HALL FARM, LODDON GARDEN VILLAGE SDL

HYDROLOGICAL ASSESSMENT: BARKHAM BROOK FLUVIAL MODEL

UNIVERSITY OF READING

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Appendices

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1 Introduction

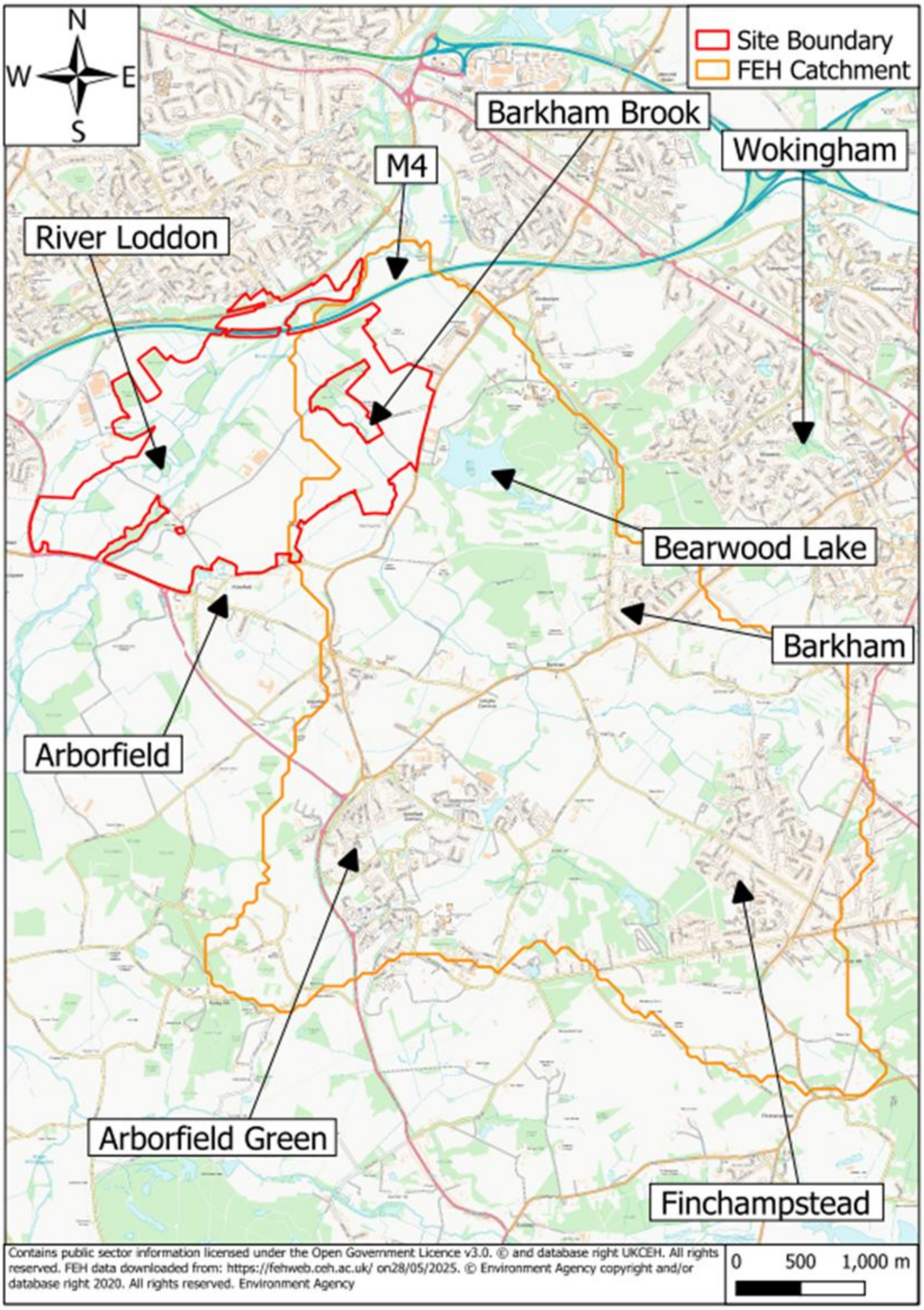
1.1 Background

1.1.1 This direct rainfall modelling report has been prepared by Abley Letchford, on behalf of the University of Reading for the Barkham Brook catchment in Berkshire.

1.1.2 This direct rainfall modelling report sets out the data and methods used to create a site-specific baseline model to represent the site-specific conditions. This report also sets out the baseline model results to define the surface water flood extents.

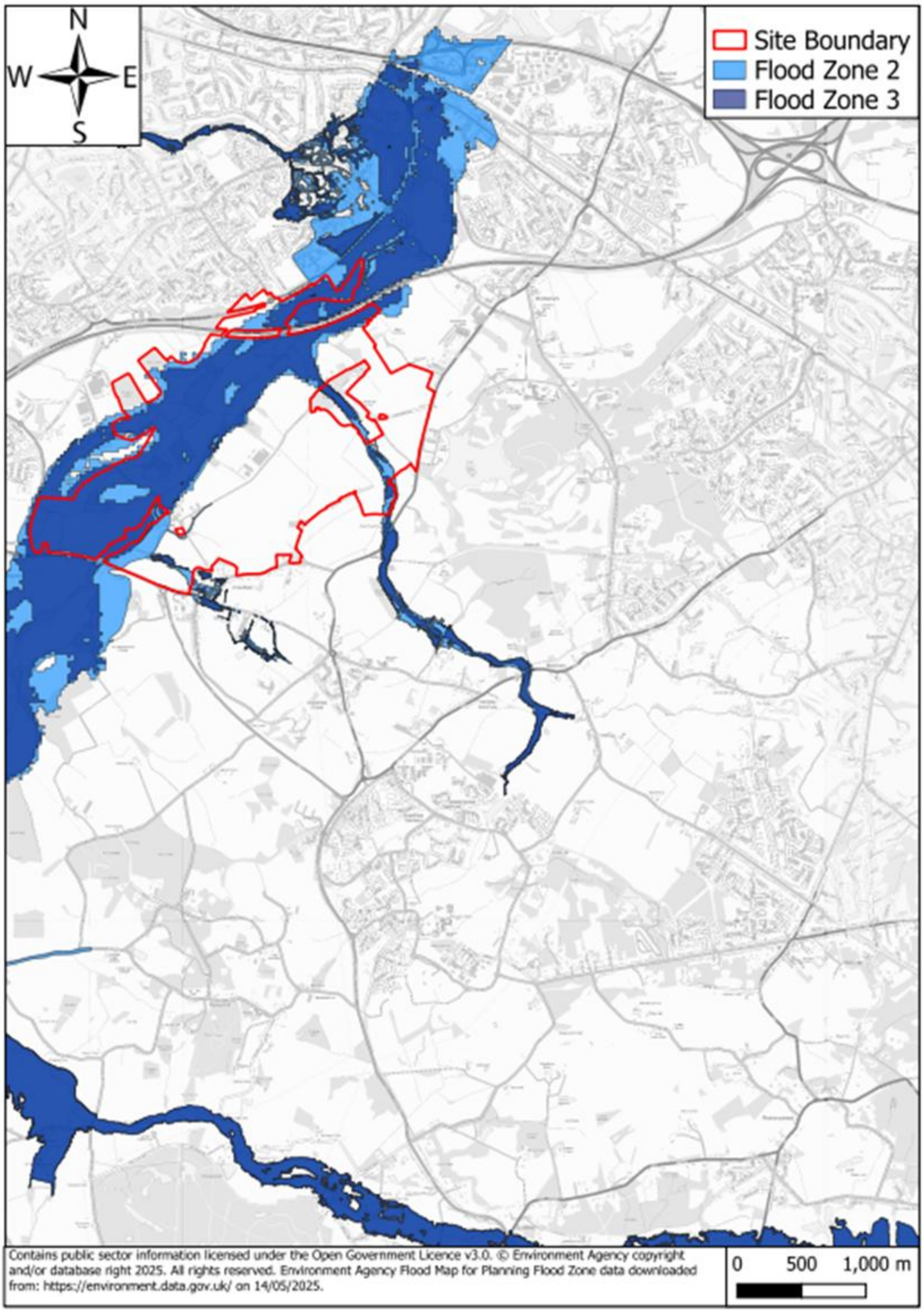
1.1.3 **Figure 1** shows the location of the site and catchment.

Figure 1 - Site Location Plan



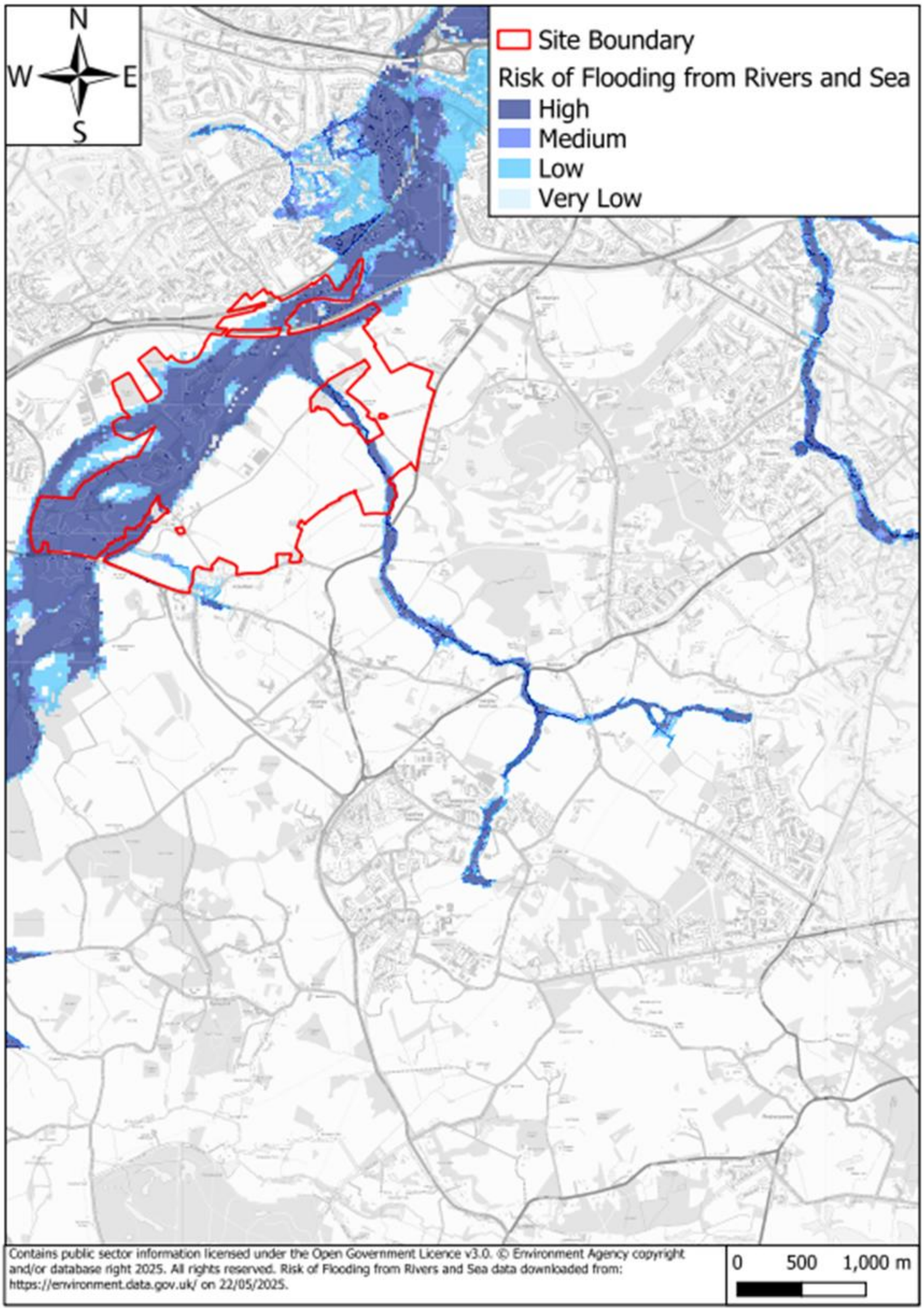
1.1.4 The Environment Agency (EA) Flood Map for Planning shows that the River Loddon is the dominant source of flooding to the west of the study area. There are areas shown to be located within Flood Zone 2 and 3 along the River Loddon, Barkham Brook and Arborfield Cut as show in **Figure 2**.

Figure 2 – EA Flood Map for Planning



1.1.5 **Figure 3** shows the NaFRA Risk of Flooding from Rivers and Sea mapping.

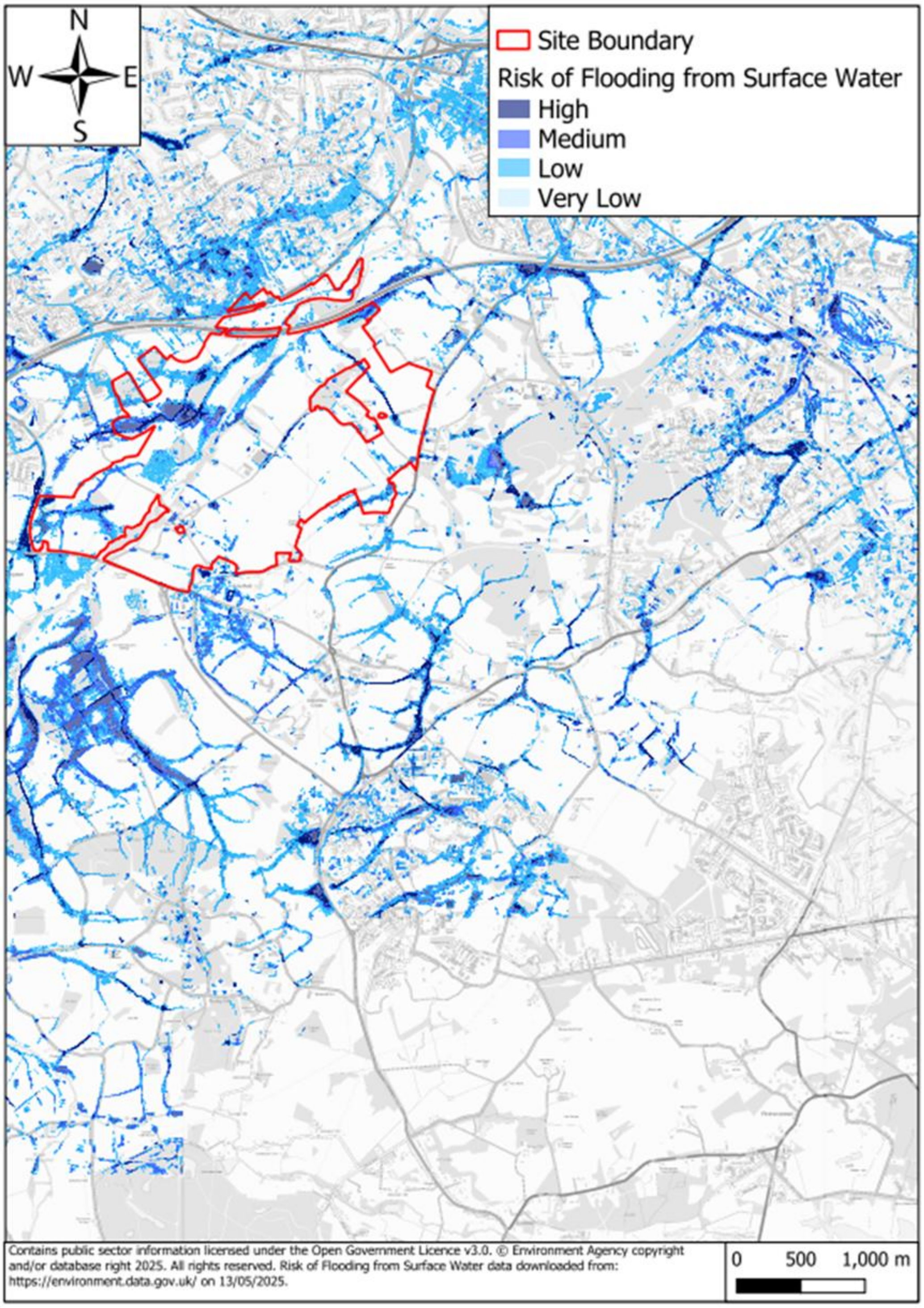
Figure 3 – NaFRA Risk of Flooding from Rivers and Sea



1.1.6 **Figure 3** shows a similar pattern of flooding to **Figure 2.**

1.1.7 **Figure 4** shows the NaFRA Risk of Flooding from Surface Water extent.

Figure 4 – NaFRA Risk of Flooding from Surface Water



1.1.8 **Figure 4** shows that there is surface water flooding along a number of Ordinary Watercourses. **Figure 4** does not show flooding along the River Loddon or Barkham Brook as the NaFRA study considers flooding from fluvial and surface water courses separately.

1.1.9 The key aim of this modelling study is to refine the flood extents using site specific data which considers the local features within the site and catchment in conjunction with local knowledge and site observations.

1.2 Scope

1.2.1 The scope of works includes the following:

- Undertake a hydrological assessment to estimate the catchment to the site and generate rainfall hyetograph for the relevant return periods.
- Build a new direct rainfall model with defined channels for the catchment using the best available data to refine the baseline surface water flood extents.
- Run the model for the following return periods; 1 in 30, 1 in 100, 1 in 1,000 annual probability scenarios.
- To assess the impact of climate change, the 1 in 100 annual probability scenario has been modelled with the most recent climate change allowances for the Loddon and Tributaries Management Catchment. A +40% climate change allowance has been applied for the 1 in 100 annual probability scenario which represents the Upper End peak rainfall allowance for the Loddon and Tributaries Management Catchment.

2 Hydrological Assessment

2.1.1 Full details for the hydrological assessment methodology and application can be found in the Abley Letchford Hydrological Assessment in Appendix 1. A summary of the hydrological assessment is included within this chapter.

2.1.2 The hydrological study derived hyetograph estimates at key locations. A lumped catchment was obtained from the Flood Estimation Handbook (FEH) webservice and updated where appropriate.

2.1.3 The study derived hyetographs for the following return periods; 1 in 30, 1 in 100 and 1 in 1000 annual probability. To assess the impact of climate change, the 1 in 100 annual probability scenario was modelled with the most recent climate change allowances for the Loddon and Tributaries Management Catchment which is 40%.

2.1.4 The hydrological analysis was completed using ReFH2 version 2.3.

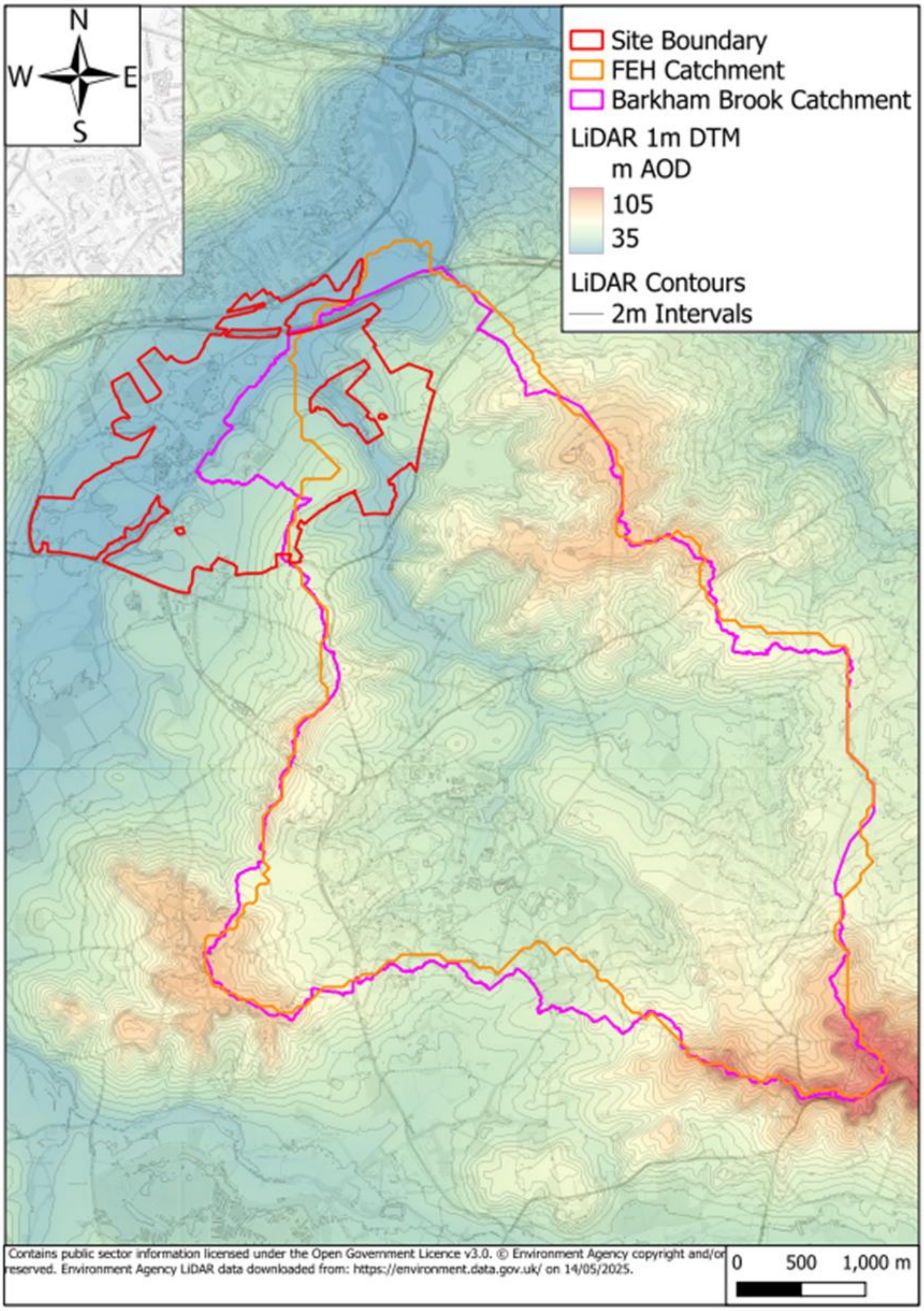
2.2 Hydrological Inflow Boundaries

2.2.1 The catchment was downloaded from the FEH Webservice.

2.2.2 The FEH catchment was adjusted using OS mapping, LiDAR data and a review of the EA indicative watershed dataset to derive the BB01 catchment deemed to be most representative of the actual catchment. The FEH catchment area was 19.7km2. The BB01 catchment has an area of 20.3km2.

2.2.3 **Figure 5** shows the extent of the FEH catchment and BB01 catchment.

Figure 5 – FEH Catchment and Hyde End (HE01) Catchment Extents



2.3 Catchment Descriptors

2.3.1 A review of the FEH Webservice catchment descriptors was carried out. A summary of key catchment descriptors and updates and summarised in **Table 1**. Further details of the checks and updates made to the catchment descriptors are provided below the table.

Table 1 – Catchment Descriptors

Catchment Descriptor	FEH Catchment Descriptor	BB01 Catchment Descriptor
AREA	19.7	20.3
BFIHOST	0.451	0.451
BFIHOST19	0.452	0.451
DPLBAR	6.71	6071
DPSBAR	25.5	25.5
FARL	0.938	0.938
FPEXT	0.1287	0.1287
LDP	11.68	11.68
PROPWET	0.29	0.29
SAAR	656	656
SPRHOST	36	36
URBEXT1990	0.0527	0.0527
URBEXT2000	0.0977	0.135

2.4 Area

2.4.1 The FEH catchment area was adjusted for the BB01 catchment using OS mapping, LiDAR data and the EA watershed dataset. The FEH catchment area was 19.7km2. The BB01 catchment area is 20.3km2.

2.5 BFIHOST and BFIHOST19

2.5.1 BFIHOST base flow index is a measure of catchment responsiveness based on the Hydrology of Soil Types (HOST) classification. It indicates the relationship between soil types and the runoff response. Permeable soils and geology tend to yield a higher baseflow.

2.5.2 BFIHOST19 is an updated method of classifying BFIHOST which improves on the classification of rarer soil types.

2.5.3 The BFIHOST values were reviewed using the Cranfield Soils online viewer and Cranfield University Soils Report. The FEH values were deemed to be reasonable and were accepted.

2.6 SPRHOST

2.6.1 SPRHOST is the standard percentage runoff associated with each HOST soil class.

2.6.2 The FEH SPRHOST values were reviewed using the Cranfield Soils online viewer and Cranfield University Soils report. The FEH values were deemed to be reasonable and were accepted.

2.7 PROPWET

2.7.1 PROPWET is a measure of the proportion of the time that the catchment soils are defined as wet. Wetter regions have higher PROPWET values. Dryer regions have lower PROPWET values. The PROPWET value for the FEH catchment is 0.29. The value is considered to be representative of the region that the BB01 catchment is in.

2.8 FARL

2.8.1 FARL is a measure of the degree of flood attenuation provided by reservoirs and lakes within a catchment. A value of 1 represents the absence of lakes or reservoirs within the catchment. Bearwood Lake is located within the catchment. The FARL value of 0.983 is therefore considered to be representative for the BB01 catchment considering the impact of the reservoir.

2.9 URBEXT and URBEXT2000

2.9.1 URBEXT and URBEXT2000 is an index of the concentration of urban and suburban areas in 1990 and 2000 respectively expressed as a fraction.

2.9.2 OS mapping and aerial photography was reviewed for the BB01 catchment and the URBEXT2000 value adjusted to reflect the suburban areas within the BB01 catchment. The URBEXT2000 value was updated using the FEH Volume 5 Equation 6.2.

2.9.3 The URBEXT2000 value was adjusted to 0.135 to reflect the recent residential development within the catchment.

2.10 SAAR

2.10.1 SAAR is a measure of the average annual rainfall between 1961 and 1990 in millimetres. The FEH catchment is adjacent to the HE01 catchment therefore both catchments will have received similar average rainfall. The SAAR value for the FEH catchment appears reasonable therefore it has been accepted for use for the BB01 catchment.

2.11 DPSBAR

2.11.1 DPSBAR is an index for the overall catchment steepness. A value of greater than 300 represents mountainous regions. A value of less than 25 represents flatter regions. The DPSBAR value for the FEH catchment is 25.5. The FEH catchment and BB01 catchment have a similar slope therefore the DPSBAR for the sites is considered representative.

2.12 ReFH2 Method

2.12.1 DPSBAR is an index for the overall catchment steepness. A value of greater than 300 represents mountainous regions. A value of less than 25 represents flatter regions. The DPSBAR value for the FEH catchment is 25.5. The FEH catchment and BB01 catchment have a similar slope therefore the DPSBAR for the sites is considered representative.

2.13 Storm Duration

2.13.1 The default ReFH2 rainfall parameters were applied. This approach is an industry standard approach. Rainfall parameters are not typically adjusted unless there is a specific reason to do so. These gave a storm duration of 11 hours and a timestep of 0.5 hours. This is the critical duration for the catchment.

2.13.2 The ReFH2 Seasonal Correction Factor (SCF) of 0.69 was used. This was the ReFH2 default value. This approach is industry standard. Parameters are not typically adjusted unless there is a specific reason to do so.

2.13.3 The ReFH2 Areas Reduction Factor (ARF) of 0.96 was used. This was the ReFH2 default value. This approach is industry standard. Parameters are not typically adjusted unless there is a specific reason to do so.

2.14 Rainfall Estimates

2.14.1 The winter seasonality was selected. This is the appropriate storm profile for rural catchments in England, according to the ReFH2 guidance.

2.14.2 The site is located in the Loddon and Tributaries Management Catchment. The relevant climate change allowance is +40% which is the Upper End allowance.

3 Model Approach and Input Data

3.1 Model Approach

3.1.1 A direct rainfall model with defined channels was constructed using TUFLOW (2025.1.0-iDP-w64).

3.1.2 Double precision TUFLOW was used, as is recommended in the TUFLOW manual for direct rainfall models.

3.1.3 The model log is included in **Appendix 2.**

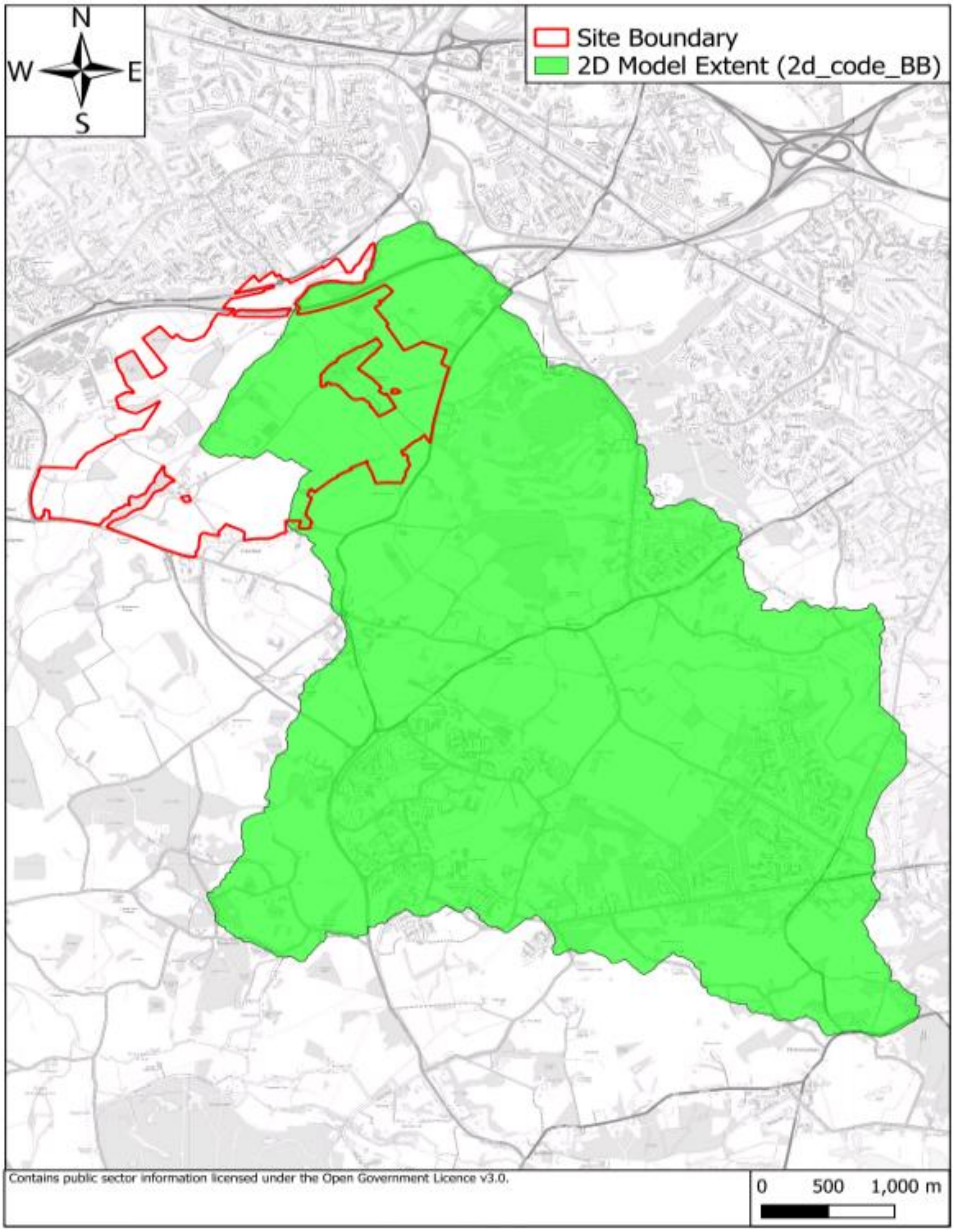
3.2 Model Domains

3.2.1 **Figure 6** shows the 2D model extent. The model domain is split into 3 grid sizes using quadtree. The area upstream of Mole Road has a 6m grid size. The area downstream of Mole Road has a 3m grid size. The areas 20m either side of a watercourse downstream of Mole Road have a grid size of 1.5m. The grid sizes have been selected to have a balance between detail and model run times.

3.2.2 The 2D model area is 21.1km^2.

3.2.3 The model domain was set slightly larger than the catchment to ensure that there was no 'glass walling' of flow along the edges of the model.

Figure 6 – 2D Model Extent



3.3 Input Data

3.3.1 The latest available software and data has been used in the hydraulic model. The data is summarised below.

3.4 Hydraulic Software and Data

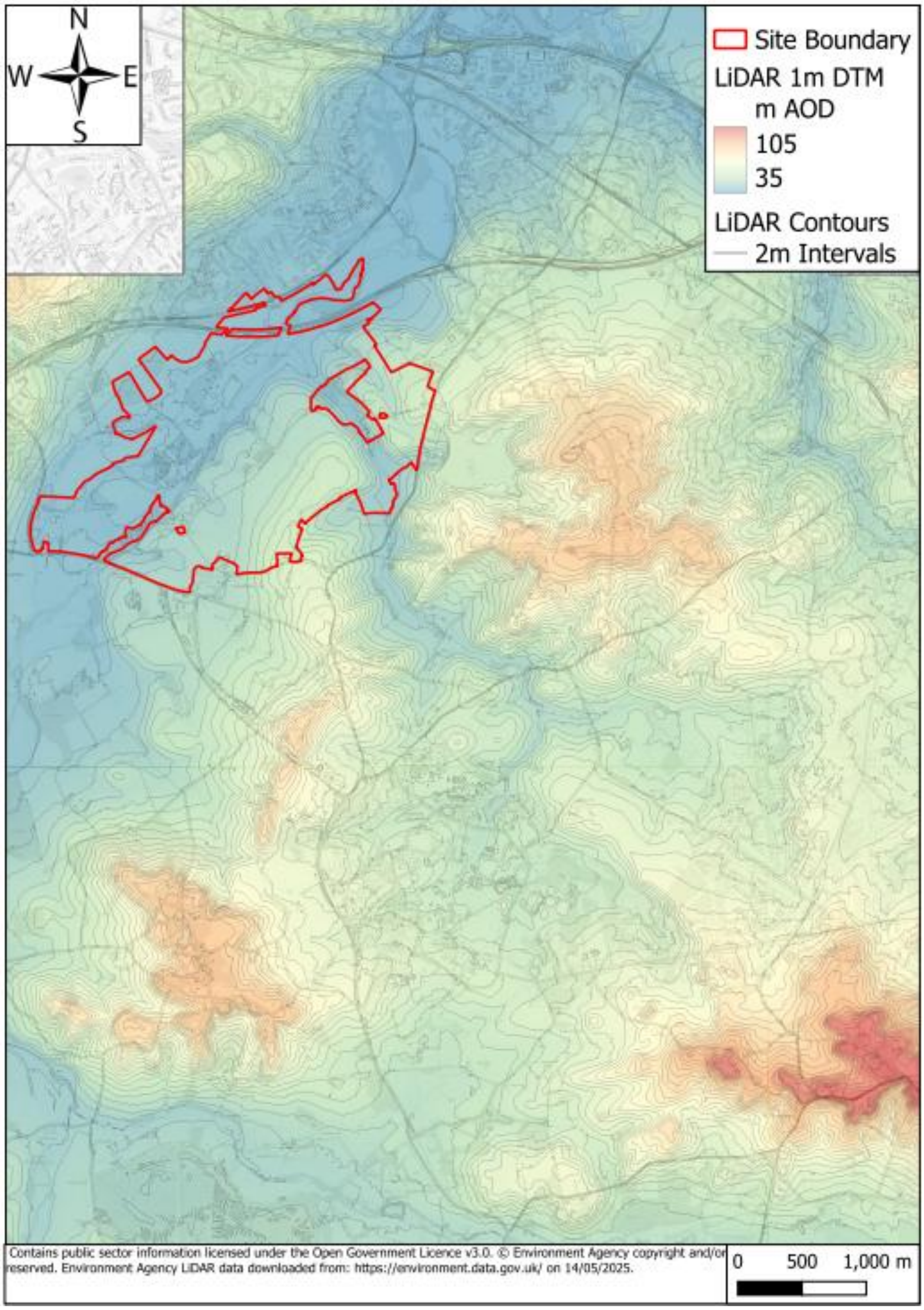
3.4.1 TUFLOW version 2025.1.0-iDP-w64 were used. This is the latest versions of the software at the time of running the model.

3.4.2 The hydrological inflows were updated using ReFH2 version 2.3. This is the latest versions of the software at the time of running the model.

3.5 LiDAR Data

3.5.1 1m DTM LiDAR flown in 2020 and 2023 was used. This is the best available data at the finest available resolution. The LiDAR data was downloaded from the Defra open-source data service platform in the 15th and 19th May 2025. **Figure 7** shows the extent of the LiDAR available for the site.

Figure 7 – EA LiDAR Coverage

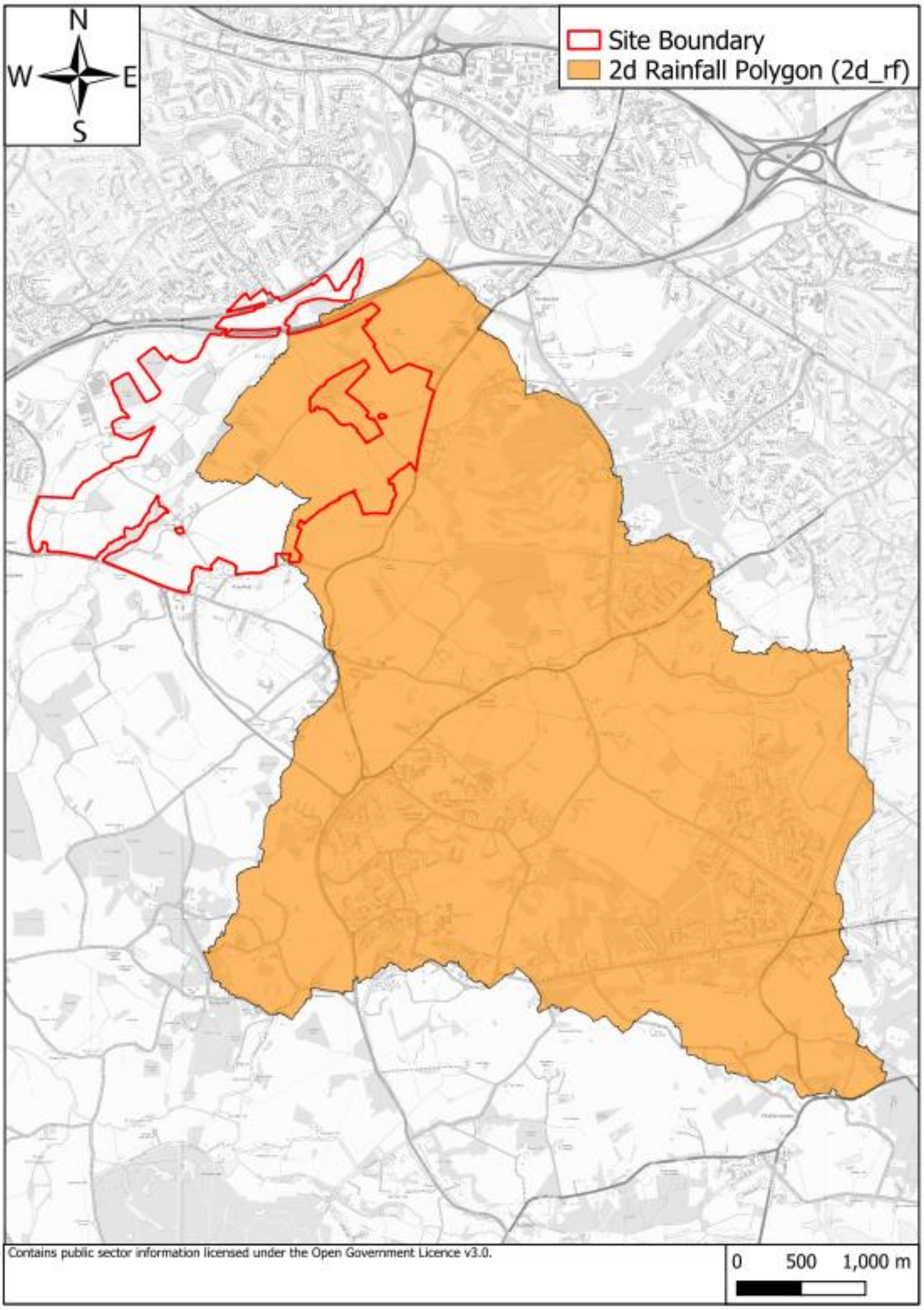


3.6 Inflow Boundaries

3.6.1 The net rainfall was added to the model using a 2d_RF boundary across the HE01 catchment. The RF represents the net rainfall.

3.6.2 **Figure 8** shows the extent of the rainfall input.

Figure 8 – Rainfall Input Location

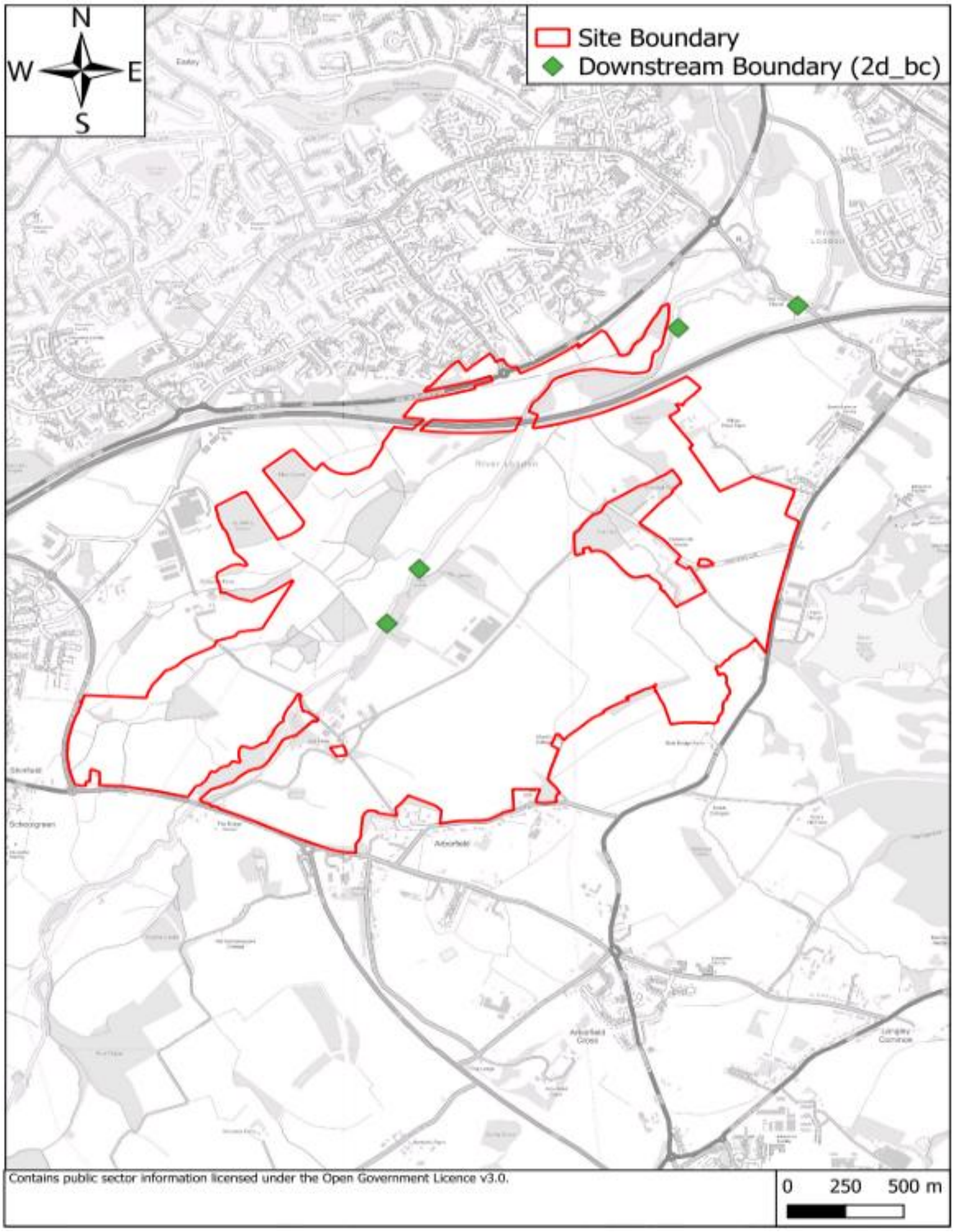


3.6.3 The catchment was lumped with uniform rainfall applied across the whole catchment.

3.6.4 The downstream boundary of the model has been set at the River Loddon. A 2d_bc (boundary condition) boundary was used to allow flow to exit the downstream boundary of the model domain and prevent any glass walling along the boundary. There are four downstream boundaries in the model, in the four locations which Barkham Brook or one of the eastern watercourses discharges into the River Loddon.

3.6.5 **Figure 9** shows the location of the downstream boundary within the model.

Figure 9 – Downstream Boundary of the Model Domain



3.7 Roughness

3.7.1 The hydraulic roughness impacts the conveyance of flood within the floodplain.

3.7.2 Polygons were downloaded from eMapSite and OS data portal to inform the land use types. eMapSite uses OS mapping to classify the land use types.

3.7.3 Manning's 'n' roughness values were assigned to the land use types within the model domain using Chow 1959 industry standard guidance, satellite imagery of the site, photographs from a site walkover and professional judgement.

3.7.4 Roughness values were applied using 2d_mat files within the .tmf file. **Figure 10** shows the location of each material layers for the OS data. **Figure 11** shows the location of each materials layer for the eMapSite data.

3.7.5 The eMapSite data is read in preference to the OS data where available as it is mode detailed.

Figure 10 – OS Materials Layers

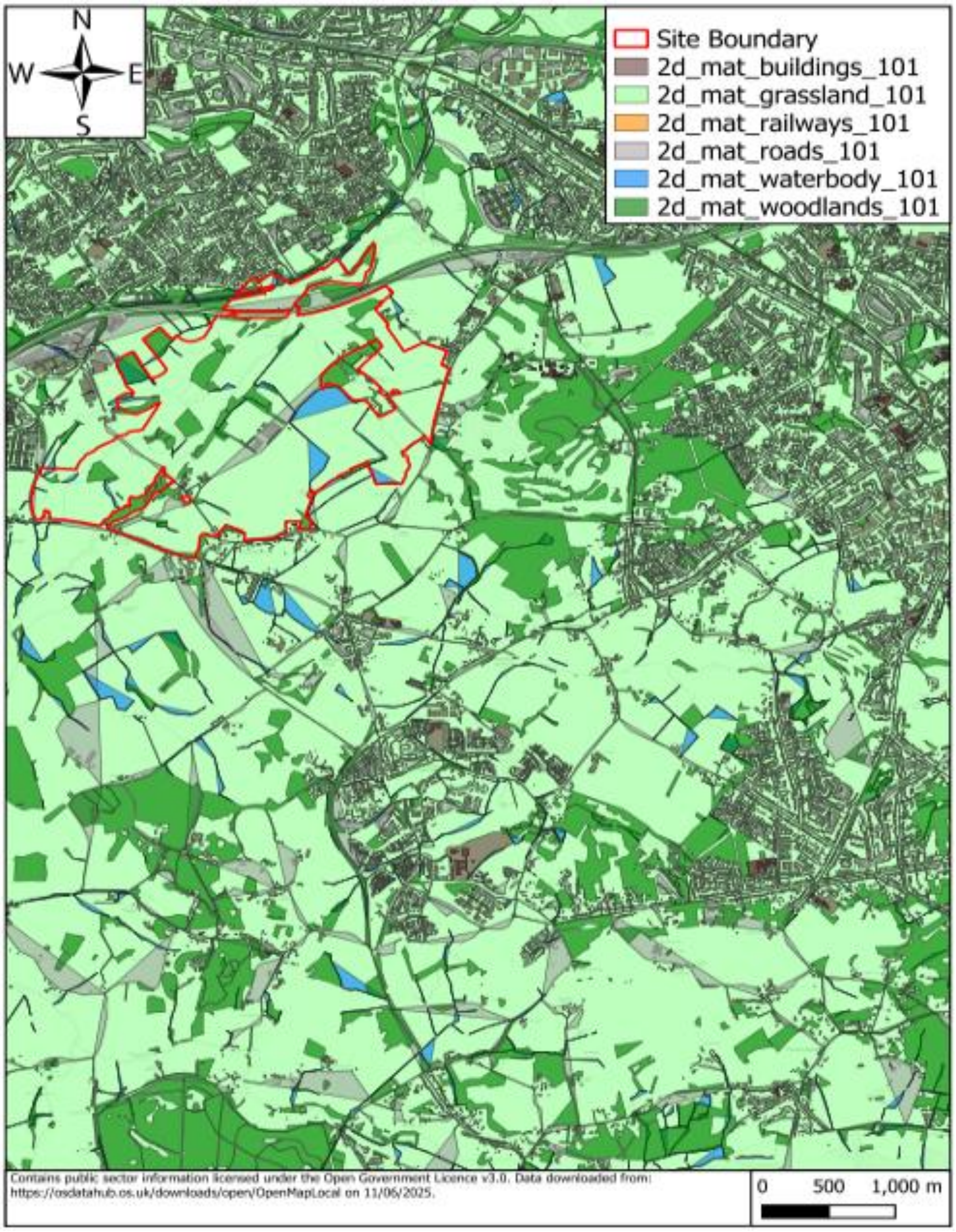
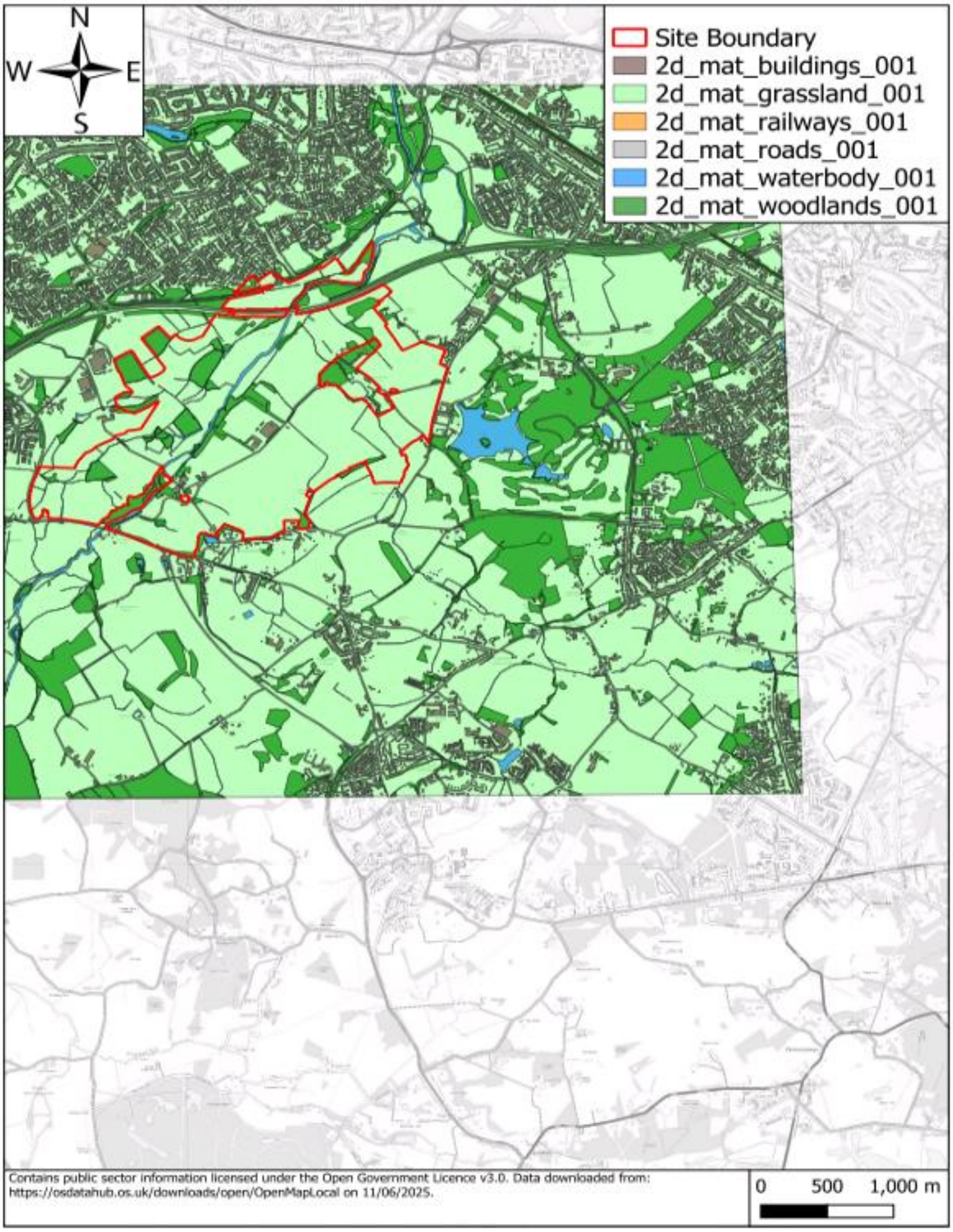


Figure 11 – eMapSite Materials Layers



3.7.6 **Table 3** summarises the land use types, and roughness values selected. The Manning's 'n' roughness values were taken from Chow, 1959.

Table 3 – Summary of Manning's 'n' Roughness Values

ID	Description	Manning's 'n' Roughness Value
10000	Grassland	0.056
10172	Roads and Pavements	0.020
10021	Buildings	1.000
10089	Waterbodies	0.035
10111	Woodland	0.100

3.7.7 A high Manning's 'n' value of 1 was used to represent the building locations within the model and direct flow around the buildings.

3.8 Structures in the 2D Domain

3.8.1 Five structures have been included within the 2D model domain. Key structures such a bridges were identified and included within the model to ensure the conveyance of flows through the structures.

3.8.2 **Figure 12** shows the location of the structures. **Table 4** summarises the structure dimensions.

Figure 12 – Location of 2D Structures

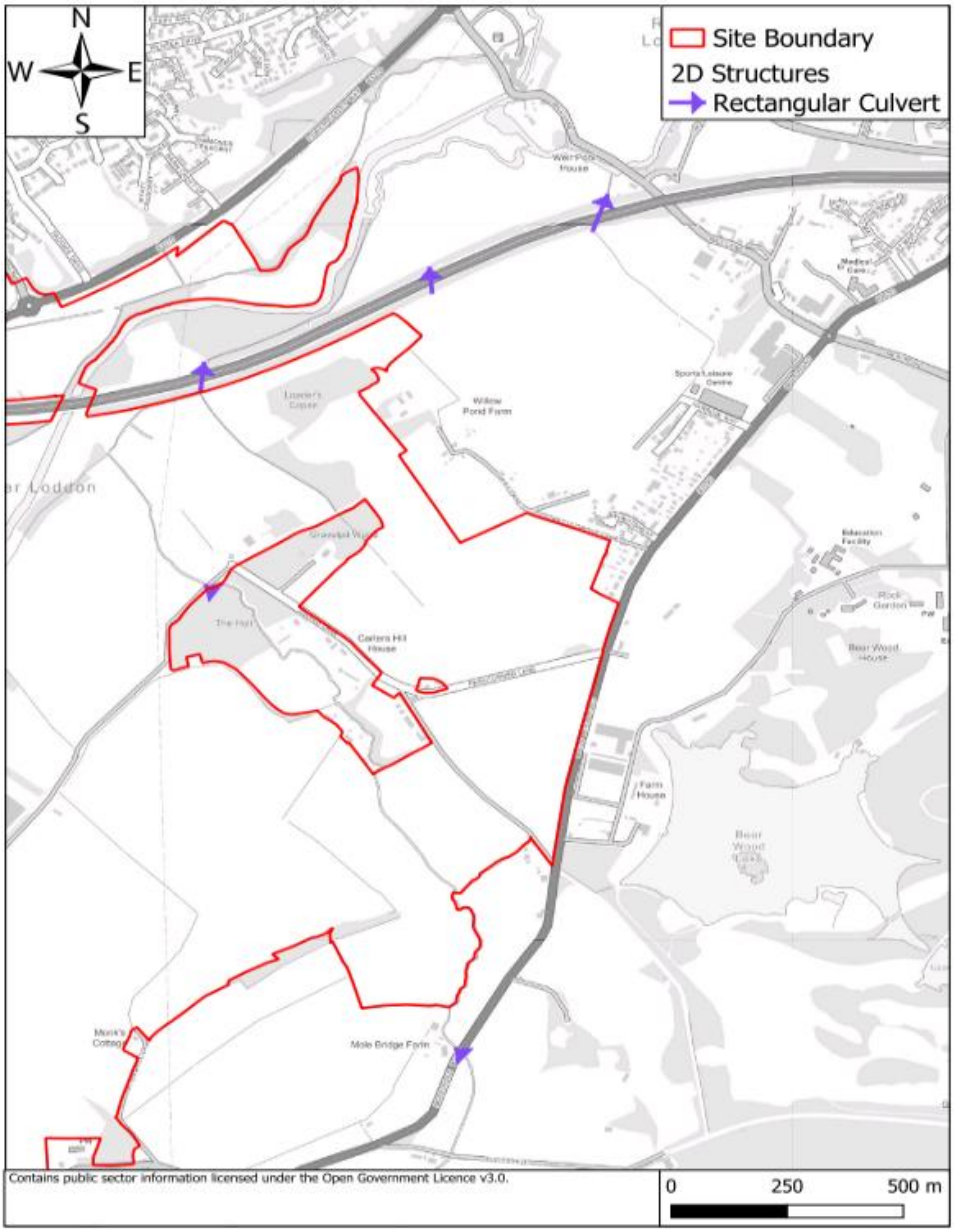


Table 4 – Summary of the 2D Structures

ID	Description	Type	Manning's 'n' Roughness Value	Length, m	Upstream Invert Level, m AOD	Downstream Invert Level, m AOD
LO05_0550C	M4 Bridge	R	0.015	50	38.75	38.50
LO26_0537C	M4 Bridge	R	0.015	48	38.19	38.19
LO56_0066C	M4 Bridge	R	0.015	50	37.42	37.42
LO05_2796C	Mole Road Bridge	R	0.015	11	42.50	42.50
LO05_1271C	The Holt Bridge	R	0.015	4	38.43	38.43

3.9 1D/ 2D Domain Links

3.9.1 The 1D in-channel and 2D floodplain components of the model are connected along the tops of the banks using HX lines.

3.10 1D/ 2D Bank Level Representation

3.10.1 Topographical survey data was used to inform the bank level representation.

3.11 Model Layers

3.11.1 **Table 5** summarises the layers used within the model domain.

Table 5 – 2D Model Layers

Layer	Purpose
1d_nwke_BB	Defines the location of the 1d channel and structures.
1d_xs_BB	Defines the 1d channel geometry.
1d_bc_BB_inflows	Defines the 1d model inflows.
1d_WLL_BB	WLL interpolate the 1d water levels across the 1d domain.
2d_code_BB_5m 2d_code_BB_1m	Defines the 2d model extent.
2d_code_river_BB	Defines the 1d model extent.
2d_bc_BB	Defines the floodplain boundary.
2d_bc_hxi_BB	Defines the link between the 1d and 2d model domains.
2d_rf_BB	Applies a rainfall hyetograph to the defined polygon.
2d_zsh_BB_P	Points defining levels along the zsh line which informs the bank levels.

2d_zsh_BB_L	Line informing the bank location. The levels are taking from the zsh points layer.
2d_zsh_BB_R	Polygon to interpolate ground levels.
2d_loc_L	Defines the model orientation.
2d_mat_BB_buildings	Defines the 2d roughness area for buildings.
2d_mat_BB_grassland	Defines the 2d roughness area for grassland.
2d_mat_BB_woodlands	Defines the 2d roughness area for woodlands.
2d_mat_BB_roads	Defines the 2d roughness area for roads and paths.
2d_mat_BB_waterbody	Defines the 2d roughness area for waterbodies.

3.12 Model Runs

3.12.1 The model was run for 25 hours with a fixed 2D timestep of 2.5 and 0.5 seconds for the 5m and 1m model domains and a fixed 1D timestep of 0.25 seconds.

3.12.2 The model was run for the following return periods:

- 1 in 30 annual probability;
- 1 in 100 annual probability;
- 1 in 1,000 annual probability; and
- 1 in 100 annual probability +40% climate change allowance.

3.12.3 The site is located within the Loddon and Tributaries Management Catchment. The relevant climate change allowance is the Upper End allowance which is +40% for this management catchment.

4 Sensitivity Testing

4.1.1 Sensitivity testing has been undertaken to assess the impact of uncertainty within the model and assumptions made.

4.2 Mannings 'n' Roughness

4.2.1 A 20% increase and decrease in the Mannings 'n' roughness estimations was modelled.

4.2.2 **Figure 13** and **Figure 14** shows the difference in the maximum flood extents for a ±20% increase and decrease in the Manning's 'n' roughness values.

Figure 13 – 1 in 100 Annual Probability +40% Climate Change Allowance Manning's Roughness Sensitivity 20% Increase

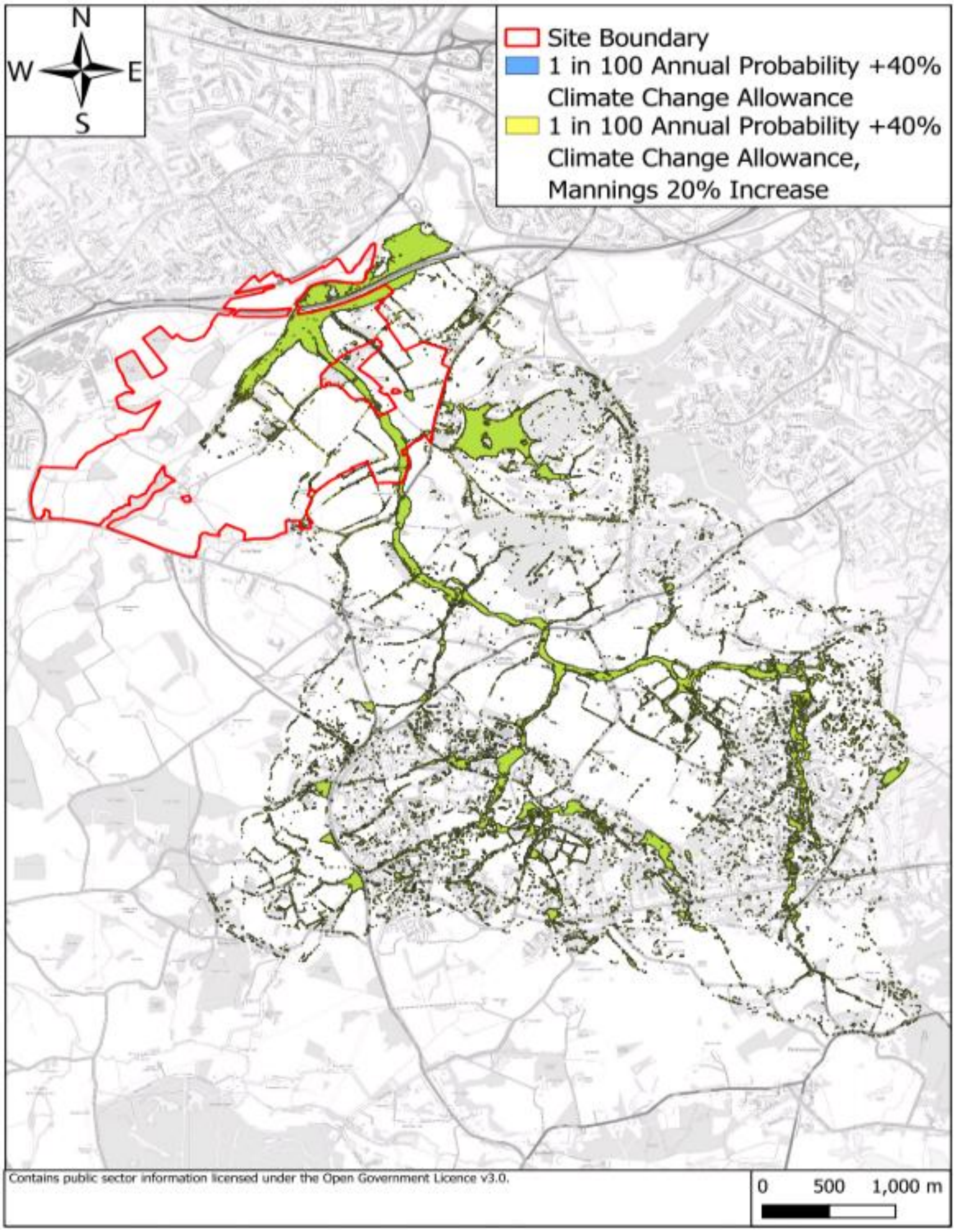
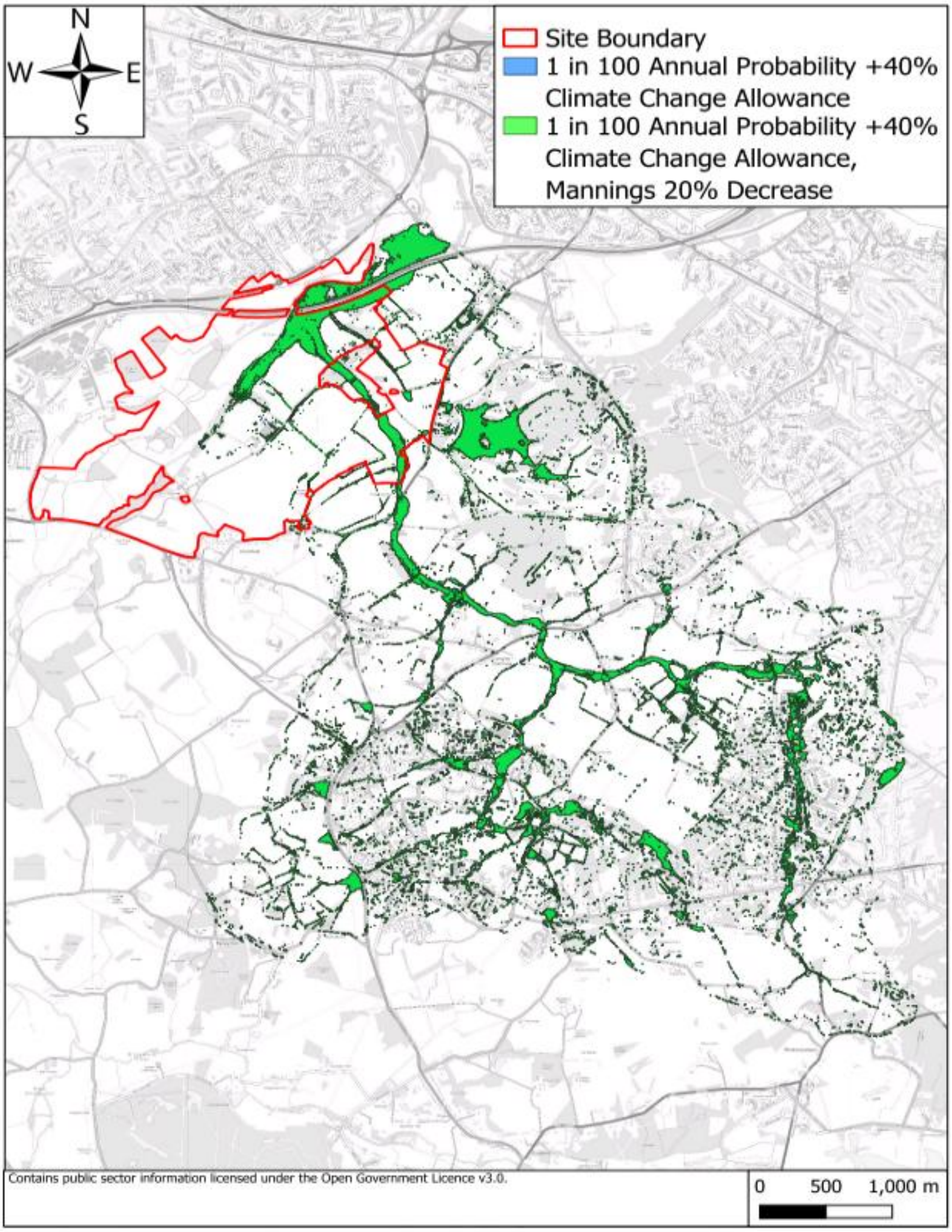


Figure 14 – 1 in 100 Annual Probability +40% Climate Change Allowance Manning's Roughness Sensitivity 20% Decrease



4.2.3 **Figure 13** shows that there is a slight increase in the modelled flood extents for the scenario with a 20% increase in the Manning's 'n' roughness values. This is as expected. The model is deemed to be insensitive to a 20% increase in the Manning's 'n' roughness values.

4.2.4 **Figure 14** shows that there is generally a slight decrease in the modelling flood extents for the scenario with a 20% decrease in the Manning's 'n' roughness values. This is as expected. The model is deemed to be insensitive to a 20% decrease in the Manning's 'n' roughness values.

4.3 Storm Duration

4.3.1 The default storm duration of 11 hours was accepted from ReFH2. Sensitivity has been carried out on the storm duration. **Figure 15** shows the modelled extent for a 9 hour storm. **Figure 16** shows the modelled extent for a 13 hour storm.

4.3.2 **Figure 15** and **Figure 16** shows that there was no significant difference in the modelled flood extents for either of the sensitivity storm durations.

Figure 15 – 1 in 100 Annual Probability +40% Climate Change Allowance 9 Hour Storm Duration

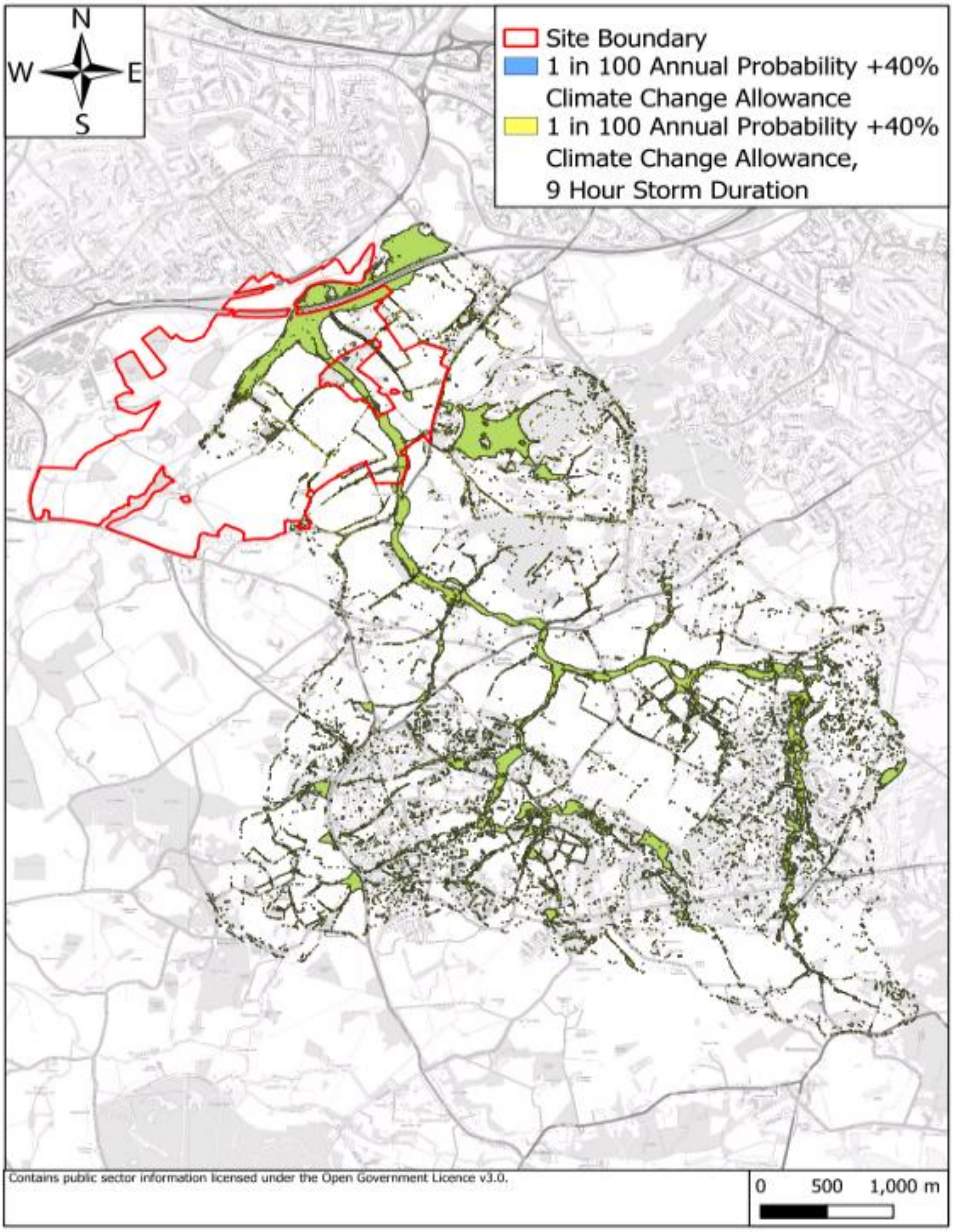
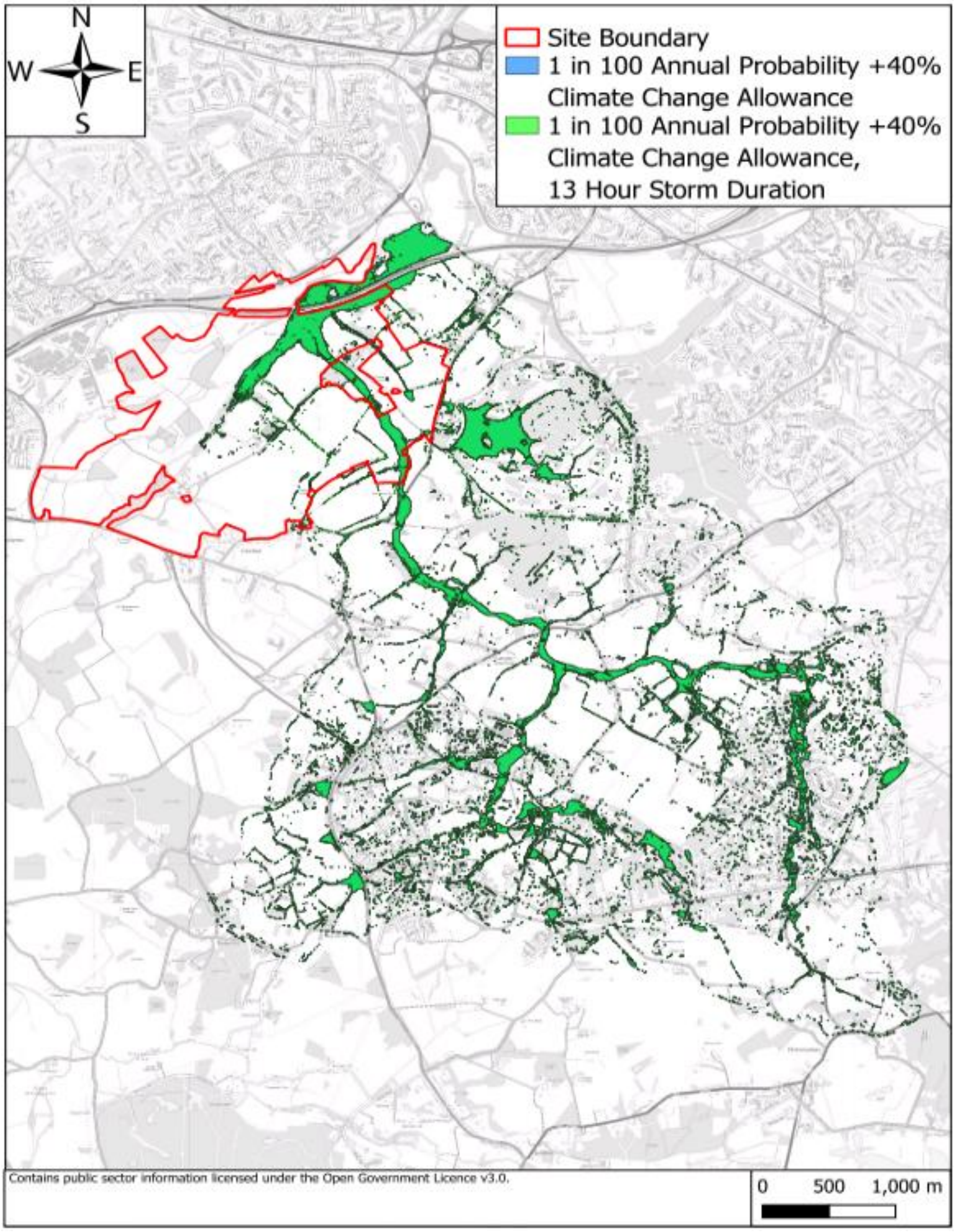


Figure 16 – 1 in 100 Annual Probability +40% Climate Change Allowance 13 Hour Storm Duration



4.4 Downstream Boundary Sensitivity

4.4.1 A 1 in 5 annual probability and a 1 in 20 annual probability flood levels from the Stantec River Loddon model were taken as two downstream boundary sensitivity scenarios. The 1 in 100 annual probability Loddon flood level was taken for the baseline model. However, in reality due to the catchment sizes and response times, it is unlikely that the peak of a 1 in 100 annual probability scenario on the Loddon would occur at the same time, therefore it is a conservative approach and likely an overestimate.

4.4.2 **Figure 17** and **Figure 18** show the modelled extents when a downstream boundary of 1 in 5 annual probability and 1 in 20 annual probability flood level from the Stantec River Loddon model is used.

Figure 17 – 1 in 100 Annual Probability +40% Climate Change Allowance, River Loddon 1 in 5 Annual Probability Downstream Boundary Sensitivity

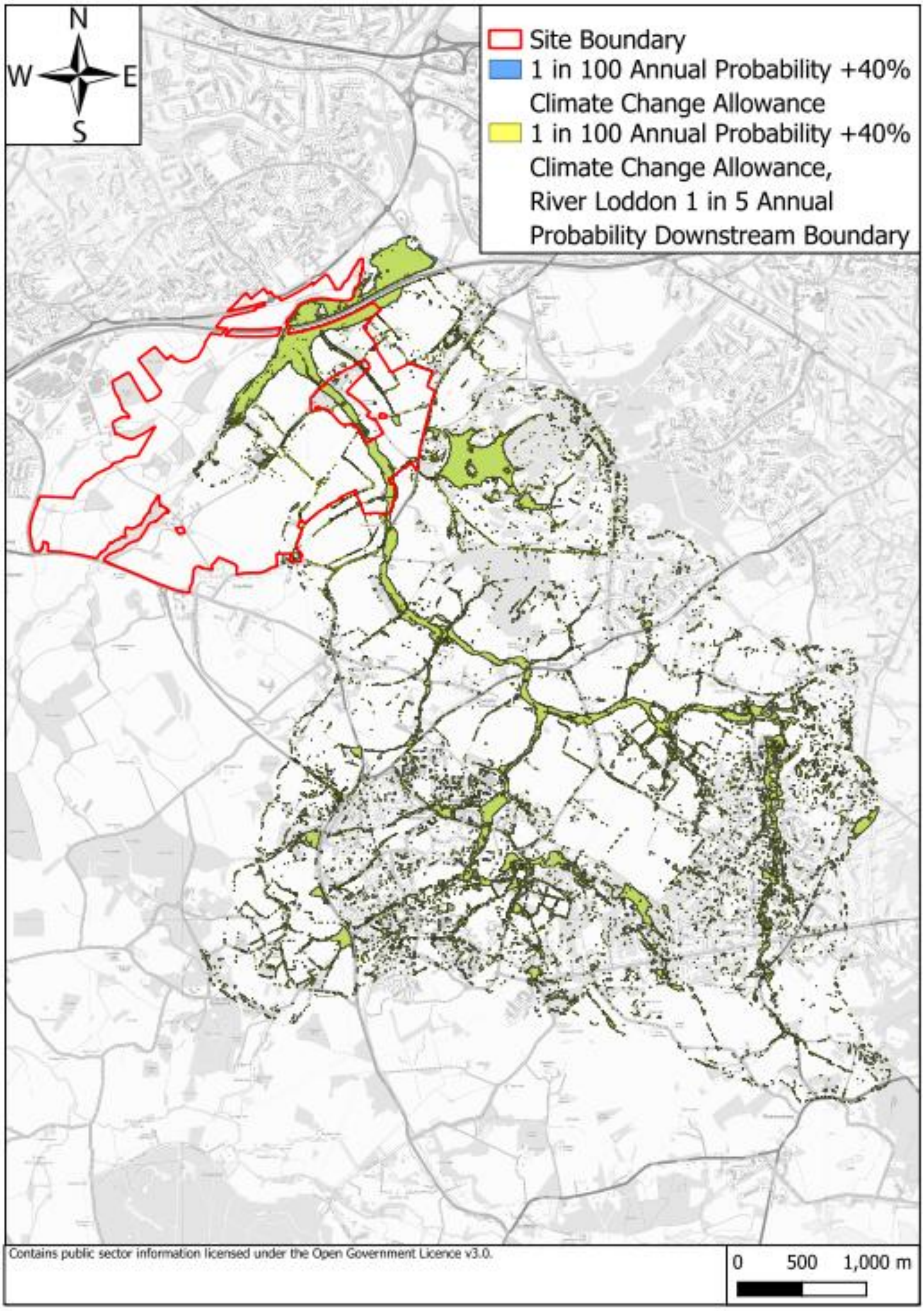
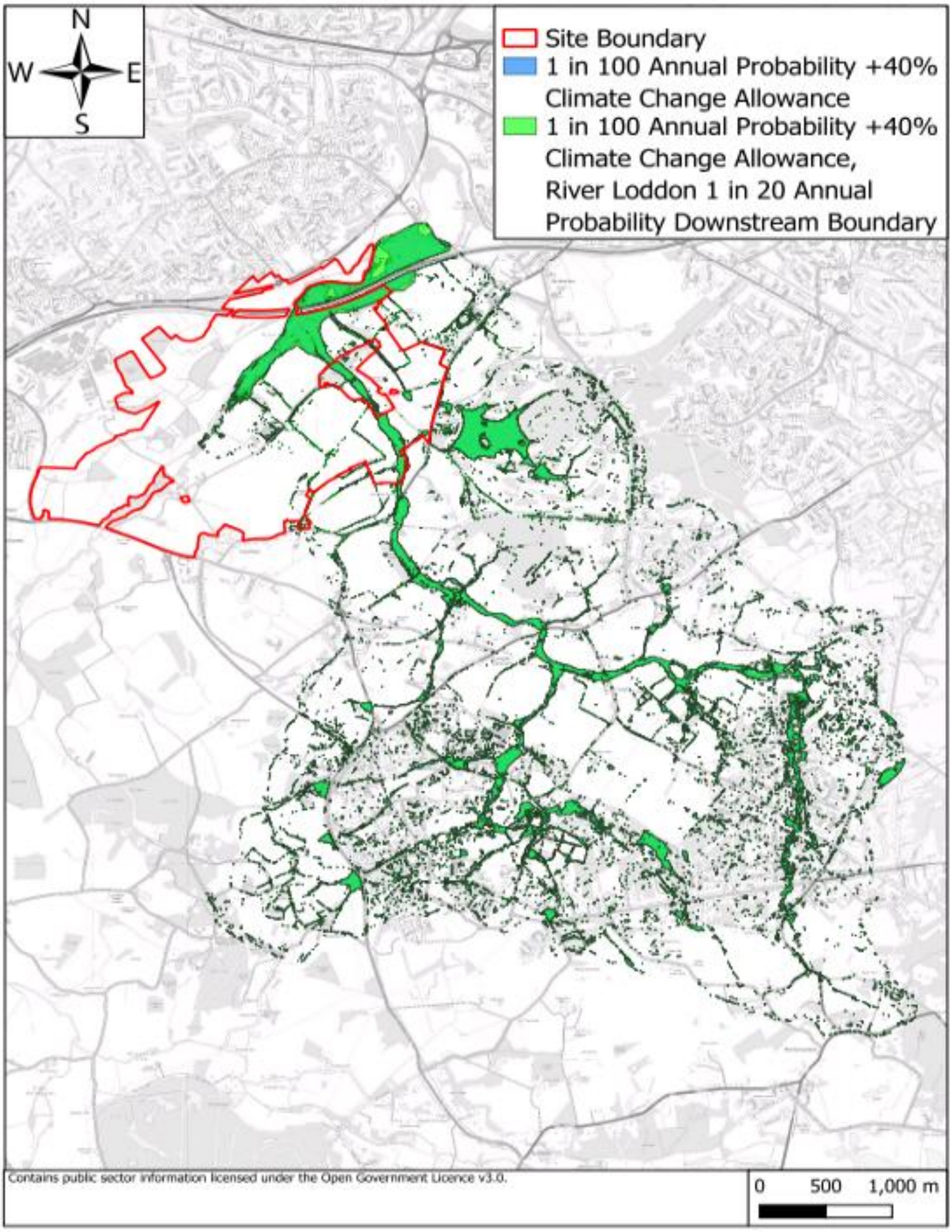


Figure 18 –1 in 100 Annual Probability +40% Climate Change Allowance, River Loddon 1 in 20 Annual Probability Downstream Boundary Sensitivity



4.4.3 **Figure 17** and **Figure 18** show that there are some difference in the downstream extent of the site, as would be expected as the downstream extent of the catchment is dominated by flooding from the River Loddon. However, there is minimal impact on flood levels and extents through the area where Barkham Brook and its tributaries are the dominant source of flood risk.

4.5 Blockage Sensitivity

4.5.1 The culverts in the model are modelled as clear culverts. Future maintenance schedules are unknown therefore the culverts have been modelled as 50% and 90% blocked to assess the impact of this on the modelled flood extents.

4.5.2 **Figure 19** and **Figure 20** show the modelled flood extents for all culverts in the model blocked by 50% and 90% respectively. **Figure 21** shows a more detailed view of the M4 area flood extents.

Figure 19 – 1 in 100 Annual Probability +40% Climate Change Allowance, 50% Culvert Blockage Scenario

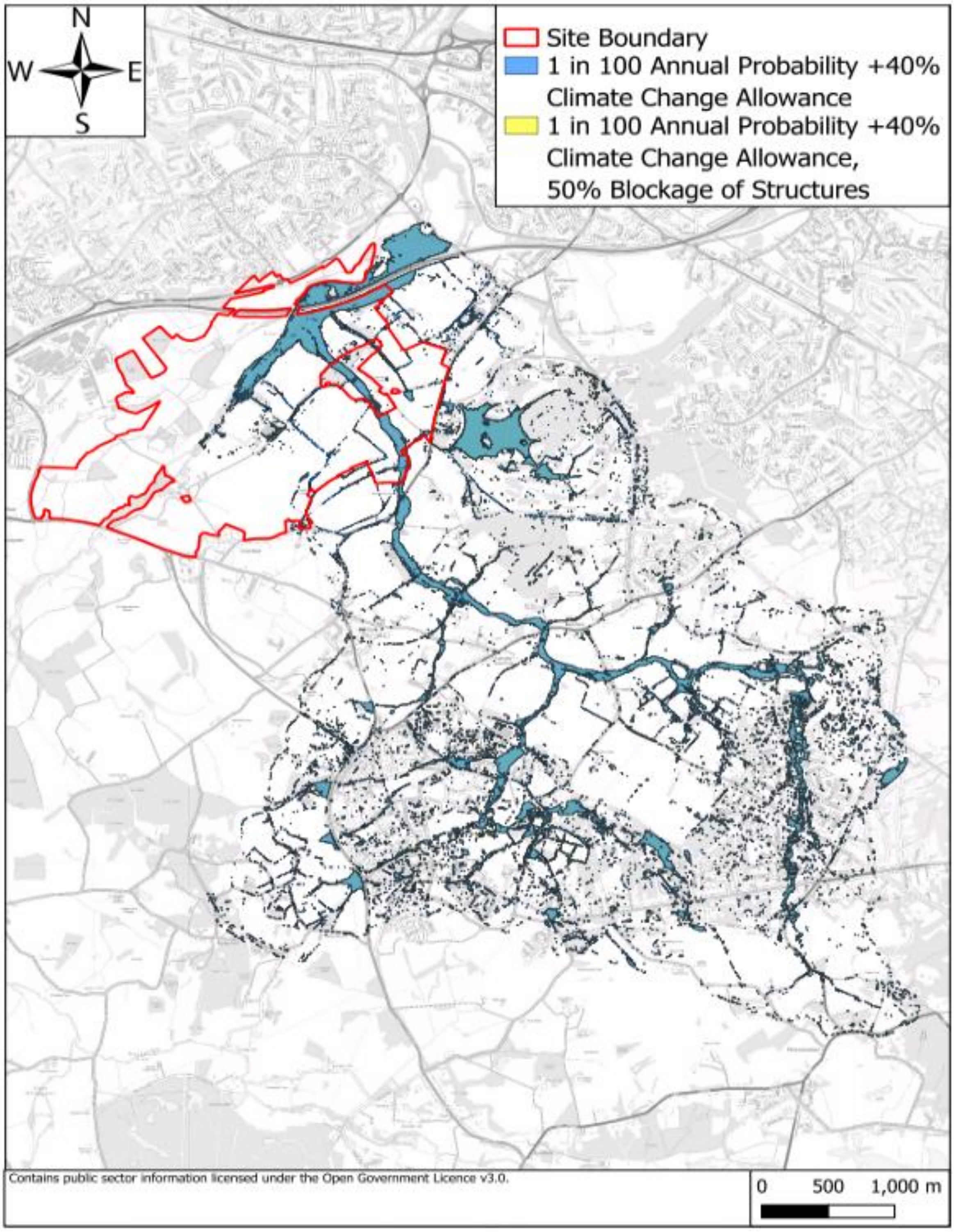


Figure 20 - 1 in 100 Annual Probability +40% Climate Change Allowance, 90% Culvert Blockage Scenario

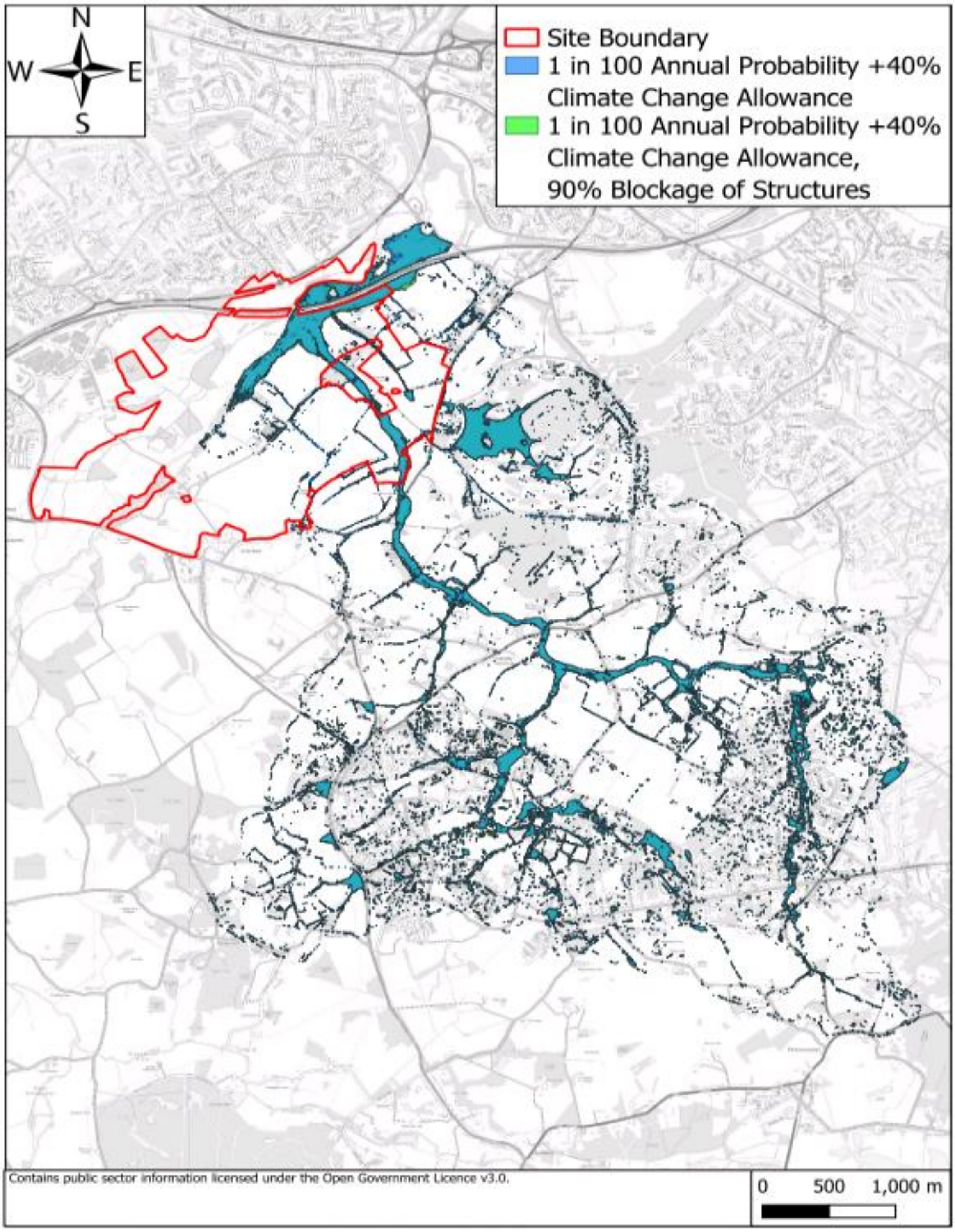
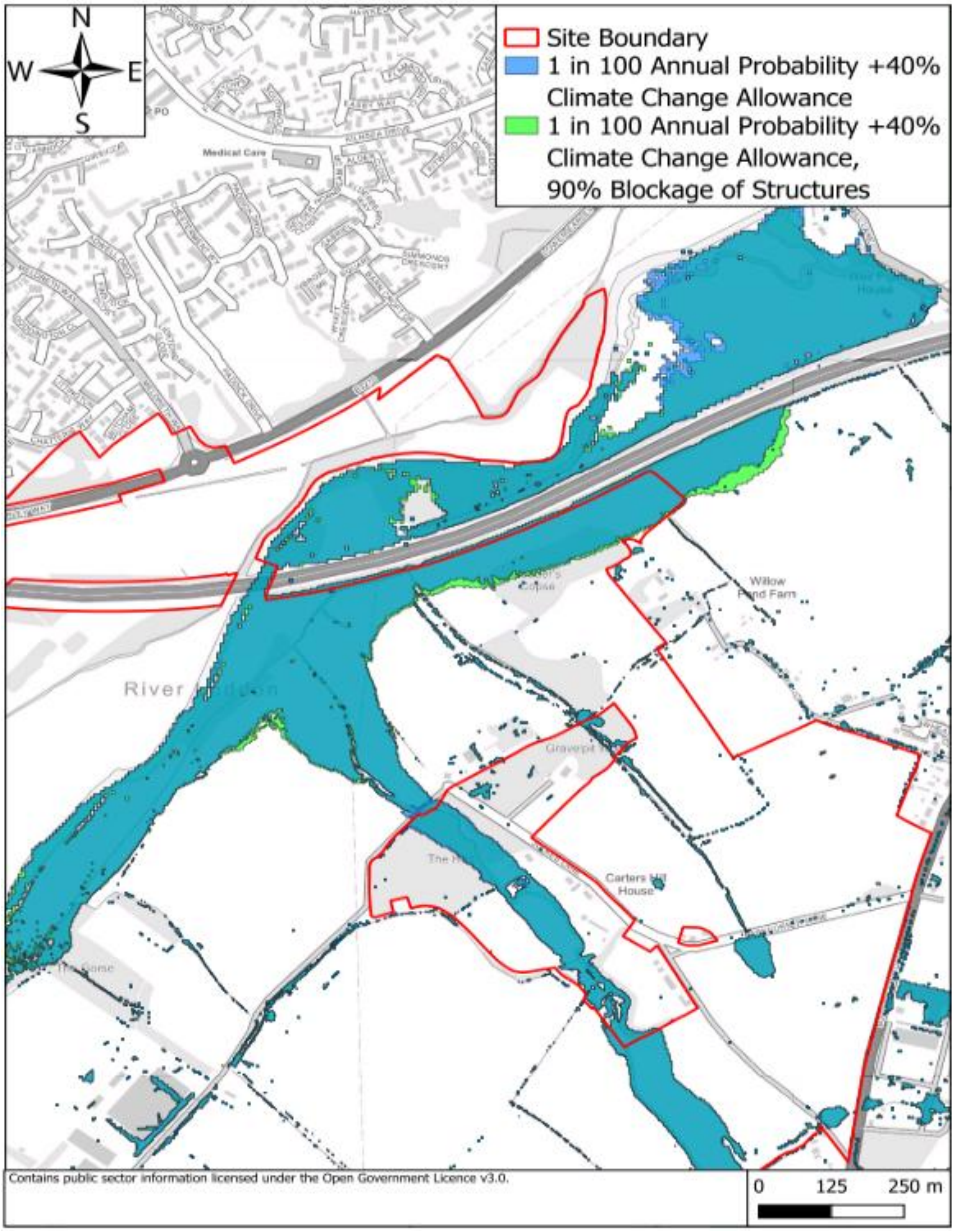


Figure 21 – 1 in 100 Annual Probability +40% Climate Change Allowance, 90% Culvert Blockage Scenario, M4 View



4.5.3 **Figures 19** and **Figure 20** show that there is a slight increase in flooding upstream of the structures, in particular upstream of the M4. **Figure 21** provides a more detailed view of this area. An increase in flooding was expected upstream of these structures as less water is conveyed through them. The location of the increased extents does not impact the masterplan for the development.

5 Model Results

5.1 Flood Extents

Overview

5.1.1 The model was run and the results were extracted for the following events:

- 1 in 30 annual probability;
- 1 in 100 annual probability;
- 1 in 1,000 annual probability; and
- 1 in 100 annual probability plus 40% climate change allowance.

5.2 Summary of the Model Outputs

5.2.1 The model is a direct rainfall model. Due to the nature of direct rainfall models, the entire 2D model domain is shown to be wet in the raw model results (as rain falls across the whole model domain). The raw model results are filtered which removes all cells with flood depths below a certain depth to show areas of flooding and remove areas that are wet due to the direct rainfall modelling method. In direct rainfall modelling, the threshold depth is generally accepted as 0.075m. This approach leads to some isolated areas of ponding. This is the same depth as the EA use in the NaFRA Risk of Flooding from Surface Water mapping.

5.3 Limitations and Assumptions

5.3.1 Key limitations and assumptions of the study are listed below:

- The FEH catchment descriptors are representative of the catchment.
- The LiDAR data is representative of the elevations across the catchment (for this study a sense check was undertaken but not a detailed review).
- The topographical survey of the elevations across the site are representative (for this study a sense check was undertaken but not a detailed review).
- The materials data is representative of the roughness of the catchment (for this study a sense check was undertaken but not a detailed review).
- A 5m and 1m grid size was used to represent the floodplain. This grid size is considered to be appropriate for the rural location and proposed development. The grid size provides a reasonable balance between the model resolution and the model run time.
- As with all hydraulic modelling, there remains some residual uncertainty within the model results. However, we have tried to mitigate this through the sensitivity testing.

6 Conclusions

6.1.1 This modelling report has been prepared by Abley Letchford, on behalf of the University of Reading to refine the surface water extents for the Barkham Brook catchment, in Berkshire.

6.1.2 The model was run for the following return periods: 1 in 30, 1 in 100, and 1 in 1000 annual probability. The maximum flood levels and extents were extracted for all of the modelled return periods.

6.1.3 The site is located within the Loddon and Tributaries Management Catchment. The latest (July 2021) climate change allowances for the catchment is +40% for the Upper End allowance which is to be used to inform FRA studies. The maximum flood levels and extents were extracted for all the modelled climate change scenario.

6.1.4 A hydrological assessment was undertaken to provide hyetographs for the catchment. The FEH catchment descriptors were reviewed and refined using a desk-based assessment. ReFH2 software was used for the hydrological assessment.

6.1.5 Sensitivity testing will be undertaken to assess the impact of uncertainty within the model and assumptions made. This will include Mannings roughness, storm duration, downstream boundary level and the blockage of key structures. The sensitivity testing showed that the modelling was insensitive to the assumptions made for roughness and storm duration. The sensitivity testing showed that the area of the catchment dominated by flooding from the River Loddon was sensitive to the downstream boundary level, but the model was insensitive where the Barkham Brook and tributaries are the dominant source of flood risk. The sensitivity showed that there was an increase in the modelled flood extents upstream of the blocked culverts, in particular at the M4, which was as expected, however this should not impact the masterplan.

Appendices

Appendix A - Hydrological Report

HALL FARM, LODDON GARDEN VILLAGE SDL

HYDROLOGICAL ASSESSMENT: BARKHAM BROOK FLUVIAL MODEL

UNIVERSITY OF READING

20 June 2025

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Date:	20 June 2025
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Appendices

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1 Summary of Assessment

1.1 Summary

1.1.1 This Flood Estimation Report has been prepared by Abley Letchford, on behalf of University of Reading to provide hyetographs for a direct rainfall model of the Barkham Brook catchment in Berkshire using the latest data, software and methods proportionate to the scope of work.

1.1.2 The study is considered to be moderate based on the Environment Agency (EA) Flood Estimation Guidance competency framework. Bearwood Lake which is a reservoir is located within the Barkham Brook catchment.

1.1.3 The catchment has the urban areas of Finchampstead, Arborfield Green, Arborfield and Barkham within it.

1.1.4 Bearwood Lake, a reservoir, is located within the Barkham Brook catchment. The catchment does not have extensive floodplain storage.

1.1.5 The catchment is not groundwater driven. They key mechanism of flooding is therefore flood flows exceeding the channel capacity and surface water runoff.

1.1.6 The catchment is ungauged and therefore a limitation of the study is the lack of locally available information.

1.1.7 The final choice of method was ReFH2.

1.2 Flood Frequencies

1.2.1 The frequency of a flood event can be expressed in either annual exceedance probability (AEP) or as a return period. A return periods is defined as the average time between years with a larger flood event. An AEP is defined as the probability of a certain size event being exceeded over a given period.

1.2.2 **Table 1** provides a conversion between return periods and AEP.

Table 1 – Annual Exceedance Probability (AEP) and Related Return Period

Annual Exceedance Probability (%)	50	20	10	5	3.33	2	1.33	1	0.5	0.1
Annual Exceedance Probability	0.5	0.2	0.1	0.05	0.033	0.02	0.0133	0.01	0.005	0.001
Return Period (years)	2	5	10	20	30	50	75	100	200	1,000

2 Method

2.1 Requirement for Flood Estimates

Overview

2.1.1 This study provides hyetographs for a direct rainfall model for the Barkham Brook catchment east of the River Loddon at in Berkshire. The latest data, methodologies and software have been used, proportionate to the scope of works.

2.1.2 The study derives hyetographs for the Barkham Brook catchment.

2.1.3 As part of the study, hyetographs will be calculated for the following return periods:

- 1 in 2
- 1 in 5
- 1 in 10
- 1 in 20
- 1 in 30
- 1 in 50
- 1 in 75
- 1 in 100
- 1 in 200
- 1 in 1000

2.1.4 Climate change will be considered for the 1 in 100 annual probability scenario. This will be discussed separately.

2.2 Project Scope

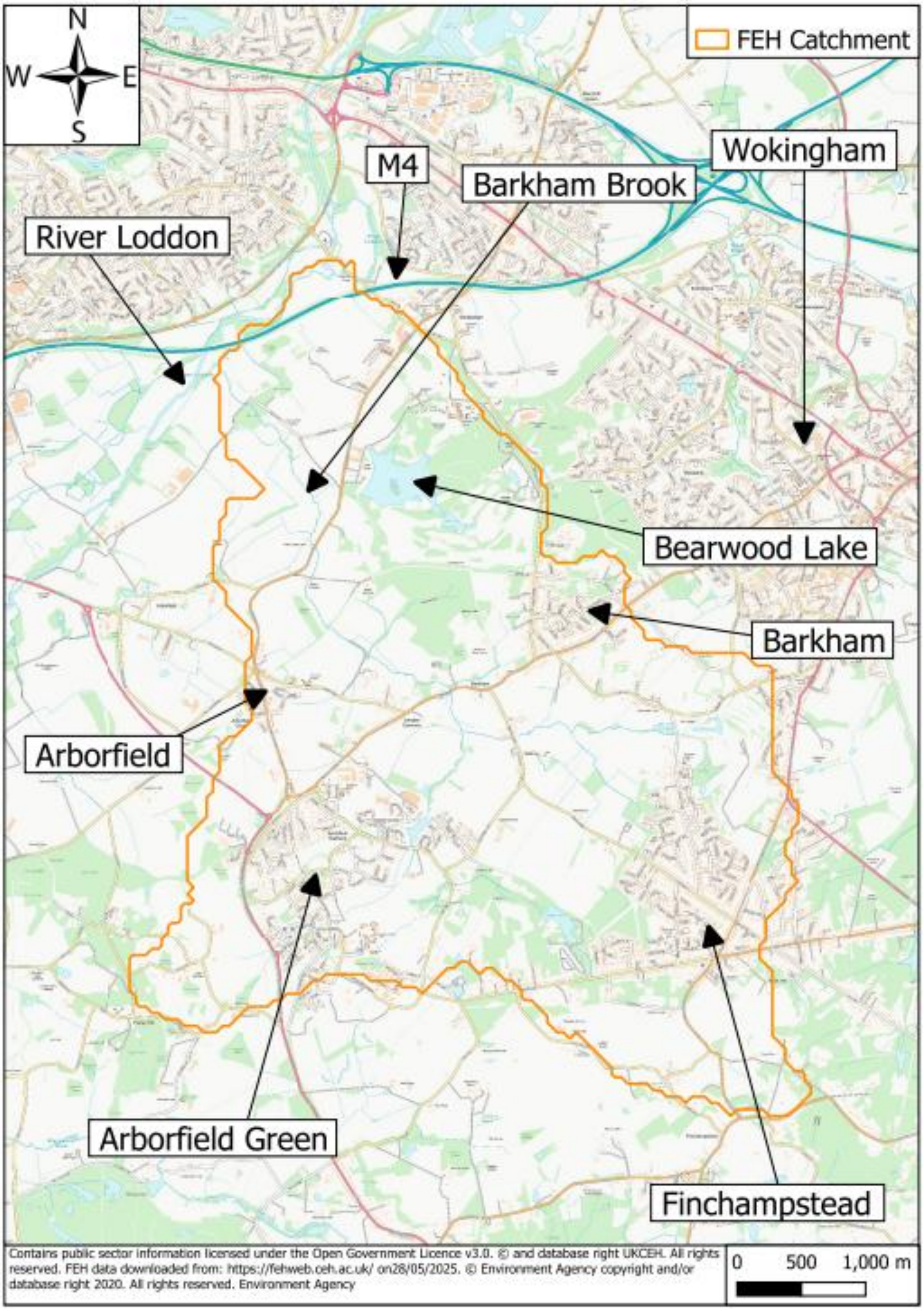
2.2.1 This study is considered to be moderate based on the EA Flood Estimation Guidance competency framework based on the presence of Bearwood Lake (reservoir) within the Barkham Brook catchment.

2.2.2 The hyetographs will be used in a direct rainfall model of the catchment to refine the modelled surface water flood extents of the catchment.

2.3 Catchment

2.3.1 The catchment area was downloaded from the FEH Web Service as part of the catchment descriptors. The catchment area, watercourses and site location are shown in **Figure 1**.

Figure 1 – Catchment Overview



2.3.2 Barkham Brook watercourse rises from the woodland area to the south of Nine Mile Ride road in Finchampstead (grid reference). Barkham Brook flows in a northerly direction into the lakes at

California Country Park to the north of Nine Mile Ride road before continuing in a northerly direction through Arborfield Green, and towards the River Loddon at Shinfield. Barkham Broom discharges into the River Loddon at approximately SU76430 70030. This is at the downstream extent of the area of interest.

2.3.3 The FEH catchment area for Barkham Brook is 19.7km2.

2.3.4 The Barkham Brook catchment has the urban areas of Finchampstead, Arborfield Green, Arborfield and Barkham in the upper and central areas of the catchment.

2.3.5 Arborfield Drain watercourse rises to the north of Swallowfield Road. It flows in a north westerly direction through Arborfield towards the River Loddon.

2.3.6 The area of interest is at the downstream extent of the catchment, as shown in **Figure 1**. Barkham Brook is the main river through the site.

2.3.7 The catchment is predominantly rural. The urban areas of Finchampstead, Arborfield Green, Arborfield and Barkham are located within the catchment.

2.4 Sources of Data

2.4.1 The latest (Version 13, September 2024) NFRA peak flow datasets were used. The dataset has been updated to include data until 30th September 2023.

2.4.2 No changes were made to the peak flow datasets.

2.5 Gauging Stations (Flow and Level)

2.5.1 There are no available gauging stations within the catchment.

2.6 Other Data Sources

2.6.1 **Table 2** summarises other sources of data used within the study

Table 2 – Summary of Other Sources of Data

Data	Relevance	Availability	Source	Details
Check flow gauging	Yes	No	NA	NA
Historic flood data	Yes	No	NA	NA
Flow or river level data for events	Yes	No	NA	NA
Rainfall data for events	Yes	No	NA	NA
Potential evaporation data	No	NA	NA	NA
Results from previous studies	Yes	No	NA	NA
Other data	No	NA	NA	NA

2.7 Hydrological Understanding of the Catchment

Conceptual Model

2.7.1 The site location and catchment area are shown in **Figure 1**. The likely cause of flooding at the site is flood flows exceeding the channel capacity and surface water flows.

Unusual Catchment features

2.7.2 The upper and central reaches of the catchment are urbanised. The watercourse flows through the urban areas of Finchampstead, Arborfield Green, Arborfield and Barkham.

2.7.3 Bearwood Lake, which is a reservoir, is located within the Barkham Brook catchment. It is located to the northwest of Barkham.

2.7.4 The catchment is not pumped.

2.7.5 The catchment is not highly permeable.

2.7.6 The catchment has not been previously mined.

2.8 Initial Choice of Approach

Is FEH Appropriate

2.8.1 FEH methods are considered to be appropriate, as the UK regulatory recommended methods for estimation of river flood frequency and design rainfall in England.

2.8.2 The ReFH2 (version 2.3) methods will be carried out.

2.8.3 The hydrograph shapes will be derived using ReFH2.

2.8.4 A lumped catchment will be used for deriving the hyetographs at the downstream point of the catchment.

Software

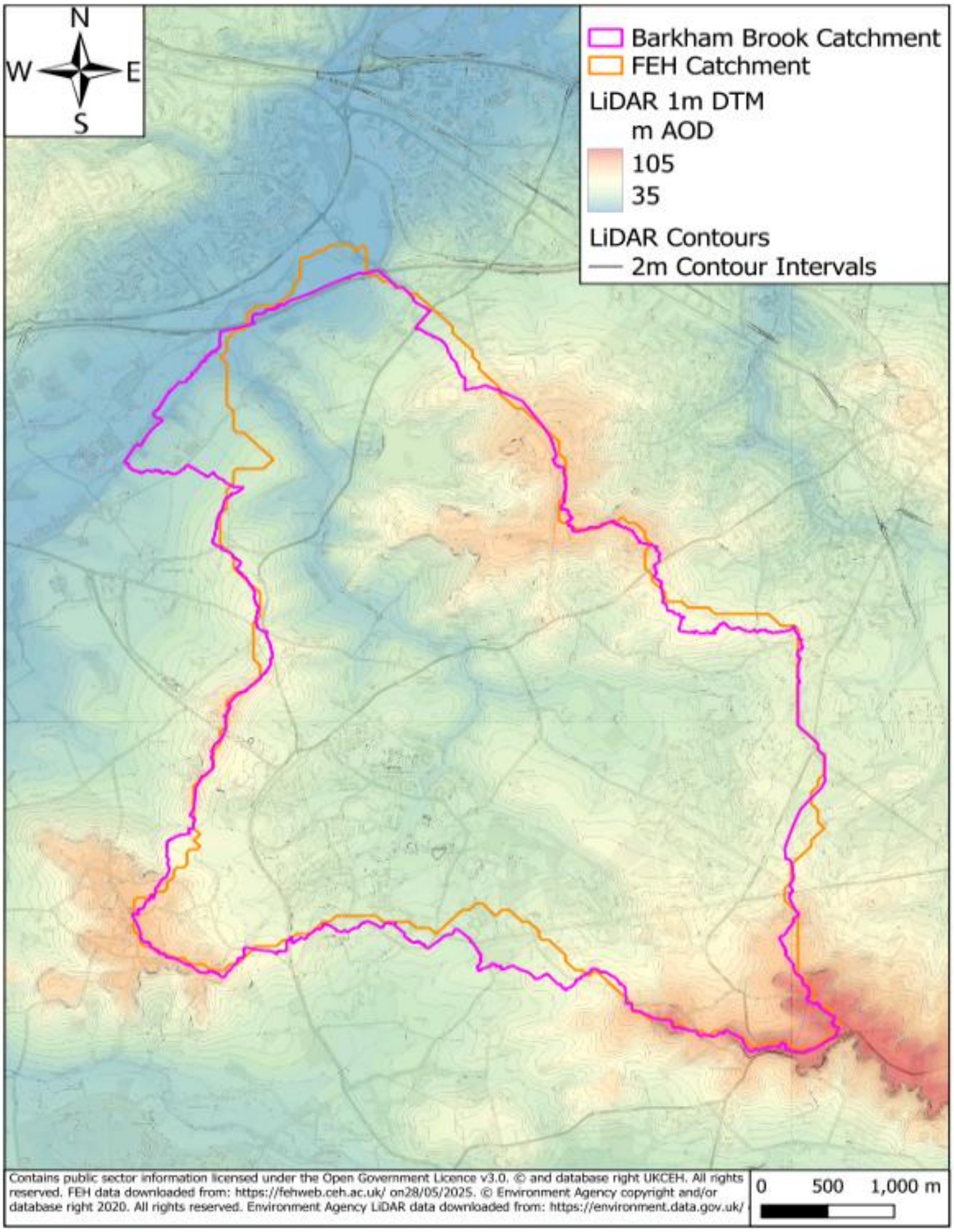
2.8.5 The following software was used in this study:

- FEH Web Service; and
- ReFH2.3.

3 Flood Estimates

3.1.1 **Figure 2** shows the located of the FEH catchment, adjusted catchment and site location.

Figure 2 – Comparison of the FEH Catchment and Adjusted Catchment Areas



3.1.2 **Table 3** summarises the subject sites.

Table 3 – Summary of the Subject Site

Site Code	Type of Estimate L – lumped catchment C – sub catchment	Watercourse	Site Name	Easting	Northing	FEH Area (km²)	Revised Area (km²)
BB01	L	Barkham Brook and tributaries	Barkham Brook and tributaries	476900	170150	19.7	20.3

3.2 Imported Catchment Descriptors

3.2.1 The catchment descriptors were extracted from the FEH Web Service.

3.2.2 The red text in **Table 4** has been used to identify the catchment descriptors that have been updated from the FEH downloaded values.

Table 4 – Summary of the Updated FEH Catchment Descriptors

Site Code	FARL	PROWET	BFIHOST	BFIHOST19	DLPBAR (km)	DPSBAR (m/km)	SAAR (mm)	URBEXT1990	URBXT2000	FPEXT
BB01	0.983	0.29	0.451	0.452	2.5	25.5	656	0.0527	0.135	0.1287

3.3 Checking Catchment Descriptors

Catchment Boundary

3.3.1 The FEH Online Service catchment boundary was checked using LiDAR data and Ordnance Survey data.

3.3.2 The catchment boundary was adjusted to consider the slope of the catchment are the road drainage network.

3.3.3 The catchment area increased from 19.7km² 20.3km², an increase of 0.6km².

BFIHOST and SPRHOST

3.3.4 BFIHOST, BFIHOST19 and SPRHOST values for the catchment were checked using the Soil Survey for England and Wales soil type mapping/ Soilscapes online viewer and Cranfield University Soil Site Report.

3.3.5 The descriptor values were updated to reflect the changes to the catchment area.

FARL

3.3.6 The FARL value was checked against OS mapping, satellite imagery, site observations and the FEH Web Service information on reservoir and lake storage areas.

3.3.7 The FARL value is considered to be appropriate.

URBEXT

3.3.8 The urban extents on the FEH Web Service were compared with OS urban extents. The urban areas of Finchampstead, Arborfield Green, Arborfield and Barkham are located within the catchment.

3.3.9 FEH Volume 5 Equation 6.2 was used to calculate the URBEXT value. Equation 4.5 in 'URBEXT2000- a new catchment descriptor' was used to calculate the URBEXT2000 value.

4 Revitalised Flood Hydrograph 2 (ReFH2)

4.1 Application of the ReFH2 Method

4.1.1 The purpose of carrying out the ReFH2 method is to estimate hyetographs for the catchment.

4.2 Parameters for ReFH2 Model

4.2.1 **Table 9** provides a summary of ReFH2 method peak flows.

Table 9 – Summary of ReFH2 Peak Flows

Site code	Method	Tp_{rural} (hours)	Tp_{urban} (hours)	C_{max} (mm) Maximum storage capacity	PR_{imp}	BL (hours) Baseflow lag	BR Baseflow recharge
BB01	CD	7.21	-	372.88	70%	45.32	1.76
OPT: Optimisation, BR: Baseflow recession fitting, CD: Catchment descriptors, DT: Data transfer							

4.3 Design Events for ReFH2 Method

4.3.1 **Table 10** provides a summary of the ReFH2 design event parameters.

Table 10 – Summary of Design Parameters

Site code	Urban or rural	Season of design event	Storm duration (hours)	Storm area for ARF
BB01	Rural	Winter	11	0.96

4.4 Flood Estimates from the ReFH2 Method

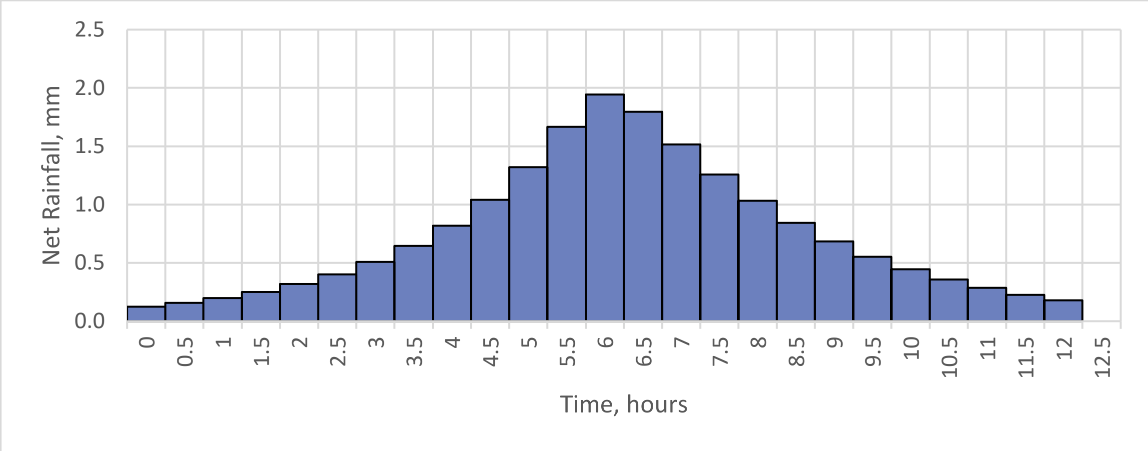
4.4.1 **Table 11** provides a summary of the ReFH2 method peak rainfall.

Table 11 – Summary of ReFH2 Method Peak Rainfall

Site code	Peak Rainfall (mm) for the following return periods (in years)									
	2	5	10	20	30	50	75	100	200	1000
BB01	1.3	1.9	2.3	2.6	2.9	3.2	3.5	3.7	4.4	6.7

4.4.2 **Figure 3** shows the 1 in 100 annual probability hyetograph.

Figure 3 – 1 in 100 Annual Probability Hyetograph



5 Discussion and Summary of Results

5.1 Choice of Method

5.1.1 The ReFH2 method was selected for this study.

5.2 Assumptions, Limitations and Uncertainty

Assumptions

5.2.1 The following assumptions were made in this study:

- The catchment descriptors are representative of the catchment
- The catchment areas are representative of the areas being drained
- The QMED values calculated are representative
- The pooling groups derived are representative of the subject catchments
- The ReFH2 hydrograph shapes are representative of the catchment response.

Limitations

5.2.2 A limitation of this study is that gauge data is not available.

Uncertainty

5.2.3 Uncertainty is not currently assessed within ReFH2.

Suitability for Future Studies

5.2.4 The hyetographs calculated as part of this study are specific to the model extent. If future studies are located within the model extent, the results should be reviewed at a minimum. If future studies are located outside of the model boundary, an update to the hydrology may be required.

5.3 Checks

5.3.1 **Table 13** provides a summary of the checks carried out.

Table 13 – Summary of Checks

Are the results consistent, for example at confluences?	NA – a single point estimate is being considered.
What do the results imply regarding the return periods of floods during the period of record?	NA – no gauge data of historic flood records available for comparison.
What is the 100-year growth factor? Is this realistic? (The guidance suggests a typical range of 2.1 to 4.0)	2.64. This is within the typical range.
If 1000-year flows have been derived, what is the range of ratios for 1000-year flow over 100-year flow?	1.63.

How do the results compare with those of other studies? Explain any differences and conclude which results should be preferred.	The EA Lower Loddon Flood Study dated 2006 included the Barkham Brook as a subcatchment. Hydrology methods and software have progressed over the 19 years since the EA study was completed, and additional years of recorded data are now available, therefore the Abley Letchford results are preferred.
Are the results compatible with the longer-term flood history?	Data from historic flood was not available at this site.
Describe any other checks on the results	NA

5.4 Final Results

5.4.1 The final accepted peak rainfall values for this study are summarised in **Table 14**.

Table 14 – Summary of the Final Accepted Peak Rainfall

Site code	Peak rainfall (mm) for the following return periods (in years)									
	2	5	10	20	30	50	75	100	200	1000
BB01	1.3	1.9	2.3	2.6	2.9	3.2	3.5	3.7	4.4	6.7

Appendices

Appendix 1 - Additional Information

UK Design Flood Estimation

Generated on 28 May 2025 14:51:24 by Hydro
Printed from the ReFH2 Flood Modelling software package, version 4.1.8879.22310

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH2)

Site details

Checksum: 1E39-7CBB

Site name: BB_101

Easting: 476900

Northing: 170150

Country: England, Wales or Northern Ireland

Catchment Area (km²): 20.3

Using plot scale calculations: No

Model: 2.3

Site description: None

Model run: 100 year

Summary of results

Rainfall - FEH22 (mm):	75.83	Total runoff (ML):	406.15
Total Rainfall (mm):	49.97	Total flow (ML):	1014.70
Peak Rainfall (mm):	11.36	Peak flow (m³/s):	10.29

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH22)

Name	Value	User-defined?
Duration (hh:mm:ss)	11:00:00	No
Timestep (hh:mm:ss)	01:00:00	No
SCF (Seasonal correction factor)	0.69	No
ARF (Areal reduction factor)	0.96	No
Seasonality	Winter	No

Loss model parameters

Name	Value	User-defined?
Cini (mm)	110.25	No
Cmax (mm)	372.88	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	7.21	No
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0.6	No
BL (hr)	48.32	No
BR	1.76	No

Urbanisation parameters

Name	Value	User-defined?
Sewer capacity (m^3/s)	0	No
Exporting drained area (km^2)	0	No
Urban area (km^2)	4.29	No
Effective URBEXT2000	0.14	n/a
Impervious runoff factor	0.7	No
Imperviousness factor	0.4	No
Tp scaling factor	0.75	No
Depression storage depth (mm)	0.5	No

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m^3/s)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	1.097	0.000	0.368	0.000	0.550	0.550
01:00:00	1.838	0.000	0.630	0.016	0.539	0.555
02:00:00	3.064	0.000	1.068	0.075	0.529	0.605
03:00:00	5.066	0.000	1.818	0.209	0.522	0.731
04:00:00	8.244	0.000	3.097	0.468	0.519	0.987
05:00:00	11.357	0.000	4.547	0.940	0.526	1.466
06:00:00	8.244	0.000	3.505	1.738	0.548	2.286
07:00:00	5.066	0.000	2.239	2.860	0.593	3.453
08:00:00	3.064	0.000	1.385	4.177	0.669	4.846
09:00:00	1.838	0.000	0.843	5.544	0.779	6.323
10:00:00	1.097	0.000	0.507	6.830	0.924	7.754
11:00:00	0.000	0.000	0.000	7.885	1.101	8.986
12:00:00	0.000	0.000	0.000	8.551	1.305	9.857
13:00:00	0.000	0.000	0.000	8.759	1.526	10.286
14:00:00	0.000	0.000	0.000	8.524	1.751	10.275
15:00:00	0.000	0.000	0.000	7.982	1.966	9.948
16:00:00	0.000	0.000	0.000	7.273	2.163	9.436
17:00:00	0.000	0.000	0.000	6.496	2.338	8.834
18:00:00	0.000	0.000	0.000	5.719	2.488	8.207
19:00:00	0.000	0.000	0.000	4.974	2.612	7.586
20:00:00	0.000	0.000	0.000	4.300	2.712	7.011
21:00:00	0.000	0.000	0.000	3.709	2.791	6.501
22:00:00	0.000	0.000	0.000	3.188	2.853	6.042
23:00:00	0.000	0.000	0.000	2.718	2.900	5.618
24:00:00	0.000	0.000	0.000	2.288	2.933	5.221
25:00:00	0.000	0.000	0.000	1.903	2.954	4.857
26:00:00	0.000	0.000	0.000	1.565	2.962	4.528
27:00:00	0.000	0.000	0.000	1.262	2.960	4.222
28:00:00	0.000	0.000	0.000	0.985	2.946	3.931
29:00:00	0.000	0.000	0.000	0.732	2.922	3.654
30:00:00	0.000	0.000	0.000	0.505	2.889	3.394
31:00:00	0.000	0.000	0.000	0.315	2.847	3.162
32:00:00	0.000	0.000	0.000	0.177	2.799	2.976
33:00:00	0.000	0.000	0.000	0.090	2.748	2.838

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m^3/s)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
34:00:00	0.000	0.000	0.000	0.041	2.694	2.735
35:00:00	0.000	0.000	0.000	0.015	2.640	2.655
36:00:00	0.000	0.000	0.000	0.003	2.587	2.590
37:00:00	0.000	0.000	0.000	0.000	2.534	2.534
38:00:00	0.000	0.000	0.000	0.000	2.482	2.482
39:00:00	0.000	0.000	0.000	0.000	2.431	2.431
40:00:00	0.000	0.000	0.000	0.000	2.381	2.381
41:00:00	0.000	0.000	0.000	0.000	2.332	2.332
42:00:00	0.000	0.000	0.000	0.000	2.285	2.285
43:00:00	0.000	0.000	0.000	0.000	2.238	2.238
44:00:00	0.000	0.000	0.000	0.000	2.192	2.192
45:00:00	0.000	0.000	0.000	0.000	2.147	2.147
46:00:00	0.000	0.000	0.000	0.000	2.103	2.103
47:00:00	0.000	0.000	0.000	0.000	2.060	2.060
48:00:00	0.000	0.000	0.000	0.000	2.018	2.018
49:00:00	0.000	0.000	0.000	0.000	1.977	1.977
50:00:00	0.000	0.000	0.000	0.000	1.936	1.936
51:00:00	0.000	0.000	0.000	0.000	1.896	1.896
52:00:00	0.000	0.000	0.000	0.000	1.858	1.858
53:00:00	0.000	0.000	0.000	0.000	1.819	1.819
54:00:00	0.000	0.000	0.000	0.000	1.782	1.782
55:00:00	0.000	0.000	0.000	0.000	1.746	1.746
56:00:00	0.000	0.000	0.000	0.000	1.710	1.710
57:00:00	0.000	0.000	0.000	0.000	1.675	1.675
58:00:00	0.000	0.000	0.000	0.000	1.641	1.641
59:00:00	0.000	0.000	0.000	0.000	1.607	1.607
60:00:00	0.000	0.000	0.000	0.000	1.574	1.574
61:00:00	0.000	0.000	0.000	0.000	1.542	1.542
62:00:00	0.000	0.000	0.000	0.000	1.510	1.510
63:00:00	0.000	0.000	0.000	0.000	1.479	1.479
64:00:00	0.000	0.000	0.000	0.000	1.449	1.449
65:00:00	0.000	0.000	0.000	0.000	1.419	1.419
66:00:00	0.000	0.000	0.000	0.000	1.390	1.390
67:00:00	0.000	0.000	0.000	0.000	1.362	1.362
68:00:00	0.000	0.000	0.000	0.000	1.334	1.334

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m^3/s)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
69:00:00	0.000	0.000	0.000	0.000	1.307	1.307
70:00:00	0.000	0.000	0.000	0.000	1.280	1.280
71:00:00	0.000	0.000	0.000	0.000	1.254	1.254
72:00:00	0.000	0.000	0.000	0.000	1.228	1.228
73:00:00	0.000	0.000	0.000	0.000	1.203	1.203
74:00:00	0.000	0.000	0.000	0.000	1.178	1.178
75:00:00	0.000	0.000	0.000	0.000	1.154	1.154
76:00:00	0.000	0.000	0.000	0.000	1.130	1.130
77:00:00	0.000	0.000	0.000	0.000	1.107	1.107
78:00:00	0.000	0.000	0.000	0.000	1.085	1.085
79:00:00	0.000	0.000	0.000	0.000	1.062	1.062
80:00:00	0.000	0.000	0.000	0.000	1.041	1.041
81:00:00	0.000	0.000	0.000	0.000	1.019	1.019
82:00:00	0.000	0.000	0.000	0.000	0.998	0.998
83:00:00	0.000	0.000	0.000	0.000	0.978	0.978
84:00:00	0.000	0.000	0.000	0.000	0.958	0.958
85:00:00	0.000	0.000	0.000	0.000	0.938	0.938
86:00:00	0.000	0.000	0.000	0.000	0.919	0.919
87:00:00	0.000	0.000	0.000	0.000	0.900	0.900
88:00:00	0.000	0.000	0.000	0.000	0.882	0.882
89:00:00	0.000	0.000	0.000	0.000	0.864	0.864
90:00:00	0.000	0.000	0.000	0.000	0.846	0.846
91:00:00	0.000	0.000	0.000	0.000	0.829	0.829
92:00:00	0.000	0.000	0.000	0.000	0.812	0.812
93:00:00	0.000	0.000	0.000	0.000	0.795	0.795
94:00:00	0.000	0.000	0.000	0.000	0.779	0.779
95:00:00	0.000	0.000	0.000	0.000	0.763	0.763
96:00:00	0.000	0.000	0.000	0.000	0.747	0.747
97:00:00	0.000	0.000	0.000	0.000	0.732	0.732
98:00:00	0.000	0.000	0.000	0.000	0.717	0.717
99:00:00	0.000	0.000	0.000	0.000	0.702	0.702
100:00:00	0.000	0.000	0.000	0.000	0.688	0.688
101:00:00	0.000	0.000	0.000	0.000	0.674	0.674
102:00:00	0.000	0.000	0.000	0.000	0.660	0.660
103:00:00	0.000	0.000	0.000	0.000	0.647	0.647

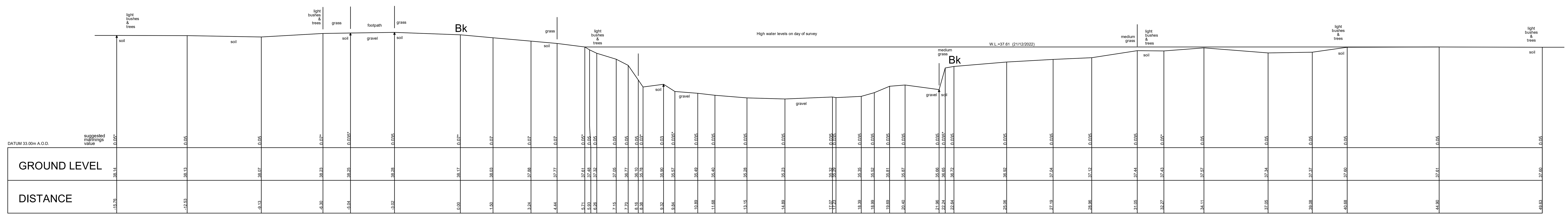
Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m^3/s)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
104:00:00	0.000	0.000	0.000	0.000	0.633	0.633
105:00:00	0.000	0.000	0.000	0.000	0.620	0.620
106:00:00	0.000	0.000	0.000	0.000	0.608	0.608
107:00:00	0.000	0.000	0.000	0.000	0.595	0.595
108:00:00	0.000	0.000	0.000	0.000	0.583	0.583
109:00:00	0.000	0.000	0.000	0.000	0.571	0.571
110:00:00	0.000	0.000	0.000	0.000	0.559	0.559

Appendix

Catchment descriptors

Name	Value	User-defined value used?
Area (km^2)	20.3	No
ALTBAR	61	No
ASPBAR	339	No
ASPVAR	0.22	No
BFIHOST	0.45	No
BFIHOST19	0.45	No
DPLBAR (km)	5.2	No
DPSBAR (mkm^{-1})	25.5	No
FARL	0.94	No
LDP	11.68	No
PROPWET	0.29	No
RMED1H	11.7	No
RMED1D	29.5	No
RMED2D	38	No
SAAR (mm)	656	No
SAAR4170 (mm)	649	No
SPRHOST	36	No
URBEXT2000	0.14	No
URBEXT1990	0.05	No
URBCONC	0.79	No
URBLOC	1.18	No
DDF parameter C	-0.03	No
DDF parameter D1	0.26	No
DDF parameter D2	0.27	No
DDF parameter D3	0.31	No
DDF parameter E	0.3	No
DDF parameter F	2.65	No
DDF parameter C (1km grid value)	-0.03	No
DDF parameter D1 (1km grid value)	0.27	No
DDF parameter D2 (1km grid value)	0.27	No
DDF parameter D3 (1km grid value)	0.32	No
DDF parameter E (1km grid value)	0.3	No
DDF parameter F (1km grid value)	2.64	No

Appendix B - Topographical Survey



DISTANCE	GROUND LEVEL	suggested mannings value
-15.76	38.14	0.05*
-12.53	38.13	0.05
-9.13	38.07	0.05
-6.30	38.23	0.07*
-5.04	38.25	0.035*
-3.02	38.28	0.035
0.00	38.17	0.07*
1.50	38.03	0.07
3.24	37.88	0.07
4.44	37.77	0.07
5.71	37.61	0.05*
5.93	37.48	0.05
6.26	37.32	0.05
7.15	37.05	0.05
7.70	36.77	0.05
8.16	36.10	0.05
8.36	35.78	0.03*
9.32	35.90	0.03
9.84	35.57	0.035*
10.89	35.49	0.035
11.68	35.40	0.035
13.15	35.28	0.035
14.89	35.23	0.035
17.07	35.32	0.035
17.20	35.28	0.035
18.39	35.35	0.035
18.99	35.52	0.035
19.69	35.81	0.035
20.40	35.87	0.035
21.96	35.66	0.035
22.24	36.65	0.035*
22.64	36.72	0.035
25.06	36.92	0.035
27.19	37.04	0.035
28.96	37.12	0.035
31.05	37.44	0.035
32.27	37.43	0.05*
34.11	37.57	0.05
37.05	37.34	0.05
39.08	37.37	0.05
40.68	37.60	0.05
44.90	37.61	0.05
49.63	37.60	0.05

River Loddon CS LO1A.0000

Centre OSNG Coordinates E.476678.41 N.170781.18

LEGEND FOR SURFACE & VEGETATION CHANGES:
ABOVE GROUND VEGETATION & SEPARATOR
GROUND SURFACE & SEPARATOR
SUGGESTED MANNINGS VALUES IN BLUE TEXT
SURVEYED BY GPS TO OSNG. LEVEL DATUM OSGM15.
ALL SECTIONS SHOWN PERPENDICULAR TO WATERCOURSE

Light Trees stone

5 0 5 10 15 20 25m

Scale: 1/100 at A1; 1/200 at A3

Client

Abley Letchford Partnership Ltd
Consulting Engineers
3 Tealgate, Charnham Park
Hungerford,
RG17 0YT

Project

Loddon Garden Village Project
Watercourses Survey
Shinfield to Winnersh
Reading

INFOMAP
SURVEYS AND MAPPING
CHARTERED SURVEYORS
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Seymours House
Sunnyside Road North
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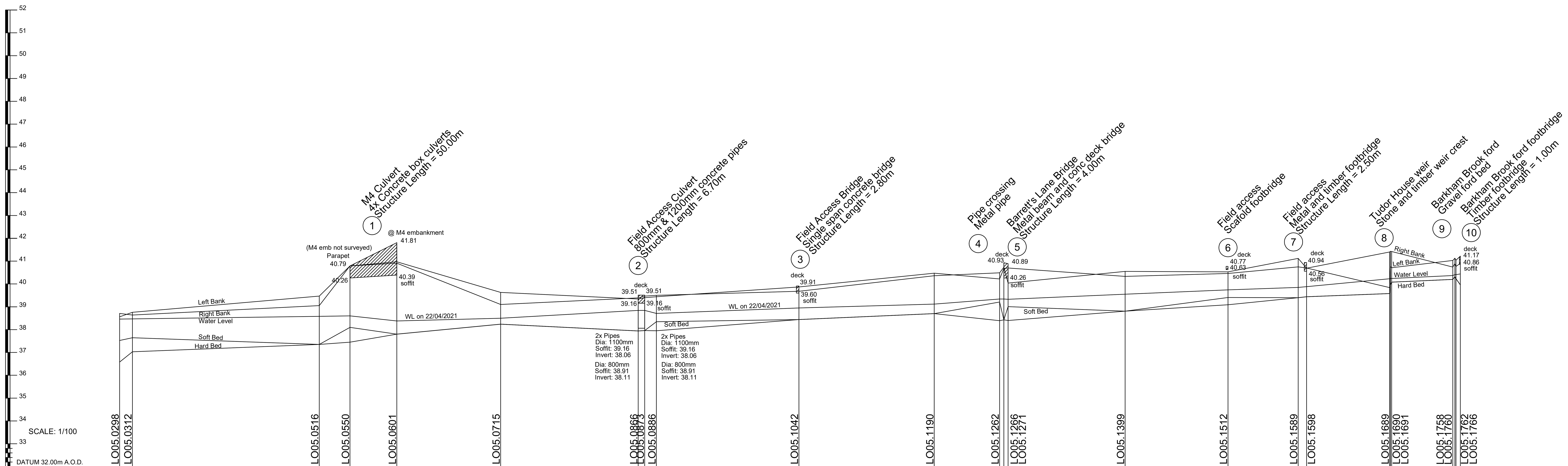
North Somerset BS23 3PZ
Tel: 01934 644060 /fax 01934 644060
E-mail: mail@infomapsurveys.co.uk
Website: www.infomapsurveys.co.uk
ISO 9001 REGISTERED FIRM

Surveyed: D.J & H.L | Apprd: R.J.FLEW
Date: December 2022 | File Ref: 1829
Scale: 1/100 at A1; 1/200 at A3 | Datum OSTN15/OSGM15

DRAWING REFERENCE

ISM/LODDON GARDEN VILLAGE PROJECT:
LO1A - River Loddon

ISM-LODDON GARDEN VILLAGE-LO1A-X-01



CHAINAGE	Section	BED MATERIAL	LEFT BANK LEVEL	RIGHT BANK LEVEL	WATER LEVEL	SOFT BED LEVEL	Hard Bed Level	REGRADE
298	LO05.0298	soil	38.56	38.71	38.46	37.53	36.58	
312	LO05.0312	soil	38.76	38.64	38.47	37.64	37.03	
516	LO05.0516	soil	39.47	39.05	38.58		37.35	
550	LO05.0550	soil	40.79	40.79	38.60	38.10	37.45	
601	LO05.0601	soil	40.97	40.91	38.38		37.80	
715	LO05.0715	gravel	39.63	39.10	38.50		38.24	
866	LO05.0866	soil	39.34	39.39	38.84		37.94	
873	LO05.0873	soil	39.40	39.47	38.84		37.96	
886	LO05.0886	soil	39.44	39.50	38.71	38.35	37.95	
1042	LO05.1042	soil	39.87	39.68	38.95		38.44	
1190	LO05.1190	gravel	40.47	40.36	39.12		38.70	
1262	LO05.1262	soil	40.22	40.49	39.34	39.21	38.39	
1266	LO05.1266	soil	40.68	40.73	39.34	39.01	38.43	
1271	LO05.1271	soil	40.70	40.04	39.33		38.40	
1399	LO05.1399	soil	40.33	40.55	39.55		38.81	
1512	LO05.1512	soil	40.46	40.53	39.74	39.41	39.09	
1589	LO05.1589	gravel	40.75	41.12	39.85		39.40	
1598	LO05.1598	gravel	40.70	40.69	39.88		39.44	
1689	LO05.1689	rubble	39.84	41.40	40.23		39.58	
1690	LO05.1690	reeds	40.76	41.43	40.24		39.96	
1691	LO05.1691	gravel	40.71	41.42	40.24		40.08	
1758	LO05.1758	concrete	41.03	40.74	40.37		40.20	
1760	LO05.1760	concrete	41.13	40.89	40.41		40.32	
1762	LO05.1762	gravel	41.04	40.77	40.41		40.23	
1766	LO05.1766	soil	41.22	40.90	40.44		39.96	

WATER COURSE Barkham Brook (LO05)
LONG SECTION Ch. 0298 TO 1766

Water Levels taken 06/12/2022-16/12/2022 & (Ch601 to 886 on 22/04/2021)

STRUCTURE SECTION
STRUCTURE No.WITH NAME 1
SURVEYED BY GPS TO OSNG. LEVEL DATUM OSGM15.

100 0 100 200 300 400 500m
Scale: 1/2500 at A1; 1/5000 at A3

Client
Abley Letchford Partnership Ltd
Consulting Engineers
3 Tealgate, Charnham Park
Hungerford,
RG17 0YT

Project
Loddon Garden Village Project
Watercourses Survey
Shinfield to Winnersh
Reading

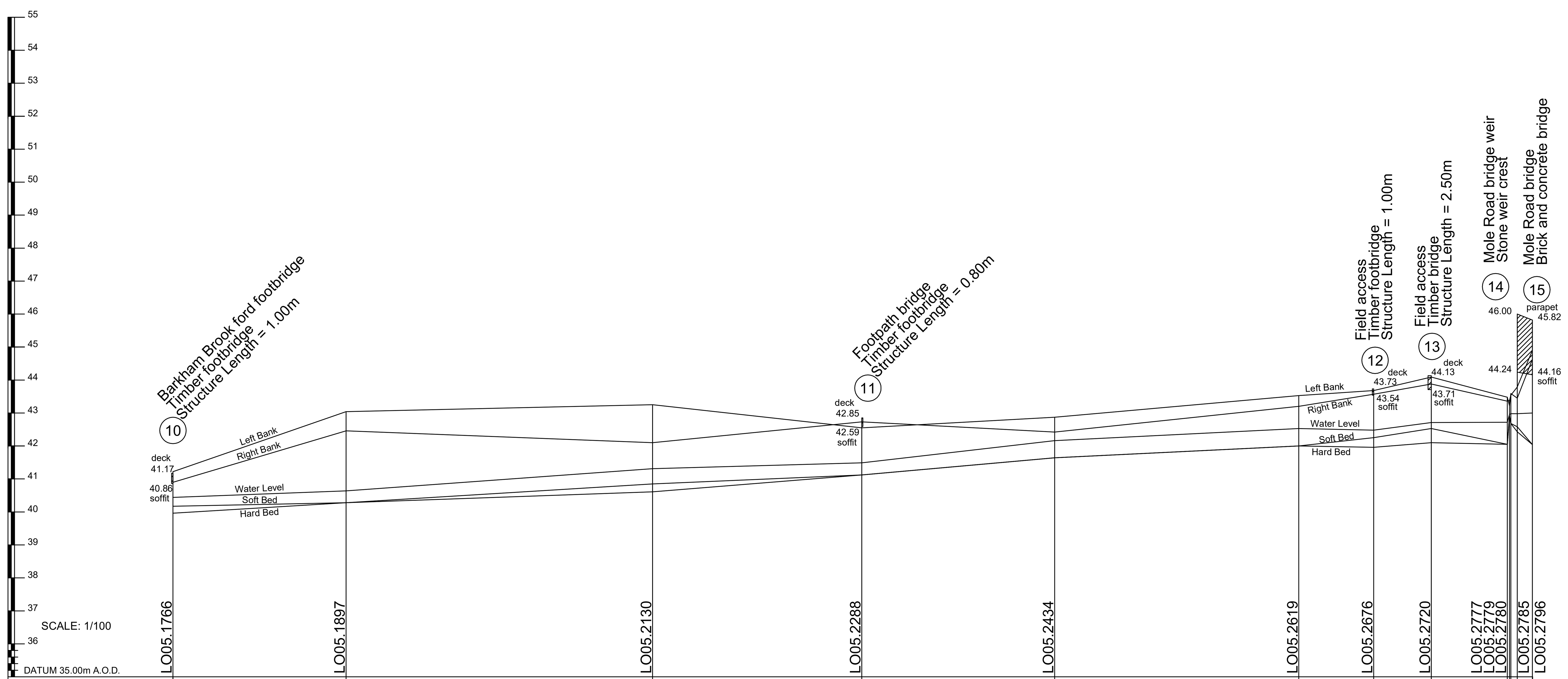
Surveyed: W.M, H,L | Apprd: R.J.FLEW
Date: Dec 2022 | File Ref: 1829
Scale: 1/2500 at A1; 1/5000 at A3 | Datum OSTN15/OSGM15

INFOMAP SURVEYS AND MAPPING
CHARTERED SURVEYORS
RICS

Seymours House
Sunnyside Road North
Weston-super-Mare
North Somerset BS23 3PZ
Tel: 01934 644060 /fax 01934 644060
E-mail: mail@infomapsurveys.co.uk
Website: www.infomapsurveys.co.uk

ISO 9001

DRAWING REFERENCE
ISM/LODDON GARDEN VILLAGE PROJECT:
LO05 - Barkham Brook
ISM-LODDON GARDEN VILLAGE-LO05-L-01



CHAINAGE	BED MATERIAL	LEFT BANK LEVEL	RIGHT BANK LEVEL	WATER LEVEL	SOFT BED LEVEL	Hard Bed Level	REGRADE
1766	soil	41.22	40.90	40.44	40.17	39.96	
1897	gravel	43.04	42.46	40.64		40.28	
2130	soil	43.25	42.10	41.31	40.85	40.61	
2288		42.55	42.73	41.49		41.12	
2434	gravel	42.87	42.42	42.16		41.64	
2619	soil	43.53	43.20	42.53		42.00	
2676	soil	43.68	43.57	42.48	42.25	41.96	
2720	soil	44.09	43.88	42.71	42.53	42.10	
2777	soil	43.48	43.36	42.72		42.05	
2779	stone	43.22	43.38	42.96		42.91	
2780	soil	43.59	43.54	42.98		42.68	
2785	soil	43.45	43.79	42.98	42.58	42.43	
2796	soil	44.63	44.90	43.00		42.04	

WATER COURSE Barkham Brook (LO05)
LONG SECTION Ch. 1766 TO 2796

Water Levels taken 08/12/2022 to 14/12/2022

STRUCTURE SECTION

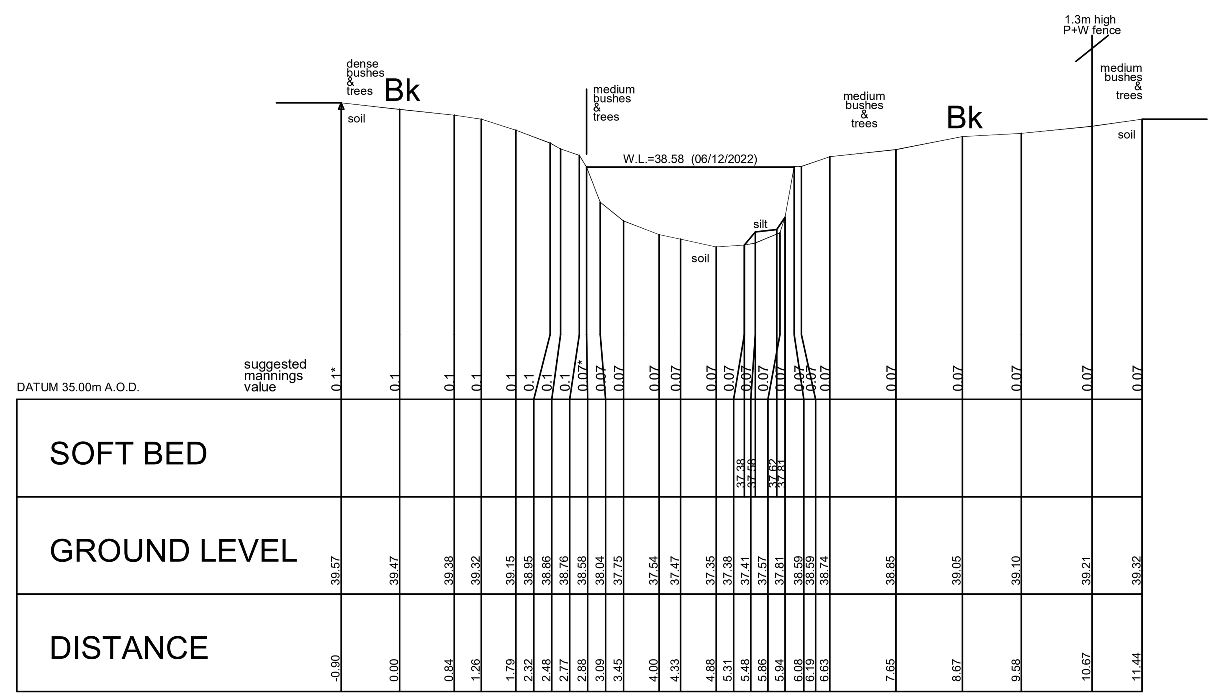
STRUCTURE No.WITH NAME (1)

SURVEYED BY GPS TO OSNG. LEVEL DATUM OSGM15.

100 0 100 200 300 400 500m

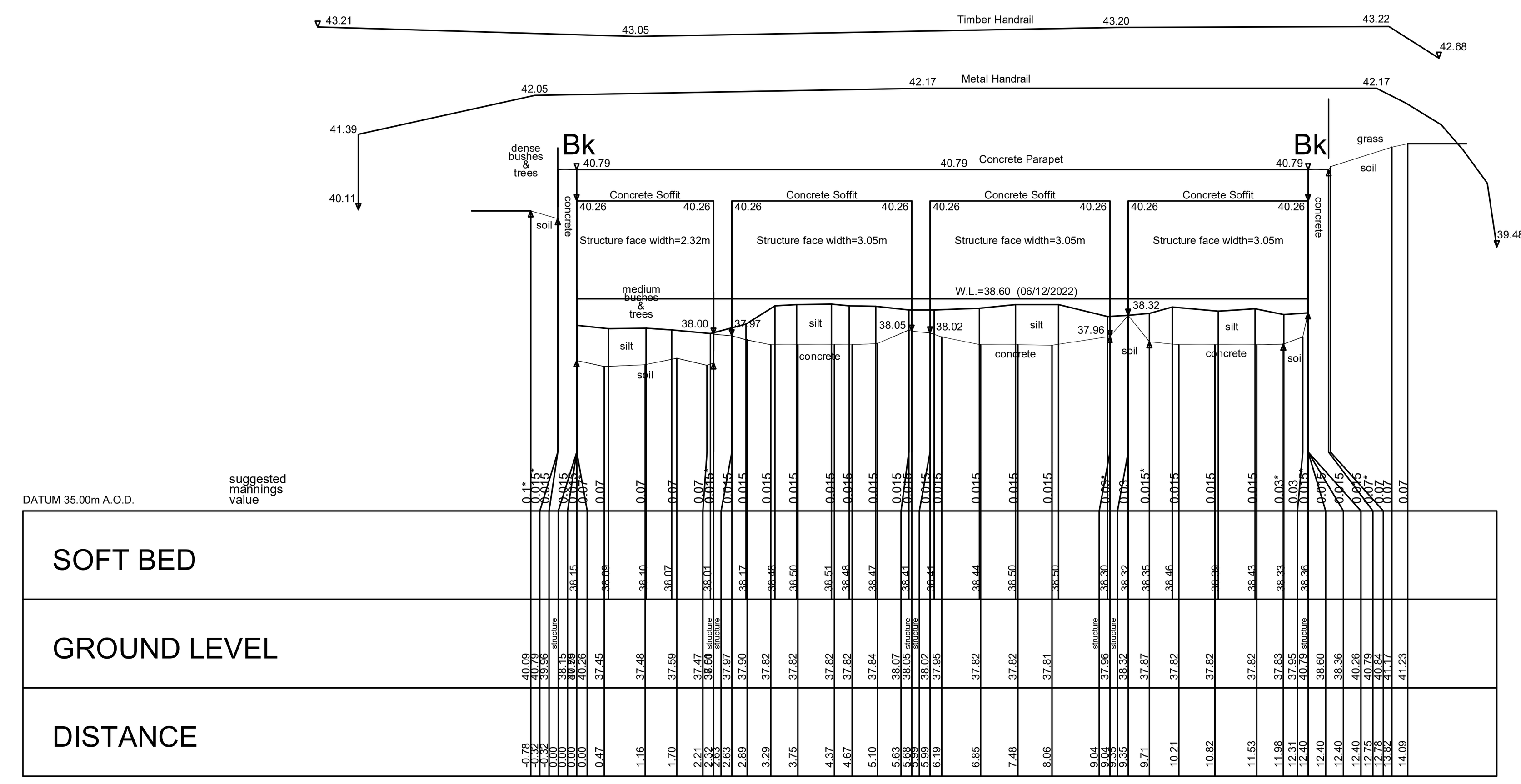
Scale: 1/2500 at A1; 1/5000 at A3

Client	Project	
Abley Letchford Partnership Ltd Consulting Engineers 3 Tealgate, Charnham Park Hungerford, RG17 0YT	Loddon Garden Village Project Watercourses Survey Shinfield to Winnersh Reading	INFOMAP SURVEYS AND MAPPING CHARTERED SURVEYORS Seymours House Sunnyside Road North Weston-super-Mare North Somerset BS23 3PZ Tel: 01934 644060 /fax 01934 644060 E-mail: mail@infomapsurveys.co.uk Website: www.infomapsurveys.co.uk
Surveyed: W.M, H,L	Apprd: R.J.FLEW	DRAWING REFERENCE
Date: Dec 2022	File Ref: 1829	ISM/LODDON GARDEN VILLAGE PROJECT: LO05 - Barkham Brook
Scale: 1/2500 at A1; 1/5000 at A3	Datum OSTN15/OSGM15	ISM-LODDON GARDEN VILLAGE-LO05-L-02

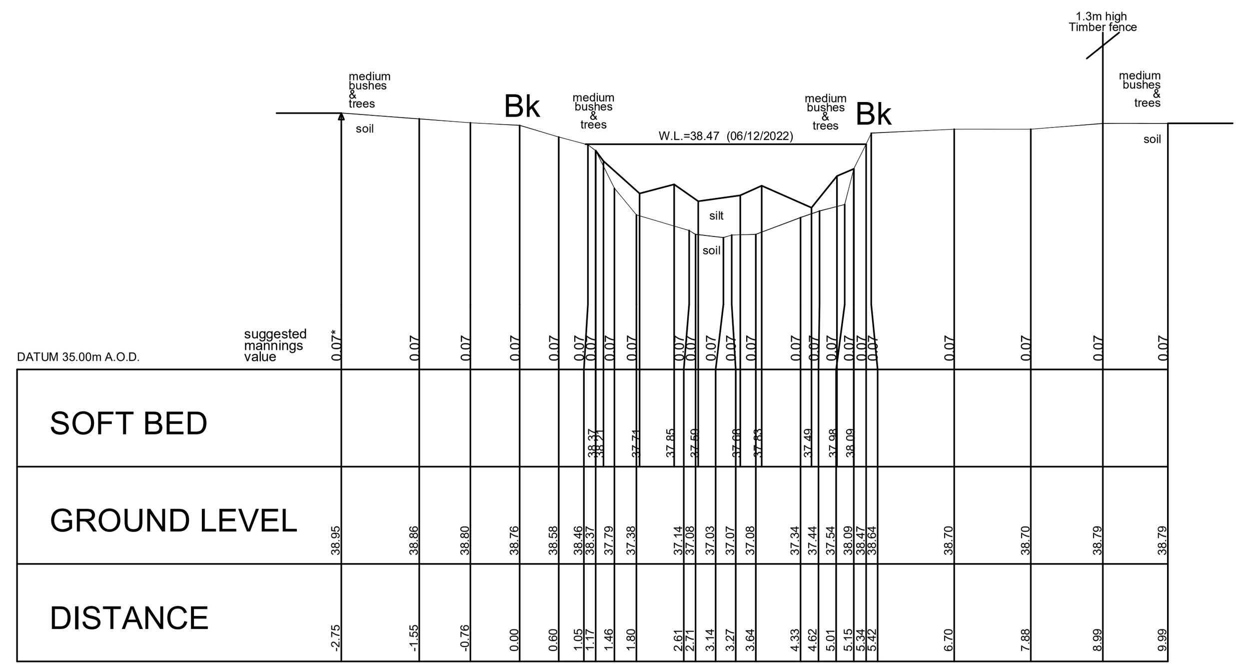


Barkham Brook CS LO05.0516
Centre OSNG Coordinates E.476091.33 N.169683.13

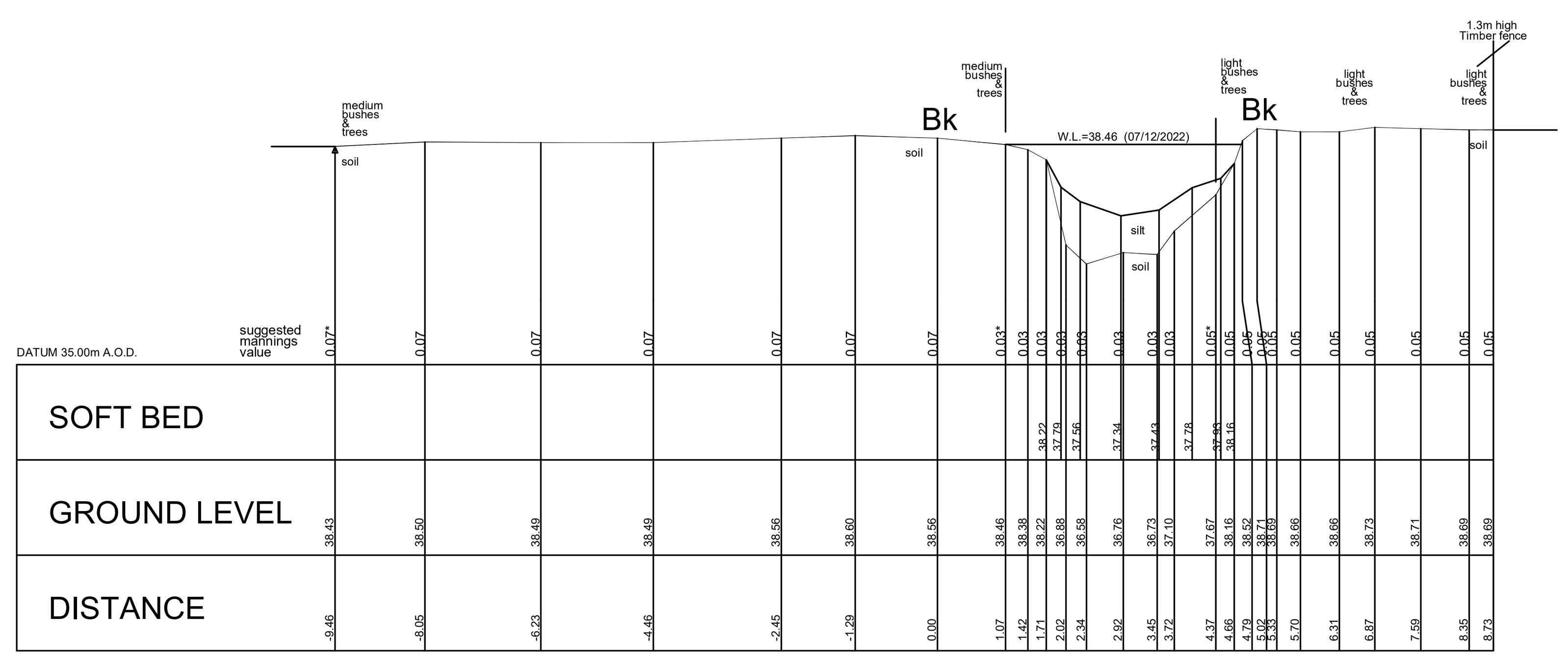
Structure no. 1. Barkham Brook Culvert
(downstream face of structure)
Description: 4x Concrete box culverts
Structure Length = 50.00m



Barkham Brook CS LO05.0550
Centre OSNG Coordinates E.476067.16 N.169662.20



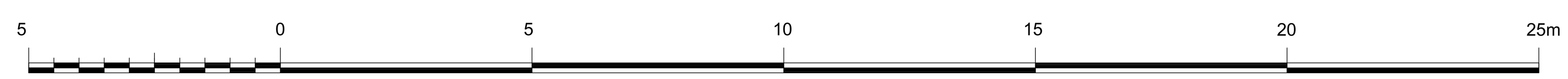
Barkham Brook CS LO05.0312
Centre OSNG Coordinates E.476279.44 N.169762.89



Barkham Brook CS LO05.0298
Centre OSNG Coordinates E.476291.74 N.169769.60

LEGEND FOR SURFACE & VEGETATION CHANGES:
ABOVE GROUND VEGETATION & SEPARATOR
GROUND SURFACE & SEPARATOR
SUGGESTED MANNINGS VALUES IN BLUE TEXT
SURVEYED BY GPS TO OSNG. LEVEL DATUM OSGM15.
ALL SECTIONS SHOWN PERPENDICULAR TO WATERCOURSE

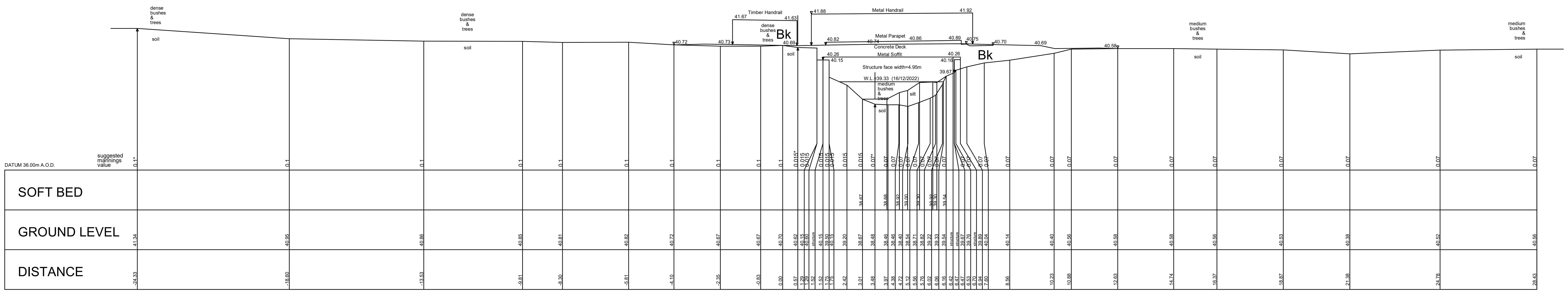
Light
Trees
stone



Scale: 1/100 at A1; 1/200 at A3

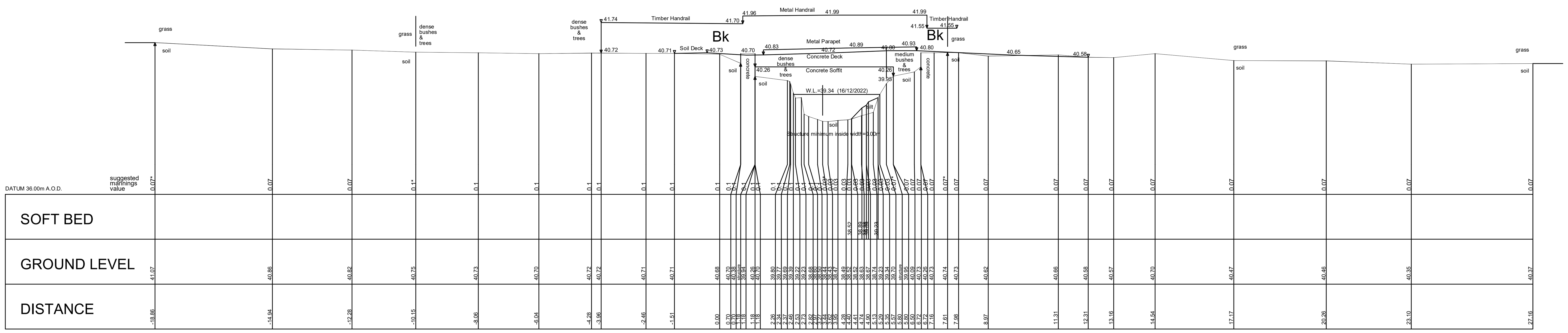
Client	Project	
Abley Letchford Partnership Ltd Consulting Engineers 3 Tealgate, Charnham Park Hungerford, RG17 0YT	Loddon Garden Village Project Watercourses Survey Shinfield to Winnersh Reading	INFOMAP SURVEYS AND MAPPING CHARTERED SURVEYORS RICS Seymours House Sunnyside Road North Weston-super-Mare North Somerset BS23 3PZ Tel: 01934 644060 /fax 01934 644060 E-mail: mail@infomapsurveys.co.uk Website: www.infomapsurveys.co.uk ISO 9001
Surveyed: W.M.	Apprd: R.J.FLEW	DRAWING REFERENCE
Date: November 2021	File Ref: 1829	ISM/LODDON GARDEN VILLAGE PROJECT: LO05 - Barkham Brook
Scale: 1/100 at A1; 1/200 at A3	Datum OSTN15/OSGM15	ISM-LODDON GARDEN VILLAGE-LO05-X-01

Structure no. 3. Barrett's Lane Bridge
(upstream face of structure)
Description: Metal beam and conc deck bridge
Structure Length = 4.00m



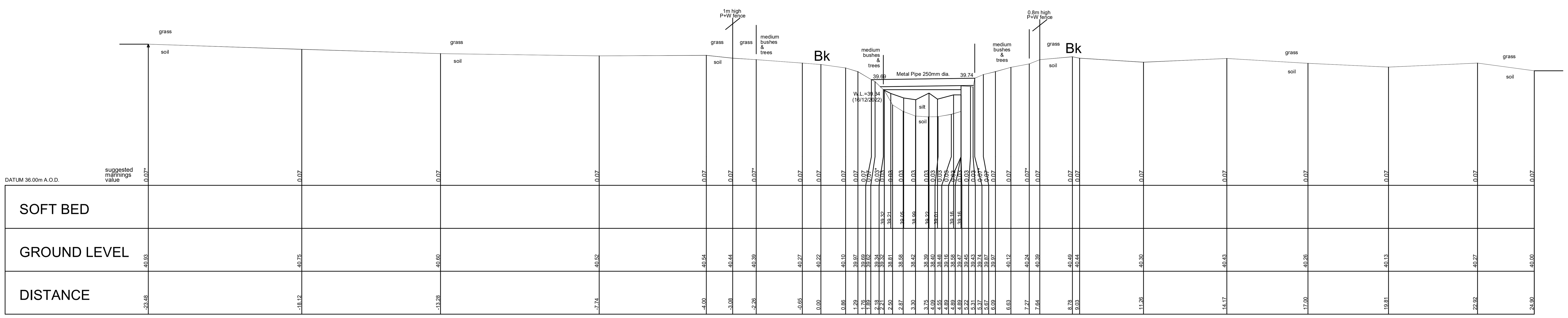
Barkham Brook CS LO05.1271
Centre OSNG Coordinates E.476077.54 N.169141.99

Structure no. 3. Barrett's Lane Bridge
(downstream face of structure)
Description: Metal beam and conc deck bridge
Structure Length = 4.00m



Barkham Brook CS LO05.1266
Centre OSNG Coordinates E.476073.72 N.169144.71

Structure no. 2. Pipe crossing
(upstream face of structure)
Description: Metal pipe



Barkham Brook CS LO05.1262
Centre OSNG Coordinates E.476069.91 N.169147.42

LEGEND FOR SURFACE & VEGETATION CHANGES:
ABOVE GROUND VEGETATION & SEPARATOR
GROUND SURFACE & SEPARATOR
SUGGESTED MANNINGS VALUES IN BLUE TEXT
SURVEYED BY GPS TO OSNG. LEVEL DATUM OSGM15.
ALL SECTIONS SHOWN PERPENDICULAR TO WATERCOURSE

Light | Trees | stone

5 0 5 10 15 20 25m

Scale: 1/100 at A1; 1/200 at A3

Client	Project
Abley Letchford Partnership Ltd Consulting Engineers 3 Tealgate, Charnham Park Hungerford, RG17 0YT	Loddon Garden Village Project Watercourses Survey Shinfield to Winnersh Reading

Surveyed: W.M.		Apprd:	R.J.FLEW
Date: November 2021		File Ref:	1829
Scale: 1/100 at A1; 1/200 at A3		Datum	OSTN15/OSGM15

INFOMAP
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Website: www.infomapsurveys.co.uk
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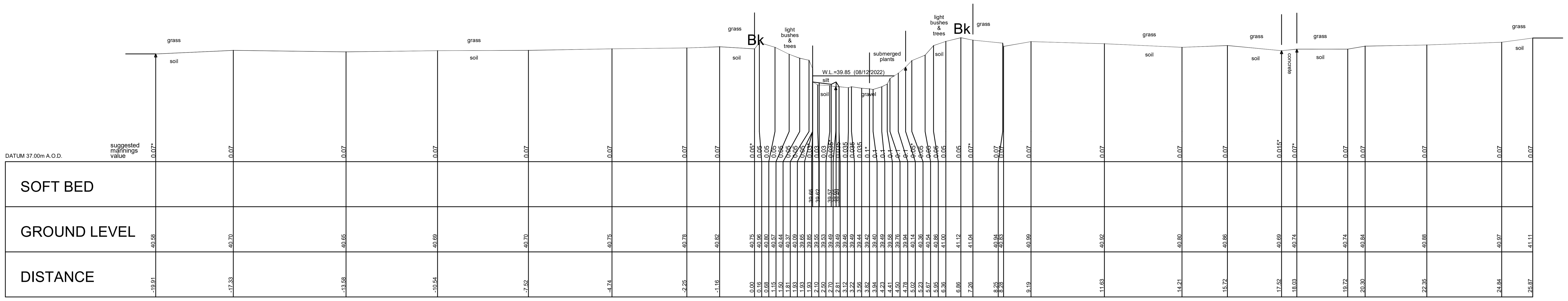
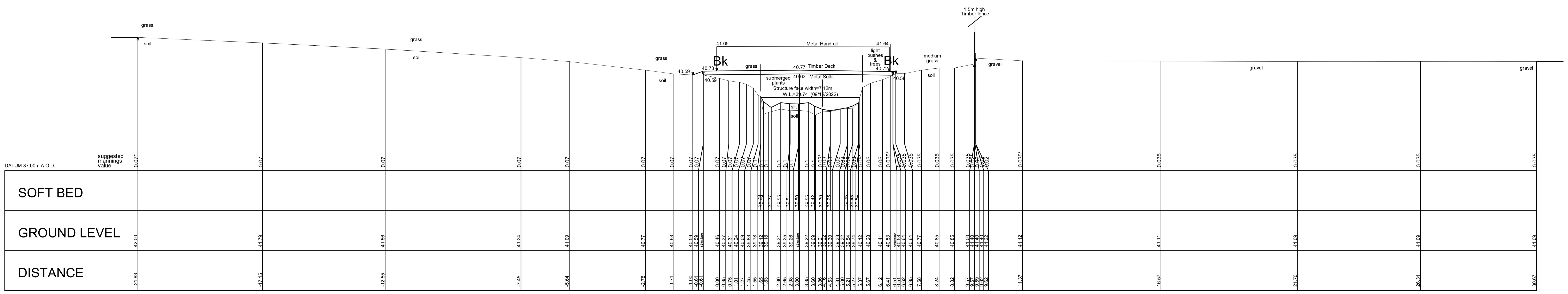
ISO 9001

DRAWING REFERENCE
ISM/LODDON GARDEN VILLAGE PROJECT:
LO05 - Barkham Brook
ISM-LODDON GARDEN VILLAGE-LO05-X-02

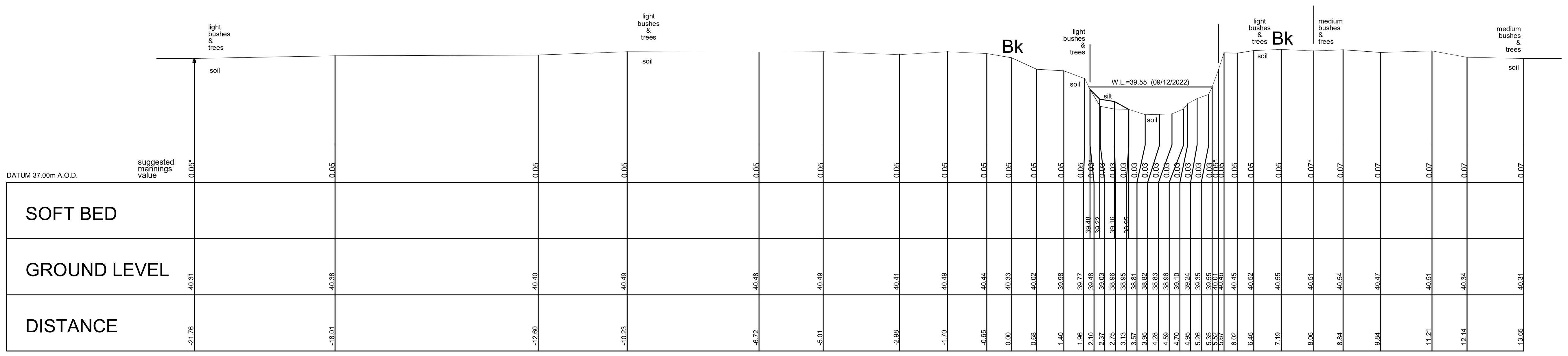


Barkham Brook CS LO05.1589
Centre OSNG Coordinates E.476275.52 N.168990.48

Structure no. 4. Field access
(upstream face of structure)
Description: Scafold footbridge



Barkham Brook CS LO05.1512
Centre OSNG Coordinates E.476221.09 N.168996.18



Barkham Brook CS LO05.1399
Centre OSNG Coordinates E.476167.22 N.169090.62

LEGEND FOR SURFACE & VEGETATION CHANGES:
ABOVE GROUND VEGETATION & SEPARATOR
GROUND SURFACE & SEPARATOR
SUGGESTED MANNINGS VALUES IN BLUE TEXT
SURVEYED BY GPS TO OSNG. LEVEL DATUM OSGM15.
ALL SECTIONS SHOWN PERPENDICULAR TO WATERCOURSE

Light Trees stone

5 0 5 10 15 20 25m

Scale: 1/100 at A1; 1/200 at A3

Client	Project	
Abley Letchford Partnership Ltd Consulting Engineers 3 Tealgate, Charnham Park Hungerford, RG17 0YT	Loddon Garden Village Project Watercourses Survey Shinfield to Winnersh Reading	INFOMAP SURVEYS AND MAPPING CHARTERED SURVEYORS RICS Seymours House Sunnyside Road North Weston-super-Mare North Somerset BS23 3PZ Tel: 01934 644060 /fax 01934 644060 E-mail: mail@infomapsurveys.co.uk Website: www.infomapsurveys.co.uk ISO 9001
Surveyed: W.M.	Apprd: R.J.FLEW	DRAWING REFERENCE
Date: November 2021	File Ref: 1829	ISM/LODDON GARDEN VILLAGE PROJECT: LO05 - Barkham Brook
Scale: 1/100 at A1; 1/200 at A3	Datum OSTN15/OSGM15	ISM-LODDON GARDEN VILLAGE-LO05-X-03

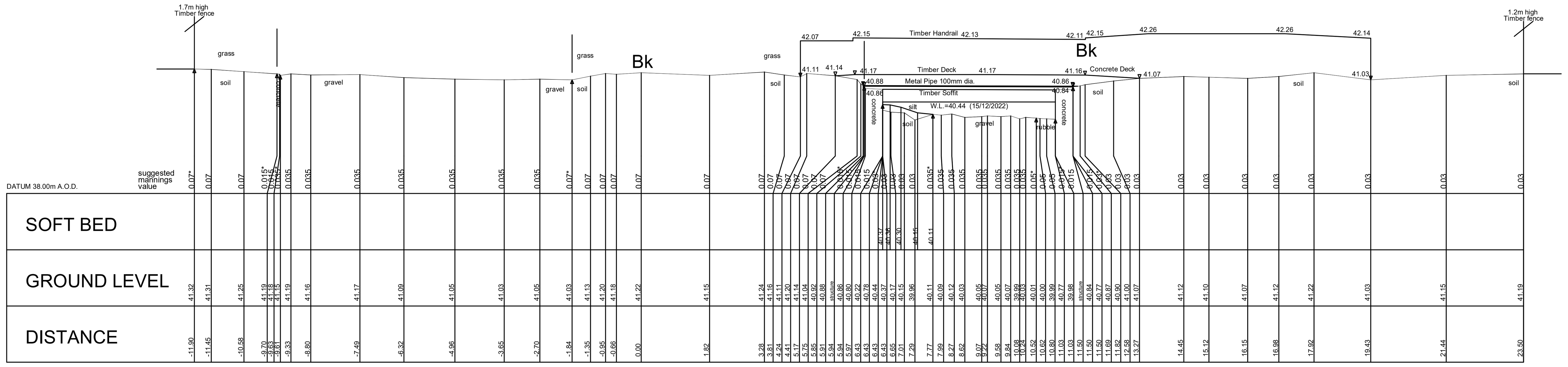
LEGEND FOR SURFACE & VEGETATION CHANGES:
ABOVE GROUND VEGETATION & SEPARATOR
GROUND SURFACE & SEPARATOR
SUGGESTED MANNINGS VALUES IN BLUE TEXT
SURVEYED BY GPS TO OSNG. LEVEL DATUM OSGM15.
ALL SECTIONS SHOWN PERPENDICULAR TO WATERCOURSE

Scale: 1/100 at A1; 1/200 at A3

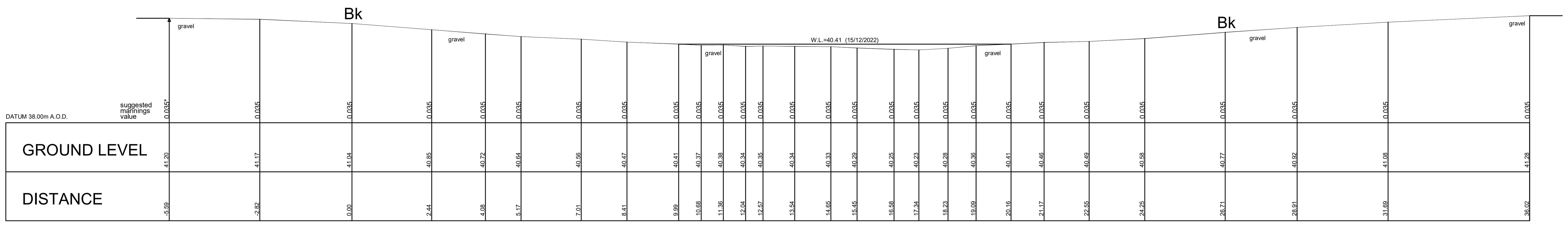
Client	Project	
Abley Letchford Partnership Ltd Consulting Engineers 3 Tealgate, Charnham Park Hungerford, RG17 0YT	Loddon Garden Village Project Watercourses Survey Shinfield to Winnersh Reading	INFOMAP SURVEYS AND MAPPING CHARTERED SURVEYORS Seymours House Sunnyside Road North Weston-super-Mare North Somerset BS23 3PZ Tel: 01934 644060 /fax 01934 644060 E-mail: mail@infomapsurveys.co.uk Website: www.infomapsurveys.co.uk

				DRAWING REFERENCE
Surveyed: W.M.	Apprd:	R.J.FLEW		ISM/LODDON GARDEN VILLAGE PROJECT: LO05 - Barkham Brook
Date: November 2021	File Ref:	1829		
Scale: 1/100 at A1; 1/200 at A3	Datum	OSTN15/OSGM15		ISM-LODDON GARDEN VILLAGE-LO05-X-04

Structure no. 8. Barkham Brook ford footbridge
(upstream face of structure)
Description: Timber footbridge
Structure Length = 1.00m

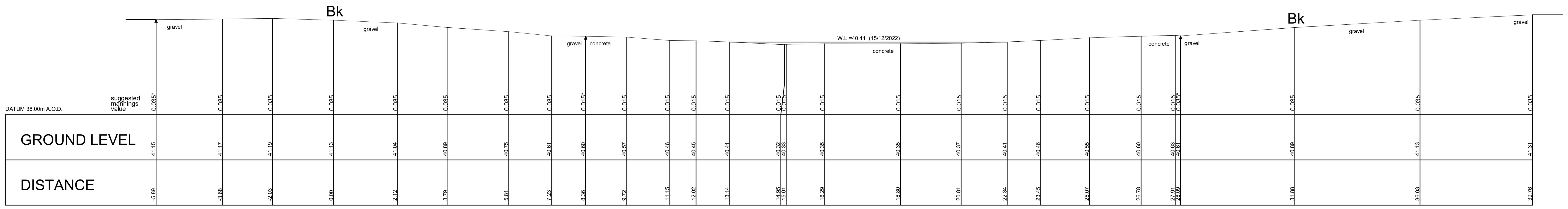


Barkham Brook CS LO05.1766
Centre OSNG Coordinates E.476360.00 N.168858.80

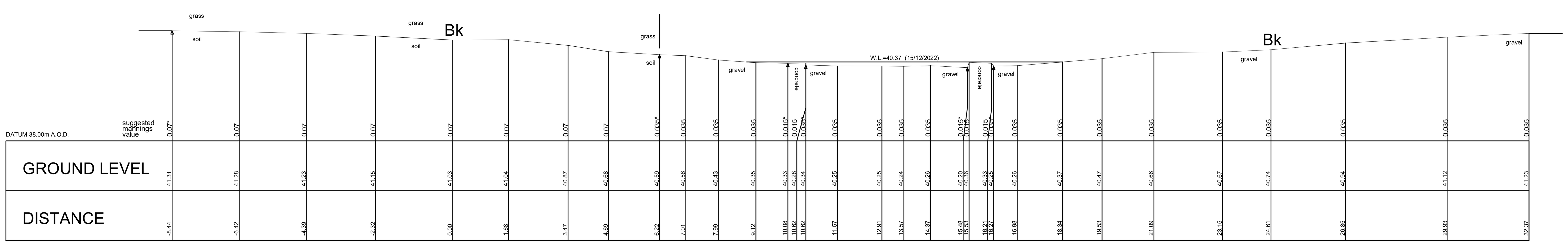


Barkham Brook CS LO05.1762
Centre OSNG Coordinates E.476356.94 N.168862.32

Structure no. 7. Barkham Brook ford
(ford crest)
Description: Gravel ford bed



Barkham Brook CS LO05.1760
Centre OSNG Coordinates E.476356.07 N.168863.33



Barkham Brook CS LO05.1758
Centre OSNG Coordinates E.476354.55 N.168865.09

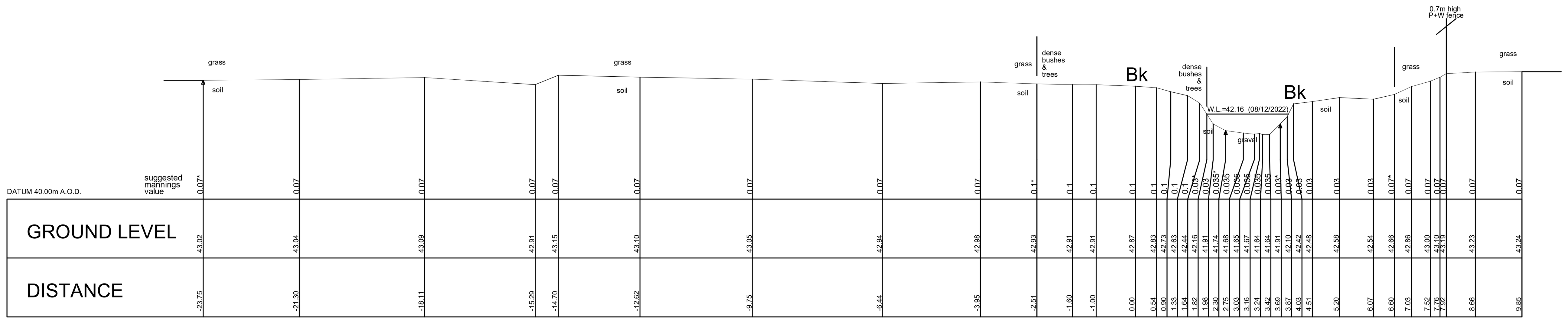
LEGEND FOR SURFACE & VEGETATION CHANGES:
ABOVE GROUND VEGETATION & SEPARATOR
GROUND SURFACE & SEPARATOR
SUGGESTED MANNINGS VALUES IN BLUE TEXT
SURVEYED BY GPS TO OSNG. LEVEL DATUM OSGM15.
ALL SECTIONS SHOWN PERPENDICULAR TO WATERCOURSE

Light
Trees
stone

5 0 5 10 15 20 25m

Scale: 1/100 at A1; 1/200 at A3

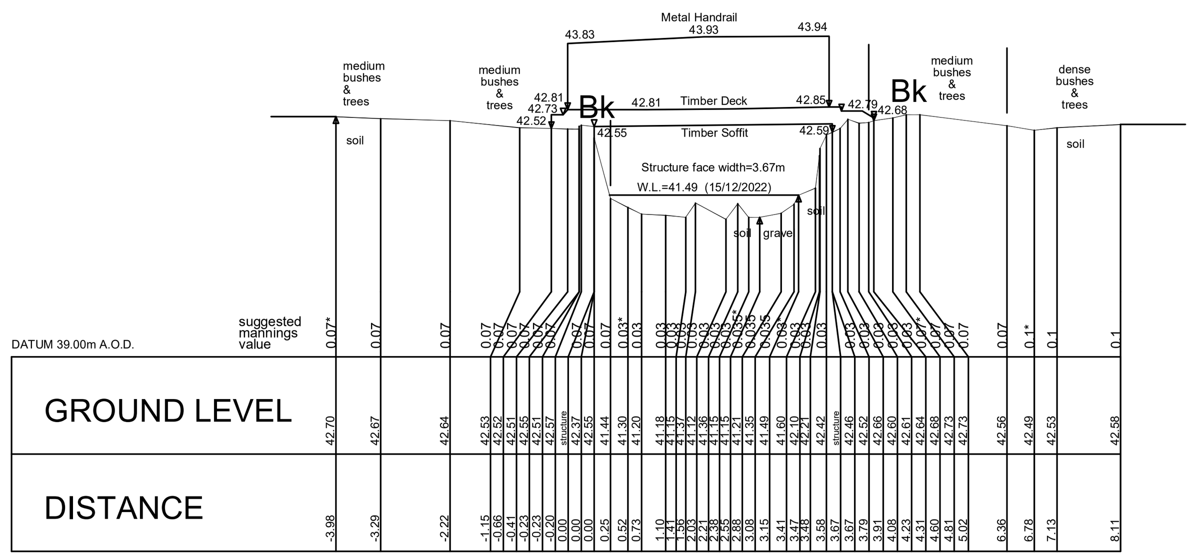
Client	Project	
Abley Letchford Partnership Ltd Consulting Engineers 3 Tealgate, Charnham Park Hungerford, RG17 0YT	Loddon Garden Village Project Watercourses Survey Shinfield to Winnersh Reading	INFOMAP SURVEYS AND MAPPING CHARTERED SURVEYORS Seymours House Sunnyside Road North Weston-super-Mare North Somerset BS23 3PZ Tel: 01934 644060 /fax 01934 644060 E-mail: mail@infomapsurveys.co.uk Website: www.infomapsurveys.co.uk
Surveyed: W.M.	Apprd: R.J.FLEW	DRAWING REFERENCE
Date: November 2021	File Ref: 1829	ISM/LODDON GARDEN VILLAGE PROJECT: LO05 - Barkham Brook
Scale: 1/100 at A1; 1/200 at A3	Datum OSTN15/OSGM15	ISM-LODDON GARDEN VILLAGE-LO05-X-05



Barkham Brook CS LO05.2434

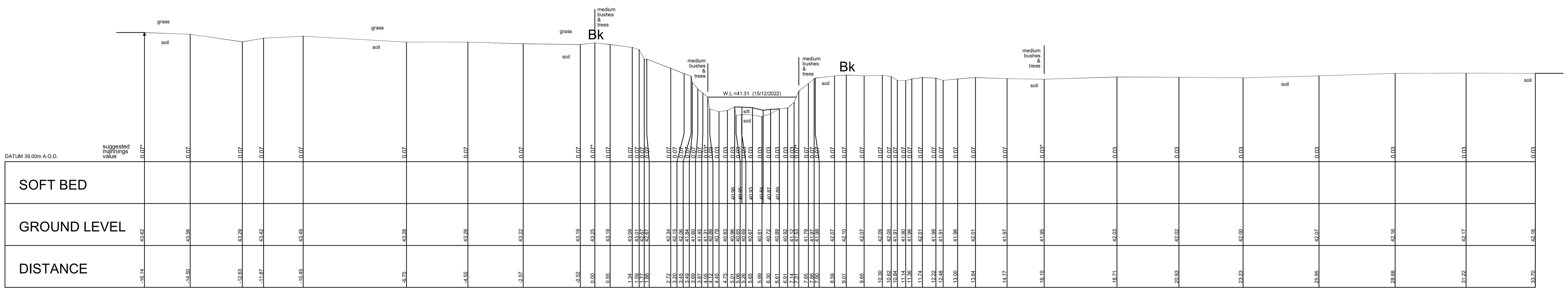
Centre OSNG Coordinates E.476647.54 N.168346.51

Structure no. 9. Footpath bridge
(downstream face of structure)
Description: Timber footbridge
Structure Length = 0.80m



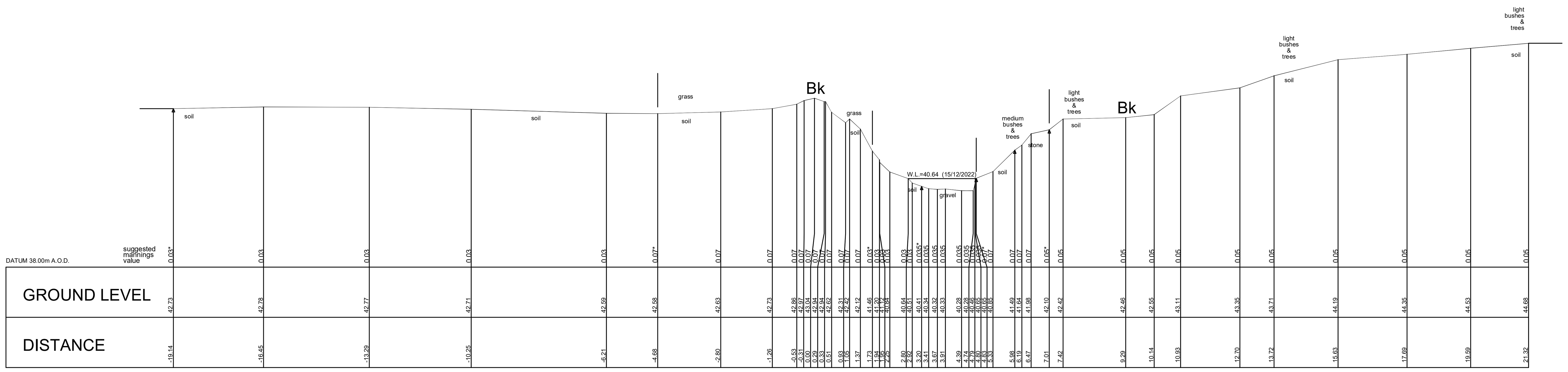
Barkham Brook CS LO05.2288

Centre OSNG Coordinates E.476585.21 N.168446.74



Barkham Brook CS LO05.2130

Centre OSNG Coordinates E.476487.08 N.168569.57



Barkham Brook CS LO05.1897

Centre OSNG Coordinates E.476425.18 N.168759.21

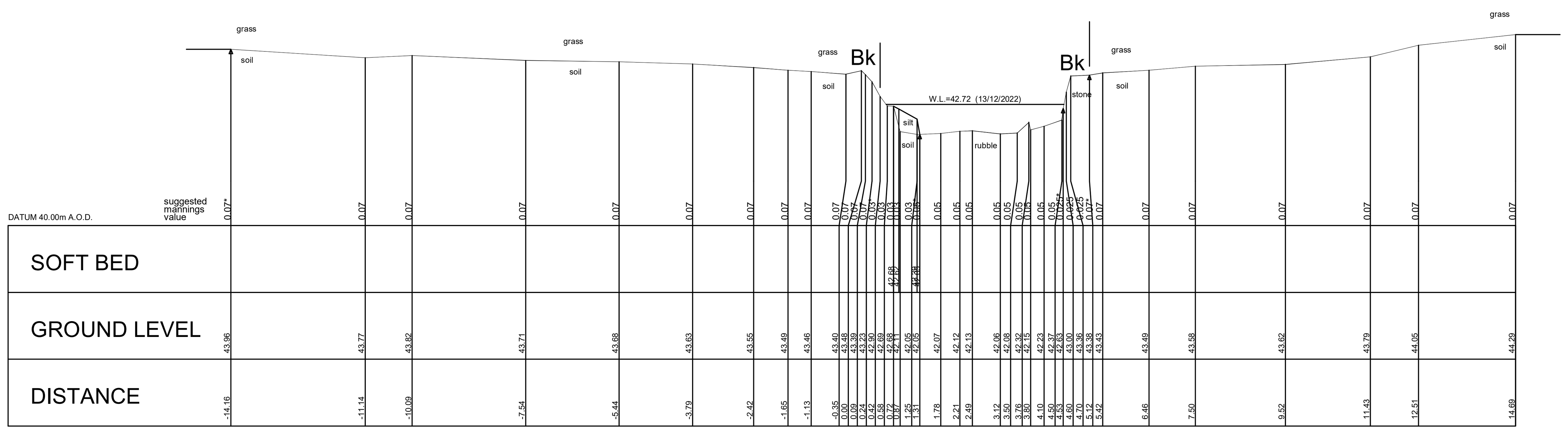
LEGEND FOR SURFACE & VEGETATION CHANGES:
ABOVE GROUND VEGETATION & SEPARATOR
GROUND SURFACE & SEPARATOR
SUGGESTED MANNINGS VALUES IN BLUE TEXT
SURVEYED BY GPS TO OSNG. LEVEL DATUM OSGM15.
ALL SECTIONS SHOWN PERPENDICULAR TO WATERCOURSE

Light
Trees
stone

5 0 5 10 15 20 25m

Scale: 1/100 at A1; 1/200 at A3

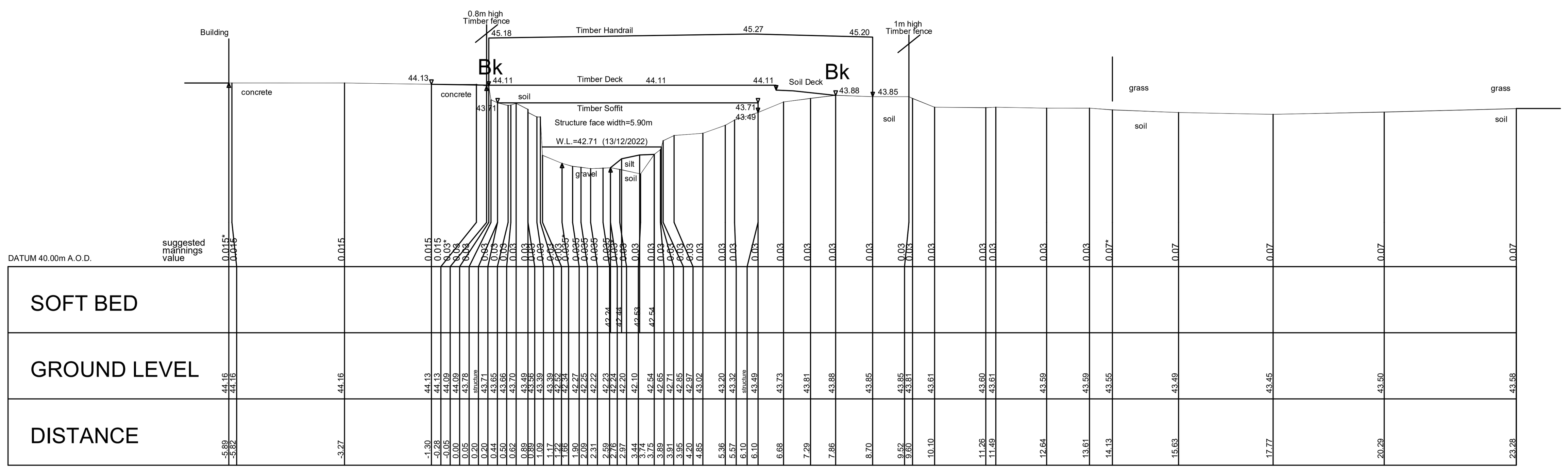
Client	Project	
Abley Letchford Partnership Ltd Consulting Engineers 3 Tealgate, Charnham Park Hungerford, RG17 0YT	Loddon Garden Village Project Watercourses Survey Shinfield to Winnersh Reading	INFOMAP SURVEYS AND MAPPING CHARTERED SURVEYORS Seymours House Sunnyside Road North Weston-super-Mare North Somerset BS23 3PZ Tel: 01934 644060 /fax 01934 644060 E-mail: mail@infomapsurveys.co.uk Website: www.infomapsurveys.co.uk
Surveyed: W.M.	Apprd: R.J.FLEW	DRAWING REFERENCE
Date: November 2021	File Ref: 1829	ISM/LODDON GARDEN VILLAGE PROJECT: LO05 - Barkham Brook
Scale: 1/100 at A1; 1/200 at A3	Datum OSTN15/OSGM15	ISM-LODDON GARDEN VILLAGE-LO05-X-06



Barkham Brook CS LO05.2779

Centre OSNG Coordinates E.476610.00 N.168050.83

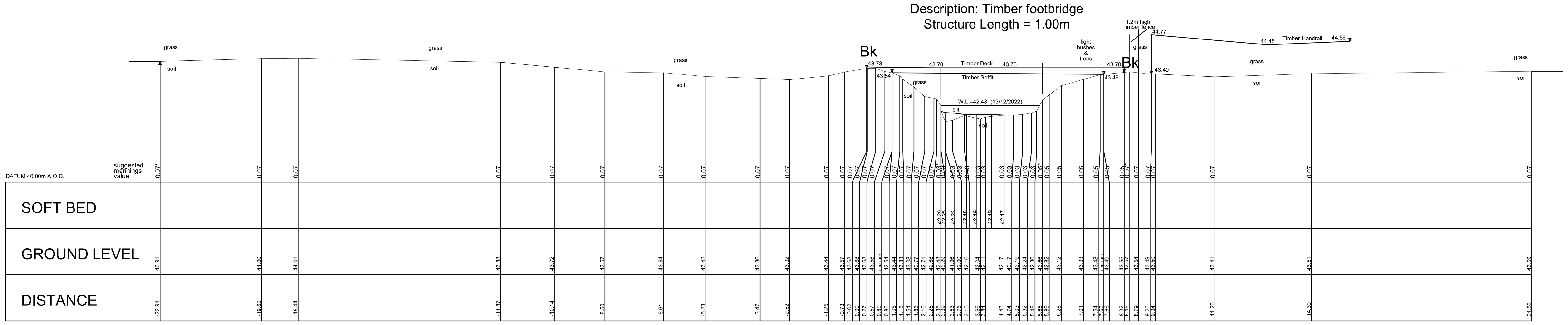
Structure no. 11. Field access
(upstream face of structure)
Description: Timber bridge
Structure Length = 2.50m



Barkham Brook CS LO05.2720

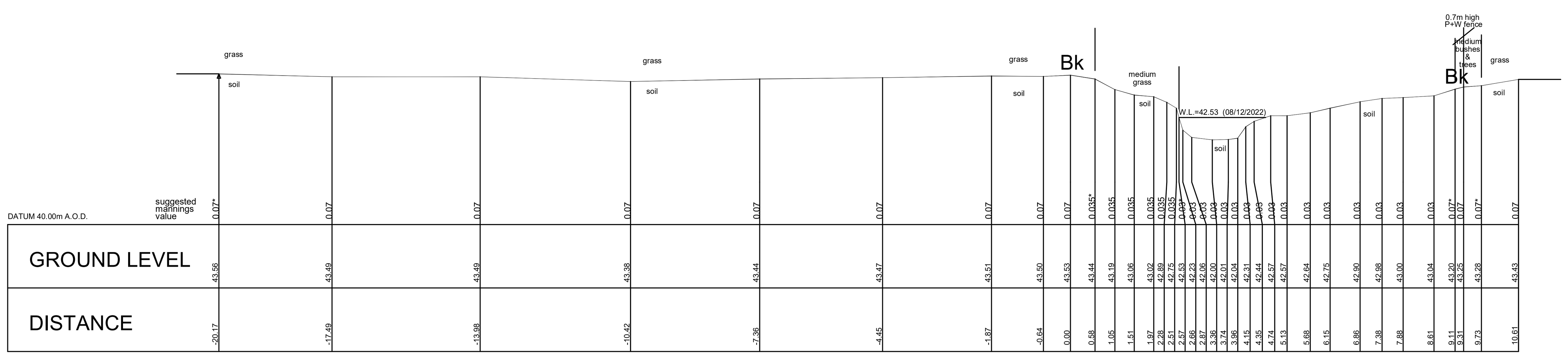
Centre OSNG Coordinates E.476580.31 N.168098.45

Structure no. 10. Field access
(upstream face of structure)
Description: Timber footbridge
Structure Length = 1.00m



Barkham Brook CS LO05.2676

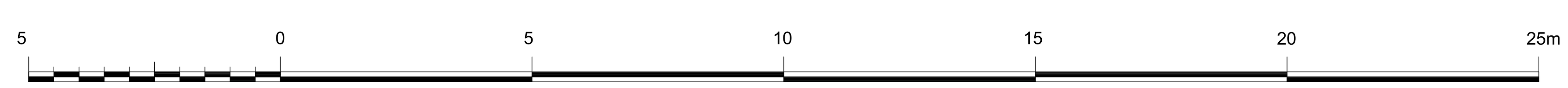
Centre OSNG Coordinates E.476593.89 N.168138.66



Barkham Brook CS LO05.2619

Centre OSNG Coordinates E.476618.06 N.168185.24

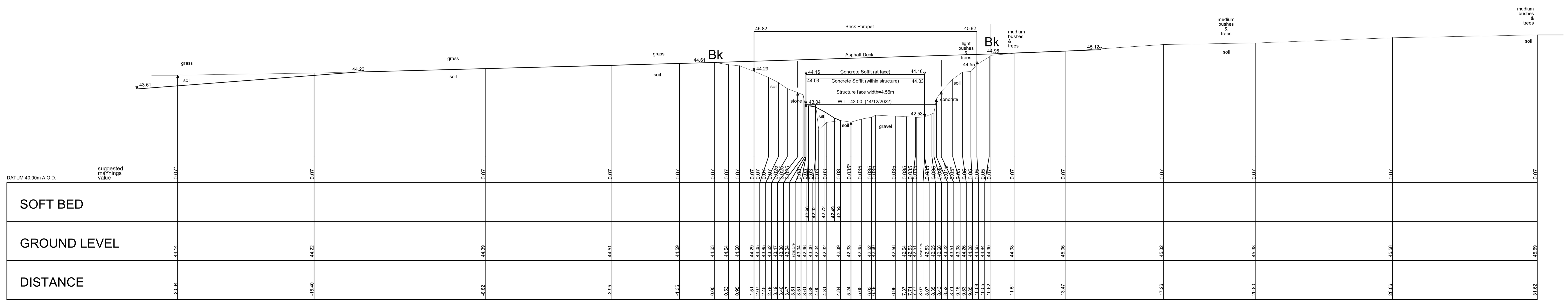
LEGEND FOR SURFACE & VEGETATION CHANGES: Light
ABOVE GROUND VEGETATION & SEPARATOR Trees
GROUND SURFACE & SEPARATOR stone
SUGGESTED MANNINGS VALUES IN BLUE TEXT
SURVEYED BY GPS TO OSNG. LEVEL DATUM OSGM15.
ALL SECTIONS SHOWN PERPENDICULAR TO WATERCOURSE



Scale: 1/100 at A1; 1/200 at A3

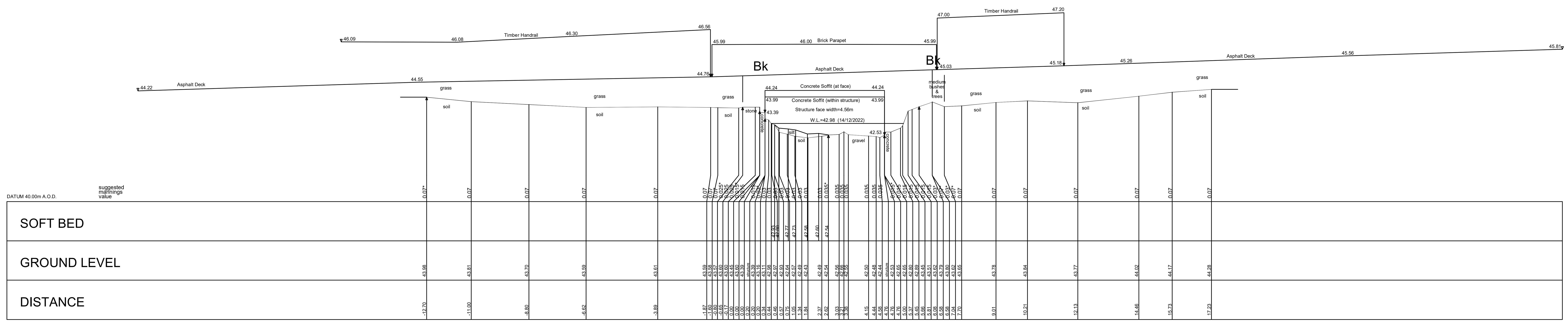
Client	Project	
Abley Letchford Partnership Ltd Consulting Engineers 3 Tealgate, Charnham Park Hungerford, RG17 0YT	Loddon Garden Village Project Watercourses Survey Shinfield to Winnersh Reading	INFOMAP SURVEYS AND MAPPING CHARTERED SURVEYORS RICS Seymours House Sunnyside Road North Weston-super-Mare North Somerset BS23 3PZ Tel: 01934 644060 /fax 01934 644060 E-mail: mail@infomapsurveys.co.uk Website: www.infomapsurveys.co.uk ISO 9001
Surveyed: W.M.	Apprd: R.J.FLEW	DRAWING REFERENCE
Date: November 2021	File Ref: 1829	ISM/LODDON GARDEN VILLAGE PROJECT: LO05 - Barkham Brook
Scale: 1/100 at A1; 1/200 at A3	Datum OSTN15/OSGM15	ISM-LODDON GARDEN VILLAGE-LO05-X-07

Structure no. 13. Mole Road bridge
(upstream face of structure)
Description: Brick and concrete bridge
Structure Length = 11.00m

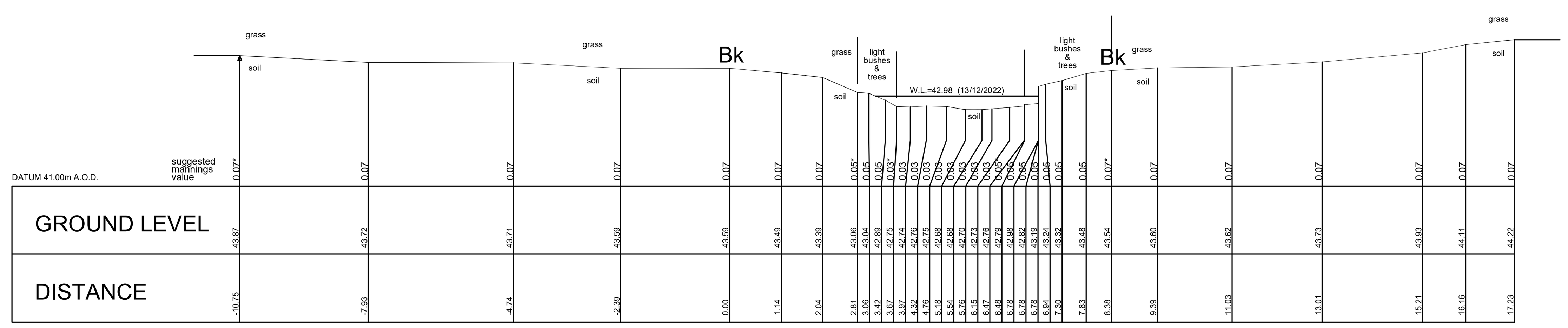


Barkham Brook CS LO05.2796
Centre OSNG Coordinates E.476623.42 N.168040.09

Structure no. 13. Mole Road bridge
(downstream face of structure)
Description: Brick and concrete bridge
Structure Length = 11.00m

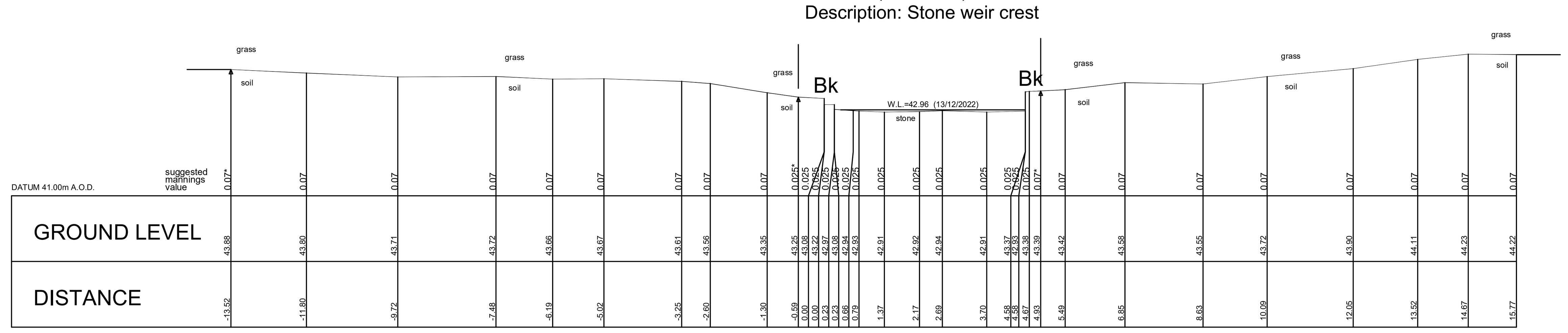


Arborfield pond channel CS LO05.2785
Centre OSNG Coordinates E.476613.86 N.168046.39



Barkham Brook CS LO05.2780
Centre OSNG Coordinates E.476610.83 N.168050.02

Structure no. 12. Mole Road bridge weir
(weir crest)
Description: Stone weir crest



Barkham Brook CS LO05.2779
Centre OSNG Coordinates E.476610.10 N.168050.73

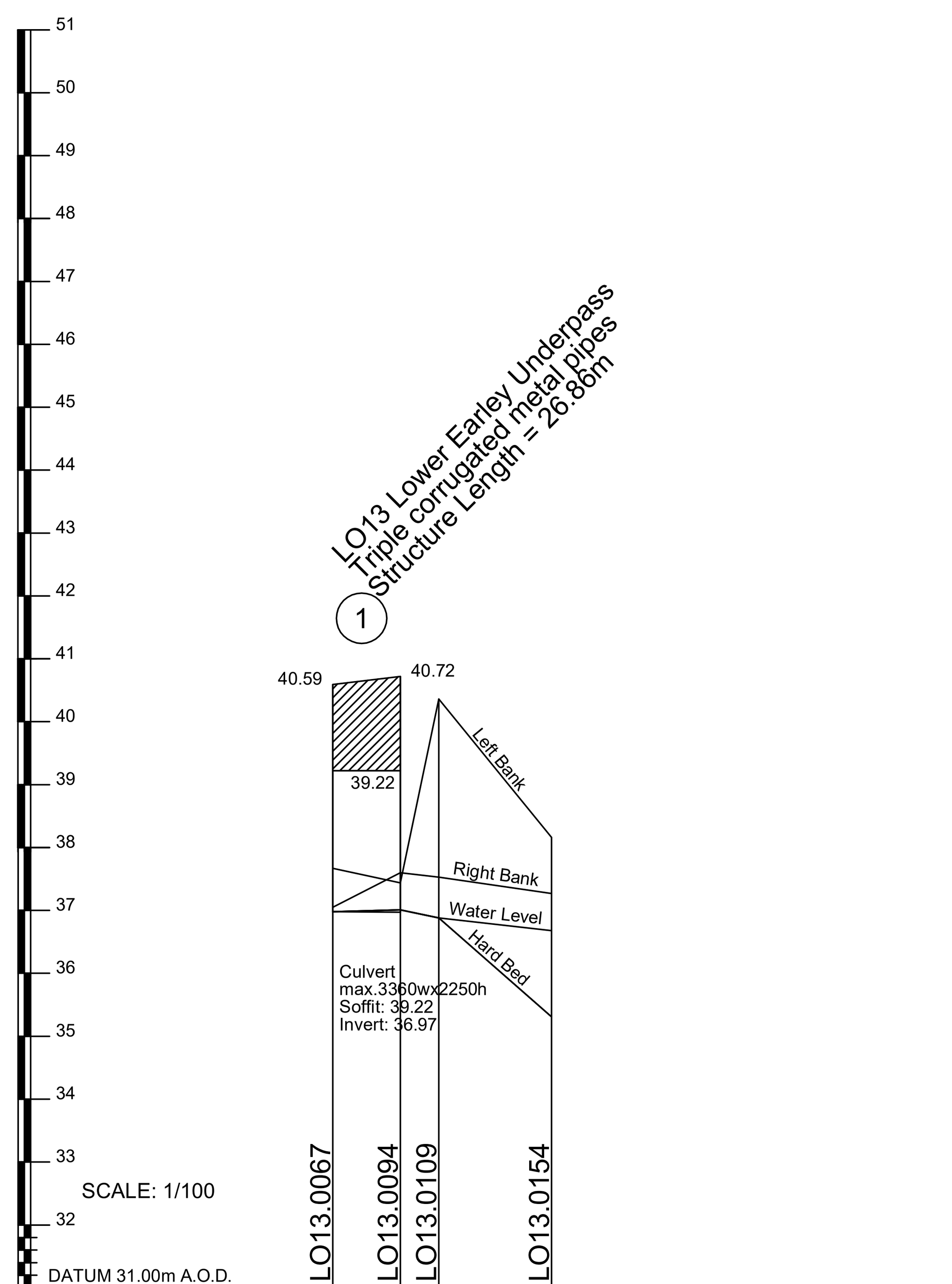
LEGEND FOR SURFACE & VEGETATION CHANGES:
ABOVE GROUND VEGETATION & SEPARATOR
GROUND SURFACE & SEPARATOR
SUGGESTED MANNINGS VALUES IN BLUE TEXT
SURVEYED BY GPS TO OSNG. LEVEL DATUM OSGM15.
ALL SECTIONS SHOWN PERPENDICULAR TO WATERCOURSE

Light | Trees | stone Δ

5 0 5 10 15 20 25m

Scale: 1/100 at A1; 1/200 at A3

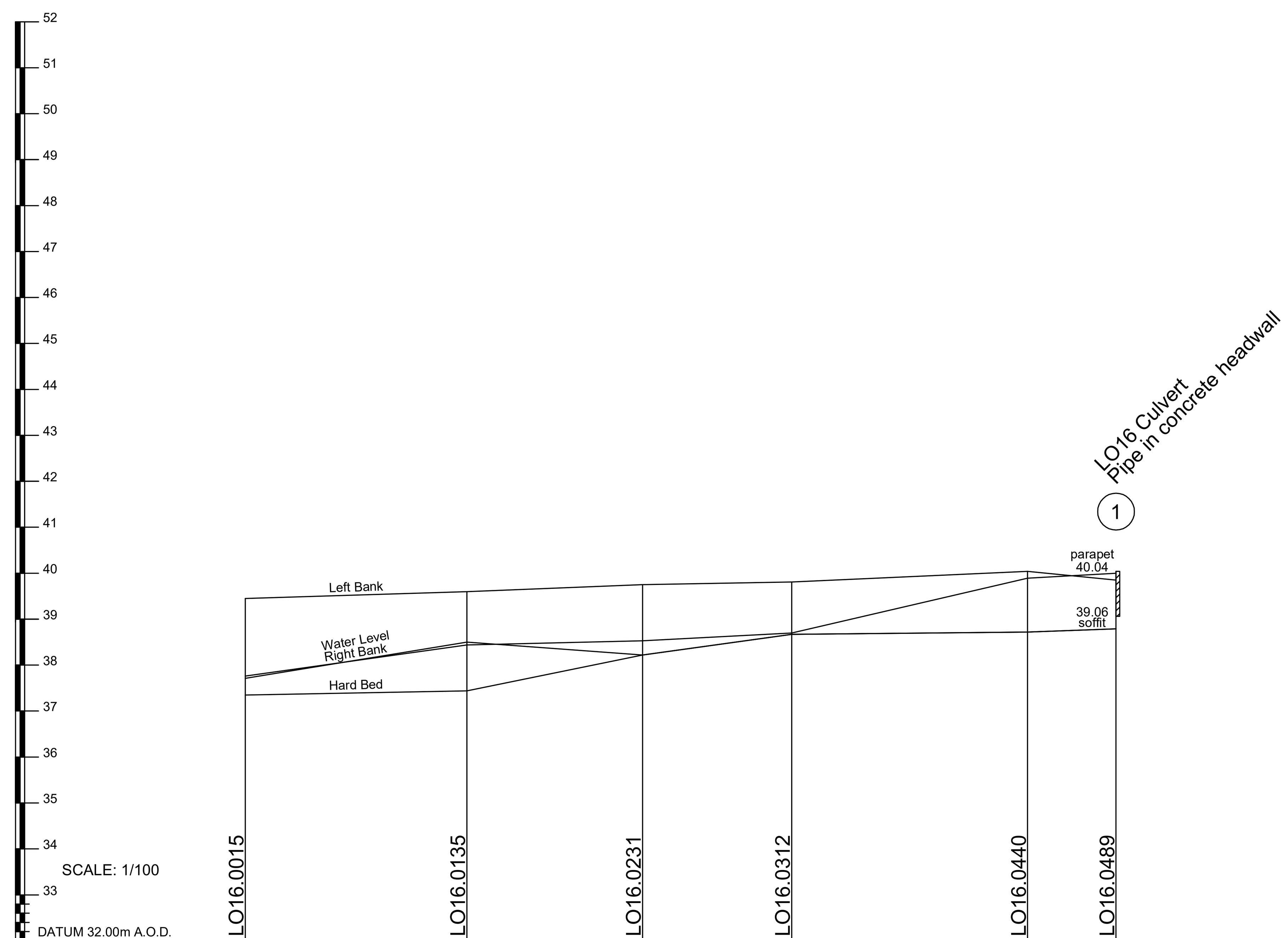
Client	Project	
Abley Letchford Partnership Ltd Consulting Engineers 3 Tealgate, Charnham Park Hungerford, RG17 0YT	Loddon Garden Village Project Watercourses Survey Shinfield to Winnersh Reading	INFOMAP SURVEYS AND MAPPING CHARTERED SURVEYORS Seymours House Sunnyside Road North Weston-super-Mare North Somerset BS23 3PZ Tel: 01934 644060 /fax 01934 644060 E-mail: mail@infomapsurveys.co.uk Website: www.infomapsurveys.co.uk
Surveyed: W.M.	Apprd: R.J.FLEW	DRAWING REFERENCE
Date: November 2021	File Ref: 1829	ISM/LODDON GARDEN VILLAGE PROJECT: LO05 - Barkham Brook
Scale: 1/100 at A1; 1/200 at A3	Datum: OSTN15/OSGM15	ISM-LODDON GARDEN VILLAGE-LO05-X-08



	LO13.0067	LO13.0094	LO13.0109	LO13.0154
BED MATERIAL	soil	soil	soil	soil
LEFT BANK LEVEL	37.67	37.44	40.36	38.16
RIGHT BANK LEVEL	37.05	37.60	37.53	37.27
WATER LEVEL				36.68
SOFT BED LEVEL				
Hard Bed Level	36.98	37.01	36.88	35.31
REGRADE				
CHAINAGE	67	94	109	154

WATER COURSE Lower Earley Way North Bypass (LO13)
LONG SECTION Ch. 0067 TO 0154

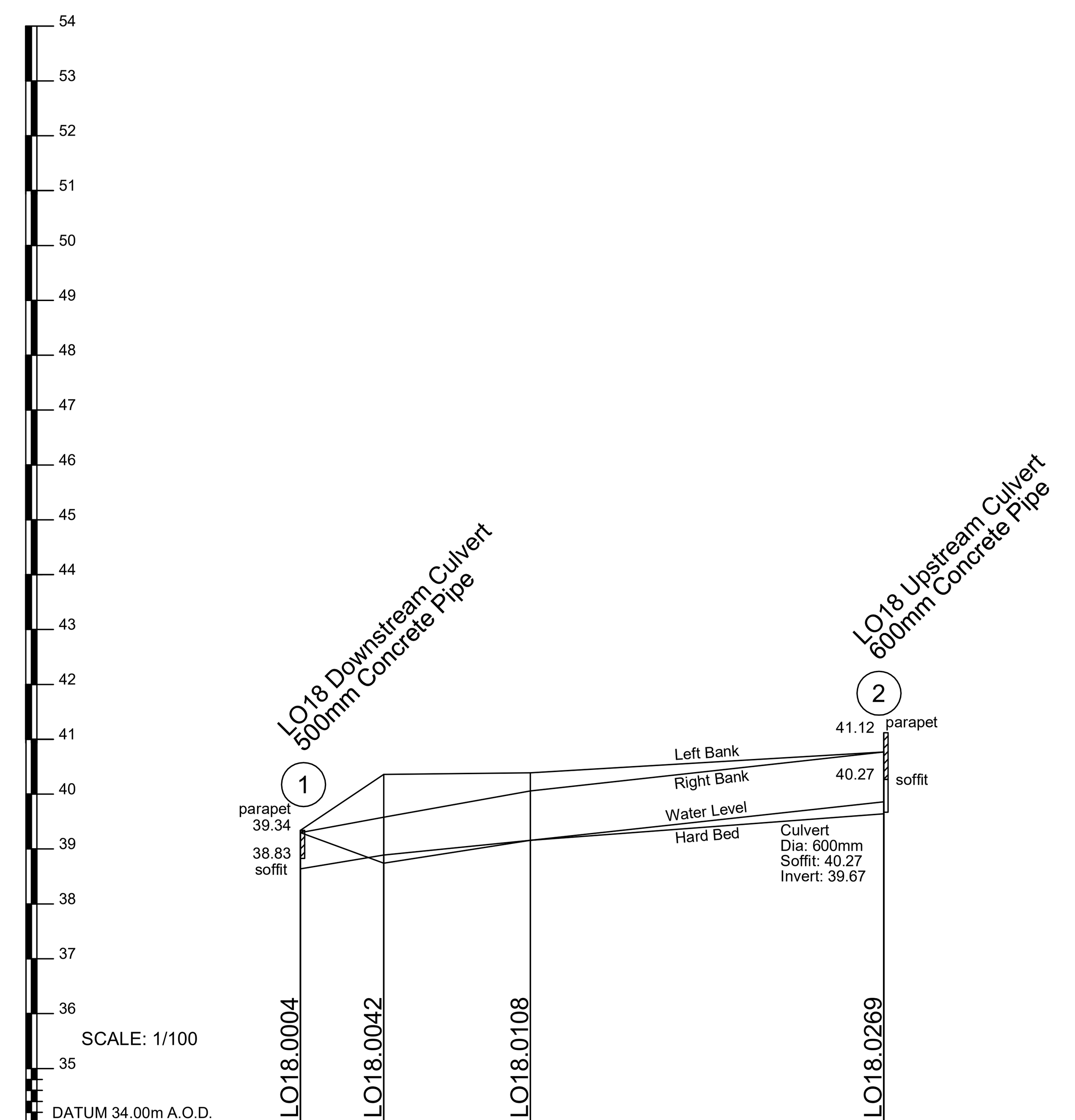
Water Levels taken 14/11/2022 to 15/11/2022



	LO16.0015	LO16.0135	LO16.0231	LO16.0312	LO16.0440	LO16.0489
BED MATERIAL	soil	soil	soil		soil	soil
LEFT BANK LEVEL	39.45	39.60	39.75	39.81	40.04	39.85
RIGHT BANK LEVEL	37.76	38.44	38.53	38.70	39.89	40.00
WATER LEVEL	37.71	38.50				
SOFT BED LEVEL						
Hard Bed Level	37.35	37.44	38.22	38.67	38.72	38.79
REGRADE						
CHAINAGE	15	135	231	312	440	489

WATER COURSE Lower Earley Way Drain 4 (LO16)
LONG SECTION Ch. 0015 TO 0489

Water Levels taken 15/11/2022 to 18/11/2022



	LO18.0004	LO18.0042	LO18.0108	LO18.0269
BED MATERIAL		soil	soil	soil
LEFT BANK LEVEL	39.34	40.36	40.39	40.77
RIGHT BANK LEVEL	39.30	39.58	40.06	40.77
WATER LEVEL	38.64	38.89		39.86
SOFT BED LEVEL				
Hard Bed Level	39.30	38.74	39.16	39.64
REGRADE				
CHAINAGE	4	42	108	269

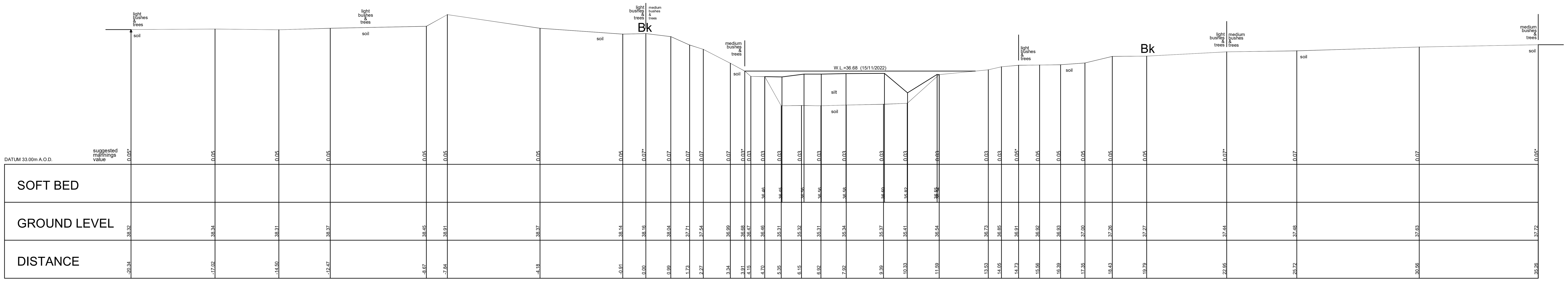
WATER COURSE Lower Earley Way Drain 3 (LO18)
LONG SECTION Ch. 0004 TO 0269

Water Levels taken 16/11/2022 to 21/11/2022

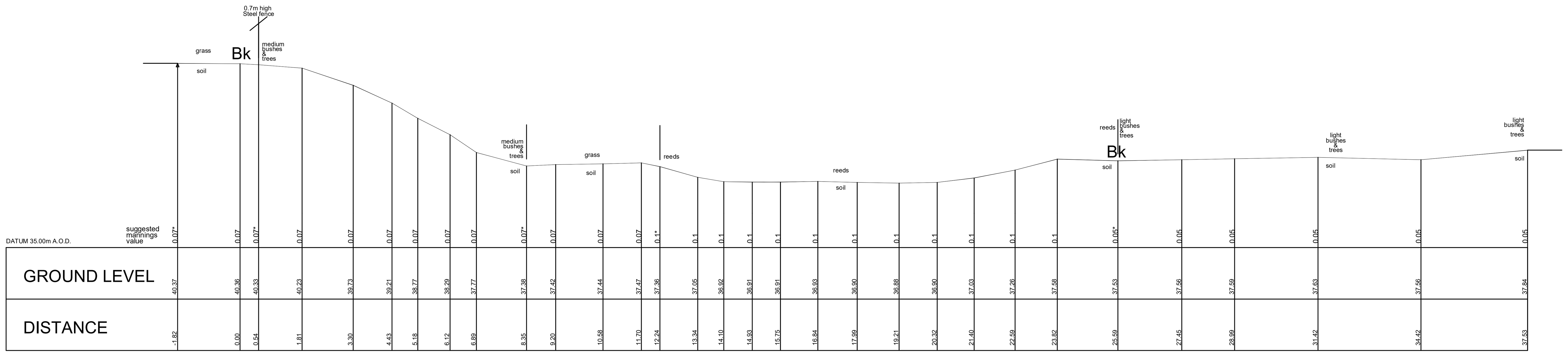
STRUCTURE SECTION
STRUCTURE No.WITH NAME 1
SURVEYED BY GPS TO OSNG. LEVEL DATUM OSGM15.

100 0 100 200 300 400 500m
Scale: 1/2500 at A1; 1/5000 at A3

Client	Project	
Abley Letchford Partnership Ltd Consulting Engineers 3 Tealgate, Charnham Park Hungerford, RG17 0YT	Loddon Garden Village Project Watercourses Survey Shinfield to Winnersh Reading	INFOMAP SURVEYS AND MAPPING CHARTERED SURVEYORS RICS Seymours House Sunnyside Road North Weston-super-Mare North Somerset BS23 3PZ Tel: 01934 644060 /fax 01934 644060 E-mail: mail@infomapsurveys.co.uk Website: www.infomapsurveys.co.uk ISO 9001
Surveyed: W.M, H,L	Apprd: R.J.FLEW	DRAWING REFERENCE ISM/LODDON GARDEN VILLAGE PROJECT: LO13 - Lower Earley Way North Bypass LO16 - Lower Earley Way Drain 2 & LO18 - Lower Earley Way Drain 3
Date: Dec 2022	File Ref: 1829	
Scale: 1/2500 at A1; 1/5000 at A3	Datum OSTN15/OSGM15	ISM-LODDON GARDEN VILLAGE-LO13-LO16-LO18-L

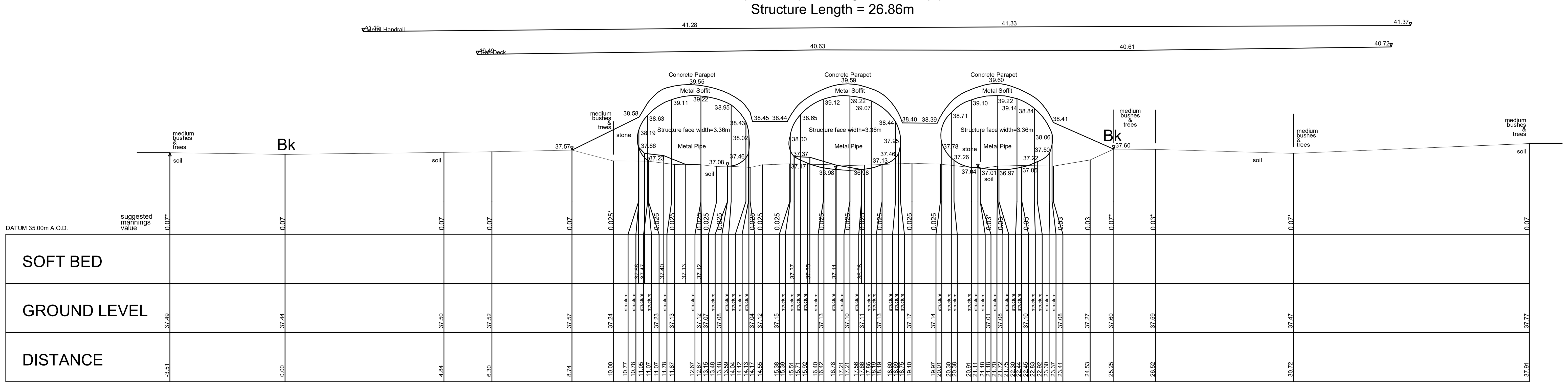


Lower Earley Way North Bypass CS LO13.0154
Centre OSNG Coordinates E.476721.56 N.170624.09



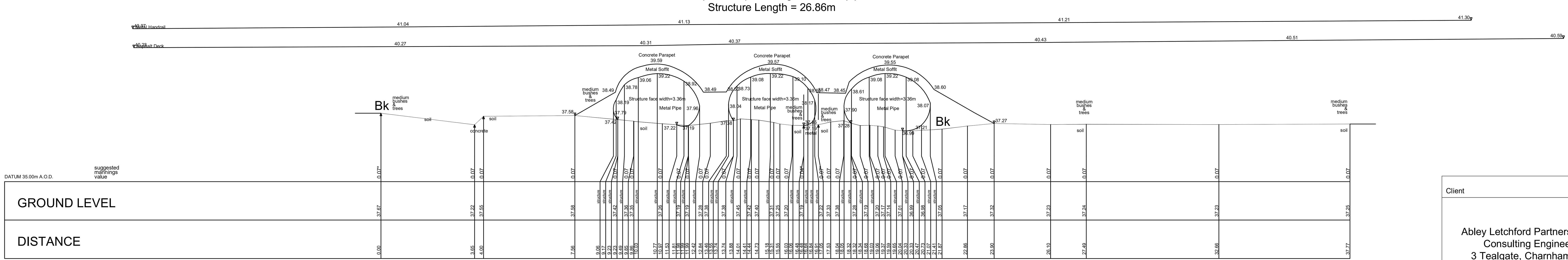
Lower Earley Way North Bypass CS LO13.0109
Centre OSNG Coordinates E.476710.99 N.170667.69

Structure no. 1. LO13 Lower Earley Underpass
(upstream face of structure)
Description: Triple corrugated metal pipes
Structure Length = 26.86m



Lower Earley Way North Bypass CS LO13.0094
Centre OSNG Coordinates E.476709.97 N.170681.99

Structure no. 1. LO13 Lower Earley Underpass
(downstream face of structure)
Description: Triple corrugated metal pipes
Structure Length = 26.86m



Lower Earley Way North Bypass CS LO13.0067
Centre OSNG Coordinates E.476685.71 N.170693.45

LEGEND FOR SURFACE & VEGETATION CHANGES:
ABOVE GROUND VEGETATION & SEPARATOR
GROUND SURFACE & SEPARATOR
SUGGESTED MANNINGS VALUES IN BLUE TEXT
SURVEYED BY GPS TO OSNG. LEVEL DATUM OSGM15.
ALL SECTIONS SHOWN PERPENDICULAR TO WATERCOURSE

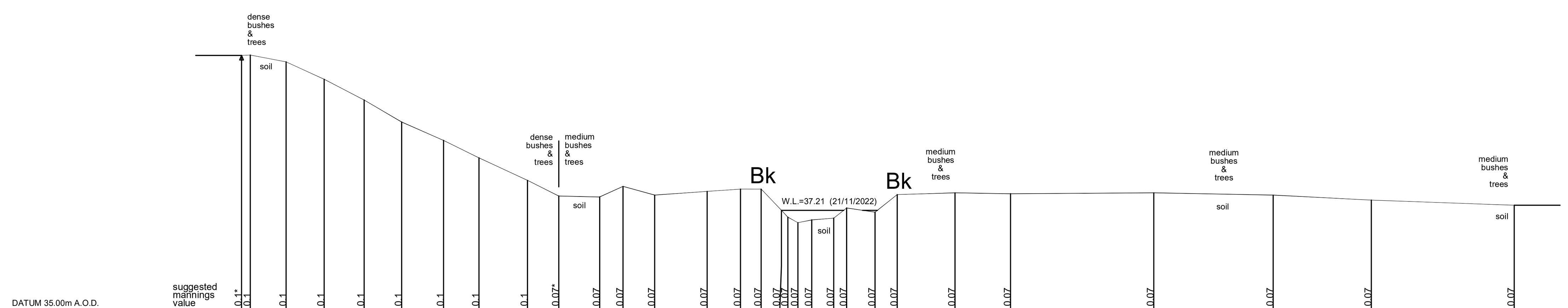
5 0 5 10 15 20 25m

Scale: 1/100 at A1; 1/200 at A3

Client	Project
Abley Letchford Partnership Ltd Consulting Engineers 3 Tealgate, Charnham Park Hungerford, RG17 0YT	Loddon Garden Village Project Watercourses Survey Shinfield to Winnersh Reading
Surveyed: W.M.	Apprd: R.J.FLEW
Date: November 2021	File Ref: 1829
Scale: 1/100 at A1; 1/200 at A3	Datum OSTN15/OSGM15

INFOMAP SURVEYS AND MAPPING
CHARTERED SURVEYORS
RICS
Seymours House
Sunnyside Road North
Weston-super-Mare
North Somerset BS23 3PZ
Tel: 01934 644060 /fax 01934 644060
E-mail: mail@infomapsurveys.co.uk
Website: www.infomapsurveys.co.uk
ISO 9001 REGISTERED FIRM

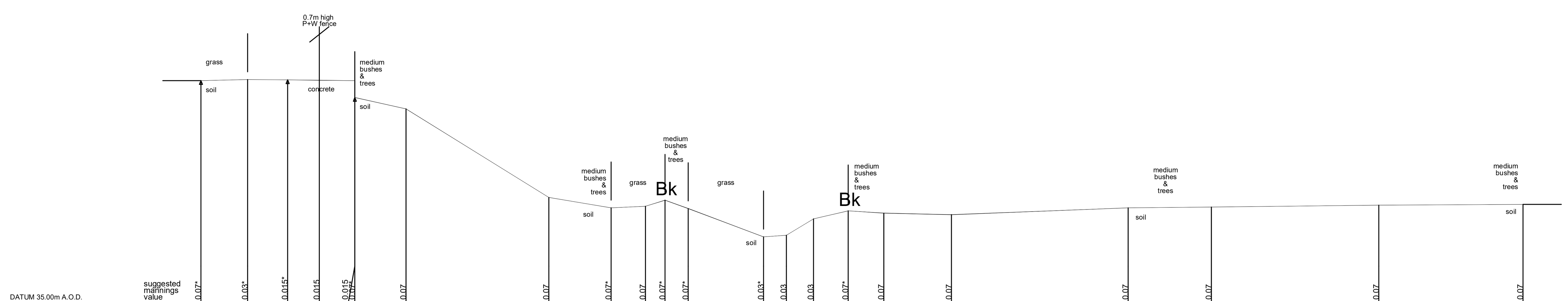
DRAWING REFERENCE
ISM/LODDON GARDEN VILLAGE PROJECT:
LO13 - Lower Earley Way North bypass
ISM-LODDON GARDEN VILLAGE-LO13-X-01



suggested mannings value	GROUND LEVEL	DISTANCE
0.1*	40.58	-11.32
0.1	40.59	-11.13
0.1	40.44	-10.35
0.1	40.06	-9.52
0.1	39.61	-8.65
0.1	39.13	-7.83
0.1	38.73	-6.92
0.1	38.35	-6.15
0.1	37.86	-5.09
0.07*	37.52	-4.41
0.07	37.50	-3.52
0.07	37.73	-3.01
0.07	37.54	-2.32
0.07	37.62	-1.18
0.07	37.67	-0.45
0.07	37.67	0.00
0.07	37.21	0.44
0.07	37.06	0.58
0.07	36.94	0.80
0.07	37.00	1.10
0.07	37.04	1.58
0.07	37.26	1.86
0.07	37.17	2.48
0.07	37.55	2.96
0.07	37.59	4.22
0.07	37.57	5.43
0.07	37.59	8.55
0.07	37.54	11.15
0.07	37.43	13.29
0.07	37.32	16.40

Lower Earley Way North Drain 1 CS LO14.0037

Centre OSNG Coordinates E.476723.45 N.170694.90



suggested mannings value	GROUND LEVEL	DISTANCE
0.07*	40.86	-12.15
0.03*	40.89	-10.93
0.015*	40.88	-9.88
0.015	40.87	-9.05
0.015	40.42	-8.12
0.07*	40.86	-8.12
0.07	40.12	-6.78
0.07	37.80	-3.04
0.07*	37.53	-1.41
0.07	37.57	-0.51
0.07*	37.73	0.00
0.07*	37.51	0.61
0.03*	36.77	2.58
0.03	36.81	3.18
0.03	37.24	3.89
0.07*	37.45	4.80
0.07	37.39	5.73
0.07	37.35	7.50
0.07	37.53	12.13
0.07	37.55	14.31
0.07	37.60	18.69
0.07	37.62	22.47

Lower Earley Way North Drain 1 CS LO14.0014

Centre OSNG Coordinates E.476732.23 N.170715.94

Client	Project
Abley Letchford Partnership Ltd Consulting Engineers 3 Tealgate, Charnham Park Hungerford, RG17 0YT	Loddon Garden Village Project Watercourses Survey Shinfield to Winnersh Reading
Surveyed: W.M.	Apprd: R.J.FLEW
Date: November 2021	File Ref: 1829
Scale: 1/100 at A1; 1/200 at A3	Datum OSTN15/OSGM15

INFOMAP
SURVEYS AND MAPPING
CHARTERED SURVEYORS
Seymours House
Sunnyside Road North
Weston-super-Mare
North Somerset BS23 3PZ
Tel: 01934 644060 /fax 01934 644060
E-mail: mail@infomapsurveys.co.uk
Website: www.infomapsurveys.co.uk
RICS
ISO 9001

DRAWING REFERENCE

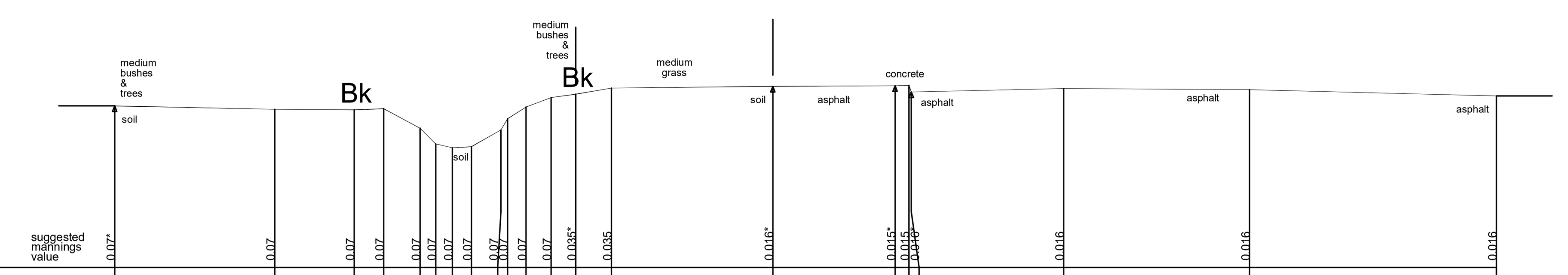
ISM/LODDON GARDEN VILLAGE PROJECT:
LO14 - Lower Earley Way North Drain 1

ISM-LODDON GARDEN VILLAGE-LO14-X-01

LEGEND FOR SURFACE & VEGETATION CHANGES:
ABOVE GROUND VEGETATION & SEPARATOR — Light | Trees |
GROUND SURFACE & SEPARATOR — stone Δ
SUGGESTED MANNINGS VALUES IN BLUE TEXT
SURVEYED BY GPS TO OSNG. LEVEL DATUM OSGM15.
ALL SECTIONS SHOWN PERPENDICULAR TO WATERCOURSE

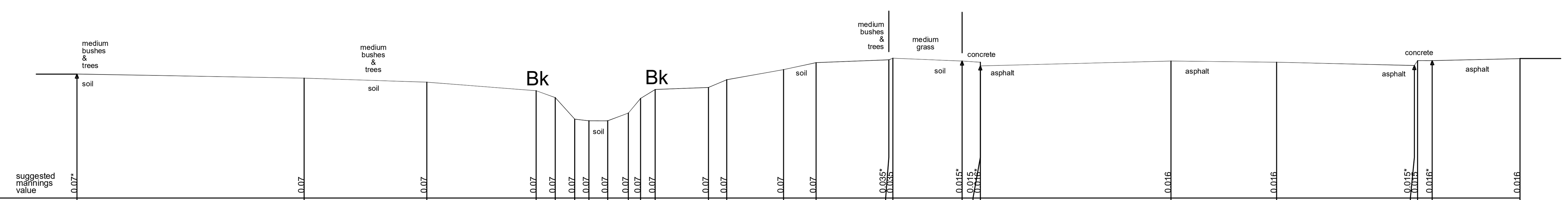
5 0 5 10 15 20 25m

Scale: 1/100 at A1; 1/200 at A3



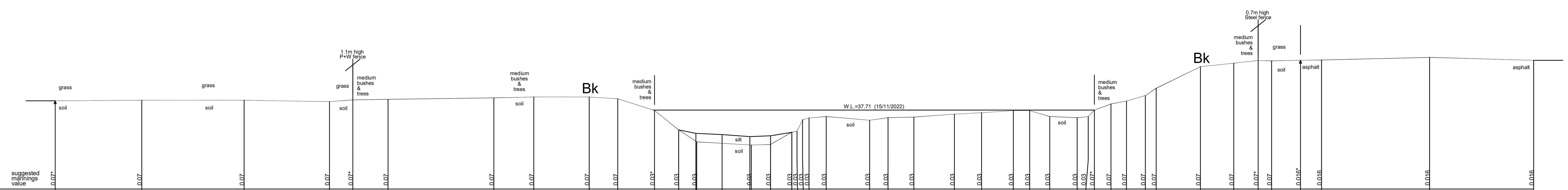
DISTANCE	GROUND LEVEL	suggested mannings value
-4.29	38.89	0.07*
-1.42	38.83	0.07
0.00	38.82	0.07
0.53	38.84	0.07
1.18	38.49	0.07
1.46	38.21	0.07
1.76	38.14	0.07
2.10	38.16	0.07
2.63	38.46	0.07
2.76	38.66	0.07
3.08	38.87	0.07
3.53	39.04	0.07
3.97	39.10	0.035*
4.61	39.21	0.035
7.50	39.24	0.016*
9.89	39.25	0.015*
9.94	39.26	0.015
9.98	39.14	0.016*
12.71	39.20	0.016
16.04	39.18	0.016
20.46	39.07	0.016

Lower Earley Way Drain 1 CS LO15.0039



DISTANCE	GROUND LEVEL	suggested mannings value
-11.30	39.05	0.07*
-5.71	38.95	0.07
-2.69	38.85	0.07
0.00	38.64	0.07
0.47	38.47	0.07
0.95	37.94	0.07
1.30	37.90	0.07
1.76	37.90	0.07
2.27	38.09	0.07
2.57	38.45	0.07
2.93	38.67	0.07
4.24	38.72	0.07
4.69	38.91	0.07
6.09	39.16	0.07
6.89	39.33	0.07
8.68	39.40	0.035*
8.78	39.44	0.035
10.48	39.37	0.015*
10.93	39.25	0.015
10.93	39.34	0.016*
15.62	39.37	0.016
18.22	39.34	0.016
21.61	39.26	0.015*
21.69	39.36	0.015
22.05	39.38	0.016*
24.21	39.43	0.016

Lower Earley Way Drain 1 CS LO15.0039



DISTANCE	GROUND LEVEL	SOFT BED	suggested mannings value
-18.32	38.03		0.07*
-15.35	38.05		0.07
-11.84	38.05		0.07
-8.91	38.00		0.07
-8.11	38.06		0.07*
-6.90	38.08		0.07
-3.27	38.13		0.07
-1.90	38.16		0.07
0.00	38.16		0.07
0.98	38.10		0.07
2.24	37.70		0.03*
3.07	37.03	37.03	0.03
3.69	36.62	36.91	0.03
		36.87	
5.56	36.51	36.80	0.03
6.22	36.53	36.63	0.03
6.95	36.95	36.95	0.03
7.13	36.98		0.03
7.32	37.38		0.03
7.54	37.44		0.03
8.13	37.49		0.03
9.62	37.36		0.03
10.25	37.45		0.03
11.14	37.47		0.03
12.53	37.57		0.03
13.46	37.62		0.03
14.55	37.69		0.03
15.11	37.69		0.03
15.80	37.49		0.03
16.74	37.45		0.03
17.12	37.49		0.03
17.33	37.71		0.07*
17.90	37.92		0.07
18.43	38.02		0.07
19.08	38.21		0.07
19.45	38.46		0.07
20.97	39.20		0.07
22.11	39.32		0.07
22.95	39.41		0.07*
23.41	39.40		0.07
24.42	39.42		0.016*
25.12	39.43		0.016
28.83	39.52		0.016
32.42	39.42		0.016

Lower Earley Way Drain 1 1 CS LO15.0038

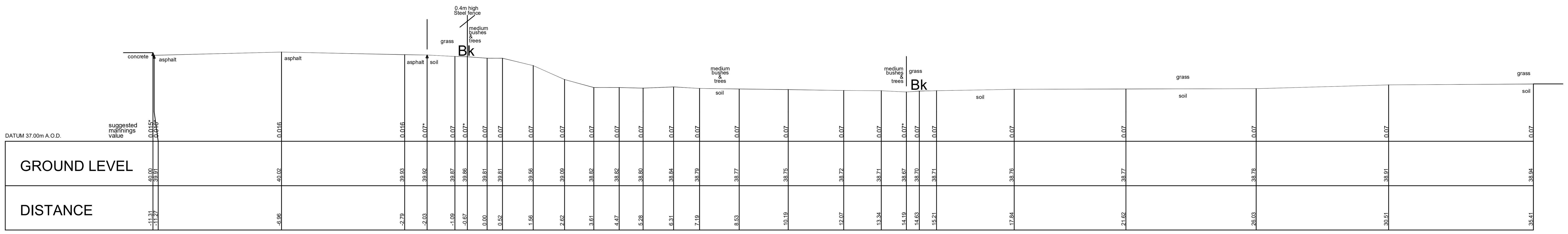
LEGEND FOR SURFACE & VEGETATION CHANGES:
ABOVE GROUND VEGETATION & SEPARATOR
GROUND SURFACE & SEPARATOR
SUGGESTED MANNINGS VALUES IN BLUE TEXT
SURVEYED BY GPS TO OSNG. LEVEL DATUM OSGM15.
ALL SECTIONS SHOWN PERPENDICULAR TO WATERCOURSE

Light | Trees | stone Δ

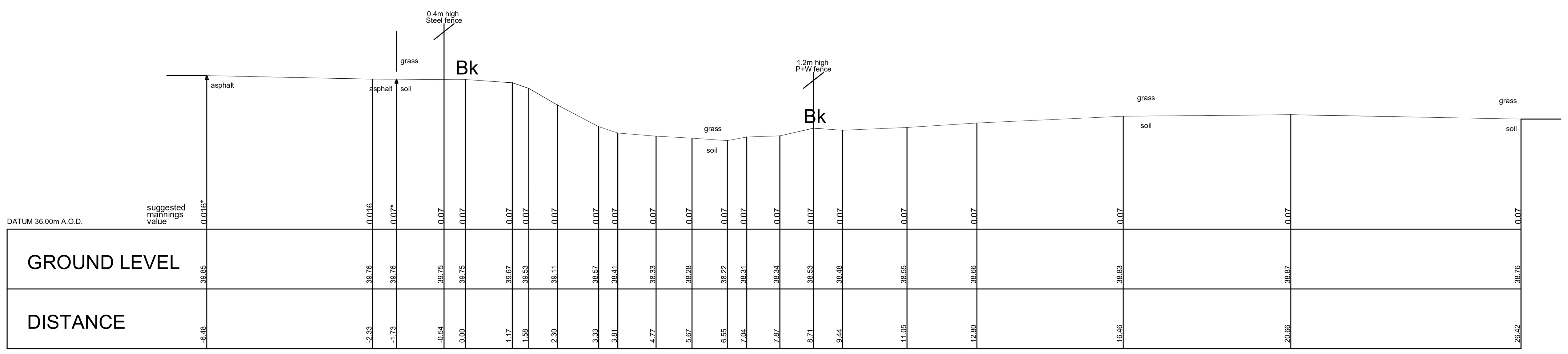
5 0 5 10 15 20 25m

Scale: 1/100 at A1; 1/200 at A3

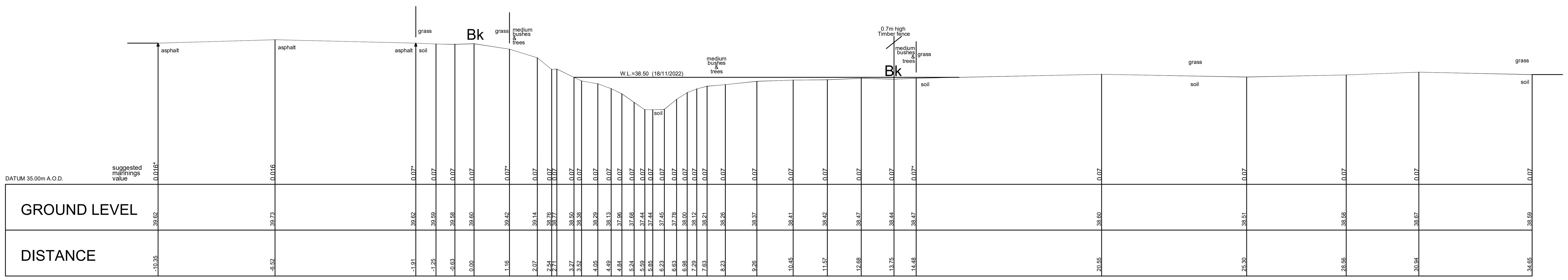
Client	Project	
Abley Letchford Partnership Ltd Consulting Engineers 3 Tealgate, Charnham Park Hungerford, RG17 0YT	Loddon Garden Village Project Watercourses Survey Shinfield to Winnersh Reading	INFOMAP SURVEYS AND MAPPING CHARTERED SURVEYORS Seymours House Sunnyside Road North Weston-super-Mare North Somerset BS23 3PZ Tel: 01934 644060 /fax 01934 644060 E-mail: mail@infomapsurveys.co.uk Website: www.infomapsurveys.co.uk
Surveyed: W.M.	Apprd: R.J.FLEW	DRAWING REFERENCE
Date: November 2021	File Ref: 1829	ISM/LODDON GARDEN VILLAGE PROJECT: LO15 - Lower Earley Way Drain 1
Scale: 1/100 at A1; 1/200 at A3	Datum OSTN15/OSGM15	ISM-LODDON GARDEN VILLAGE-LO15-X-01



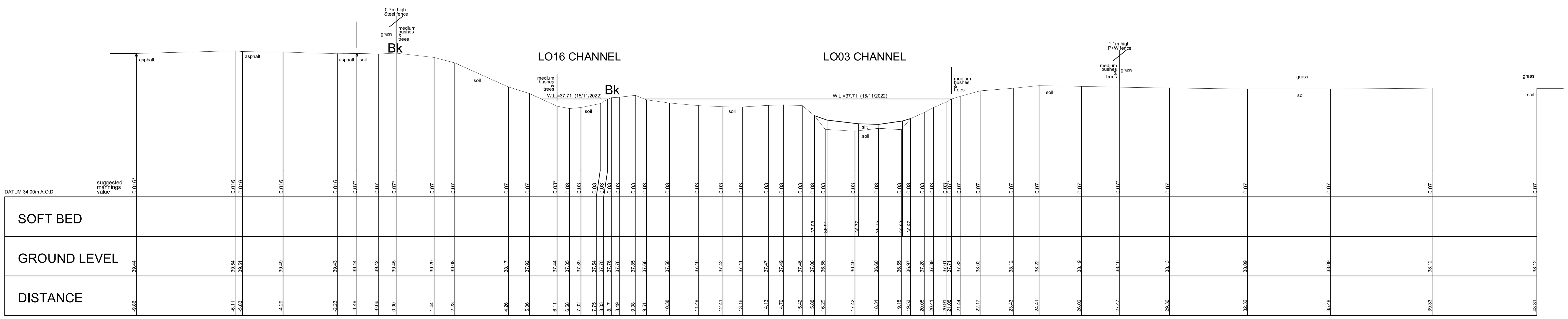
Lower Earley Way Drain 2 CS LO16.0312
Centre OSNG Coordinates E.476239.96 N.170138.65



Lower Earley Way Drain 2 CS LO16.0231
Centre OSNG Coordinates E.476298.75 N.170194.60



Lower Earley Way Drain 2 CS LO16.0135
Centre OSNG Coordinates E.476365.18 N.170263.35



Lower Earley Way Drain 2 CS LO16.0015
Centre OSNG Coordinates E.476448.25 N.170350.59

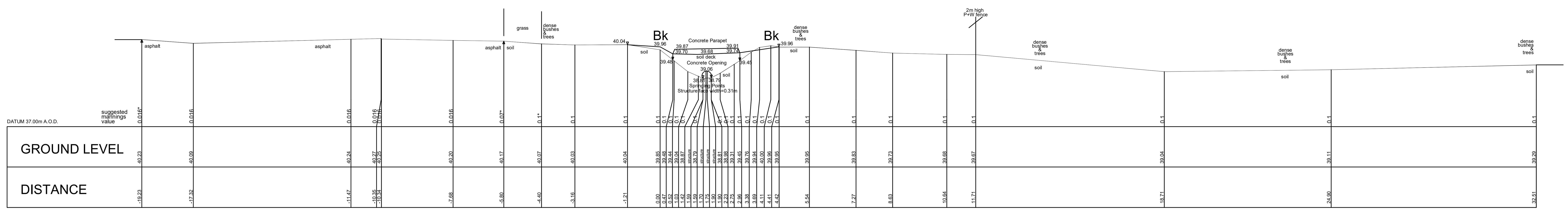
LEGEND FOR SURFACE & VEGETATION CHANGES:
ABOVE GROUND VEGETATION & SEPARATOR — Light / Trees / stone
GROUND SURFACE & SEPARATOR
SUGGESTED MANNINGS VALUES IN BLUE TEXT
SURVEYED BY GPS TO OSNG. LEVEL DATUM OSGM15.
ALL SECTIONS SHOWN PERPENDICULAR TO WATERCOURSE

5 0 5 10 15 20 25m

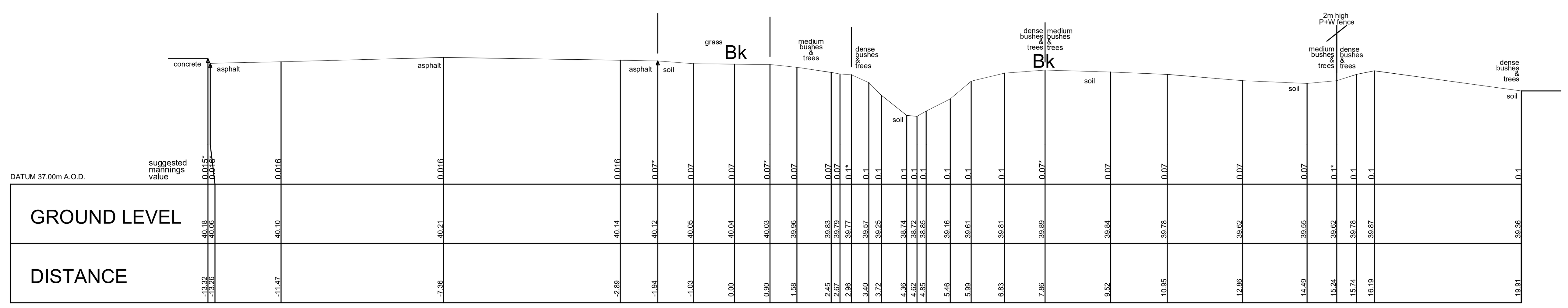
Scale: 1/100 at A1; 1/200 at A3

Client	Project	
Abley Letchford Partnership Ltd Consulting Engineers 3 Tealgate, Charnham Park Hungerford, RG17 0YT	Loddon Garden Village Project Watercourses Survey Shinfield to Winnersh Reading	INFOMAP SURVEYS AND MAPPING CHARTERED SURVEYORS Seymours House Sunnyside Road North Weston-super-Mare North Somerset BS23 3PZ Tel: 01934 644060 /fax 01934 644060 E-mail: mail@infomapsurveys.co.uk Website: www.infomapsurveys.co.uk RICS ISO 9001
Surveyed: W.M.	Apprd: R.J.FLEW	DRAWING REFERENCE
Date: November 2021	File Ref: 1829	ISM/LODDON GARDEN VILLAGE PROJECT: LO16 - Lower Earley Way Drain 2
Scale: 1/100 at A1; 1/200 at A3	Datum: OSTN15/OSGM15	ISM-LODDON GARDEN VILLAGE-LO16-X-01

Structure no. 1. LO16 Culvert
(downstream face of structure)
Description: Pipe in concrete headwall



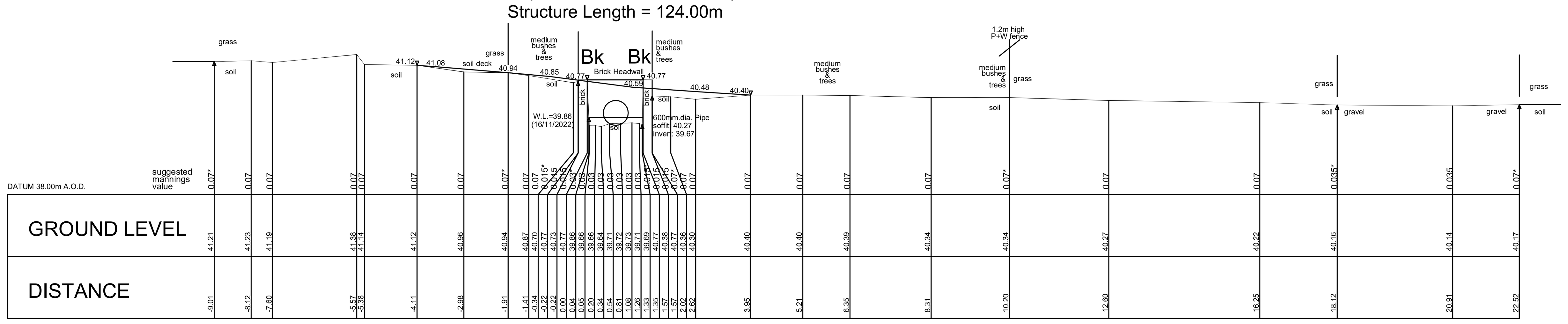
Lower Earley Way Drain 2 CS LO16.0489
Centre OSNG Coordinates E.476106.20 N.170023.75



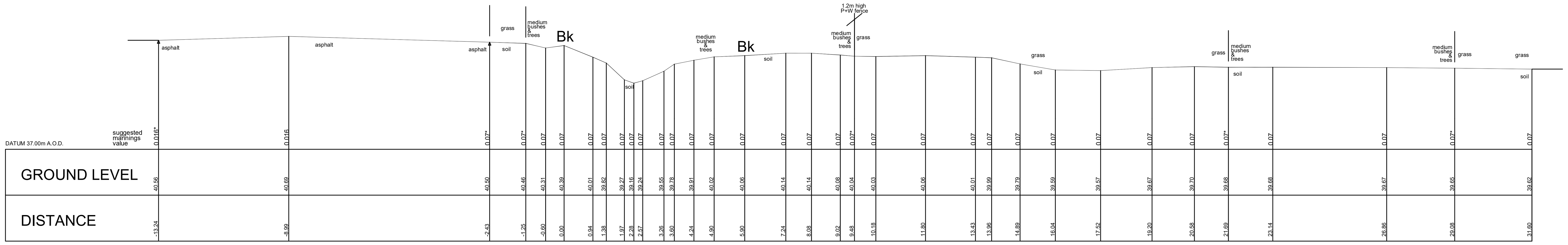
Lower Earley Way Drain 2 CS LO16.0440
Centre OSNG Coordinates E.476142.51 N.170055.27

Client	Project	
Abley Letchford Partnership Ltd Consulting Engineers 3 Tealgate, Charnham Park Hungerford, RG17 0YT	Loddon Garden Village Project Watercourses Survey Shinfield to Winnersh Reading	INFOMAP SURVEYS AND MAPPING CHARTERED SURVEYORS Seymours House Sunnyside Road North Weston-super-Mare North Somerset BS23 3PZ Tel: 01934 644060 /fax 01934 644060 E-mail: mail@infomapsurveys.co.uk Website: www.infomapsurveys.co.uk
Surveyed: W.M.	Apprd: R.J.FLEW	DRAWING REFERENCE
Date: November 2021	File Ref: 1829	ISM/LODDON GARDEN VILLAGE PROJECT: LO16 - Lower Earley Way Drain 2
Scale: 1/100 at A1; 1/200 at A3	Datum OSTN15/OSGM15	ISM-LODDON GARDEN VILLAGE-LO16-X-02

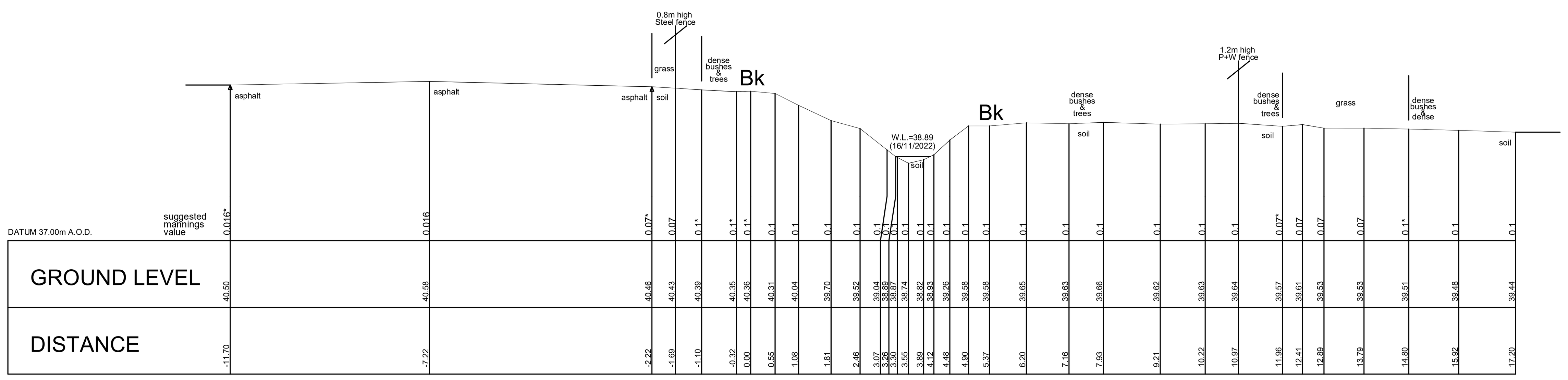
Structure no. 2. LO18 Upstream Culvert
(downstream face of structure)
Description: 600mm Concrete Pipe
Structure Length = 124.00m



Lower Earley Way Drain 3 CS LO18.0269
Centre OSNG Coordinates E.475742.34 N.169807.28

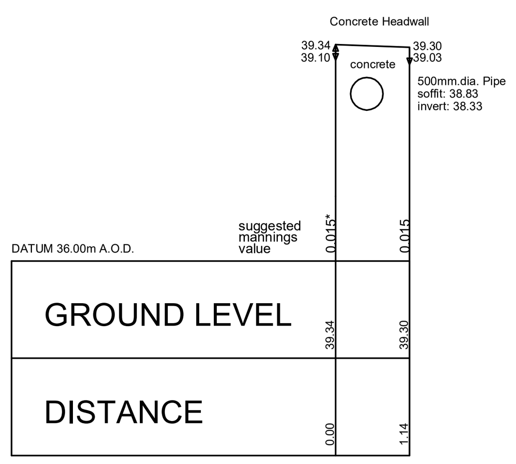


Lower Earley Way Drain 3 CS LO18.0108
Centre OSNG Coordinates E.475886.83 N.169878.16



Lower Earley Way Drain 3 CS LO18.0042
Centre OSNG Coordinates E.475944.01 N.169912.30

Structure no. 1. LO18 Downstream Culvert
(downstream face of structure)
Description: 500mm Concrete Pipe
Structure Length = 5.00m
(Limited Access, approximate / partial)



Lower Earley Way Drain 3 CS LO18.0004
Centre OSNG Coordinates E.475976.61 N.169931.80

LEGEND FOR SURFACE & VEGETATION CHANGES:
ABOVE GROUND VEGETATION & SEPARATOR
GROUND SURFACE & SEPARATOR
SUGGESTED MANNINGS VALUES IN BLUE TEXT
SURVEYED BY GPS TO OSNG. LEVEL DATUM OSGM15.
ALL SECTIONS SHOWN PERPENDICULAR TO WATERCOURSE

Light | Trees | stone Δ

5 0 5 10 15 20 25m

Scale: 1/100 at A1; 1/200 at A3

Client	Project	
Abley Letchford Partnership Ltd Consulting Engineers 3 Tealgate, Charnham Park Hungerford, RG17 0YT	Loddon Garden Village Project Watercourses Survey Shinfield to Winnersh Reading	INFOMAP SURVEYS AND MAPPING CHARTERED SURVEYORS RICS Seymours House Sunnyside Road North Weston-super-Mare North Somerset BS23 3PZ Tel: 01934 644060 /fax 01934 644060 E-mail: mail@infomapsurveys.co.uk Website: www.infomapsurveys.co.uk ISO 9001
Surveyed: W.M.	Apprd: R.J.FLEW	DRAWING REFERENCE
Date: November 2021	File Ref: 1829	ISM/LODDON GARDEN VILLAGE PROJECT: LO18 - Lower Earley Way Drain 3
Scale: 1/100 at A1; 1/200 at A3	Datum OSTN15/OSGM15	ISM-LODDON GARDEN VILLAGE-LO18-X-01