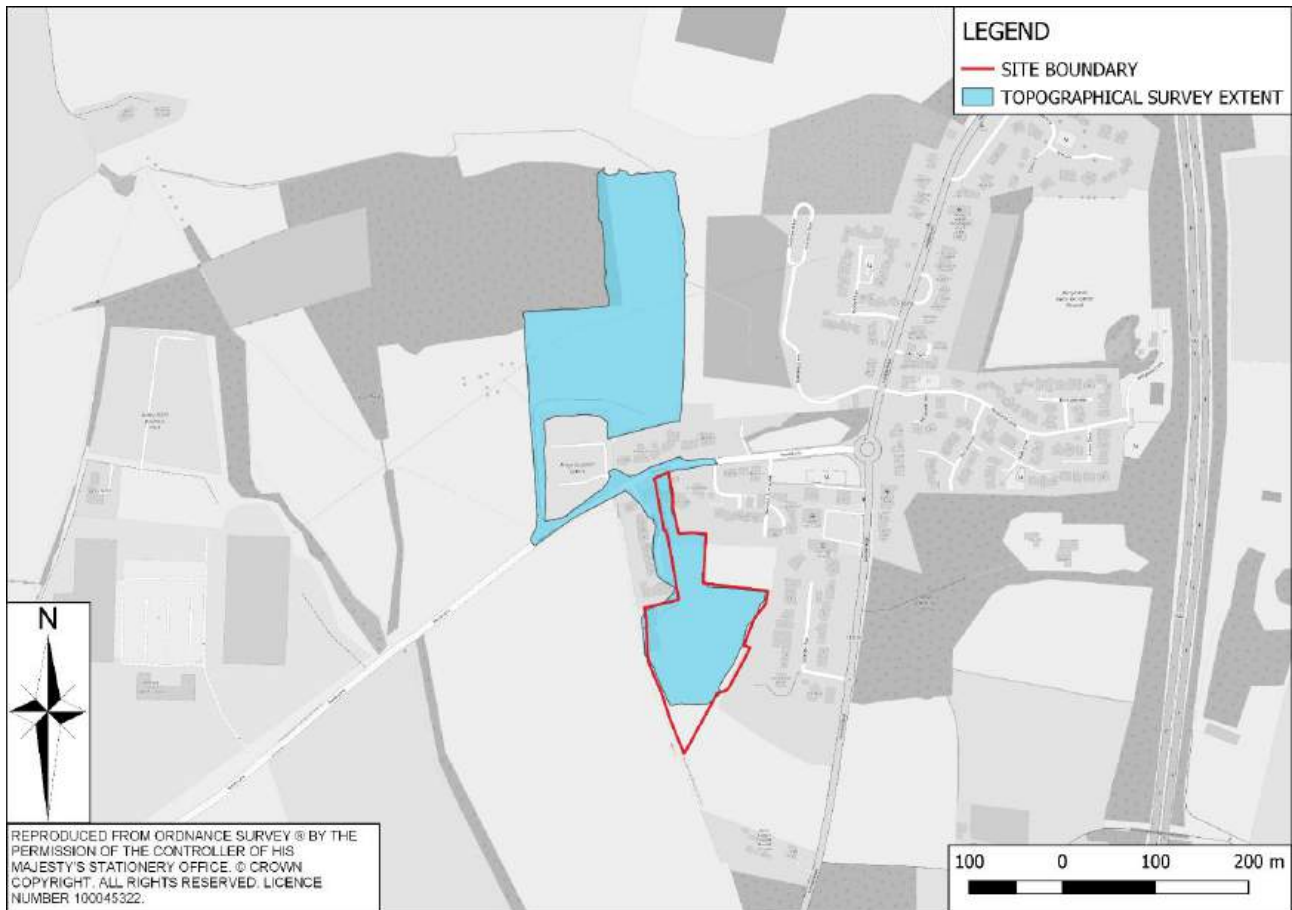
2.2.2 LiDAR data is very beneficial as it is available across a large amount of Britain and is the standard source used within models of floodplains in the UK. It is however, a poor source of data in areas of dense vegetation or complex urban areas. Therefore, topographical survey data is more favourable when available. Topographical survey data has been obtained across the area of the site as detailed in **Section 2.3**.

2.3 Topographical Survey

2.3.1 Topographical surveys of the site were undertaken by Sunshine Survey Limited in April 2021 and by 3D Services (South East) Limited in July 2020. The extent of the surveys is shown in **Figure 2.2**. The detailed survey are shown in **Appendix A**.



Figure 2.2: Topographical Survey Extent



2.3.2 The point data received from the survey has been converted to form a 3D interpolated surface that has been incorporated into the model.

2.3.3 The topographical survey has been compared to the LiDAR data and it is determined that the topographical survey closely matches the trends of the LiDAR with levels that are typically 0.1 to 0.2 metres lower. The topographical survey data provides more detailed levels in the location of ditches and vegetation.



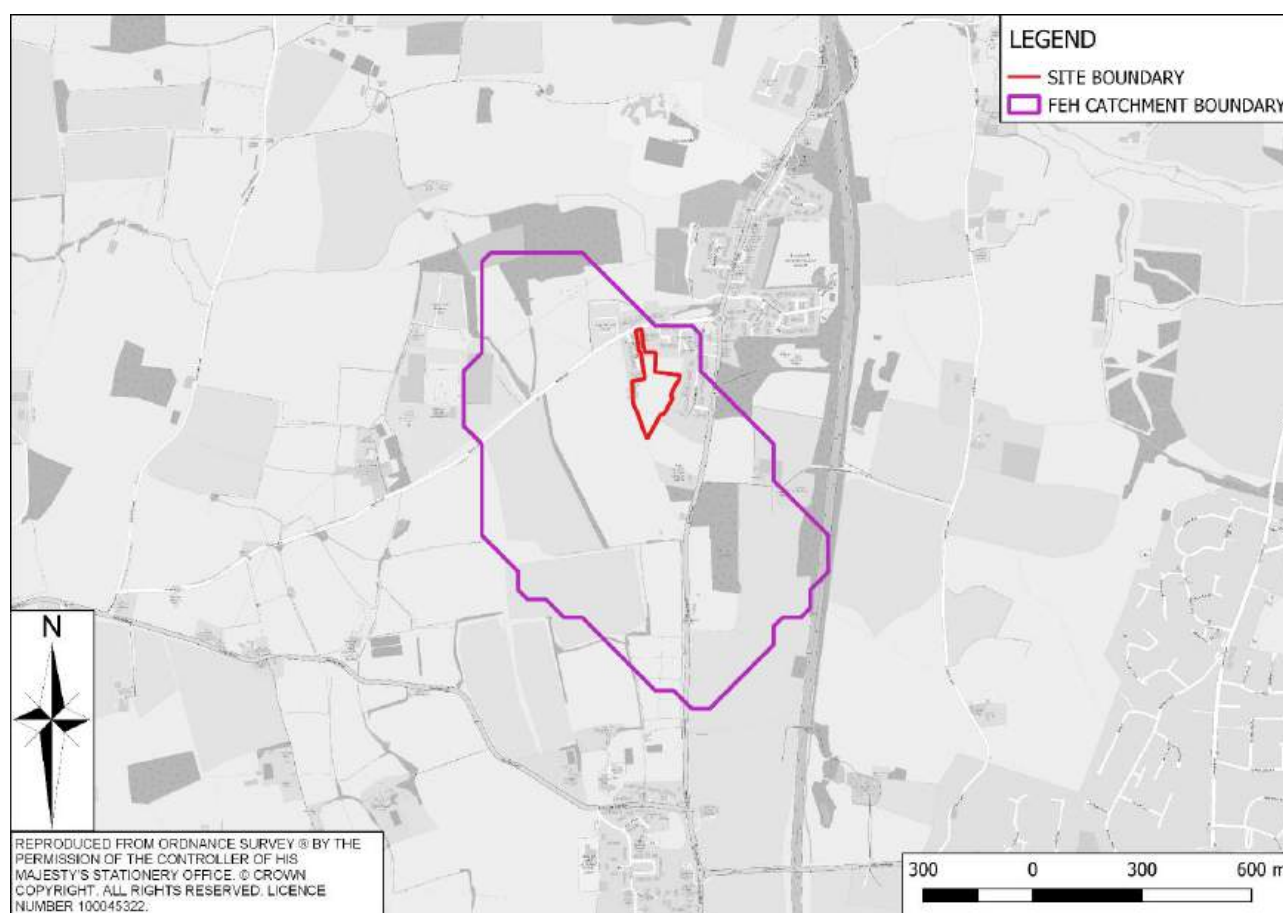
3.0 HYDROLOGICAL ANALYSIS

3.1.1 A hydrological analysis was undertaken as part of this study to derive the rainfall hyetographs for the hydraulic model. A summary of this analysis is provided in this section.

3.2 Methodology

3.2.1 The purpose of this hydrological analysis is to create rainfall hyetographs for input into the hydraulic model. This has been undertaken in accordance with the Centre for Ecology and Hydrology Flood Estimation Handbook (FEH) methods. The FEH catchment boundary is presented in **Figure 3.1**.

Figure 3.1 FEH Catchment Boundary



3.2.2 Design and net rainfall hyetographs have been calculated using the Revitalised Flood Hydrograph (ReFH) Method for the 3.3% AEP, 1% AEP and 0.1% AEP events. The hyetographs have been calculated using the FEH catchment descriptors downloaded from the FEH Webservice.



3.2.3 The design rainfall hyetograph has been applied to urban areas, with the net rainfall hyetograph applied to the rural areas. The net rainfall hyetograph has been created using the losses model from the ReFH2 rainfall-runoff method. Losses are controlled by a single parameter, the maximum soil moisture storage capacity (Cmax). This was estimated from the BFIHOST and PROPWET, two of the FEH catchment descriptors. The initial starting value of the soil moisture (Cini) was also estimated from catchment descriptors. The default Cmax and Cini values generated by ReFH2 have been used. This is detailed in **Section 5.2**. For urban areas, a runoff coefficient of 70% was selected.

3.2.4 This hydrological analysis methodology has been selected owing to the small catchment area and the fact that the overland flow routes in the area do not originate from a specific single point of discharge.

3.3 Climate Change

3.3.1 Due to uncertainties in flood estimation and expected climate change impacts, it is usually required that hydrological analysis of peak rainfall include an allowance for increased rainfall due to climate change as required in the NPPF and PPG. The latest guidance, available from May 2022, provides updated climate change allowances and is now required for all new Flood Risk Assessments.

3.3.2 The anticipated increase in the rainfall intensity varies for each management catchment for both the 3.3% AEP and 1% AEP rainfall event. It is based on two grades – central allowance and upper end allowance (**Table 3.1**). The range of allowances included is based on percentiles. The central allowance is based on the 50th percentile and upper end allowance is based on the 95th percentile. The selection of peak rainfall intensity allowance will depend on the nature of the proposed development and its design life.

Table 3.1: Anticipated Change in Peak Rainfall Intensity for Cuckmere and Pevensey Levels Management Catchment for the 3.33% AEP and 1% AEP Rainfall Event

Epoch	Central allowance		Upper end allowance	
	3.3% AEP	1% AEP	3.3% AEP	1% AEP
2050s	20%	20%	35%	45%
2070s	20%	25%	40%	45%

3.3.3 EA guidance suggests that all residential development should have a minimum design lifetime of 100 years. For all developments with a lifetime beyond 2100 the upper end allowance should be used. Therefore, a 45% climate change allowance for the 1% AEP rainfall event is the most appropriate allowance to be considered for the site based on a design lifetime of 100 years.



3.4 Catchment Data

3.4.1 The catchment descriptors obtained from the FEH Webservice catchments are shown below in **Table 3.2**.

Table 3.2: Key Catchment Characteristics

Catchment Descriptor	Catchment 1
EASTING (metres (m))	526050
NORTHING (m)	526433
AREA (km ²)	0.78
FARL	1
PROPWET	0.34
BFIHOST19	0.236
LDP (kilometres (km))	1.53
DPLBAR (km)	0.81
DPSBAR (m/km)	22.7
SAAR (millimetres (mm))	824
SPRHOST	49.06
URBEXT1990	0.0497
URBEXT2000	0.0353
FPEXT	0.0929
Pumped watercourse?	No
Any unusual catchment features? In particular is BFIHOST>0.65, SPRHOST<20, URBEXT2000>0.150, FARL<0.90 or high FPEXT?	No

4.0 HYDRAULIC MODELLING

4.1 Methodology

Software

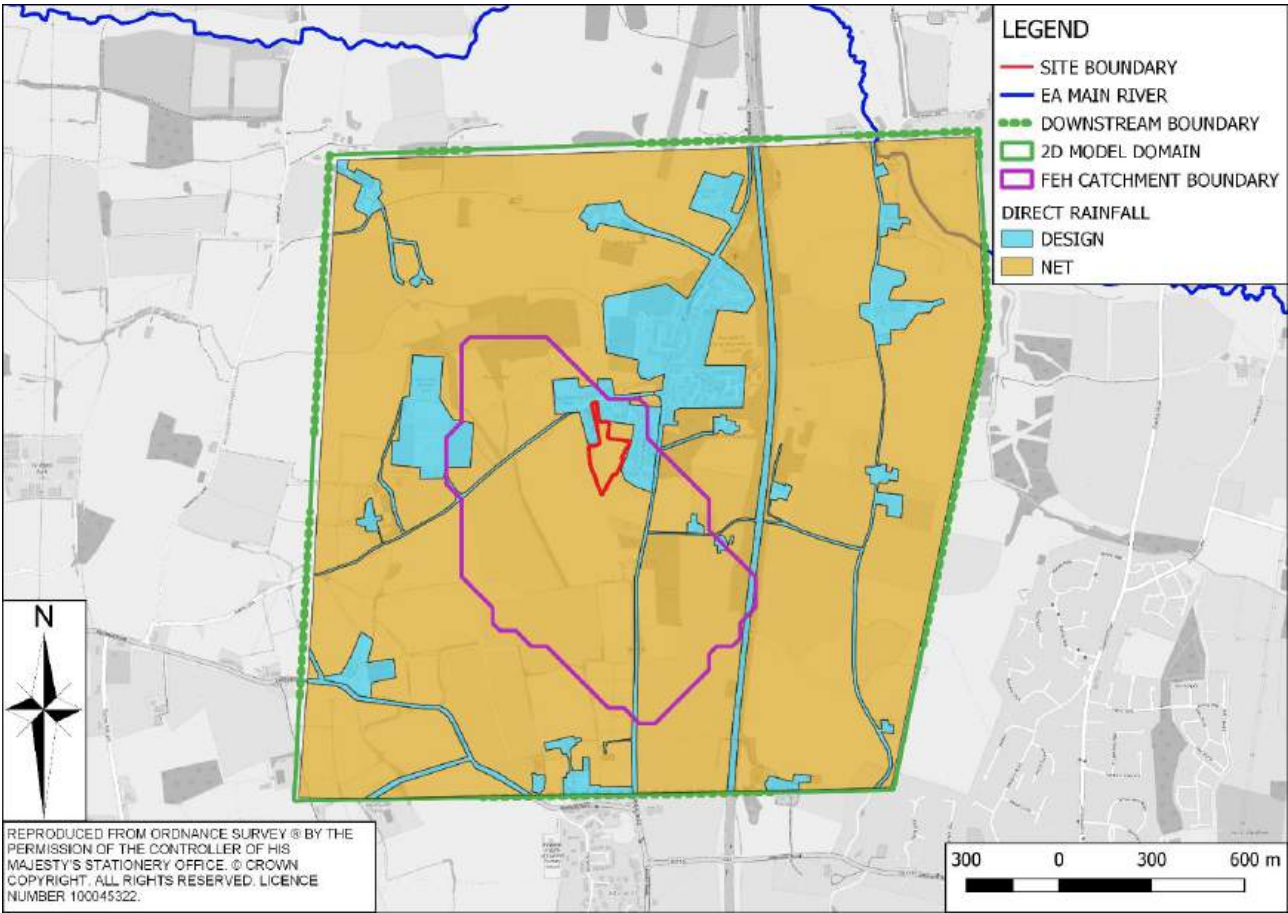
4.1.1 The hydraulic model is 2D model constructed in TUFLOW (version 2023-03-AE-iSP-w64) with the use of HPC solver. This software is able to model culverted networks with a 2D floodplain model based on a finite grid approach.

2D Domain

4.1.2 The 2D domain was constructed using TUFLOW and based upon filtered LiDAR data. The active area of the domain is 4.37 km². Topographical survey data has been used to represent the 2D domain within the site boundary. A grid size of 2m was chosen to allow for detailed modelling of the overland flood paths. Refer to **Figure 4.1** for the hydraulic model schematic.



Figure 4.1: Model Schematic





Flood Defences

4.1.3 There are no known formal flood defences along the modelled watercourses.

Boundary Conditions

4.1.4 A Rainfall verses Time (RF) boundary, based on current land use, has been created to apply the rainfall hyetograph to the model.

4.1.5 A 2D Stage-Discharge (HQ) boundary condition, based on floodplain slope, has been applied to the downstream boundary of the model to allow flow to exit the 2D domain. The boundaries have been given a constant water surface slope value of 0.001 m/m.

Roughness

4.1.6 Floodplain roughness has been represented within the model by using Manning's n values for roughness. Parameters were chosen with reference to standard values (Chow, 1959), using site visit photographs and engineering judgement. The roughness values used within the model are detailed in **Table 4.2**.

Table 4.1: Manning's n Values

Material	Manning's n
TUFLOW – Woodland	0.06
TUFLOW – Roads	0.025
TUFLOW – Buildings	0.5
TUFLOW – Inland Water	0.035

Run Parameters

4.1.7 No changes have been made to the default model run parameters.

4.1.8 A 1.0 second timestep has been used for the model runs. This is in accordance with the recommended timestep that should be between one quarter and half the grid cell size.

4.1.9 A simulation end time of 4 hours has been selected for all model runs to ensure peak flows are met in all locations throughout the model.



4.2 Model Health

Model Stability

4.2.1 The majority of the model shows little fluctuation in model results through the 2D. Negative depths have not been detected during the model simulations.

4.2.2 Mass error expresses the difference between the total simulated water inputted into the model against the total water retained in the model, less any water below that has exited through boundary conditions. This can be used to assess the stability of the model.

4.2.3 The mass balance error at the end of the model runs was within +/-0.05% in 2D which is acceptable for the assessment of the flood risk at the site.

Model Warnings and Checks

4.2.4 All warnings and checks within the model are associated with non-critical TUFLOW checks.



5.0 MODEL PROVING

5.1 *Calibration and Other Models*

5.1.1 Calibration of a model is important to ensure that the model schematisation accurately represents the system being modelled.

5.1.2 No existing models are available in the vicinity of the site. In addition, no historic flooding records have been made available for the purpose of this study.

5.1.3 Thus, in this study, no calibration data was available for the model and therefore a greater emphasis was put on understanding the model sensitivity and model uncertainty.

5.2 *Sensitivity Analysis*

5.2.1 Sensitivity analysis has been undertaken to develop an understanding of the relationship between key factors and the model results. This has been carried out using the baseline 1% AEP storm event scenario and has reviewed the sensitivity of the model to roughness and the definition of the downstream boundary.

Roughness

5.2.2 The work of Chow provides a broad method of classifying surface roughness. It is important to determine how significant an impact the assumed values are likely to have on performance of the flood model. The influence of Manning's n values has been tested by increasing and decreasing the model roughness by 20%.

5.2.3 A comparison of the peak flood depth between these scenarios and the baseline scenario indicates minor changes in the peak flood depth within the site boundary (less than +/- 0.02m).

Figure 5.1 and **Figure 5.2** show the difference map for increasing and decreasing the Manning's n.



Figure 5.1: Manning’s n + 20% and Baseline Peak Depth Comparison for 1% AEP

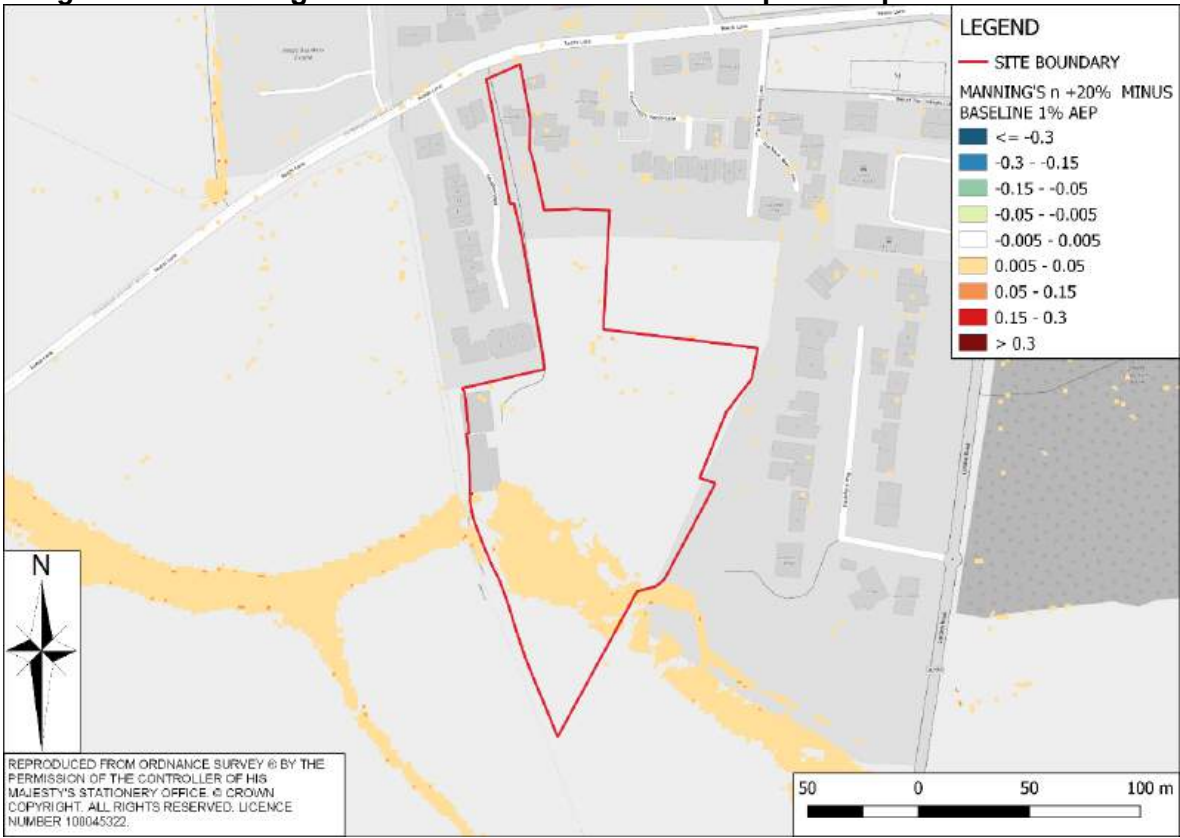
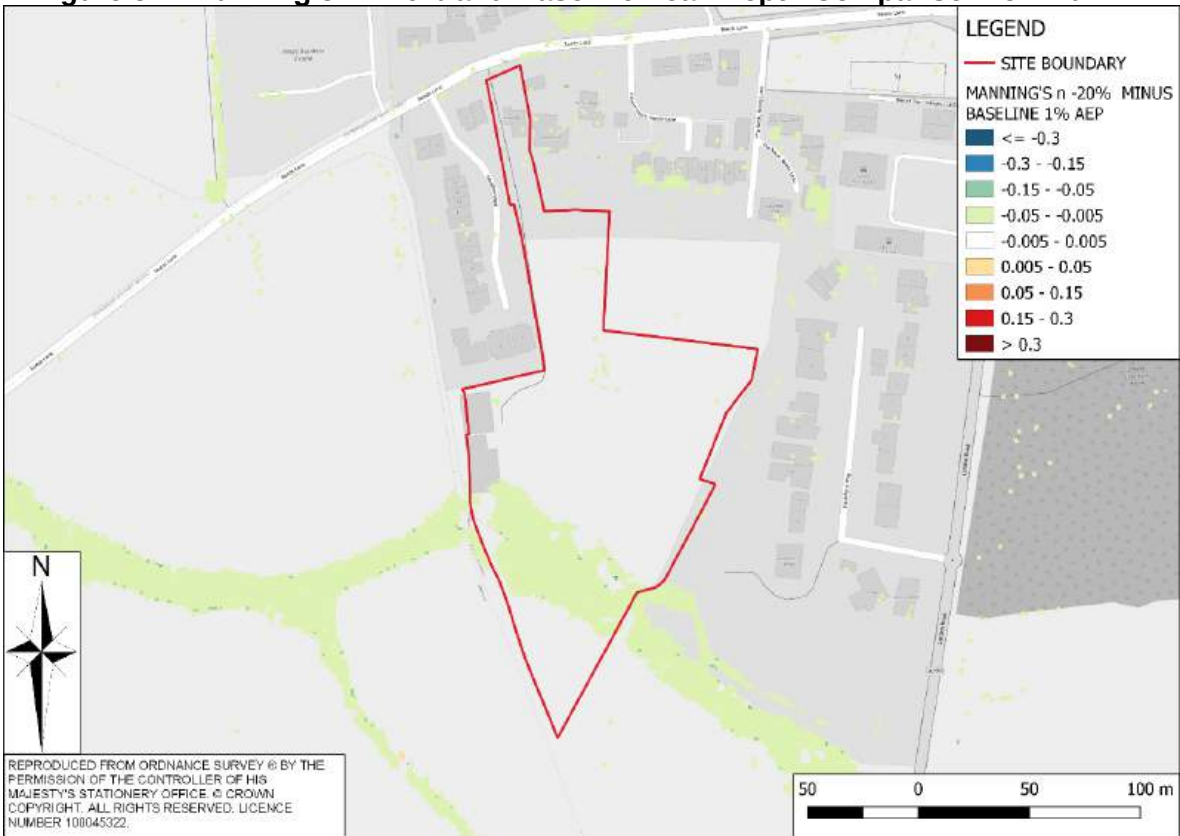


Figure 5.2: Manning’s n - 20% and Baseline Peak Depth Comparison for 1% AEP





Downstream Boundary

5.2.4 Sensitivity analysis has been undertaken on the gradient of the downstream boundary. A comparison of the peak flood depths has shown negligible differences. Therefore, the model is not sensitive to changes to the downstream boundary.

Summary

5.2.5 By inspection of the sensitivity scenario results, it is concluded that the model:

- Is not sensitive to increases in the Manning's roughness;
- Is not sensitive to decreases in the Manning's roughness; and
- Is not sensitive to alterations to the downstream boundary gradient.

5.2.6 As the model is not sensitive to the changes in the parameters tested, it is considered to provide a robust prediction of the storm events simulated.



6.0 MODEL RESULTS

6.1 *Baseline Scenario*

6.1.1 The primary aim of the hydraulic modelling study is to demonstrate that the proposed development is not at risk of flooding and does not increase the risk of flooding elsewhere. The model was used to predict pluvial flood levels for the following events.

- 3.3% AEP (1 in 30 year)
- 1% AEP (1 in 100 year)
- 1% AEP plus 45% climate change (1 in 100 year plus 45% climate change)
- 0.1% AEP (1 in 1,000 year)

6.1.2 The modelled results for the baseline scenario are shown in **Figure 6.1** to **Figure 6.4**. The results show that the flooding on the site is along the watercourse located at the southern part of the site. Localised flooding elsewhere on the site is due to water ponding in ground depression.

6.1.3 The link to model and result files are presented in **Appendix B**.



Figure 6.1: Peak Flood Depth for 3.3% AEP Event – Baseline Scenario

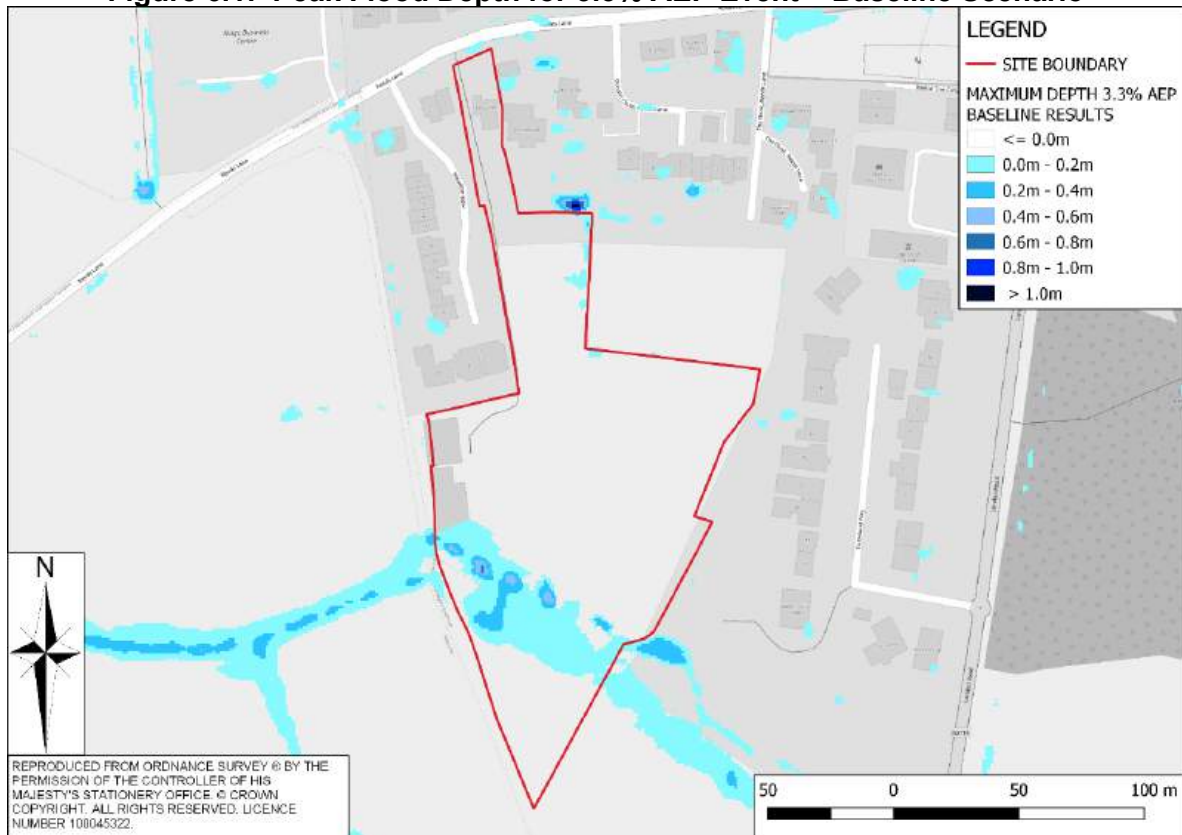


Figure 6.2: Peak Flood Depth for 1% AEP Event – Baseline Scenario

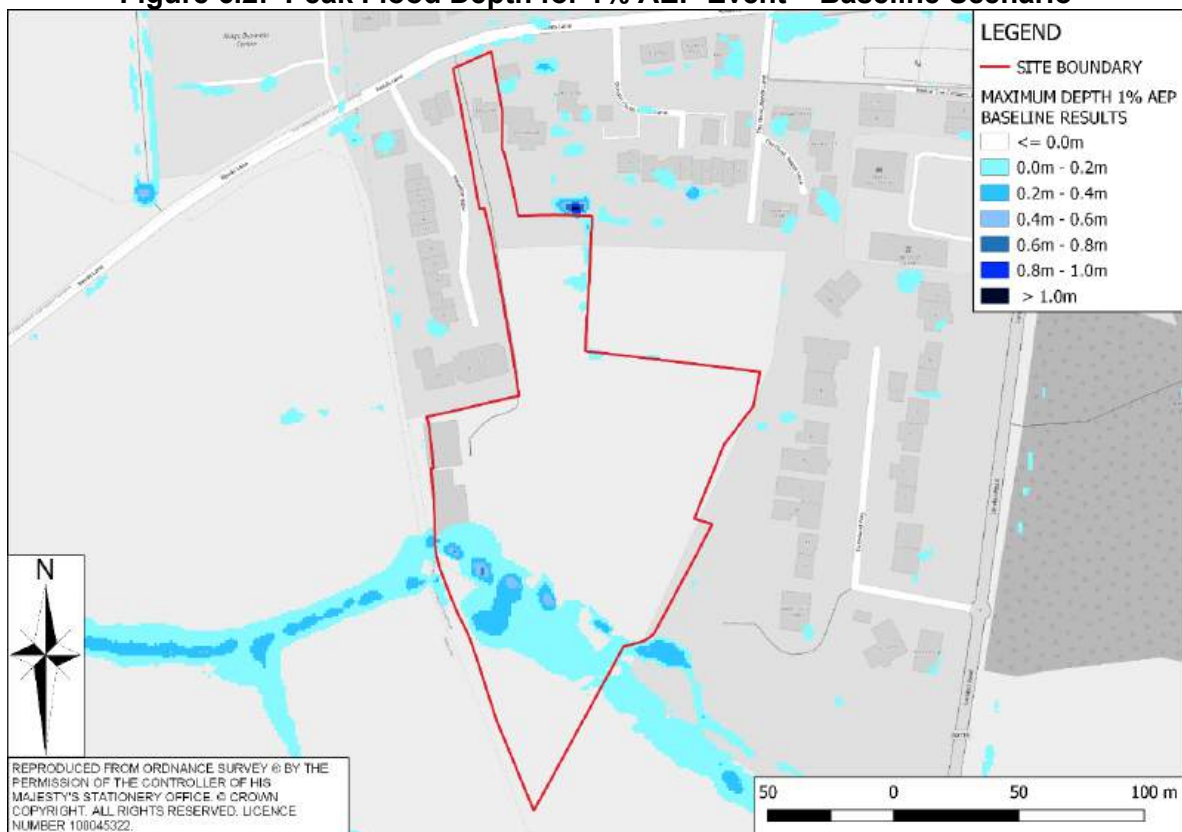




Figure 6.3: Peak Flood Depth for 1% AEP + 45%CC Event – Baseline Scenario

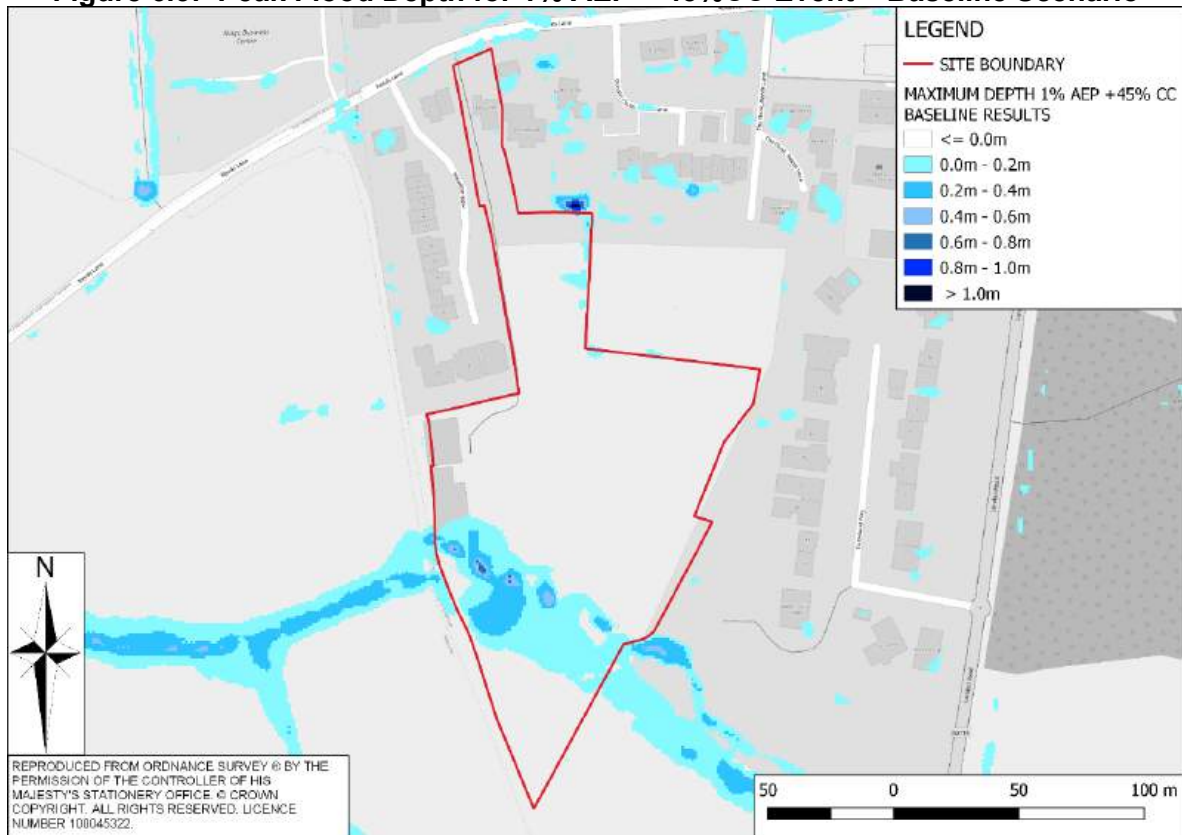
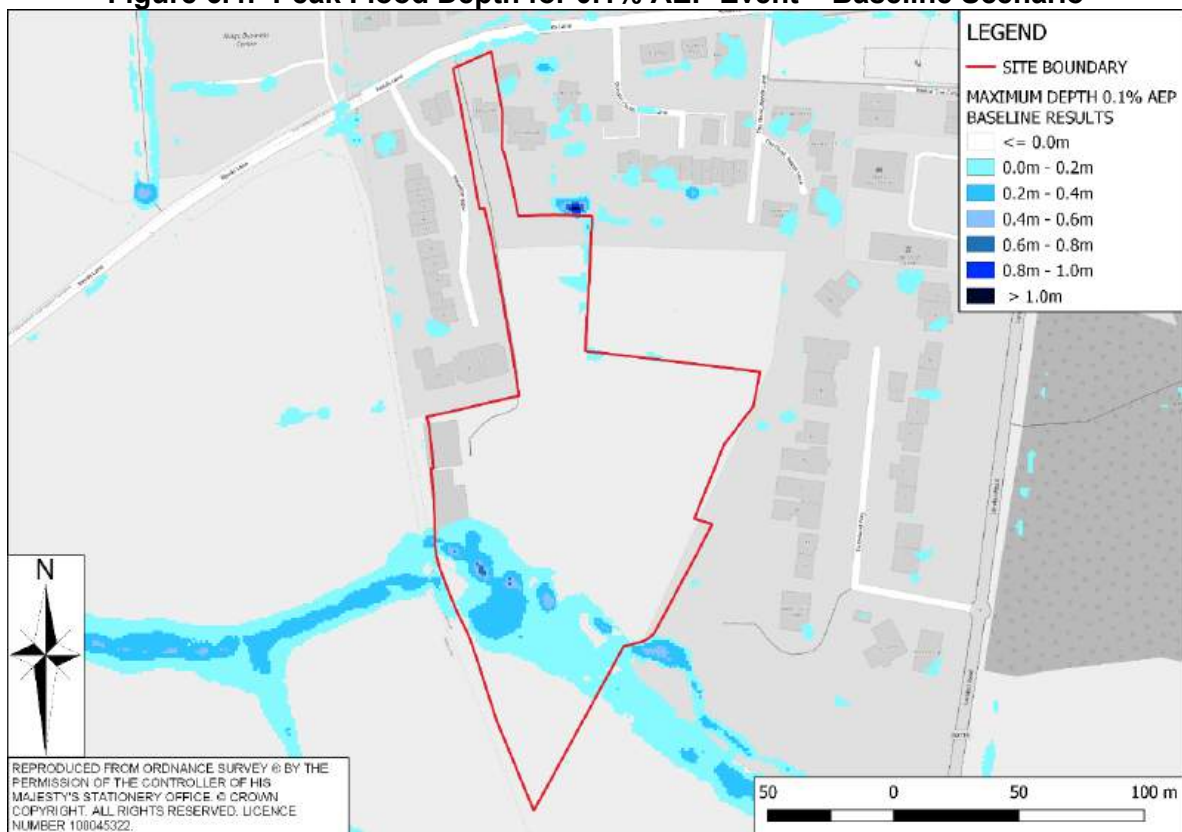


Figure 6.4: Peak Flood Depth for 0.1% AEP Event – Baseline Scenario

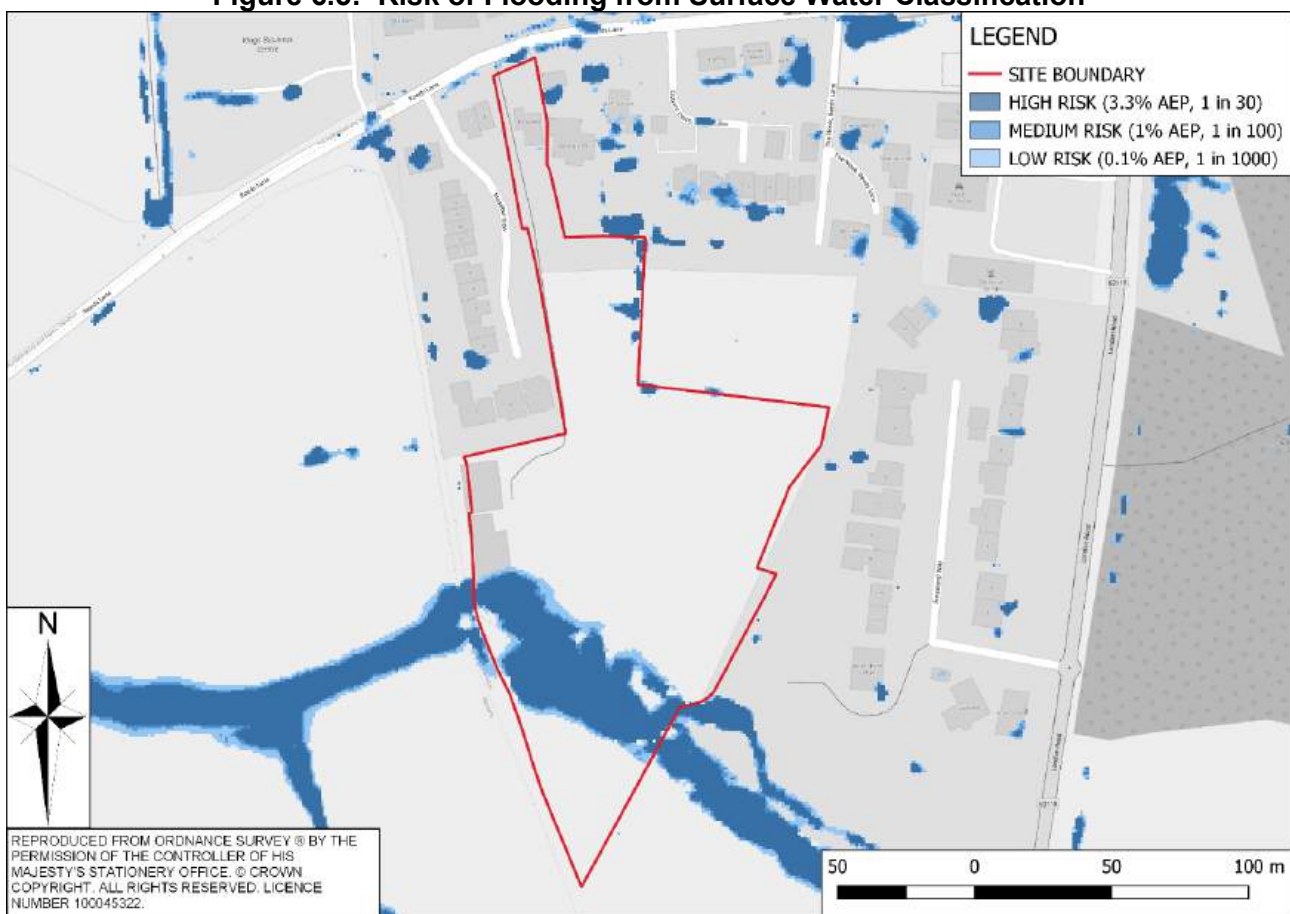




6.2 Risk of Flooding from Surface Water Classification

6.2.1 The updated surface water classification for the site, based on the above modelling, is shown in **Figure 6.5**. The results show that the southern part of the site fall within low (0.1% AEP) to high (3.3% AEP) risk of flooding from surface water. There are localised flooding along the ditch near the northern boundary that falls within low (0.1% AEP) to high (3.3% AEP) risk of flooding from surface water. The majority of the remainder of the site is within very low (<0.1% AEP) to low (0.1% AEP) risk of flooding from surface water.

Figure 6.5: Risk of Flooding from Surface Water Classification



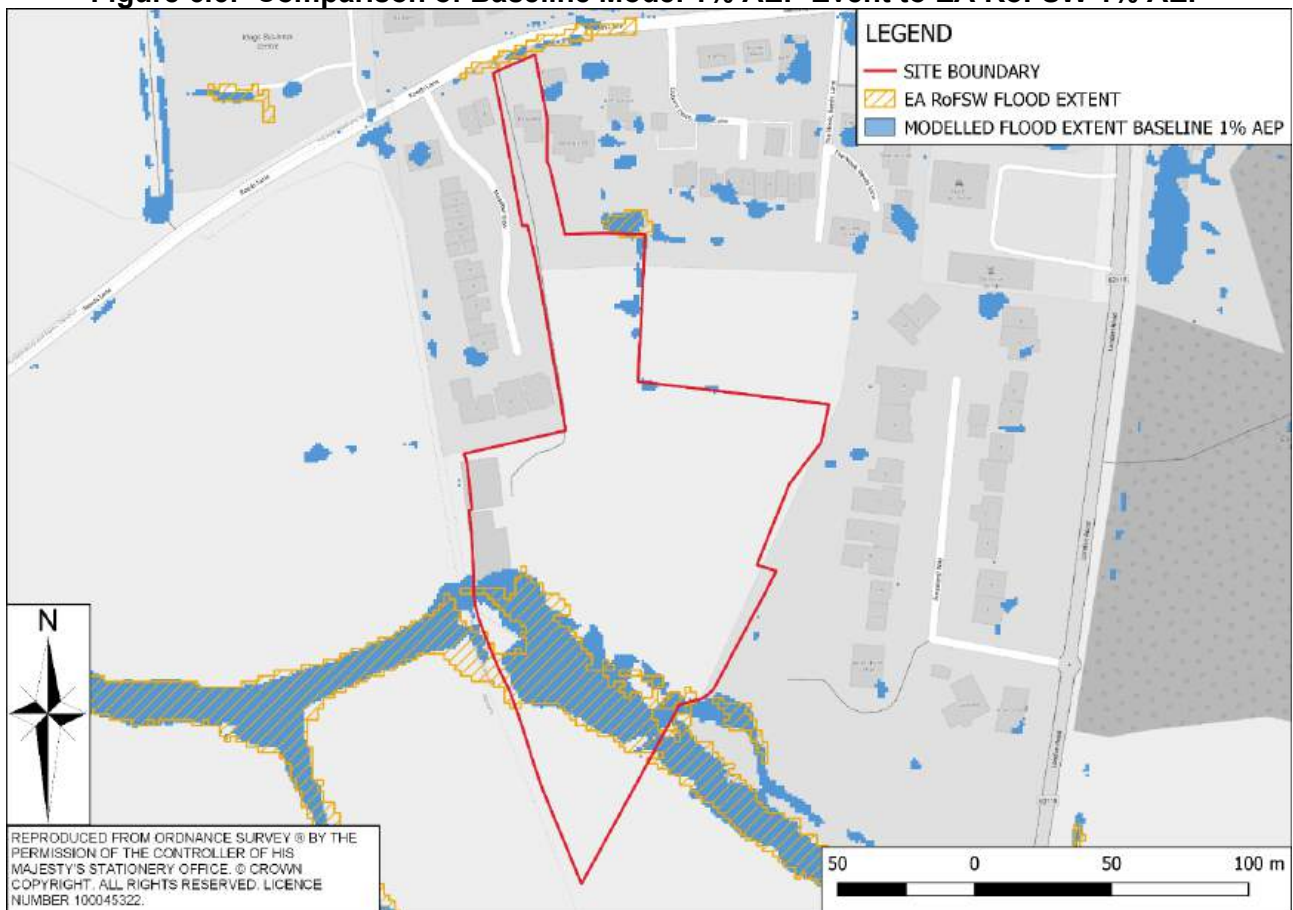
6.3 Comparison with the Environment Agency Flood Mapping

6.3.1 The modelled flood extent for the baseline scenario 1% AEP storm event has been compared to the EA RoFSW medium risk mapping (1% AEP). The comparison of the extent is shown in **Figure 6.6**.



6.3.2 These results show that the modelled flood extent for the 1% AEP storm event matches most of the EA RoFSW medium risk extent, with localised flooding and flow paths shown clearer especially along the ditch near the northern boundary.

Figure 6.6: Comparison of Baseline Model 1% AEP Event to EA RoFSW 1% AEP





6.4 Post-development Scenario

6.4.1 The post-development scenario has been run for the design flood event (1% AEP + 45%CC). The model results are shown in **Figure 6.7**. A comparison of the post-development and baseline results is shown in **Figure 6.8**.

6.4.2 The post-development scenario includes:

- An increase in ground levels of the dwellings, access road and area near the pumping station.

6.4.3 In addition, the drainage strategy for the proposed development intends to take all the surface water from the developed area of the site and discharge it at greenfield runoff rates. This has been modelled by removing the rainfall from the developed area of the site.

6.4.4 The development proposal will result in a betterment to flooding to the north. The remainder of the model domain shows negligible changes in water level.

6.4.5 The post-development scenario shows no increased flood levels outside of the site boundary. There is a minor reduction on the floodplain extent in comparison to the baseline scenario.



Figure 6.7: Peak Flood Depth for 1% AEP + 45%CC Event – Post-Development Scenario

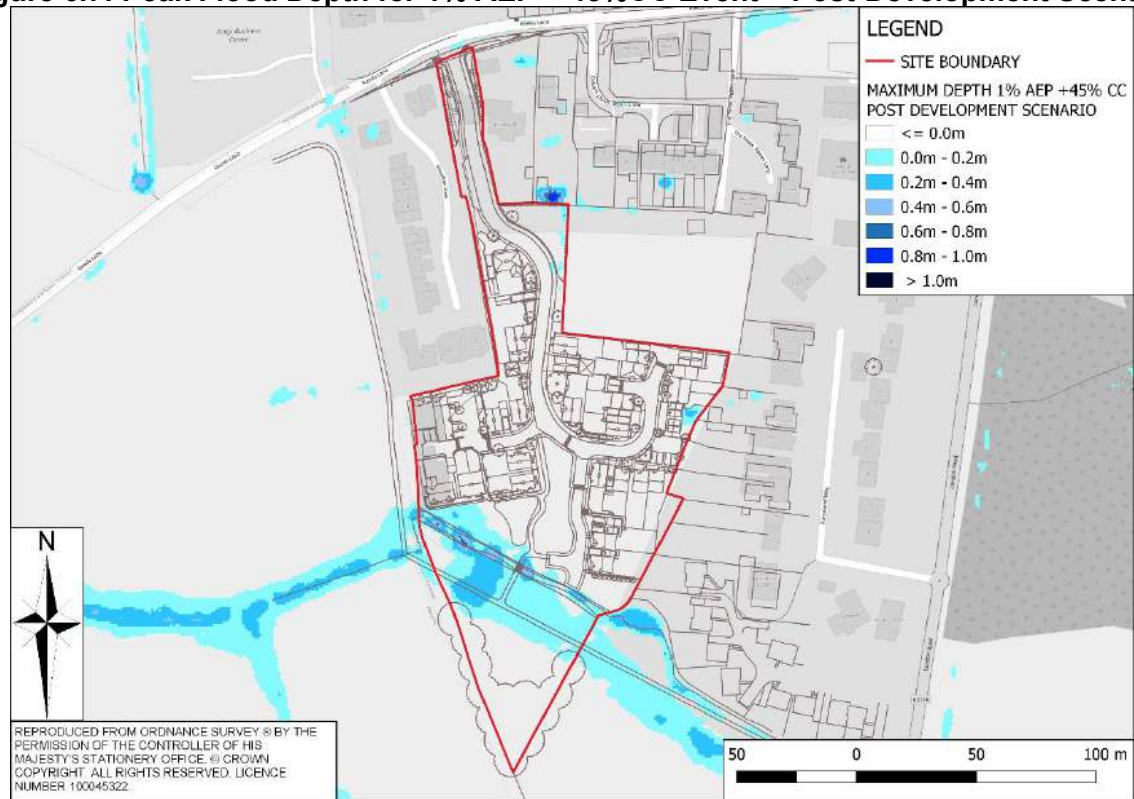
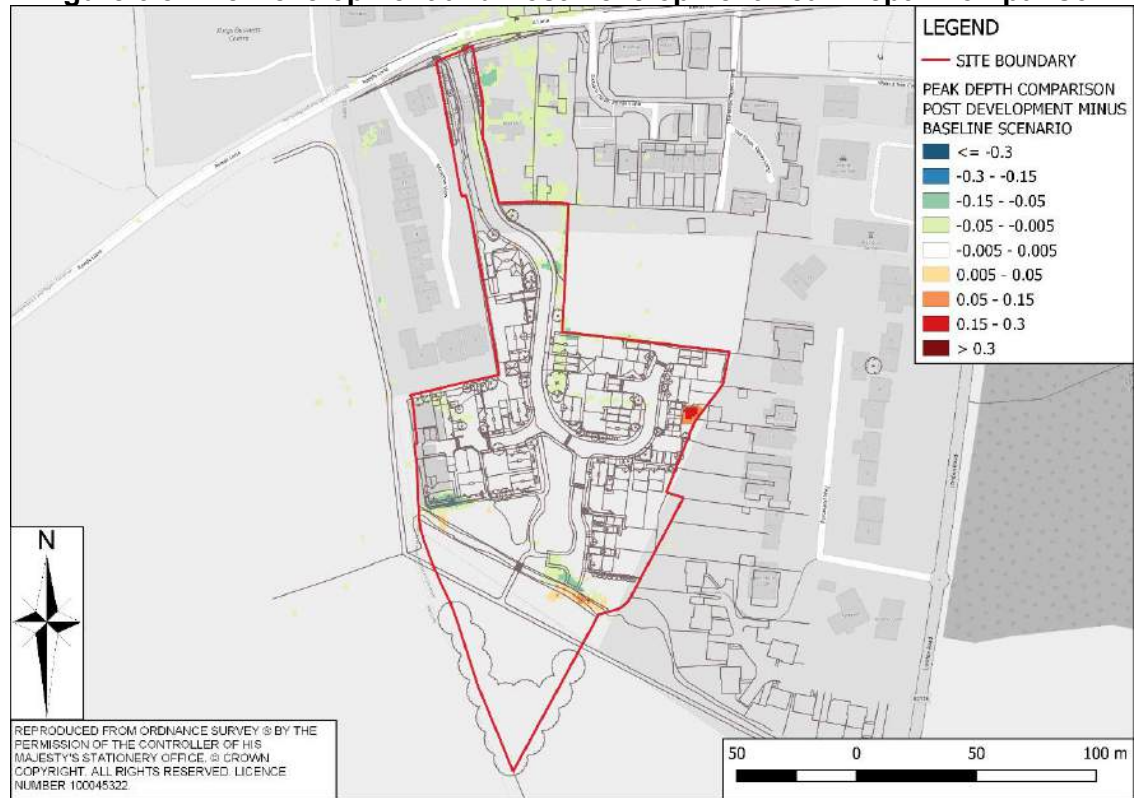


Figure 6.8: Pre-Development and Post-Development Peak Depth Comparison





7.0 MODEL ASSUMPTIONS AND LIMITATIONS

7.1 *Assumptions*

7.1.1 The following assumptions have been made in the development of the hydraulic model:

- The ground model has been derived from EA LiDAR DTM data, obtained from the EA open survey portal. The data has been assumed to be fit for purpose. Some small adjustments have been made to localised areas, specifically where the LiDAR did not pick up drainage channels and watercourses obscured by vegetation.
- 2D surface roughness values have been assumed based on online aerial photography and site visit photographs. Sensitivity of the model to these roughness parameters was carried out through an increase and decrease of 20%.

7.2 *Limitations*

7.2.1 The following limitations of the hydraulic model should be noted:

- The hydraulic model has been produced for a site-specific flood risk assessment of the proposed development. The area of interest is defined by the red line boundary and therefore the model should not be used by third parties to assess flood risk elsewhere in the model domain;
- The model has been tested on normal design storms only, due to the complexity and variability of real storm events, the flood risk profile determined by this model is a prediction only; and
- No hydrometric data exists for the watercourses within the model. Consequently, the model cannot be calibrated against observed data.



8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 *Conclusions*

8.1.1 Odyssey has been commissioned by Antler Homes to undertake a site-specific hydraulic modelling assessment, in support of Local Plan Representations for residential development at Land off Reeds Lane, Sayers Common.

8.1.2 According to the current Environment Agency (EA) Risk of Flooding from Surface Water (RoFSW) map, parts of the site are subject to a 'low' to 'high' risk of pluvial flooding (0.1% and 3.33% Annual Exceedance Probability (AEP), respectively). Since the RoFSW mapping was undertaken to inform a national database, the modelling does not take into consideration detailed site-specific topographical survey or allow for investigation of proposed scenarios. Therefore, it was necessary to carry out direct rainfall hydraulic modelling of the catchments draining into the site to quantify the risk from overland flows, and to determine flood levels and the resulting flood extents.

8.1.3 The model was constructed using the TUFLOW hydraulic modelling software package. The 2D domain was designed to cover the area at risk of flooding with a 2m grid cell size.

8.1.4 The baseline modelling results show that the flooding on the site is along the southern part of the site along the watercourse. Flooding elsewhere on the site is primarily due to water building up in localised ground depression.

8.1.5 The post-development scenario shows no increased flood levels outside of the site boundary. There is a minor reduction on the floodplain extent in comparison to the baseline scenario.

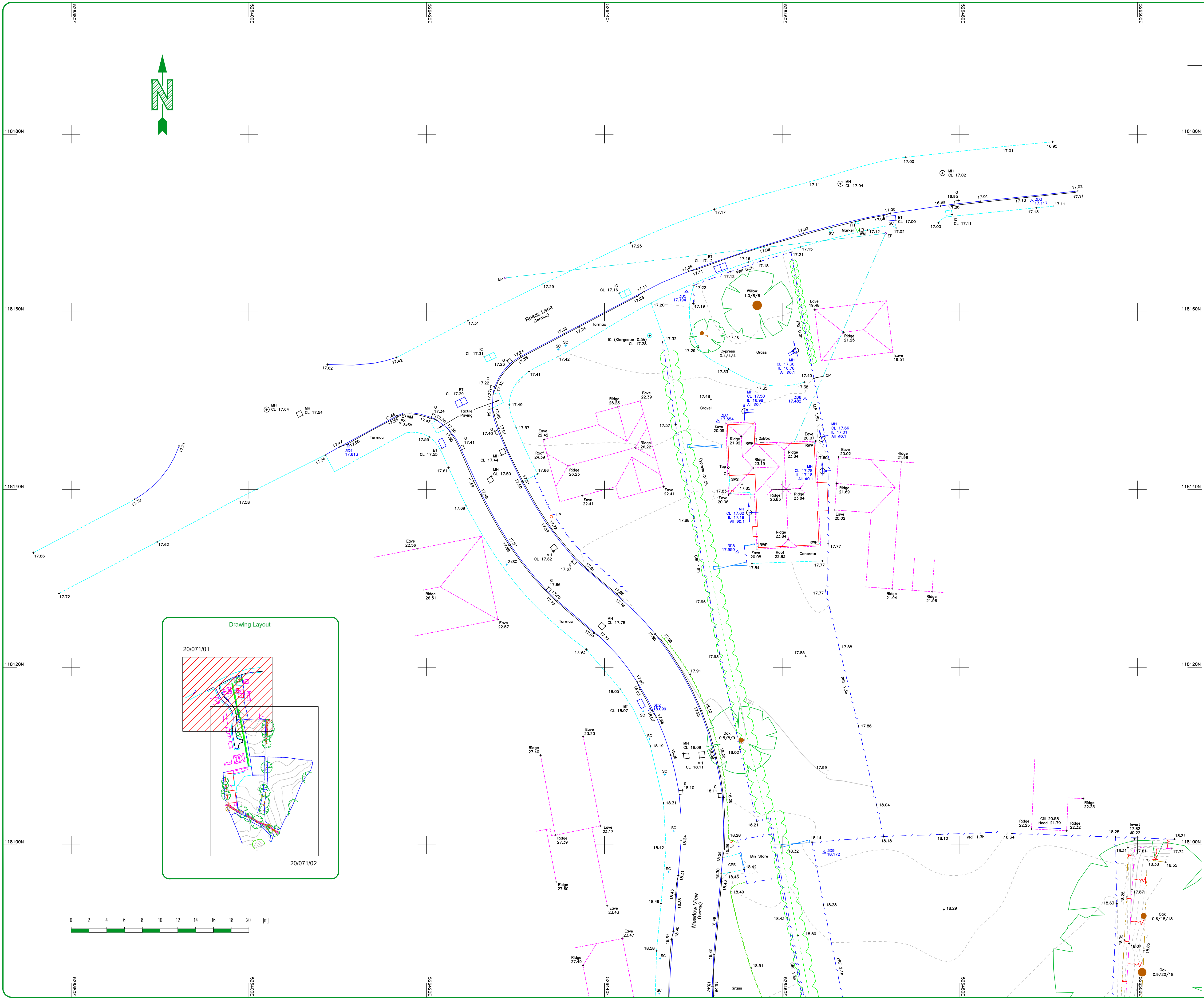
8.2 *Recommendations*

8.2.1 The modelling has been used to re-define the risk of flooding for surface water mapping across the site. The modelling outputs confirm that the site falls in 'high' to 'very low' risk of pluvial flooding.

8.2.2 It is recommended that this hydraulic assessment is accepted as the best available source of information for the site, informing the mitigation measures captured within the proposed scheme to appropriately manage the risk of pluvial flooding to the site and the wider catchment.

APPENDIX A

Survey Data: Topographical Survey



Survey Station Coordinates			
Station	Easting	Northing	Level
3D1	526466.551	118081.625	18.990
3D2	526465.115	118116.185	18.099
3D3	526488.093	118172.465	17.117
3D4	526411.205	118144.852	17.613
3D5	526440.236	118162.261	17.104
3D6	526462.572	118150.187	17.482
3D7	526452.757	118147.696	17.554
3D8	526454.957	118132.961	17.950
3D9	526464.742	118099.162	18.172
3D10	526474.648	118019.250	19.352
3D11	526494.839	117992.680	18.507
3D12	526520.257	118006.362	19.624
3D13	526743.916	117920.937	19.114
3D14	526446.544	117963.788	18.901
3D15	526467.071	117953.301	18.721
3D16	526467.757	117996.846	19.293
GPS1	526511.696	117955.632	19.627

LEGEND

	Building		Tree
	Glass Roof		Leaning Tree
	Open Sided Buildings		Hedges
	Survey Station		Canopy Line
	Banks		Walls
	Spot Levels		Fences
	Steps Up		Sapling

ABBREVIATIONS (WHERE APPLICABLE)

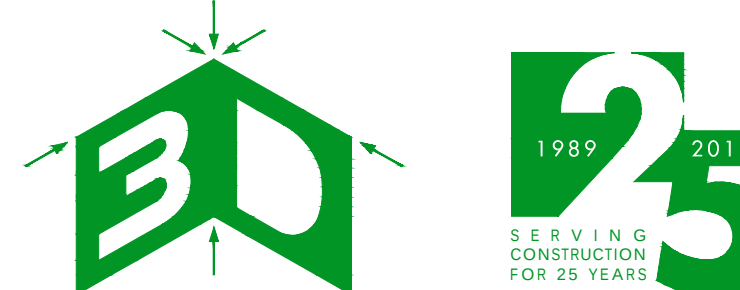
BOLLARD	BRITISH TELECOM BOX	BRITISH TELECOM IC	CABLE TELEVISION BOX	CABLE TELEVISION IC	CONCRETE	CHANGE POINT	CONCRETE PAVING SLABS	COVER LEVEL	DAMP PROOF COURSE	ELECTRICITY POLE	EARTH ROAD	FLOWER BED	FINISHED FLOOR LEVEL	FIRE HYDRANT	GAS VALVE	GUILLY	INSPECTION COVER	INVERT LEVEL	PIPE INVERT LEVEL	KERO OUTLET	LAMP POST
BOL	BTB	BT	CTB	TV	CONC	CP	CPS	CL	DPC	EP	ER	FB	FRL	FH	GV	G	IC	IL	INV	KO	LP
LETTER BOX	MANHOLE	MARKER	NOTICE BOARD	OVERHEAD CABLES	PARKING METER	RODDING EYE	ROAD NAME PLATE	ROAD SIGN	RAINFATHER PIPE	STOP COOK	STRUCTURAL SLAB LEVEL	STOP VALVE	TELEPHONE CALL BOX	TRAFFIC LIGHTS	TOP OF WALL	TELEGRAPH POLE	UNKNOWN	UNABLE TO LIFT	VENT PIPE	WATER METER	WASH OUT
LB	MH	MKR	NB	OHC	PM	RE	RNP	RS	RWP	SC	SSL	SV	TCS	TL	TOW	TP	UNK	UTL	VP	WM	WO

DATUM USED : ALL LEVELS BASED ON OS DATUM.
HORIZONTAL GRID IS BASED ON OS COORDINATES. ALL INFORMATION CREATED BY GPS DATA.

FOR USERS OF THIS DRAWING IN DIGITAL FORMAT:
THIS DRAWING HAS BEEN SURVEYED TO A DEGREE OF ACCURACY COMMENSURATE WITH THE SCALE INDICATED IN THE TITLE PANEL AND ANY DIMENSIONS EXTRACTED SHOULD BE TREATED AS SUCH.

Revisions		
Date	Revision	Amendment

3D Services (South East) Ltd
Unit 5 Coopers Place, Combe Lane, Wormley, Surrey GU8 5SZ
Tel: 01428 684144 · Fax: 01428 685522 · surveys@3dservices.co.uk



Member of

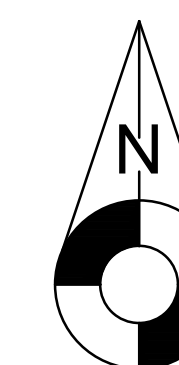
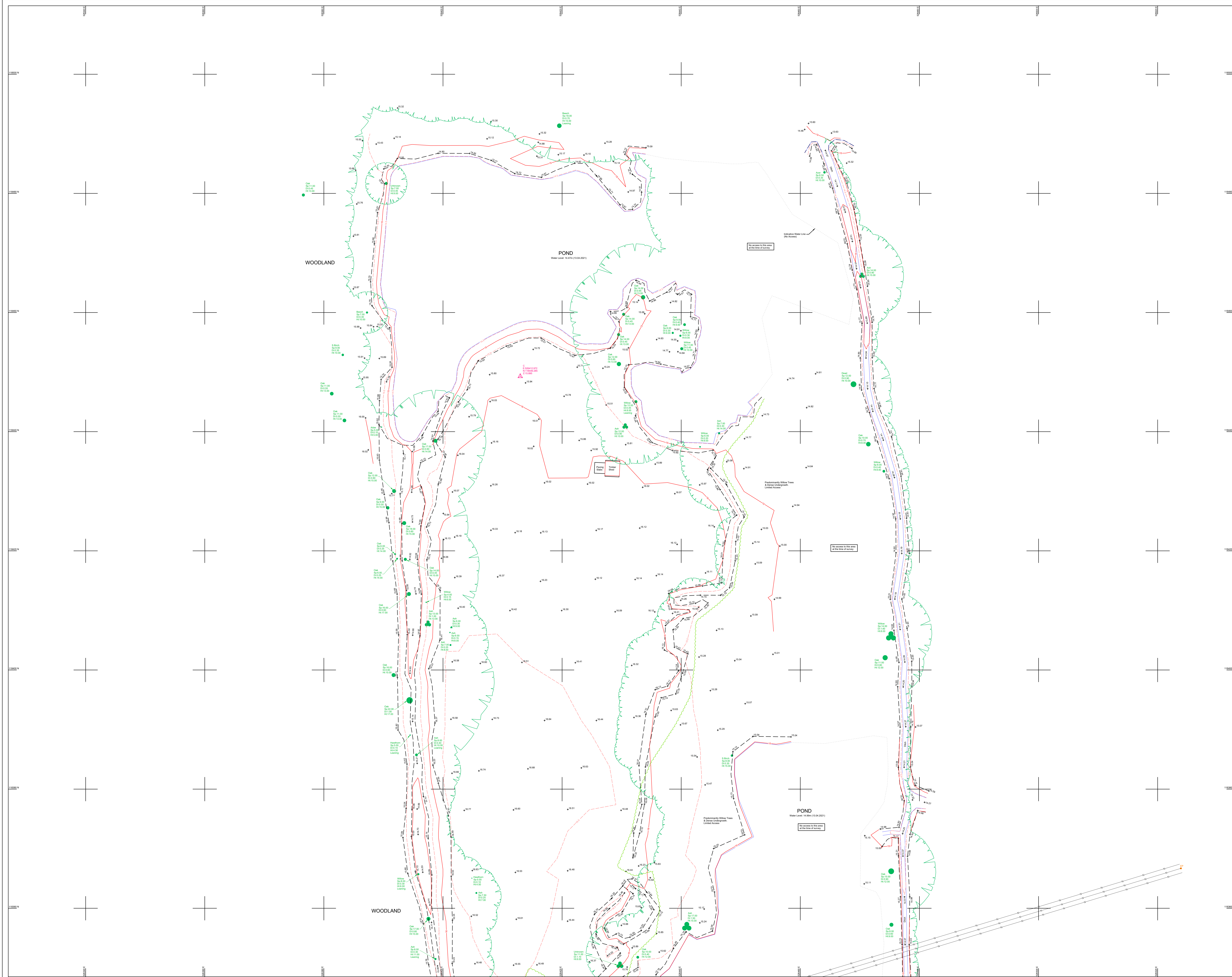
Client
ANTLER HOMES

Surveyed	Drawn	Checked	Date
RMC	CSG	RMC	06/07/20

Project
CHESEPEKE, SAYERS COMMON

Title
DETAIL SURVEY
Sheet 1 of 2

Job No	Drawing No	Revision	Scale/Size
20/071	20/071/01		1:200 A1



Sheet Location Diagram

1

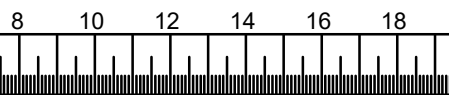
LEGEND

Common Abbreviations		EBC Code	
AC	AC Voltage	MS	Motor
AD	AC Drive	MT	Motor Transformer
AG	AC Ground	ND	Not Done
BC	BC Voltage	OD	Outside Diameter
BD	Bending Stress	OH	Over Heat
BE	Bending Stress Cyclic	OL	Over Load
BF	Bending Stress	OR	Over Rate
BI	Bolt	PA	Pressure
BM	Bolt Material	PC	Pressure Control
BO	Bolt Torque	PE	Pressure Element
BS	Bolt Size	PF	Power Factor
BT	Bolt Tightening	PI	Pressure Indicator
BU	Bolt Tightening	PL	Pressure Limit
CA	Cover	PM	Pressure Monitor
CB	Cover Bolt	PN	Pressure Nipple
CC	Cover Cover	PO	Pressure Outlet
CD	Cover Drive	PP	Pressure Pipe
CE	Control Element	PS	Pressure Switch
CF	Control Element	PT	Pressure Transducer
CG	Control Element	PU	Pressure Unit
CH	Control Element	RV	Relief Valve
CI	Control Element	SA	Stop Action
CJ	Control Element	SB	Stop Button
CK	Control Element	SC	Stop Control
CL	Control Element	SD	Stop Drive
CM	Control Element	SE	Stop Element
CN	Control Element	SF	Stop Flow
CO	Control Element	SH	Stop Heat
CP	Control Element	SI	Stop Inlet
CQ	Control Element	SL	Stop Limit
CR	Control Element	SM	Stop Motor
CS	Control Element	SN	Stop Nipple
CT	Control Element	SO	Stop Outlet
CU	Control Element	SP	Stop Pressure
CV	Control Element	ST	Stop Temperature
CW	Control Element	SV	Stop Valve
CA	Control Element	SW	Stop Water
CB	Control Element	TX	Transducer
CC	Control Element	TY	Transducer
CD	Control Element	UZ	Unusable
CE	Control Element	VA	Valve
CF	Control Element	VB	Valve Bolt
CG	Control Element	VC	Valve Cover
CH	Control Element	VD	Valve Drive
CI	Control Element	VE	Valve Element
CJ	Control Element	VF	Valve Flow
CK	Control Element	VG	Valve Gasket
CL	Control Element	VH	Valve Head
CM	Control Element	VI	Valve Inlet
CN	Control Element	VJ	Valve Joint
CO	Control Element	VK	Valve Key
CP	Control Element	VL	Valve Line
CQ	Control Element	VM	Valve Material
CR	Control Element	VO	Valve Outlet
CS	Control Element	VP	Valve Pressure
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CQ	Control Element	VP	Valve Pressure

Font

[illegible]

Scale Bar @ 1/200



Notes

The accuracy and/or precision of this drawing is dependent on the original specification. Sanshine Survey, Ltd. should be consulted before use of scales other than those stated.

This drawing provides positions and description of features on the ground at the time the survey was undertaken and in no way implies legal title or boundary ownership.

Where boundary alignment lines are added to the survey drawing and are taken from the original information supplied, they are shown as dashed lines. The contents of drawings quality and scale. They are provided on the basis of opinion and do not imply legal accuracy.

Detail required outside of site boundaries with no permission for access or public right of way may be surveyed by remote measurement where possible, the detail shown is indicative. This also applies to areas within the site with limited or no access or on an unsafe working environment.

Tree species have been identified as accurately as possible, but clarification checks should be carried out by a tree specialist.

Underground drainage and service information shown has been measured within the chamber where available. Corrections and alignments of pipework runs outside of the chamber are shown as indicated. Whilst the drawing is not intended to be a legal document, the information user should satisfy themselves of the completeness and accuracy before undertaking any works essential in critical areas.

All care has been taken in the preparation of this drawing any discrepancies found should be referred to Sanshine Survey, Ltd.

San Coordinate Control

Plan co-ordinates relate to a local survey grid coincident with OS National Grid using OSTN15 transformation at Control Station A. Scale factor 1.00 applied.

ANALYSIS RESULTS



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Project Title: THE OLD BRICKWORKS, REED LANE,
SAYERS COMMON

Client: RESIDE DEVELOPMENTS LTD.

Description: **TOPOGRAPHICAL** (Sheet 1 of 1)

Date	16.04.2021	Scale	1/200 @ A0
Job No.	GY5194	Surveyor	GARY

Orig No.	11001	Owner	HR
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APPENDIX B

Model Files

<https://odysseyconsultllp.sharepoint.com/:f:/g/EmTLEKJ2d3RHjva6cutPpqUBaCKnfwf5aX0TP1YnUnmj4A>

APPENDIX H

SuDS Operation and Maintenance Requirements

TABLE 20.15 Operation and maintenance requirements for pervious pavements

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm 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	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
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, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Many of the specific maintenance activities for pervious pavements can be undertaken as part of a general site cleaning contract (many car parks or roads are swept to remove litter and for visual reasons to keep them tidy) and therefore, if litter management is already required at site, this should have marginal cost implications.

Generally, pervious pavements require less frequent gritting in winter to prevent ice formation. There is also less risk of ice formation after snow melt, as the melt water drains directly into the underlying sub-base and does not have chance to refreeze. A slight frost may occur more frequently on the surface of pervious pavements compared to adjacent impermeable surfaces, but this is only likely to last for a few hours. It does not happen in all installations and, if necessary, this can be dealt with by application of salt. It is not likely to pose a hazard to vehicle movements.

► Generic health and safety guidance is presented in **Chapter 36**.

CDM 2015 requires designers to ensure that all maintenance risks have been identified, eliminated, reduced and/or controlled where appropriate. This information will be required as part of the health and safety file.

TABLE 21.3 Operation and maintenance requirements for attenuation storage tanks

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from pre-treatment structures and/or internal forebays	Annually, or as required
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows 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

21.14 REFERENCES

BARNES, G E (2010) *Soil mechanics: principles and practice, third edition*, Palgrave Macmillan, Hampshire, UK (ISBN: 978-0-23057-980-4)

BCA (2014) *Design standards for box culverts*, BCA Technical Advice Note, Box Culvert Association, Leicester, UK. Go to: <http://tinyurl.com/qy6bmfx>

BETTESS, R (1996) *Infiltration drainage – manual of good practice*, R156, CIRIA, London, UK (ISBN: 978-0-86017-457-8). Go to: www.ciria.org

BRE (1991) *Soakaway design*, BRE Digest 365, Buildings Research Establishment, Bracknell, UK (ISBN: 0-85125-502-7)

CPSA (2013) *Technical design guide*, Concrete Pipeline Systems Association, Leicester, UK. Go to: www.concretepipes.co.uk/page/technical-guide

D'ARCY, B, ELLIS, J, FERNER, R, JENKINS, A and DILS, R (2000) *Diffuse pollution impacts, the environmental and economic impacts of diffuse pollution in the UK*, Terence Dalton Publishers, Suffolk, UK (ISBN: 978-1-87075-246-6)

DECC (2012) *Government response to "Home insulation. A report on the call for evidence carried out by OFT"*, Department of Energy and Climate Change, London, UK. Go to: <http://tinyurl.com/n9l4psx>

DfT (1998) *Manual of contract documents for highway works. Volume 1: Specification for highway works*, HMSO, London, UK (ISBN: 978-0-11552-705-0). Go to: <http://tinyurl.com/nuhk8c3>

DfT (2001) *Manual of contract documents for highway works. Volume 1: Series 2500 Special structures*, HMSO, London, UK. Go to: <http://tinyurl.com/l3tap4z>

DfT (2009) *Manual of contract documents for highway works. Volume 1: Series 600 Earthworks*, HMSO, London, UK. Go to: <http://tinyurl.com/phx5yj>

TABLE 22.1 Operation and maintenance requirements for detention basins

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly
	Cut grass – for spillways and access routes	Monthly (during growing season), or as required
	Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually (as set out in Chapter 23)
Occasional maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years, or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial actions	Repair erosion or other damage by reseedling or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

22.13 REFERENCE

KENNARD, M F, HOSKINS, C G and FLETCHER, M (1996) *Small embankment reservoirs*, R161, CIRIA, London, UK (ISBN: 978-0-86017-461-5). Go to: www.ciria.org

Statutes

Reservoir Act 1975 (c.23)

Health and Safety at Work (etc) Act 1974 (c.37)

Building Act 1984 (c.55)

Flood and Water Management Act 2010 (c.29)

Construction (Design and Management) Regulations (CDM) 2015