Shorts Park, Shortstown

Flood Risk and Drainage Briefing Note

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1. Introduction

1.1. Waterman Infrastructure and Environment have been commissioned to undertake a Flood Risk and Drainage review to support the Local Plan submission for 'Shorts Park' development located at Shortstown, Bedfordshire (hereafter referred to as 'the Site'). The Site is located in the Borough of Bedford, and within the statutory district of Bedfordshire and the River Ivel Internal Drainage Board (IDB)

1.2. This Briefing Note has been produced to outline the flood risk constraints relevant to the Site, and to produce a preliminary surface and foul water drainage strategy to feed into and inform the development masterplan. It is important that spatial constraints such as indicative floodplains and Sustainable Drainage Systems (SuDS) are incorporated into the scheme proposals during the early stages of the design process to ensure that the scheme is robust moving forwards.

1.3. The drainage strategy outlined in this note is indicative only, based on the current masterplan concept plan. As the masterplan develops, the drainage strategy would be amended accordingly.

Site Description

1.4. The Site is approximately 14.5 hectares (ha) in size and currently comprises predominantly grass and scrubland areas. There is also a balancing pond located in the northeast of the Site.

Figure 1: Site Location Plan

Key

Site Boundary

Source: Google Maps

1.5. The topographic survey (Appendix A) indicates that ground levels across the Site fall to the east, from a high point of approximately 27.79m AOD in the western corner of the Site to a low point of

approximately 27.21m AOD adjacent to the Sites north-eastern boundary.

Proposed Development

1.6. The proposed development (Appendix B) would comprise a residential scheme providing up to 350 units, including a 30% provision for affordable housing, along with associated infrastructure and public open space.

2. Planning Policy

Flood Risk

2.1. The National Planning Policy Framework[i] (NPPF) last revised in February 2019 and its supporting Planning Practice Guidance[ii] (PPG) states that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere.

2.2. The Bedford Borough Council (BBC) Local Flood Risk Management Strategy (LFRMS)[iii] states that within the Borough, the IDBs and the Environment Agency (EA) have byelaws to protect the water corridor and manage flood risk placing restrictions on the corridor adjacent to the watercourse/river channels an flood defences that prevent them from being developed or obstructed. They also protect flood risk by placing restrictions on floodplains.

2.3. The watercourses within and in the vicinity of the Site area are governed by the Bedfordshire and River Ivel IDB. The IDB have stated that any watercourse or land drainage ditch within the Board's area is subject to its byelaws, the most pertinent being:

- No development will be permitted within 9m of a watercourse, measured from the top of bank on both sides of the watercourse

Surface Water Drainage

2.4. The NPPF states that major developments should incorporate SuDS unless there is clear evidence that this would be inappropriate. The systems used should:

- Take account of advice from the Lead Local Flood Authority (LLFA) and IDB where applicable;
- Have appropriate proposed minimum operational standards;
- Have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development, and
- Where possible, provide multifunctional benefits.

2.5. The BBC LFRMS states that in their aim to provide resilience against climate change, SuDS should be delivered through the planning process, with all major developments managing rainwater and surface water that replicated natural drainage.

2.6. The BBC Supplementary Planning Document (SPD) for SuDS[iv] states that the most preferable options for drainage are discharge into ground (minimum acceptable rate of 1 x 10^{-5} m/s) and discharge into a surface water body, with the least preferential option being discharge into a surface water sewer.

2.7. BBC as LLFA have the following requirements relating to surface water drainage:

- Attenuation should be designed to accommodate flows for the 1 in 100 year event plus a 40% allowance for climate change;
- 10% allowance for urban creep; and
- Discharge rate as agreed by Bedford and River Ivel IDB.

2.8. The Bedfordshire and River Ivel IDB also require that any surface water discharge should be restricted to 4 l/s per contributing impermeable hectare.

2.9. For discharge into the ground, the Bedford Borough Council SPD limits the acceptable depth of infiltrating SuDS to 2.0m below ground level (bgl), with a minimum of 1.2m clearance between the base of the infiltration SuDS and peak seasonal groundwater levels. It further states that at steep sites with permeable superficial deposits and impermeable bedrock, infiltrating SuDS could result in sloping instabilities, requiring a geotechnical investigation to confirm the feasibility.

2.10. Appropriate pollution prevention measures should be incorporated into the design. As per the Bedford Borough Council SPD, clean water from roofs can be directly discharged to any soakaway or watercourse. The SuDS Mitigation Index approach as per the CIRIA SuDS Manual[v] should be used for runoff from all other hardstanding areas.

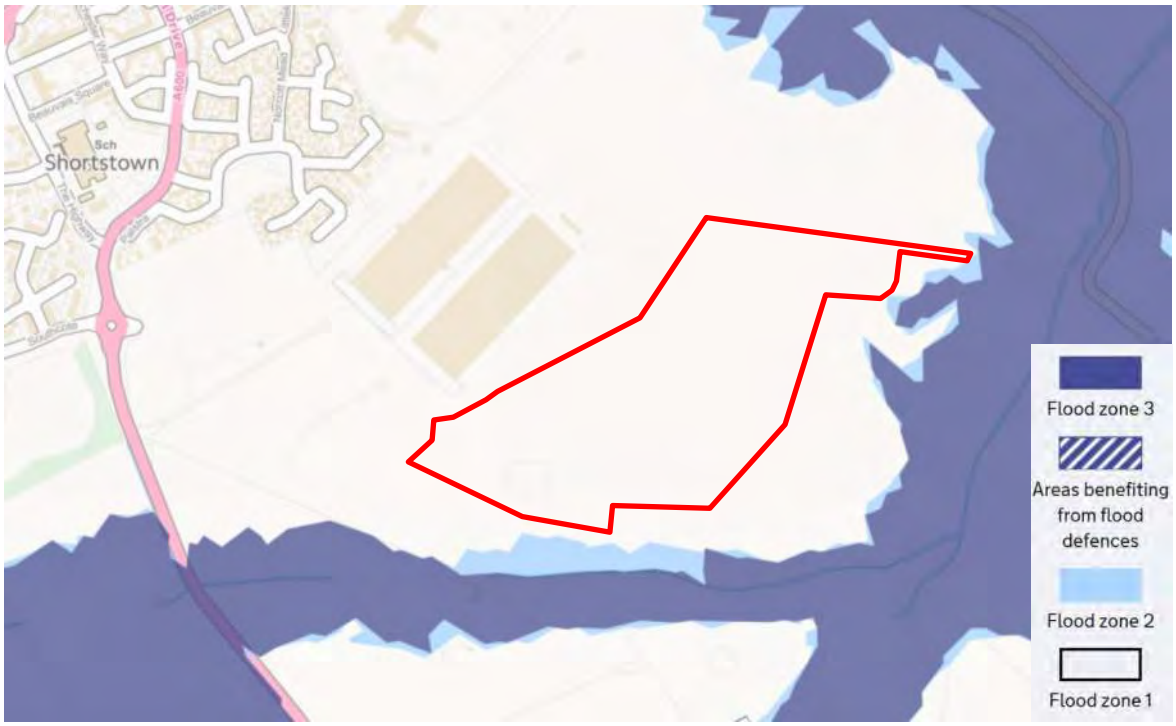
3. Flood Risk

Tidal/Fluvial

3.1. There are no tidal waterbodies within the vicinity of the Site, therefore the risk of flooding to the Site from tidal sources is negligible.

3.2. The EA's Flood Map for Planning (Figure 2) shows that the Site is located within Flood Zone 1, land defined as having less than 0.1% annual probability (1 in 1000 year) of flooding and is therefore considered to be at low risk of flooding.

Figure 2: Environment Agency's Flood Map for Planning



Key

Site Boundary

Source: https://flood-map-for-planning.service.gov.uk

3.3. According to the Bedford Borough Council LFRMS, the primary source of flood risk throughout the Borough is fluvial from the River Great Ouse, which is classified as a Main River. The River Great Ouse is located approximately 1.7km to the north of the Site. The Cople Brook flows to the east and is located a maximum of 100m to the south of the Site.

3.4. As part of a recent modelling study carried out by Waterman, a new fully linked 1D/2D hydraulic model was built to improve the representation of flood risk from the Cople Brook. The results of this modelling study are included in Appendix C. The results indicate that the Site would remain free of flooding during all events up to and including the present day 1 in 1000 year, and the future 1 in 100 year events for the year 2100, taking account of the impacts of climate change.

3.5. As such, it is considered that the risk of fluvial flooding to the Site is low.

Pluvial

3.6. Pluvial flooding, also known as surface water flooding, can occur when natural and engineered drainage systems have insufficient capacity and are overwhelmed by the volume of rainfall. Pluvial flooding can occur in rural areas during medium intensity, long duration rainfall evens where saturated ground conditions prevent infiltration into the subsoil. This flood water would then be conveyed via overland flow routes dictated by the local topography.

Overland Surface Water

3.7. The EA's Flood Risk from Surface Water mapping sets out a high level, national scale assessment of pluvial flooding at the Site. The mapping shows (Figure 3) that the Site is predominantly at 'very low risk' of flooding (less than 0.1% annual probability), however, some areas are indicated to be at 'low risk' (between 0.1% and 1% annual probability) to 'high risk' (greater than 3.3% annual probability).

Figure 3: Environment Agency's Flood Risk from Surface Water Mapping

Key

Site Boundary

Source: https://flood-warning-information.service.gov.uk

3.8. During the 'high risk' event, the areas adjacent to the north-western side of Hangar 1 are predicted to flood to depths of below 0.3m. However, the remainder of the Site would be free of flooding.

3.9. During the 'medium risk' event (between 1% and 3.3% annual probability), flooding adjacent to Hangar 1 would be more extensive and could potentially reach depths of up to 0.9m in a small, isolated area to the northwest of the Hangar. A few small, isolated areas to the west of the Hangar would also become at risk of flooding to depths of up to 0.3m during the 'medium risk' scenario.

3.10. During the 'low risk' event, a larger area to the northwest of the Hangar would become at risk of

flooding to depths of up to 0.9m, and a larger area to the west of the Hangar would become at risk of flooding to depths of below 0.3m. In addition to the increases in flood extent in these areas, several areas to the centre and east of the Site would become at risk of flooding. The flood depths in these areas would be predominantly below 0.3m, however, a small area to the south of Hangar 2 could potentially flood to depths of up to 0.9m.

3.11. Upon reviewing this mapping against the topographic survey for the Site, it is noted that the areas indicated to be at risk of flooding during the 'medium risk' and 'low risk' events are topographically low spots and it is likely that any rainfall on these areas would become trapped and be unable to drain away. The only area that could potentially be part of an overland flow route would be the area of flooding to the southwest of Hangar 1 and 2, and this area is not indicated to flood to a significant extent.

3.12. There is an existing ditch along to the western boundary of the Site, adjacent to the A600. However, the mapping indicates that this ditch does not pose a risk of flooding to the Site.

3.13. The areas of the Site where residential accommodation is proposed are shown to be predominantly at 'very low risk' of flooding, with a small area shown to be at 'low risk'. The proposed surface water drainage strategy would manage any rainwater falling on these areas of the Site.

3.14. It is therefore considered that the risk of pluvial flooding to the Site is predominantly 'very low risk', with some areas being at 'low risk' and 'medium risk'.

Sewers

3.15. The BBC LFRMS states that 5,280 properties have been identified as being at risk of surface water flooding in the Borough, with 3,400 of these located within Bedford town. It states that this surface water flooding relates to urban areas where rapid runoff from impermeable areas exceeds the drainage capacity, i.e. sewer flooding.

3.16. As the Site is currently comprised of mostly undeveloped land, the risk of flooding due to insufficient capacity and potential blockages in the local drainage system is considered negligible. Therefore, the risk of sewer flooding to the Site is considered to be low.

Groundwater

3.17. Groundwater flooding is most likely to occur in low-lying areas underlain by permeable sub-surface geology, where groundwater emerges due to a high water table following prolonged periods of heavy rainfall.

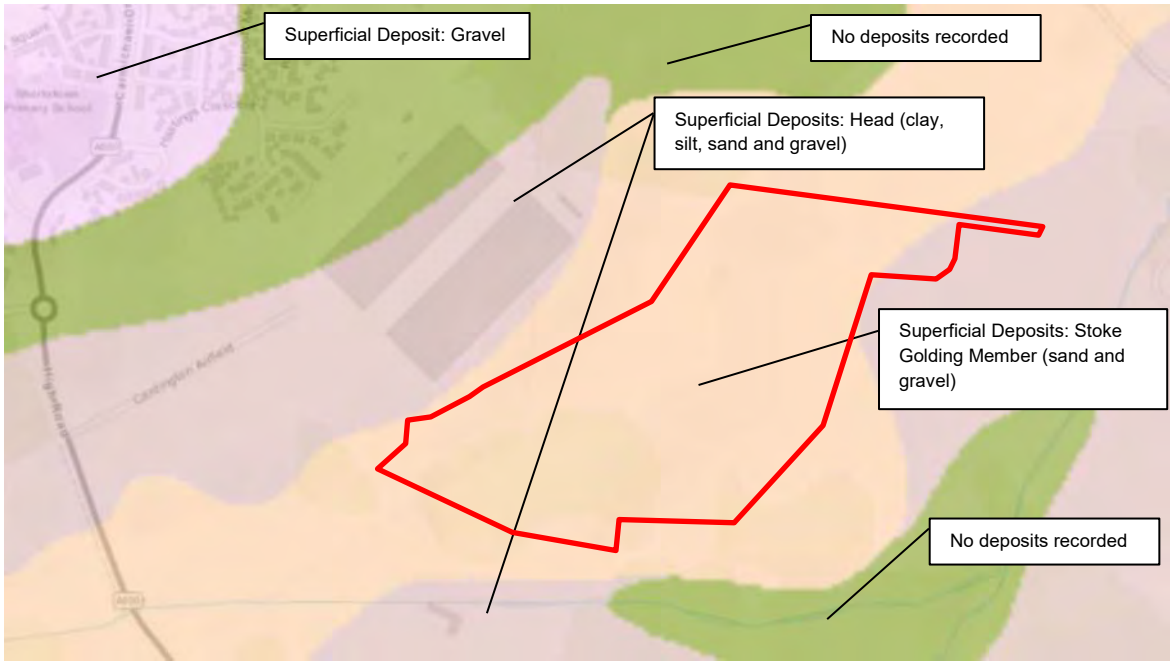
3.18. The natural geological sequence beneath the Site has been established through a review of the British Geological Survey (BGS) online Geology of Britain Viewer (Figure 4, overleaf) and historic borehole records. According to the BGS mapping, the Site is underlain by the Stoke Golding Member in the southern areas, comprised of sand and gravel. In the northern areas of the Site, the underlying geology is Head deposits, comprised of clay, silt, sand and gravel, with some areas to the north of Hangar 1 with no superficial deposits recorded. The bedrock geology at the Site is the Peterborough Mudstone Member.

3.19. Several boreholes located to the southwest of Hangar 2, directly adjacent to the Sites boundary, were reviewed and it was found that groundwater was encountered at depths of approximately 2.5m to 3.0m below ground level (bgl).

3.20. According to the BBC LFRMS, none of the underlying bedrock in the Borough support major aquifers,

indicating that they are unlikely to have the potential to store and transmit large quantities of water. Consequently, the LFRMS states that the risk of groundwater flooding in the borough is generally considered to be low. However, where there are superficial deposits of sand and gravel, such as those present on-site, there is the potential for groundwater to be present, as confirmed through the historic borehole records.

Figure 4: British Geological Survey Geology of Britain Viewer



Key

Site Boundary

Source: http://mapapps.bgs.ac.uk/geologyofbritain3d/

3.21. The LFRMS confirms that the EA, the IDB and BBC hold no records of historic groundwater flooding in the area.

3.22. It is therefore considered that while the risk of groundwater flooding to the Site is low, if basement development is proposed, this would need to demonstrate that it would not significantly displace any potential groundwater flows beneath the Site which could increase flood risk off-site. Also, any proposed basements would need to be adequately waterproofed to prevent the ingress of groundwater.

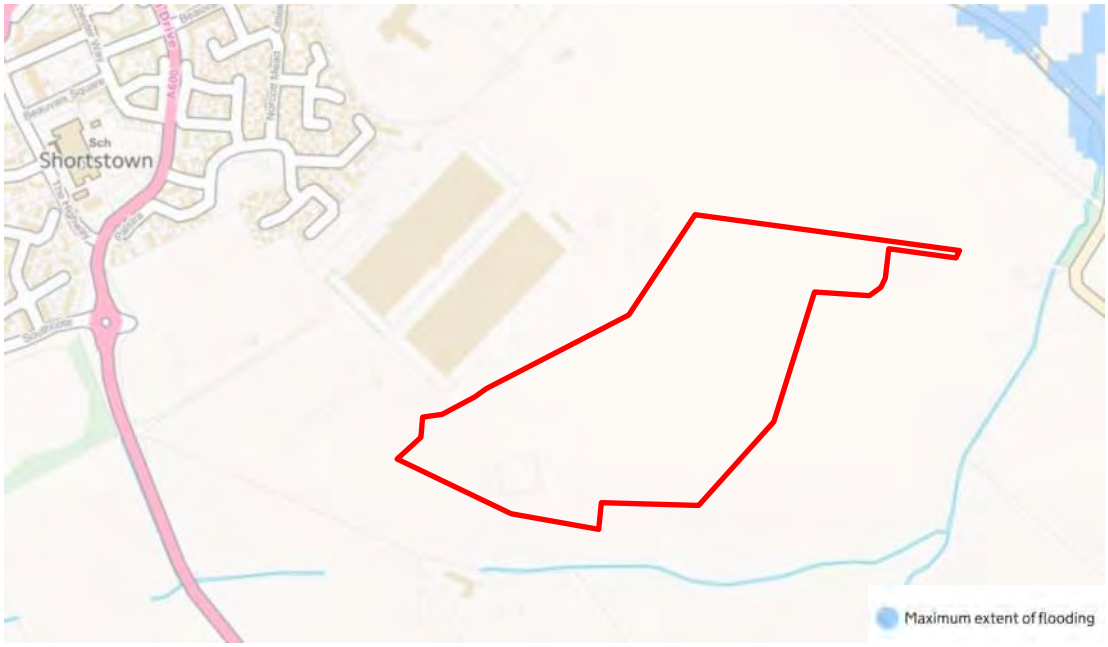
Artificial Sources

3.23. The EA's Flood Risk from Reservoirs mapping presents the largest extent that could potentially be affected in the event of a reservoir failure. The mapping shows (Figure 5, overleaf) that the Site would not be affected in such a flood event.

3.24. The development proposals (Appendix B) show that there are two large attenuation ponds located to the northeast of the Site and to the west of the Site, which form part of the surface water drainage strategy for the wider Cardington development. The ponds are therefore likely to be managed and maintained appropriately and the risk of overtopping from these ponds is considered to be low.

3.25. The risk of flooding from artificial sources is therefore considered to be low.

Figure 5: Environment Agency's Flood Risk from Reservoirs



Key

Site Boundary

Source: https://flood-warning-information.service.gov.uk

4. Surface Water Drainage

4.1. A preliminary surface water drainage strategy is outlined below, in order to ensure that the considerations and spatial requirements of SuDS features are incorporated into the early stages of design.

Existing Drainage

4.2. Anglian Water sewer records (Appendix D) indicate a number of public sewers located in the vicinity of the Site. These are summarised in Table 1 below.

Table 1: Existing Sewers

Location	Sewer
Greycote Roundabout (west of the Site)	Anglian Water surface water sewer with outfall to assumed ditch (600mm diameter)
A600 (west of the Site)	Anglian Water foul water rising main (100mm diameter)

4.3. As the Site is predominantly undeveloped land, it is anticipated that the existing drainage regime is a combination of natural shallow infiltration an overland flows towards the Cople Brook, as dictated by the Site's topography.

Discharge Rate and Location

4.4. The Bedfordshire and River Ivel IDB has confirmed that they require surface water discharge into watercourse under their management to be restricted to 4 l/s/ha applied to the proposed impermeable area.

4.5. Due to the Site being mostly undeveloped (i.e. greenfield), attenuation should be provided in the most sustainable manner through the use of SuDS. Water quality should be considered to ensure that any potential pollutants are managed appropriately prior to being discharged.

4.6. The Building Regulations and Planning Policy Guidance set out a hierarchy of surface water discharge, which should be adhered to in decreasing order of preference:

I. Discharge to ground;

II. Discharge to a surface water body;

III. Discharge to a surface water sewer; and

IV. Discharge to a combined sewer.

4.7. BGS records indicate that the Site is underlain by the generally impermeable Peterborough Mudstone Member. However, a significant portion of the Site is underlain by superficial deposits of the Stoke Golding Member, comprised of sands and gravel. Therefore, drainage via infiltration may be possible in these areas. It is recommended that soakage testing is undertaken as soon as possible to determine the infiltration rates at the Site and the feasibility of discharge to ground. The Site is not located within a Source Protection Zone as defined by the EA and it is not anticipated that there would be contamination within the ground as it is currently predominantly undeveloped.

4.8. The Cople Brook is located a short distance to the south of the Site and is located within the client's

ownership boundary. In lieu of soakage testing results and in line with the drainage hierarchy, it is proposed to discharge surface water runoff into this Brook.

Surface Water Drainage Strategy

4.9. To reduce the need for surface water pumping from lower areas, the proposed drainage strategy assumes that all surface water runoff will drain to a single attenuation feature located centrally along the Sites southern boundary. This strategy aims to keep the length of drainage runs as short as possible. Attenuation would be provided within a detention basin (Appendix E) which would then discharge to the Cople Brook located to the south of the Site.

4.10. The Bedfordshire and River Ivel IDB require that any surface water discharge should be restricted to 4 l/s per contributing impermeable hectare. Based on a proposed residential area of 8.11ha (Appendix B), an assumed 70% proposed impermeable area has been used for the calculations and including a 10% allowance for urban creep, the total impermeable area for the calculations would be 6.24ha (77% of the residential development area of 8.11ha). This results in a discharge rate of 25.0 l/s for the Site.

4.11. MicroDrainage Source Control module has been used to calculate the required attenuation volumes for the 1 in 100 year event plus a 40% allowance for climate change (Appendix F), in order to restrict runoff from the Site to 4 l/s/ha. Source Control considers all storm durations and return periods. Based on a restriction to 25.0 l/s, approximately 4955m^3 of attenuation would be required at the Site (Appendix F).

4.12. The Site has very shallow topography, indicating that a gravity discharge may be difficult to achieve, even with shallow pipe gradients. To reduce the depths required within piped drainage runs, a 1.5m deep conveyance swale is proposed along the south-western boundary of the Site, and a 1m deep swale is proposed along the eastern boundary of the Site (Appendix E). This provides a deep, open conveyance feature which piped drainage runs from the Sites extremities can connect into, thereby minimising the amount of ground raising required.

4.13. Based on a strategy including the above swales, approximately 0.2m of ground raising would be required in the southwest of the Site, rising to approximately 1.5m in the north-western corner (Appendix E). Approximately 0.7m of ground raising would be required in the northeast of the Site in order to achieve a minimum gradient for the conveyance swale along the eastern boundary (Appendix E). It is anticipated that the cut obtained from excavating the detention basin could be repurposed to achieve some of the fill requirements.

4.14. The amount of ground raising required would be subject to the developing masterplan and would be confirmed during detailed design with cut and fill calculations. Alternatively, shallow swales could be incorporated within the verges of proposed roads to provide a high-level conveyance route for runoff to avoid ground raising.

4.15. The strategy shown is very tight in terms of levels and further design development might result in more ground raising being required to achieve gravity discharge than would be considered cost effective and sustainable. In this event, surface water would need to be pumped to the basins, however, this is considered to be a less sustainable and therefore, less favourable option.

4.16. The following assumptions have been made for the purposes of this high-level assessment:

- Percentage impermeable area (PIMP): 70% including a 10% allowance for urban creep (77% total PIMP);
- Detention basins designed as dry, with no permanent water level;

- Detention basin dimensions: 2m depth, 1 in 4 side slopes, 9m maintenance buffer;
- 1 in 200 minimum pipe gradients, to achieve self-cleaning velocities;
- 1 in 500 minimum gradient for the swale, to maintain a positive flow direction; and
- The areas included within the drainage catchments only include the area to the south and east of Hangar 2, in line with the Concept Plan (Appendix B).

Water Quality

4.17. The most sustainable way to drain surface water is through the use of SuDS, which need to be considered in relation to site-specific constraints. SuDS mimic the natural drainage system and provide a method of surface water drainage which can decrease the quantity of water discharged, and hence reduce the risk of flooding. In addition, to reducing flood risk, SuDS features improve water quality and provide biodiversity and amenity benefits.

4.18. At this stage of the scheme design, the basins were sized in order to contain all of the required storage volume for each catchment. However, in order to fulfil the treatment requirements outlined in the CIRIA SuDS Manual, and to maximise the benefits provided, it is recommended that a range of SuDS features are considered. This is outlined in Table 3 below.

Table 2: Sustainable Drainage Techniques

Device	Description	Comments	✓/✗
Green / brown roofs (source control).	Provide soft landscaping at roof level which reduces surface water runoff.	Depending on the pitch of proposed roofs, green/brown roofs could potentially be incorporated. This would be dependent on the proposed use of the building as these features are generally not considered suitable for private residential dwellings. Therefore, appropriate locations may be limited	✓
Pervious surfaces (source control).	Storm water is allowed to infiltrate through the surface into a storage layer, from which it can either infiltrate and / or slowly release to sewers.	Pervious surfacing could potentially be included within the proposed private car parking areas, and areas not likely to be trafficked by HGVs. Infiltration may be feasible across a large part of the Site, subject to soakage, therefore, there is the potential for unlined pervious surfaces which allow infiltration through the sub-base	✓
Rainwater harvesting (source control).	Reduces the annual average rate of runoff from a site by reusing water for non-potable uses e.g. toilet flushing or water butts.	There are no constraints to the incorporation of rainwater harvesting. However, the reduction in surface water runoff from the Site cannot be quantified with certainty as this would be dependent on the demand for harvested rainwater. Water butts could be considered for individual properties	✓
Swales (permeable conveyance).	Broad shallow channels that convey / store runoff, and allow infiltration (ground conditions permitting).	Deep swales are recommended to the west and east of the Site to provide an open conveyance feature in order to minimise the amount of land raising required. Swales could also be designed to allow for infiltration, subject to soakage testing. The attenuation provided in swales would be quantified as the masterplan progresses into more detail	✓

Device	Description	Comments	✓/✗
Filter drains & perforated pipes (permeable conveyance).	Trenches filled with granular materials (which are designed to take flows from adjacent impermeable areas) that convey runoff while allowing infiltration (ground conditions permitting).	Infiltration may be feasible for large parts of the Site, subject to soakage testing. Filter drains could be incorporated into the development to provide treatment as well as shallow conveyance.	✓
Bioretention Systems / Rain Garden (end of pipe treatment).	A shallow landscaped depression which allows runoff to pond temporarily on the surface before filtering through vegetation and underlying soils.	The incorporation of bioretention systems/rain gardens is encouraged as they would provide amenity benefits as well as attenuation and treatment of runoff. These features could also be designed to allow for infiltration, dependent on soakage testing.	✓
Ponds (end of pipe treatment)	Depressions in the surface designed to store runoff without infiltration through the base.	Dry ponds are recommended as the primary form of SuDS for the development. Ponds would provide amenity and biodiversity benefits as well as the main function of providing attenuation.	✓

5. Foul Drainage

5.1. The proposed foul drainage system would be designed in accordance with BS EN 752 – Drain and Sewer Systems Outside Buildings, BS EN 12056 – Gravity Drainage Systems Inside Buildings and Approved Document H of Building Regulations.

5.2. As the Site is currently predominantly greenfield land, there are no public foul sewers within the Site. Based on Anglian Water asset records (Appendix D), there is a foul water rising main located within the A600 to the west of the Site, which rises from a pumping station located approximately 500m to the south of the Site, in the vicinity of Gorse Farm. Connections into existing rising mains are typically considered unacceptable, therefore an alternative solution would be required. The asset plans also indicate an existing foul water pumping station to the north of Hangar 1 (Appendix D).

5.3. Due to the topography of the Site, pumping of foul water would be required for the entire Site. An estimated 2 no. pumping stations would be required at the Site with associated rising mains, shown indicatively on the Preliminary Drainage Strategy Plan (Appendix E).

5.4. Off-site sewer connections would need to be requisitioned from Anglian Water, under S.98 of the Water Industry Act 1991, to serve the Site. Towards the southern edge of the Site, 1 no. pumping station would be required to serve the southern and western parts of the Site. To the north-eastern end of the Site, 1 no. pumping station would be required to serve the northern and eastern parts of the Site. Due to the uncertainty surrounding the capacity of the existing foul water sewer and pumping station to the north of Hangar 1, it is likely that the Site would discharge into the existing foul sewer network located within Southcote Road.

5.5. Due to the increase in foul flows post-development, it is anticipated that the existing Anglian Water pumping station would require some upgrades to accommodate the additional flows. The proposed foul flows would be quantified as the masterplan develops, and a pre-development enquiry would be submitted to Anglian Water to confirm the preferred discharge points to the public sewer network and the level of upgrades required.

6. Conclusions and Recommendations

6.1. The Site is located within Flood Zone 1, denoting a low annual probability of flooding from fluvial sources.

6.2. The risk of pluvial flooding to the Site has been confirmed as 'very low risk', with some areas being at 'low risk' and 'medium risk'. The risk of overland surface water flooding would be managed appropriately within the proposed drainage strategy.

6.3. The risk of flooding to the Site from groundwater and artificial sources has also been assessed and found to be low.

6.4. The Cople Brook, to the south and east of the Site is classified as an Ordinary Watercourse and falls under the responsibility of the Bedfordshire and River Ivel IDB. No development or ground raising would be acceptable within 9m of this watercourse.

6.5. The underlying geology at the Site (superficial deposits of gravel and sand) suggest that infiltration may be feasible for large parts of the Site. It is recommended that soakage testing is undertaken to confirm the infiltration rates at the Site.

6.6. In lieu of infiltration rates, surface water runoff from the Site would be restricted to 4 l/s/ha as requested by the IDB and attenuated within a detention basin prior to discharging to the Cople Brook. Based on a restriction to this rate, approximately 4955m^3 of attenuation would be required at the Site. As the masterplan proposals are developed, the drainage strategy would need to be updated to suit.

6.7. The Site has very shallow topography, therefore ground raising would be required within the western, northern and eastern corners of the Site to achieve a gravity discharge to the detention basin. To minimise the amount of ground raising required, deep swales have been incorporated along the south-western and eastern boundaries to convey surface water runoff from the extremities of the Site.

6.8. The possibility of including a wide variety of SuDS should be assessed as the masterplan progresses, including pervious paving, green/brown roofs, rain gardens and rainwater harvesting.

6.9. Foul flows from the development would likely be discharged via pumped rising mains to the nearby public sewer system within Southcote Road. Off-site sewer connections would need to be requisitioned from Anglian Water to serve the Site.

6.10. Due to the increase in foul flows post-development, it is anticipated that upgrades would be required to the Anglian Water sewer network to accommodate the additional flows. The proposed foul flows would be quantified as the masterplan develops, and a pre-development enquiry would be submitted to Anglian Water to confirm the preferred discharge points and the level of upgrades required.

6.11. The proposed masterplan has been designed in accordance with the recommendations included within this report and is therefore considered suitable for development from a flood risk and drainage perspective.

7. References

[i] Ministry of Housing, Communities and Local Government, last revised February 2019. National Planning Policy Framework.

[ii] Ministry of Housing, Communities and Local Government, March 2014. Planning Practice Guidance.

[iii] Bedford Borough Council, November 2015. Local Flood Risk Management Strategy.

[iv] RAB Consultants/Bedford Borough Council, February 2018. Supplementary Planning Document for Sustainable Drainage Systems.

[v] CIRIA C753, 2015. The SuDS Manual.

APPENDICES

A. Topographic Survey

246800 N

246700 N

246600 N

246500 N

507700 E

507800 E

507900 E

508000 E

508100 E

Notes:

1. GRID AND LEVELS BASED ON ORDNANCE DATUM, DERIVED FROM THE NATIONAL GNSS NETWORK. LOCAL SCALE FACTOR 0.99974 APPLIED.
2. DRAINAGE INFORMATION HAS BEEN DETERMINED WITHOUT MAN ENTRY INTO CHAMBERS AND WHILST EVERY EFFORT HAS BEEN MADE TO CORRECTLY IDENTIFY THIS INFORMATION, IT SHOULD ALWAYS BE CHECKED IN AREAS THAT ARE CRITICAL TO THE FUTURE PROPOSAL.
3. ALL SEWERS ARE PRESUMED TO BE STRAIGHT BETWEEN CHAMBERS, WITH ROUTES /CONNECTIVITY OBTAINED USING ACOUSTIC METHODS ONLY. THESE ARE TO BE CONSIDERED ASSUMED AND SHOULD BE INVESTIGATED FURTHER IN CRITICAL AREAS.
4. TREE AND HEDGE SPECIES HAVE BEEN IDENTIFIED AS ACCURATELY AS POSSIBLE BUT SHOULD BE CROSS CHECKED IN CRITICAL AREAS.

Coordinate Table

Station	Description	Easting	Northing	Level
MKS100	ROAD NAIL	507678.670	246729.123	33.791
MKS101	ROAD NAIL	507771.680	246713.243	32.120
MKS102	ROAD NAIL	507858.363	246732.990	31.918
MKS103	ROAD NAIL	507928.386	246774.010	32.000
MKS104	ROAD NAIL	508019.581	246880.118	31.453
MKS105	ROAD NAIL	508120.678	246985.017	30.586

TOPOGRAPHICAL KEY

GENERAL ABBREVIATIONS

SURVEY STATION
BANKING
HEDGE SPREADS
WOODLAND CANOPY
ARROW ON STEPS / RAMPS INDICATES DIRECTION UP/AWARDS
TREES
GATE
KERB CHANNEL
ROAD UNKERBED
FOOTPATH
CHANGE IN SURFACE
FENCE
WALL
OVERHEAD ELECTRIC
OVERHEAD TELECOM
FOUL SEWER
SURFACE SEWER
P-TRAP
BACK DROP (EXTERNAL)
BACK DROP (INTERNAL)
BUILDING
OPEN SIDED BUILDING
OVERHANG / CANOPY
GLASSHOUSE
CONTOUR
SPOT LEVEL
SONAR LEVEL
BORE HOLE
TRIAL HOLE

AIR CONDITIONING UNIT	ACU
AIR VALVE	AV
ARCHIVE	AR
BACK DROP	BD
BASE LEVEL	BL
BELISHA BEACON	BB
BOLLARD	BO
BOLLARD LIGHT	BOL
BRICK	BK
BUS STOP	BS
CABLE RISER	CR
CABLE TV COVER	CATV
CABLES TO GROUND	CTG
CCTV	CTV
CONTROL BOX	CB
COVER LEVEL	CL
CROSSING CONTROL BUTTON	CCB
DAMP PROOF COURSE	DPC
DRAINAGE CHANNEL	DCH
ELECTRIC	E
ELECTRICITY POLE	EP
EARTH ROD	ER
FIRE HYDRANT	FH
FLOOR LEVEL	FL
FOOTPATH	FP
FOUL WATER	FW
GAS GOVERNOR	GG
GAS VALVE	GV
GULLY	GY
HARD BED	HB
INSPECTION COVER	IC
KERB LEVEL	KL
KERB OUTLET	KO
LAMP POST	LP
MANHOLE	MH
MARKER POST	MK
METER	M
NO PIPES VISIBLE	NPV
OSGB ORDNANCE SURVEY BENCH MARK	OSBM
P-TRAP	PT
POST	PO
POST BOX	P BOX
RODDING EYE	RE
ROAD SIGN	RSI
RAIN WATER PIPE	RWP
RETAINING WALL	RW
SOFT BED	SB
STOP COCK	SC
STREET NAME PLATE	SNP
STOP VALVE	SV
SOIL PIPE	SVP
SOIL VENT PIPE	SVP
SURFACE WATER	SW
TACTILE PAVING	TAC
TELECOM POLE	TP
TELECOM INSPECTION COVER	TEL
TELEPHONE CALL BOX	TCB
TELEPHONE	T
TOP OF WALL	TOW
TRAFFIC LIGHT	TL
TRAFFIC LIGHT COVER	TLC
THRESHOLD LEVEL	THL
UNABLE TO LOCATE	UTL
UNABLE TO RAISE	UTR
UNDER SURVEY	US
VENT PIPE	VP
WATER LEVEL	WL
WATER METER	WM
WASH OUT	WO
WATER METER	WR
WATER TAP	WT

FENCE ABBREVIATIONS

BARBED WIRE FENCE	BW	IRON RAILINGS	IR
CLOSE BOARDED FENCING	CBF	OPEN MESH FENCE	OM
CONCRETE PANEL FENCE	CPL	POST AND RAIL FENCE	PR
CORRUGATED IRON FENCE	CI	POST AND WIRE FENCE	PW
CHAIN LINK FENCE	CL	WIRE MESH FENCE	WM
CHESTNUT PALING	CNP		

Sheet Layout: (Not to Scale)

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0m 5 10 15 20 25 30 35 40 45 50 55

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GALLAGHER DEVELOPMENTS

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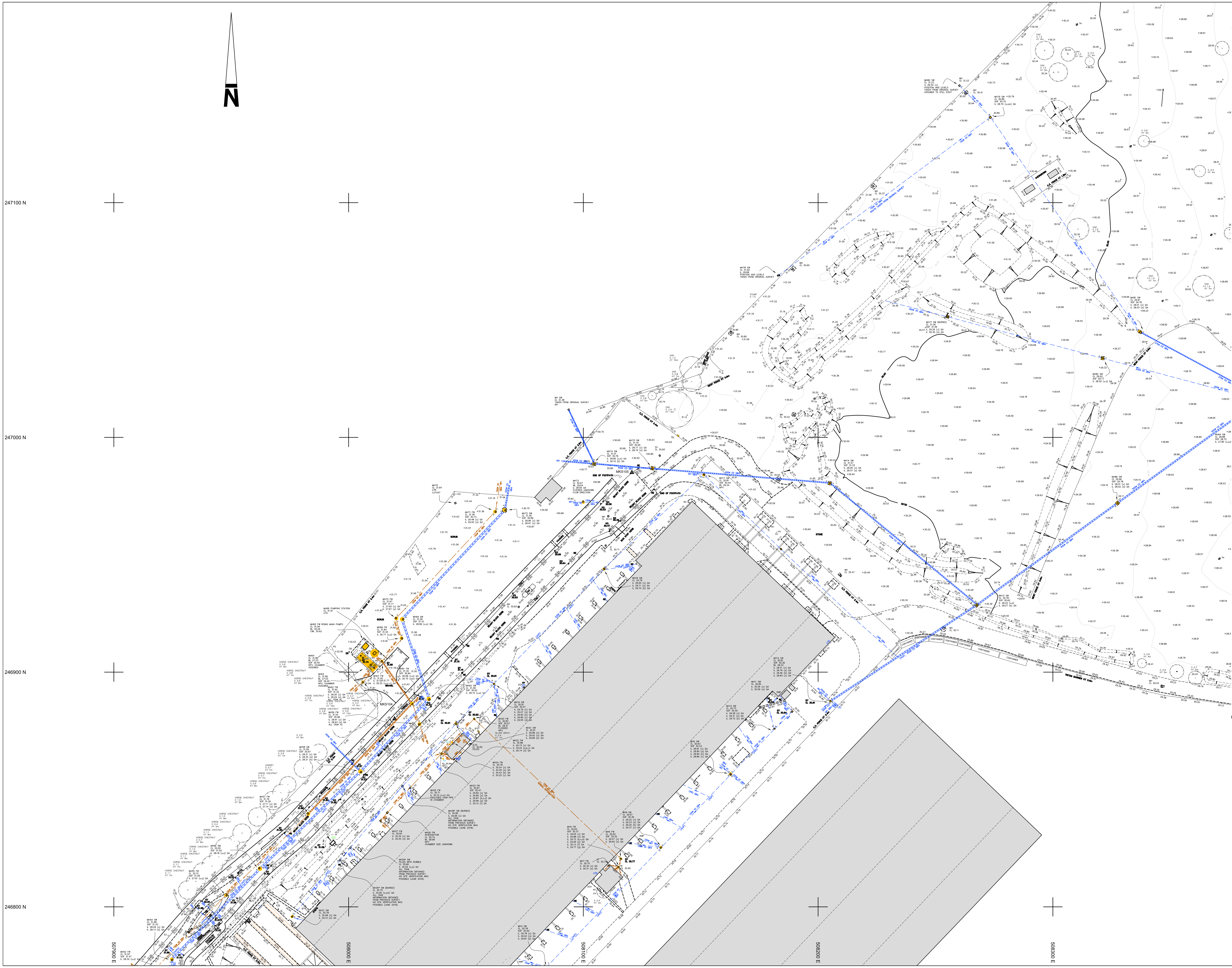

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MKS101	ROAD NAIL	507771.680	246713.243	32.120
MKS102	ROAD NAIL	507858.363	246732.990	31.918
MKS103	ROAD NAIL	507928.386	246774.010	32.000
MKS104	ROAD NAIL	508019.581	246880.118	31.453
MKS105	ROAD NAIL	508120.678	246985.017	30.586

TOPOGRAPHICAL KEY

SURVEY STATION 5
BANKING (TOP / BOTTOM)
HEDGE SPREADS
WOODLAND CANOPY
ARROW ON STEPS / RAMPS INDICATES DIRECTION UPWARDS
TREES (SPREAD & GIRTH SHOWN TO SCALE)
GATE
KERB CHANNEL
ROAD UNKERBED
FOOTPATH
CHANGE IN SURFACE
FENCE
WALL
OVERHEAD ELECTRIC
OVERHEAD TELECOM
FOUL SEWER
SURFACE SEWER
P-TRAP
BACK DROP (EXTERNAL)
BACK DROP (INTERNAL)
BUILDING
OPEN SIDED BUILDING
OVERHANG / CANOPY
GLASSHOUSE
CONTOUR 25.50
SPOT LEVEL + 127.13
SONAR LEVEL 127.13
BORE HOLE BH
TRIAL HOLE TH

GENERAL ABBREVIATIONS

AIR CONDITIONING UNIT	ACU
AIR VALVE	AV
AVERAGE	Av.
BACK DROP	BD
BASE LEVEL	BL
BELISHA BEACON	BB
BOLLARD	BO
BOLLARD LIGHT	BOL
BRICK	BK
BUS STOP	BS
CABLE RISER	CR
CABLE TV COVER	CATV
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CATCH PIT	CP
CONTROL BOX	CB
COVER LEVEL	CL
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DAMP PROOF COURSE	DPC
DRAINAGE CHANNEL	DCH
DROP KERB	DK
ELECTRICITY POLE	EP
EARTH ROD	ER
FIRE HYDRANT	FH
FLOOR LEVEL	FL
FOOTPATH	FP
FOUL WATER	FW
GAS RISER	GR
GAS VALVE	GV
GULLY	GY
HARD BED	HB
INSPECTION COVER	IC
INVERT LEVEL	IL
KERB OUTLET	KO
LAMP POST	LP
MANHOLE	MH
MARKER POST	MK
METER	MT
NO PIPES VISIBLE	NPV
ORDNANCE SURVEY BENCH MARK	OSBM
P-TRAP	PT
POST	PO
POST BOX	P.BOX
RODDING EYE	RE
ROAD SIGN	RS
RAIN WATER PIPE	RWP
RETAINING WALL	RW
SOFT BED	SB
STOP COCK	SC
STREET NAME PLATE	SNP
STOP VALVE	SV
SOIL PIPE	SP
SOIL VENT PIPE	SVP
SURFACE WATER	SW
TACTILE PAVING	TAC
TELECOM POLE	TP
TELECOM INSPECTION COVER	TEL
TELEPHONE CALL BOX	TCB
TICKET MACHINE	TM
TOP OF WALL	TOW
TRAFFIC LIGHT	TL
TRAFFIC LIGHT COVER	TLC
THRESHOLD LEVEL	THL
UNABLE TO LOCATE	UTL
UNABLE TO RAISE	UTR
UNABLE TO SURVEY	UTS
VENT PIPE	VP
WATER LEVEL	WL
WATER METER	WM
WASH OUT	WO
WATER RISER	WR
WATER TAP	WT

FENCE ABBREVIATIONS

BARBED WIRE FENCE	B/W	IRON RAILINGS	I/R
CLOSE BOARDED FENCE	C/B	LARCH LAP FENCE	L/L
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CORRUGATED IRON FENCE	C/I	POST AND WIRE FENCE	P/W
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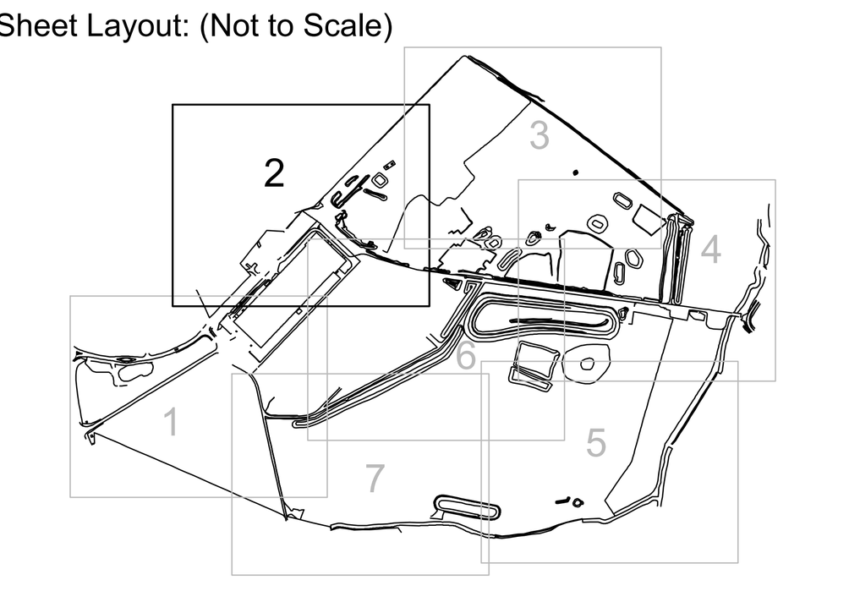

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GALLAGHER
DEVELOPMENTS

RAF Cardington
Cardington
Bedfordshire

Topographical Survey

Scale:	Sheet Size:	Sheet Number:	Date:
1:500	A0	2	April 2020

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28446	-	SGB	NS	-

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TOPOGRAPHICAL KEY

SURVEY STATION
BANKING
HEDGE SPREADS
WOODLAND CANOPY
ARROW ON STEPS / DIRECTION OF STEPS
TREES
GATE
KERB CHANNEL
ROAD UNKERBED
FOOTPATH
CHANGE IN SURFACE
FENCE
WALL
OVERHEAD ELECTRIC
OVERHEAD TELECOM
FOUL SEWER
SURFACE SEWER
P-TRAP
BACK DROP (EXTERNAL)
BACK DROP (INTERNAL)
BUILDING
OPEN SIDED BUILDING
OVERHANG / CANOPY
GLASSHOUSE
CONTOUR
SPOT LEVEL
SONAR LEVEL
BORE HOLE
TRIAL HOLE

GENERAL ABBREVIATIONS

AIR CONDITIONING UNIT	ACU
AIR VALVE	AV
ASH BIN	AB
BACK DROP	BD
BASE LEVEL	BL
BELISHA BEACON	BB
BOLLARD	BO
BOLLARD LIGHT	BOL
BRICK	BK
BUS STOP	BS
CABLE RISER	CR
CABLE TV COVER	CATV
CABLES TO GROUND	CTG
CAT LADDER	CR
CONTROL BOX	CB
COVER LEVEL	CL
CROSSING CONTROL BUTTON	CCB
DAMP PROOF COURSE	DPC
DRAINAGE CHANNEL	DCH
EASEMENT	EP
ELECTRICITY POLE	ER
EARTH ROD	FH
FIRE HYDRANT	FL
FLOOR LEVEL	FP
FOOTPATH	FW
FOUL WATER	GV
GAS VALVE	GY
GULLY	HB
HARD BED	IC
INSPECTION COVER	KC
KERB OUTLET	LP
LAMP POST	MH
MANHOLE	MK
MARKER POST	MT
METER	NPI
NO PIPES VISIBLE	PBM
PERMANENT SURVEY BENCH MARK	PTP
P-TRAP	PO
POST	P_BOX
POST BOX	RE
RODDING EYE	RSI
ROAD SIGN	RWP
RAIN WATER PIPE	SW
RETAINING WALL	SB
SOFT BED	SC
STOP COCK	SNP
STREET NAME PLATE	SV
STOP VALVE	SVP
SOIL VENT PIPE	SW
SURFACE WATER	TAC
TACTILE PAVING	TP
TELECOM POLE	TEL
TELECOM INSPECTION COVER	TCB
TELEPHONE CALL BOX	TM
TRANSFORMER	TOW
TOP OF WALL	TL
TRAFFIC LIGHT	TLC
TRAFFIC LIGHT COVER	THL
THRESHOLD LEVEL	UTL
UNABLE TO LOCATE	UTR
UNABLE TO RAISE	VP
VENT PIPE SURVEY	WL
VENT PIPE	WM
WATER LEVEL	WO
WATER METER	WR
WASH OUT	WT
WATER RESTRICTER	
WATER TAP	

FENCE ABBREVIATIONS

BARBED WIRE FENCE	BW
CHAIN LINK FENCE	CL
CONCRETE PANEL FENCE	CPL
CORRUGATED IRON FENCE	CI
CHAIN LINK FENCE	CL
CHESTNUT PALING	CNP
IRON RAILINGS	IR
LARCH LAP FENCE	LL
POST AND RAIL FENCE	P/R
POST AND WIRE FENCE	PW
WIRE MESH FENCE	WM

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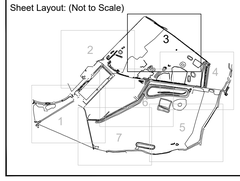

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GALLAGHER DEVELOPMENTS

RAF Cardington
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Topographical Survey

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PRELIMINARY

247300 N
247200 N
247100 N
247000 N
508400 E
508600 E
508800 E

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GATE
KERB CHANNEL
ROAD UNKERBED
FOOTPATH
CHANGE IN SURFACE
FENCE
WALL
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GENERAL ABBREVIATIONS

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POST	PO
POST BOX	P.BOX
RODDING EYE	RE
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RAIN WATER PIPE	RWP
SOFT BED WALL	SBW
SOFT BED	SB
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TELEPHONE MACHINE	TM
TOP OF WALL	TOW
TRAFFIC LIGHT	TL
TRAFFIC LIGHT COVER	TLC
THRESHOLD LEVEL	THL
UNABLE TO LOCATE	UTL
UNABLE TO RAISE	UTR
UNDER GROUND SURVEY	UGS
VENT PIPE	VP
WATER LEVEL	WL
WATER METER	WM
WASH OUT	WO
WATER TANK	WR
WATER TAP	WT

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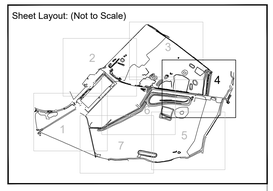

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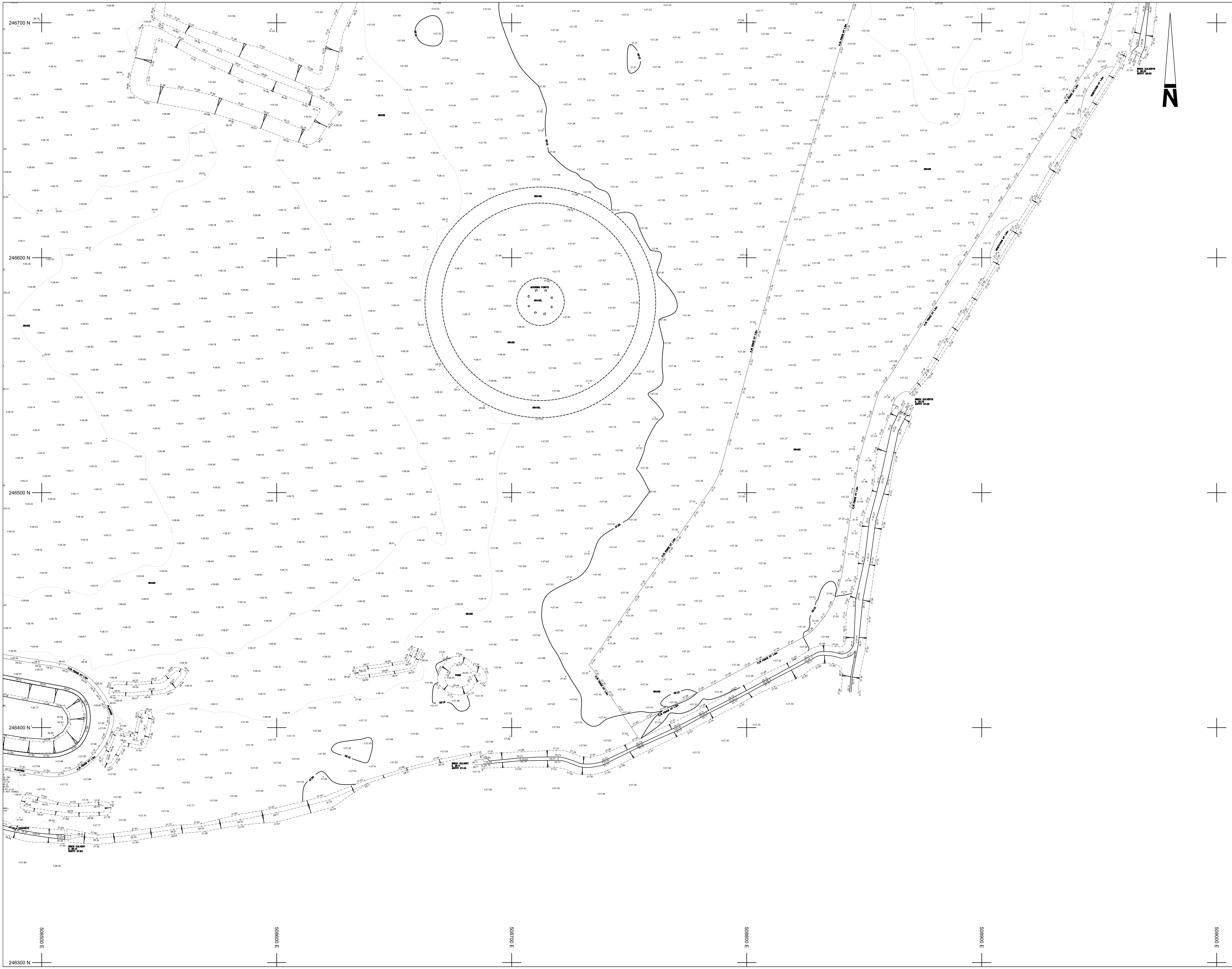

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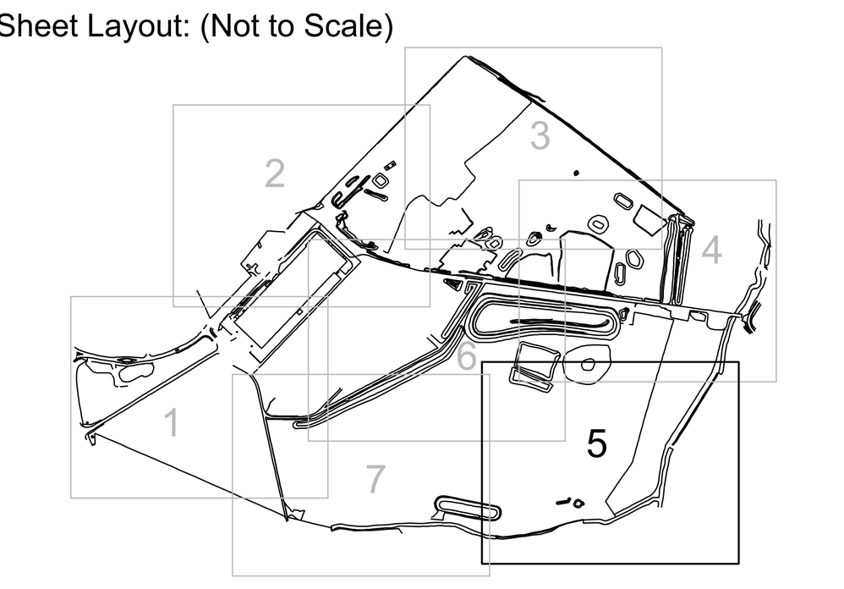
TOP OF WALL	TOW
TRAFFIC LIGHT	TL
TRAFFIC LIGHT COVER	TLC
THRESHOLD LEVEL	THL
UNABLE TO LOCATE	UTL
UNABLE TO RAISE	UTR
UNABLE TO SURVEY	UTS
VENT PIPE	VP
WATER LEVEL	WL
WATER METER	WM
WASH OUT	WO
WATER RISER	WR
WATER TAP	WT

FENCE ABBREVIATIONS

BARBED WIRE FENCE	B/W	IRON RAILINGS	I/R
CLOSE BOARDED FENCE	C/B	LARCH LAP FENCE	L/L
CONCRETE PANEL FENCE	CPL	POST AND RAIL FENCE	P/R
CORRUGATED IRON FENCE	C/I	POST AND WIRE FENCE	P/W
CHAIN LINK FENCE	C/L	WIRE MESH FENCE	W/M
CHESTNUT PALING	CNP		

Sheet Layout: (Not to Scale)



Revision | Description | Surv. by | Check. by | App. by | Date

0m 5 10 15 20 25 30 35 40 45 50 55

mksurveys

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GALLAGHER DEVELOPMENTS

RAF Cardington
Cardington
Bedfordshire

Topographical Survey

Scale:	Sheet Size:	Sheet Number:	Date:
1:500	A0	5	April 2020

Project Number:	Rev:	Surveyed by:	Checked by:	Approved by:
28446	-	SGB	NS	-

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4. TREE AND HEDGE SPECIES HAVE BEEN IDENTIFIED AS ACCURATELY AS POSSIBLE BUT SHOULD BE CROSS CHECKED IN CRITICAL AREAS.

Coordinate Table

Station	Description	Easting	Northing	Level
MKS100	ROAD NAIL	507678.670	246729.123	33.791
MKS101	ROAD NAIL	507771.680	246713.243	32.120
MKS102	ROAD NAIL	507858.363	246732.990	31.918
MKS103	ROAD NAIL	507928.386	246774.010	32.000
MKS104	ROAD NAIL	508019.581	246880.118	31.453
MKS105	ROAD NAIL	508120.678	246985.017	30.586

TOPOGRAPHICAL KEY

GENERAL ABBREVIATIONS

SURVEY STATION	5	AIR CONDITIONING UNIT	ACU
		AIR VALVE	AV
BANKING	TOP / BOTTOM	BACK DROP	BD
		BASE LEVEL	BL
HEDGE SPREADS		BELISHA BEACON	BB
		BOLLARD	BO
WOODLAND CANOPY		BRICK WALL LIGHT	BWL
		BRICKS	BK
ARROW ON STEP(S) INDICATES STEPS DIRECTION UPWARDS		BUS STOP	BS
		CABLE RISER	CR
		CABLE TV COVER	CATV
		CABLES TO GROUND	CTG
		CAT'S EYE	CE
		CONTROL BOX	CB
		COVER LEVEL	CL
TREES	SPREAD & GIRTH SHOWN TO SCALE	CROSSING CONTROL BUTTON	CCB
		DAMP PROOF COURSE	DPC
		DRAINAGE CHANNEL	DCH
		ELECTRIC	E
		ELECTRICITY POLE	EP
		EARTH ROD	ER
GATE		FIRE HYDRANT	FH
		FLOOR LEVEL	FL
KERB CHANNEL		FOOTPATH	FP
		FOUL WATER	FW
ROAD UNKERBED		GAS GOVER	GV
		GAS VALVE	GV
FOOTPATH		GULLY	GY
		HARD BED	HB
CHANGE IN SURFACE		INSPECTION COVER	IC
		INVERT LEVEL	IL
FENCE		KERB OUTLET	KO
		LAMP POST	LP
WALL		MANHOLE	MH
		MARKER POST	MK
OVERHEAD ELECTRIC		METER	MT
		NO PIPES VISIBLE	NPV
OVERHEAD TELECOM		ORDNANCE SURVEY BENCH MARK	OSBM
		P-TRAP	PTP
FOUL SEWER		POST	PO
		POST BOX	P.BOX
SURFACE SEWER		RODDING EYE	RE
		ROAD SIGN	RSI
P-TRAP		RAIN WATER PIPE	RWP
		RETAINING WALL	RW
BACK DROP (EXTERNAL)		SOFT BED	SB
		STOP COCK	SC
BACK DROP (INTERNAL)		STREET NAME PLATE	SNP
		STOP VALVE	SV
BUILDING		SOIL PIPE	SP
		SOIL VENT PIPE	SVP
OPEN SIDED BUILDING		SURFACE WATER	SW
		TACTILE PAVING	TAC
OVERHANG / CANOPY		TELECOM POLE	TP
		TELECOM INSPECTION COVER	TEL
GLASSHOUSE		TELEPHONE CALL BOX	TCB
		TELEPHONE	T
CONTOUR	26.50	TOP OF WALL	TOW
		TRAFFIC LIGHT	TL
SPOT LEVEL	+ 127.13	TRAFFIC LIGHT COVER	TLC
SONAR LEVEL	⊙ 127.13	THRESHOLD LEVEL	THL
		UNABLE TO LOCATE	UTL
BORE HOLE	BH	UNABLE TO RAISE	UTR
TRIAL HOLE	TH	VERGE POST / SURVEY	VP
		VENT PIPE	VP
		WATER LEVEL	WL
		WATER METER	WM
		WASH OUT	WO
		WATER TROUGH	WR
		WATER TAP	WT

FENCE ABBREVIATIONS

BARBED WIRE FENCE	B/W	IRON RAILINGS	I/R
CLOSE BOARDED FENCE	C/B	LARCH LAP FENCE	LLF
CONCRETE PANEL FENCE	C/PL	POST AND RAIL FENCE	P/R
CORRUGATED IRON FENCE	CFI	PALISADE METAL FENCE	PMF
CHAIN LINK FENCE	C/L	WIRE MESH FENCE	W/M
CHESTNUT PALING	CNP		

Sheet Layout: (Not to Scale)

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0m 5 10 15 20 25 30 35 40 45 50 55

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GALLAGHER DEVELOPMENTS

RAF Cardington
Cardington
Bedfordshire

Topographical Survey

Scale:	Sheet Size:	Sheet Number:	Date:
1:500	A0	6	April 2026
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28446	-	SGB	NS	-

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MKS105	ROAD NAIL	508120.678	246985.017	30.586

TOPOGRAPHICAL KEY

GENERAL ABBREVIATIONS

SURVEY STATION — 5

BANKING — TOP / BOTTOM

HEDGE SPREADS

WOODLAND CANOPY

ARROW ON STEPS / RAMPS INDICATES DIRECTION UPWARDS

TREES — SPREAD & GIRTH SHOWN TO SCALE

GATE

KERB CHANNEL

ROAD UNKERBED

FOOTPATH

CHANGE IN SURFACE

FENCE

WALL

OVERHEAD ELECTRIC

OVERHEAD TELECOM

FOUL SEWER

SURFACE SEWER

P-TRAP

BACK DROP (EXTERNAL)

BACK DROP (INTERNAL)

BUILDING

OPEN SIDED BUILDING

OVERHANG / CANOPY

GLASSHOUSE

CONTOUR — 25.50

SPOT LEVEL — + 127.13

SONAR LEVEL — 127.13

BORE HOLE — BH

TRIAL HOLE — TH

AIR CONDITIONING UNIT	ACU
AIR VALVE	AV
ANTENNA	AN
BACK DROP	BD
BASE LEVEL	BL
BELISHA BEACON	BB
BOLLARD	BO
BOLLARD LIGHT	BOL
BRICK	BK
BUS STOP	BS
CABLE RISER	CR
CABLE TV COVER	CATV
CABLES TO GROUND	CTG
CATCH PIT	CP
CHAMBER / BOX	CH
COVER LEVEL	CL
CROSSING CONTROL BUTTON	CCB
DAMP PROOF COURSE	DPC
DRAINAGE CHANNEL	DCH
ELECTRIC	EP
ELECTRICITY POLE	EP
EARTH ROD	ER
FIRE HYDRANT	FH
FLOOR LEVEL	FL
FOOTPATH	FP
FOUL WATER	FW
GAS GOVERNOR	GG
GAS VALVE	GV
GULLY	GY
HARD BED	HB
INSPECTION COVER	IC
INVERT LEVEL	IL
KERB OUTLET	KO
MANHOLE	MH
MARKER POST	MK
METER	MT
NO PIPES VISIBLE	NPV
PERMANENT SURVEY BENCH MARK	PSBM
PYLON	PY
POST	PO
POST BOX	P BOX
RODDING EYE	RE
ROAD SIGN	RS
RAIN WATER PIPE	RWP
RETAINING WALL	RW
SOFT BED	SB
STOP COCK	SC
STREET NAME PLATE	SNP
STOP VALVE	SV
SOIL PIPE	SVP
SOIL VENT PIPE	SVP
SURFACE WATER	SW
TACTILE PAVING	TAC
TELECOM POLE	TP
TELECOM INSPECTION COVER	TEL
TELEPHONE CALL BOX	TCB
TRAFFIC ENGINE	TM
TOP OF WALL	TOW
TRAFFIC LIGHT	TL
TRAFFIC LIGHT COVER	TLC
THRESHOLD LEVEL	THL
UNABLE TO LOCATE	UTL
UNABLE TO RAISE	UTR
UNABLE TO SURVEY	UTS
VENT PIPE	VP
WATER LEVEL	WL
WATER METER	WM
WASH OUT	WO
WATER TOWER	WR
WATER TAP	WT

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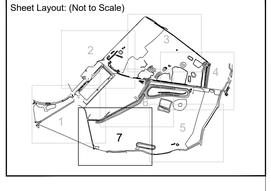

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Bedfordshire

Topographical Survey

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1:500	A0	7	April 2020
Project Number:	Rev:	Surveyed by:	Checked by: / Approved by:
28446	-	SGB	NS / -

246600 N
246500 N
246400 N
246300 N
508000 E
508100 E
508200 E
508300 E
508400 E

B. Development Proposals

The scaling of this drawing cannot be assured

Revision		Date	Drn	Ckd
H	Layout Amended	10.07.2020	DR	MV

Site Boundary	14.49 Ha
Residential Development	08.11 Ha

Public Open Space to meet LPA Policy AD28
(Of the total 06.21Ha POS Provision, 04.34Ha of this needs to meet the Forest of Marston Vale Policy)

Informal and Amenity Green Space Including Basins, Swales and 0.71 Ha to contribute towards the Forest of Marston Vale Policy	03.79 Ha
Accessible Natural Green Space	01.73 Ha
Parks and Gardens	00.50 Ha
Equipped / Natural Play Areas	00.19 Ha
Main Infrastructure	00.17 Ha
Potential bus route	
Potential bus stop	
400m isochrone from bus stop	
Potential Vehicular Access	
Potential Pedestrian/Cycle Access to A600	
Additional Land required to meet the Forest of MV Policy	01.90 Ha

0 50 100 150 200 250m

N

Project
Land South of Cardington Hangars

Drawing Title
Concept Plan

Date	Scale	Drawn by	Check by
06.07.2020	1:5000 @A2	KU	MV

Project No	Drawing No	Revision
31550	BL-M-03	H

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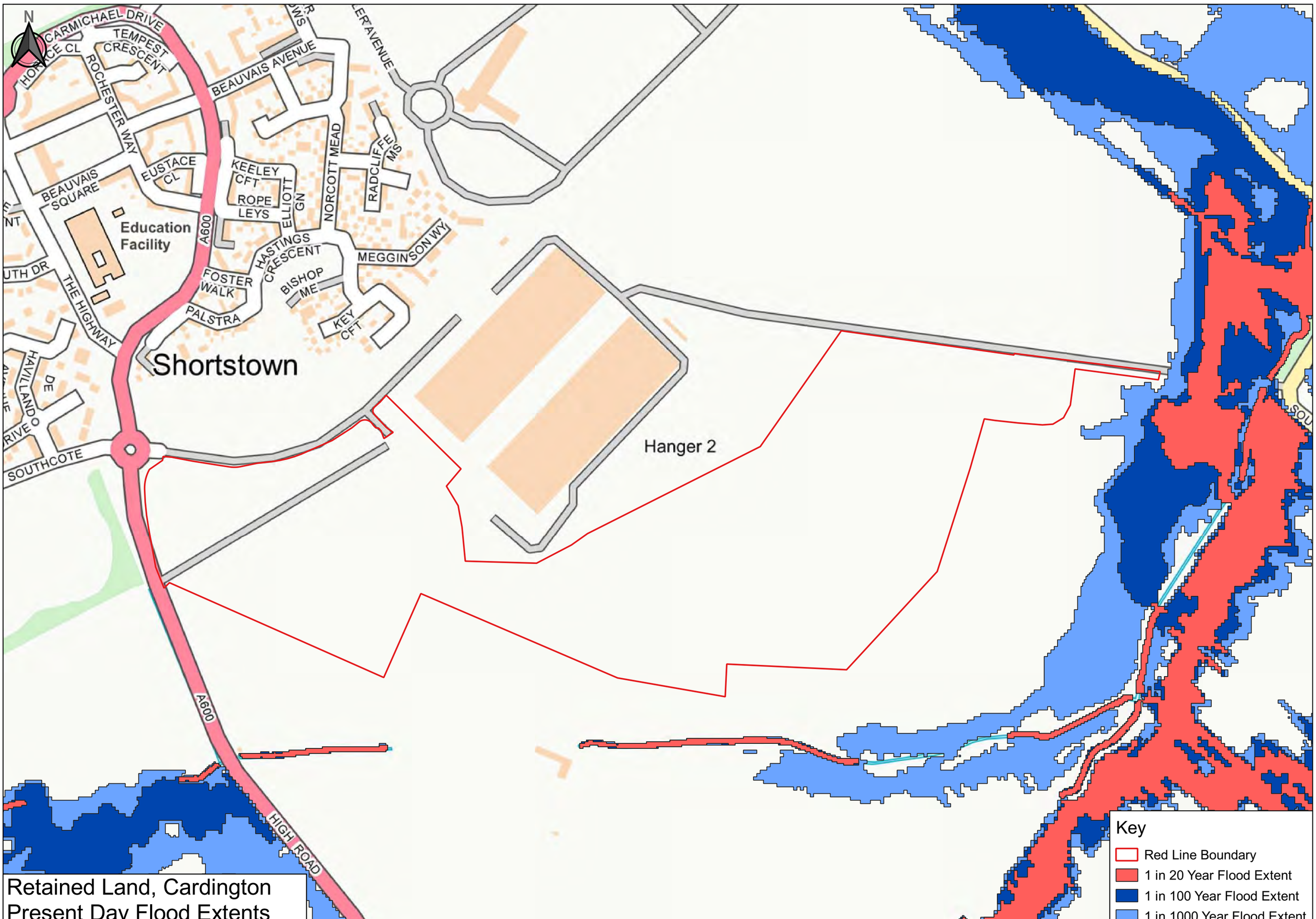
\\bartonwillmore\cfs\Cambridge\Files\31000 - 31999\31500-31599\31550 CARDINGTON HANGARS\A4 - Drawings & Registers\Masterplanning\31550 BL-M-03 Concept Plan Rev H.dwg - A2

C. Hydraulic Modelling Results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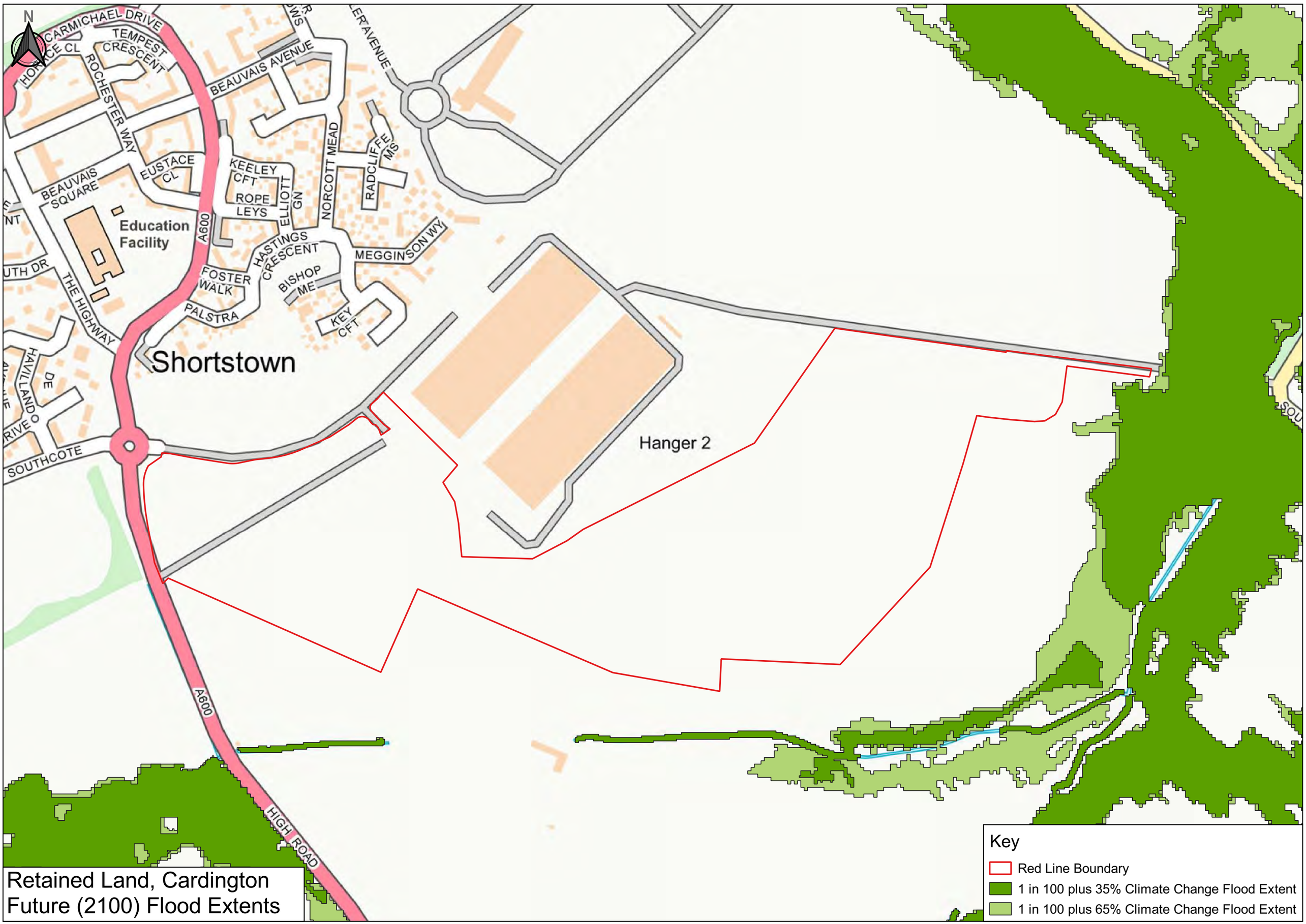
CARMICHAEL DRIVE
TEMPEST CRESCENT
HORACE CL
ROCHESTER WAY
BEAUVAIS AVENUE
BEAUVAIS SQUARE
EUSTACE CL
KEELEY CFT
ROPE LEYS
ELLIOTT GN
NORCOTT MEAD
RADCLIFFE MS
Education Facility
A600
HASTINGS CRESCENT
MEGGINSON WY
FOSTER WALK
BISHOP ME
PALSTRA
KEY CFT
THE HIGHWAY
Shortstown
HAVILLAND DE
SOUTHCOTE
Hanger 2
A600
HIGH ROAD
Retained Land, Cardington
Present Day Flood Extents
Key
Red Line Boundary
1 in 20 Year Flood Extent
1 in 100 Year Flood Extent
1 in 1000 Year Flood Extent


N
CARMICHAEL DRIVE
TEMPEST CRESCENT
ROCHESTER WAY
BEAUVAIS AVENUE
BEAUVAIS SQUARE
EUSTACE CL
KEELEY CFT
ROPE LEYS
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FOSTER WALK
BISHOP ME
PALSTRA
KEY CFT
THE HIGHWAY
Shortstown
SOUTHCOTE
Hanger 2
A600
HIGH ROAD
Retained Land, Cardington
Future (2100) Flood Extents
Key
Red Line Boundary
1 in 100 plus 35% Climate Change Flood Extent
1 in 100 plus 65% Climate Change Flood Extent

D. Anglian Water Sewer Records

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Date: 14/05/19

Scale: 1:1250

Map Centre: 506679,247043

Data updated: 30/04/19

Our Ref: 311242 - 1

Wastewater Plan A0

This plan is provided by Anglian Water pursuant its obligations under the Water Industry Act 1991 sections 198 or 199. It must be used in conjunction with any search results attached. The information on this plan is based on data currently recorded but position must be regarded as approximate. Service pipes, private sewers and drains are generally not shown. Users of this map are strongly advised to commission their own survey of the area shown on the plan before carrying out any works. The actual position of all apparatus MUST be established by trial holes. No liability whatsoever, including liability for negligence, is accepted by Anglian Water Services Limited or any employee or contractor for any error in or omission from this plan or for any damage or loss arising from its inaccuracy or from any act or omission of any such person in reliance on the information contained on this plan or on the data printed. This plan is produced by Anglian Water Services Limited (c) Crown copyright and database rights 2019 Ordnance Survey 100022432. This map is to be used for the purposes of viewing the location of Anglian Water plant only. Any other uses of the map data or further copies is not permitted. This notice is not intended to exclude or restrict liability for death or personal injury resulting from negligence.

Foul Sewer		Outfall*	Sewage Treatment Works
Surface Sewer			
Combined Sewer		Inlet*	Public Pumping Station
Final Effluent			
Rising Main*		Manhole*	Decommissioned Pumping Station
Private Sewer*			
Decommissioned Sewer*			

*(Colour denotes effluent type)

donal.odonovan@watermangroup.com

Area 1

love every drop
anglianwater

Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert
0000	507067	247008	F	39.56	37.85	1.71
0200	506054	247294	F	-	-	-
0200	507093	247245	F	28.7	26.72	1.98
0201	507080	247267	F	26.8	22.97	3.83
0202	507068	247260	F	26.64	23.08	3.56
0203	507039	247251	F	27.68	23.18	4.5
0300	506089	247344	F	28.421	27.347	1.074
0300	507086	247309	F	26.13	22.64	3.49
0301	506074	247302	F	28.649	-	-
0302	506075	247393	F	27.32	25.56	1.76
0303	506023	247380	F	27.08	25.08	2
0304	506081	247371	F	28.34	-	-
0400	507070	247420	F	-	20.93	-
0401	507067	247425	F	-	22.15	-
0500	507073	246590	F	32.41	30.09	2.32
0501	507044	246573	F	32.1	29.86	2.24
0600	507085	246610	F	32.71	30.26	2.45
0601	507008	246672	F	33.85	31.94	1.91
0602	507030	246685	F	34.17	31.73	2.44
0700	507002	246745	F	36.34	34.25	2.09
0701	507026	246757	F	36.44	33.97	2.47
0702	507057	246774	F	36.82	34.24	2.58
0703	507053	246707	F	34.64	31.51	3.13
0704	507062	246776	F	-	-	-
0706	507090	246777	F	-	-	-
0707	507092	246752	F	-	-	-
0708	507069	246711	F	-	-	-
0709	507060	246715	F	-	-	-
0710	507055	246724	F	-	-	-
0711	507040	246743	F	-	-	-
0801	507024	246811	F	38.76	36.95	1.81
0802	507068	246831	F	38.8	36.59	2.21
0803	507087	246801	F	37.79	36.24	1.55
0804	507053	246878	F	40.08	39.38	0.7
0805	507022	246871	F	40.02	38.76	1.26
0806	507017	246880	F	40.19	38.67	1.52
0807	507014	246888	F	40.34	38.57	1.77
0901	507008	246904	F	40.51	37.3	3.21
0902	507018	246965	F	40.11	38.9	1.21
0903	507083	246905	F	40.34	39.14	1.2
0904	507086	246911	F	40.38	39.09	1.29
0905	507049	246989	F	39.87	38.35	1.52
0906	507032	246981	F	40.23	38.66	1.57
1000	507162	247052	F	39.8	37.37	2.43
1001	507114	247030	F	39.69	37.72	1.97
1200	507131	247289	F	26.37	23.13	3.24
1201	507105	247277	F	26.63	22.87	3.76
1300	506142	247331	F	29.035	27.812	1.223
1300	507169	247350	F	25.92	22.33	3.59
1301	506101	247313	F	28.733	27.506	1.227
1500	506170	247507	F	-	21.91	-
1500	507197	246574	F	32.03	29.5	2.53
1504	507168	246587	F	31.87	29.84	2.03
1600	507113	246682	F	34.04	31.03	3.01
1603	507193	246652	F	32.99	30.61	2.38
1604	507196	246665	F	-	-	-
1605	507192	246667	F	-	-	-
1606	507182	246670	F	-	-	-
1701	507168	246789	F	37.33	35.63	1.7
1702	507172	246733	F	-	-	-
1703	507143	246745	F	-	-	-
1704	507135	246740	F	-	-	-
1705	507149	246758	F	-	-	-
1706	507129	246765	F	-	-	-
1707	507125	246743	F	-	-	-
1708	507133	246764	F	-	-	-
1709	507101	246776	F	-	-	-
1710	507120	246718	F	-	-	-
1711	507111	246722	F	-	-	-
1712	507174	246737	F	-	-	-
1713	507170	246727	F	-	-	-
1714	507177	246720	F	-	-	-
1715	507168	246794	F	-	-	-
1801	507167	246803	F	-	-	-
2000	507217	247073	F	40.09	36.89	3.2
2001	507205	247068	F	40.07	37.17	2.9
2100	507279	247102	F	-	-	-
2101	507276	247121	F	-	-	-
2102	507266	247125	F	-	-	-
2103	507260	247125	F	-	-	-
2104	507255	247124	F	-	-	-
2300	506264	247388	F	28.726	26.527	2.199
2300	507263	247387	F	25.96	22.08	3.88
2301	506221	247362	F	29.079	26.819	2.26
2302	506239	247371	F	28.659	26.762	1.897
2303	506209	247371	F	29.06	26.93	2.13
2304	506279	247391	F	28.709	26.664	2.045
2305	506294	247398	F	28.675	26.73	1.945
2400	506259	247416	F	26.407	26.302	0.105
2400	507269	247420	F	25.42	21.83	3.59
2401	506258	247428	F	27.04	25.38	1.66
2401	507278	247477	F	25.5	21.78	3.72
2402	506275	247434	F	26.73	24.82	1.91
2500	507232	246562	F	31.87	29.84	2.03
2501	507257	246573	F	32.02	30.05	1.97
2600	507269	246645	F	32.58	30.15	2.43
2601	507255	246650	F	32.7	29.91	2.79
2602	507237	246652	F	32.83	29.8	3.03
2603	507211	246638	F	32.81	29.29	3.52
2604	507211	246613	F	32.41	29.21	3.2
2605	507279	246638	F	32.55	30.25	2.3
2606	507287	246625	F	32.61	30.36	2.25
2607	507237	246656	F	-	-	-
2608	507228	246672	F	-	-	-
2609	507227	246675	F	-	-	-
2610	507226	246677	F	-	-	-
2611	507222	246676	F	-	-	-
2612	507205	246672	F	-	-	-
2613	507202	246665	F	-	-	-
2701	507244	246778	F	36.87	35.27	1.6
2702	507279	246716	F	35.57	34.67	0.9
2703	507300	246679	F	34.61	33.07	1.54
2704	507239	246714	F	-	-	-
2705	507222	246713	F	-	-	-
2706	507252	246707	F	-	-	-
2707	507241	246707	F	-	-	-
2708	507213	246722	F	-	-	-
2709	507224	246717	F	-	-	-
2710	507221	246703	F	-	-	-
2711	507218	246703	F	-	-	-
2901	507222	246942	F	40.8	38.93	1.87
2902	507261	246941	F	40.77	38.17	2.6
2903	507280	246942	F	40.772	37.952	2.82
2904	507280	246931	F	40.73	38.06	2.67
2905	507220	246903	F	40.444	38.754	1.69
2906	507257	246920	F	-	-	-
3000	507360	247069	F	-	-	-
3002	507328	247086	F	-	-	-
3003	507324	247094	F	-	-	-
3004	507331	247080	F	-	-	-
3005	507331	247072	F	-	-	-
3100	507394	247185	F	-	-	-
3101	507370	247173	F	-	-	-
3102	507387	247152	F	40.336	35.691	4.645
3103	507335	247127	F	-	-	-
3104	507368	247177	F	-	-	-
3105	507366	247182	F	-	-	-
3106	507364	247187	F	-	-	-
3200	507360	247299	F	34.95	32.49	2.46
3201	507399	247226	F	39.79	34.04	5.75
3300	507339	247373	F	-	-	-
3301	507329	247367	F	-	-	-
3400	506370	247442	F	28.351	25.42	2.931
3400	507315	247426	F	-	-	-
3401	506371	247432	F	28.107	26.18	1.927
3600	507313	246651	F	-	-	-
3601	507322	246631	F	-	-	-
3602	507327	246630	F	-	-	-
3603	507375	246650	F	-	-	-
3604	507302	246677	F	33.67	31.51	2.16
3605	507306	246678	F	-	-	-
3606	507299	246663	F	33.44	31.07	2.37
3700	507393	246789	F	-	-	-
3801	507392	246881	F	-	-	-
3802	507363	246854	F	-	-	-
3803	507381	246815	F	-	35.489	-
3804	507391	246819	F	37.489	35.863	1.626
3901	507337	246966	F	40.704	37.524	3.18
3902	507395	246993	F	40.702	37.102	3.6
3903	507378	246903	F	-	-	-
3904	507338	246911	F	-	-	-
3905	507386	246989	F	-	-	-
4001	507401	247099	F	40.595	38.39	2.205
4100	507405	247161	F	-	-	-
4400	506446	247448	F	26.79	23.78	3.01
5400	506516	247467	F	27.13	23.25	3.88
6503	506605	247506	F	-	-	-
7100	506743	247200	F	26.18	24.51	1.67
7300	506713	247397	F	-	21.29	-
8200	506887	247231	F	-	-	-
8201	506873	247245	F	26.6	23.93	2.67
8202	506820	247227	F	26.78	24.18	2.6
8400	506897	247409	F	-	21.11	-
8500	506825	246574	F	-	-	-
8501	506839	246583	F	-	-	-
8502	506876	246577	F	-	-	-
8801	506878	246818	F	40.04	39.13	0.91
9200	506972	247229	F	27.52	23.47	4.05
9201	505979	247282	F	-	-	-
9201	506956	247252	F	26.5	23.58	2.92
9300	505950	247362	F	27.64	24.61	3.03
9301	505964	247303	F	-	-	-
9400	505996	247471	F	-	22.1	-
9500	506947	246563	F	-	-	-
9501	506969	246568	F	-	-	-
9701	506954	246779	F	38.65	37.93	0.72
9702	506990	246796	F	38.71	37.44	1.27
9703	506914	246776	F	-	-	-
9704	506943	246784	F	-	-	-
9801	506976	246829	F	39.5	38.51	0.99
9802	506928	246848	F	40.33	38.54	1.79
9803	506939	246852	F	40.35	38.4	1.95
9804	506961	246862	F	40.32	38.15	2.17
9805	506954	246877	F	40.38	38.04	2.34
9806	506991	246877	F	40.36	38.38	1.98
9807	506982	246872	F	40.38	38.33	2.05
9808	506913	246839	F	-	-	-
9809	506918	246828	F	-	-	-
9810	506927	246811	F	-	-	-
9901	506990	246949	F	39.95	36.74	3.21
9902	506987	246956	F	40.04	36.61	3.43
9903	506899	246913	F	40.08	39.13	0.95
9904	506910	246917	F	40.07	38.97	1.1
9905	506931	246926	F	40.06	37.62	2.44
9906	506957	246939	F	40.03	37.23	2.8
9907	506979	246952	F	40.06	37.01	3.05
0250	506043	247294	S	-	-	-
0351	506074	247304	S	28.698	27.133	1.565
0352	506092	247343	S	28.484	26.757	1.727
0353	506076	247396	S	27.32	25.11	2.21
0354	506018	247382	S	27.12	25.22	1.9
0355	506084	247372	S	28.328	26.514	1.814
0356	506065	247301	S	-	-	-
0357	506014	247318	S	-	-	-
0554	507047	246573	S	32.1	30.77	1.33
0555	507074	246590	S	32.38	30.87	1.51
0650	507002	246640	S	33.47	31.92	1.55
0651	507028	246681	S	34.09	32.48	1.61
0652	507085	246696	S	34.3	32.65	1.65
0653	507087	246611	S	32.72	30.99	1.73
0752	507055	246707	S	34.65	33.02	1.63
0753	507040	246735	S	35.5	33.51	1.99
0754	507056	246772	S	36.78	35.22	1.56
0755	507013	246749	S	36.39	34.53	1.86
0756	507044	246736	S	-	-	-
0757	507063	246775	S	-	-	-
0758	507092	246751	S	-	-	-
0759	507097	246777	S	-	-	-
0760	507060	246714	S	-	-	-
1351	506143	247333	S	29.058	27.291	1.767
1352	506103	247317	S	28.732	26.965	1.767
1353	506165	247371	S	28.82	27.351	1.469
1354	506187	247380	S	28.872	27.589	1.283
1355	506204	247374	S	29.014	27.719	1.295
1451	506198	247423	S	27.2	25.05	2.15
1553	507198	246571	S	31.94	30.27	1.67
1556	507171	246584	S	32.06	30.59	1.47
1651	507116	246685	S	34.08	32.11	1.97
1652	507142	246673	S	33.62	31.95	1.67
1653	507196	246652	S	32.92	31.11	1.81
1751	507200	246787	S	-	-	-
1752	507175	246729	S	-	-	-
1753	507143	246742	S	-	-	-
1754	507136	246738	S	-	-	-
1755	507151	246749	S	-	-	-
1756	507125	246742	S	-	-	-
1758	507121	246717	S	-	-	-
1759	507120	246741	S	-	-	-
1760	507187	246773	S	-	-	-
1761	507178	246736	S	-	-	-
1762	507174	246725	S	-	-	-
2351	506265	247391	S	28.681	26.946	1.735
2352	506217	247362	S	29.301	28.115	1.186
2353	506242	247375	S	28.611	27.247	1.364
2354	506277	247392	S	28.736	27.052	1.684
2451	506261	247431	S	26.7	25.04	1.66
2452	506300	247401	S	29.123	27.664	1.459
2550	507232	246561	S	31.82	30.59	1.23
2551	507256	246571	S	32	30.89	1.11
2655	507213	246638	S	32.79	30.69	2.1
2656	507213	246612	S	32.35	30.53	1.82
2659	507237	246650	S	32.85	30.8	2.05
2660	507256	246649	S	32.69	31.03	1.66
2661	507267	246645	S	32.61	31.08	1.53
2662	507289	246617	S	-	-	-
2663	507279	246636	S	32.57	31.15	1.42
2664	507260	246691	S	-	-	-
2665	507200	246662	S	-	-	-
2666	507268	246694	S	-	-	-
2751	507220	246771	S	-	-	-
2752	507239	246763	S	-	-	-
2753	507261	246724	S	-	-	-
2754	507242	246711	S	-	-	-
2755	507220	246711	S	-	-	-
2756	507215	246768	S	-	-	-
2757	507252	246705	S	-	-	-
2758	507243	246706	S	-	-	-
2759	507223	246717	S	-	-	-
2760	507220	246704	S	-	-	-
3451	506373	247434	S	28.161	26.76	1.401
3452	506260	247415	S	28.341	26.478	1.863
3453	506372	247445	S	28.332	26.575	1.757
3454	506379	247446	S	27.18	25.04	2.14
3455	506378	247411	S	28.414	26.955	1.459
3651	507385	246651	S	-	-	-
3652	507340	246632	S	-	-	-
3653	507315	246683	S	-	-	-
3751	507368	246707	S	-	-	-
3851	507376	246820	S	-	-	-
3853	507390	246816	S	37.462	35.938	1.524
3854	507386	246814	S	46.4	44.975	1.425
3951	507339	246901	S	-	-	-
7850	506796	246878	S	-	-	-
8550	506826	246572	S	-	-	-
8551	506840	246580	S	-	-	-
8552	506883	246573	S	-	-	-
8750	506857	246773	S	-	-	-
8850	506837	246810	S	-	-	-
8851	506885	246839	S	-	-	-
8852	506837	246816	S	-	-	-
8853	506852	246823	S	-	-	-
8854	506830	246819	S	-	-	-
8855	506816	246890	S	-	-	-
9252	505976	247283	S	-	-	-
9253	505977	247259	S	-	-	-
9352	505968	247314	S	-	-	-
9353	505961	247304	S	-	-	-
9550	507000	246592	S	-	-	-
9551	506947	246560	S	-	-	-
9552	506971	246567	S	-	-	-
9650	506993	246661	S	33.68	32.13	1.55
9651	506911	246671	S	-	-	-
9652	506963	246648	S	-	-	-
9653	506938	246655	S	-	-	-
9750	506964	246705	S	35.45	33.75	1.7
9751	506958	246720	S	35.88	33.99	1.89
9752	506906	246796	S	-	-	-
9753	506914	246778	S	-	-	-
9754	506917	246762	S	-	-	-

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Date: 14/05/19

Scale: 1:1250

Map Centre: 508007,247035

Data updated: 30/04/19

Our Ref: 311242 - 2

Wastewater Plan A0

This plan is provided by Anglian Water pursuant its obligations under the Water Industry Act 1991 sections 198 or 199. It must be used in conjunction with any search results attached. The information on this plan is based on data currently recorded but position must be regarded as approximate. Service pipes, private sewers and drains are generally not shown. Users of this map are strongly advised to commission their own survey of the area shown on the plan before carrying out any works. The actual position of all apparatus MUST be established by trial holes. No liability whatsoever, including liability for negligence, is accepted by Anglian Water Services Limited in respect of any claims arising out of the use of this plan including but not limited to claims relating to the position of any pipe, sewer or disposal main or any item of apparatus. This information is valid for the date printed. This plan is produced by Anglian Water Services Limited (c) Crown copyright and database rights 2019 Ordnance Survey 100022432.This map is to be used for the purposes of viewing the location of Anglian Water plant only. Any other uses of the map data or further copies is not permitted. This notice is not intended to exclude or restrict liability for death or personal injury resulting from negligence.

Foul Sewer		Outfall*	Sewage Treatment Works
Surface Sewer		Combined Sewer	Inlet*	Public Pumping Station
Final Effluent		Rising Main*		
Private Sewer*		Manhole*	Decommissioned Pumping Station
Decommissioned Sewer*			

*(Colour denotes effluent type)

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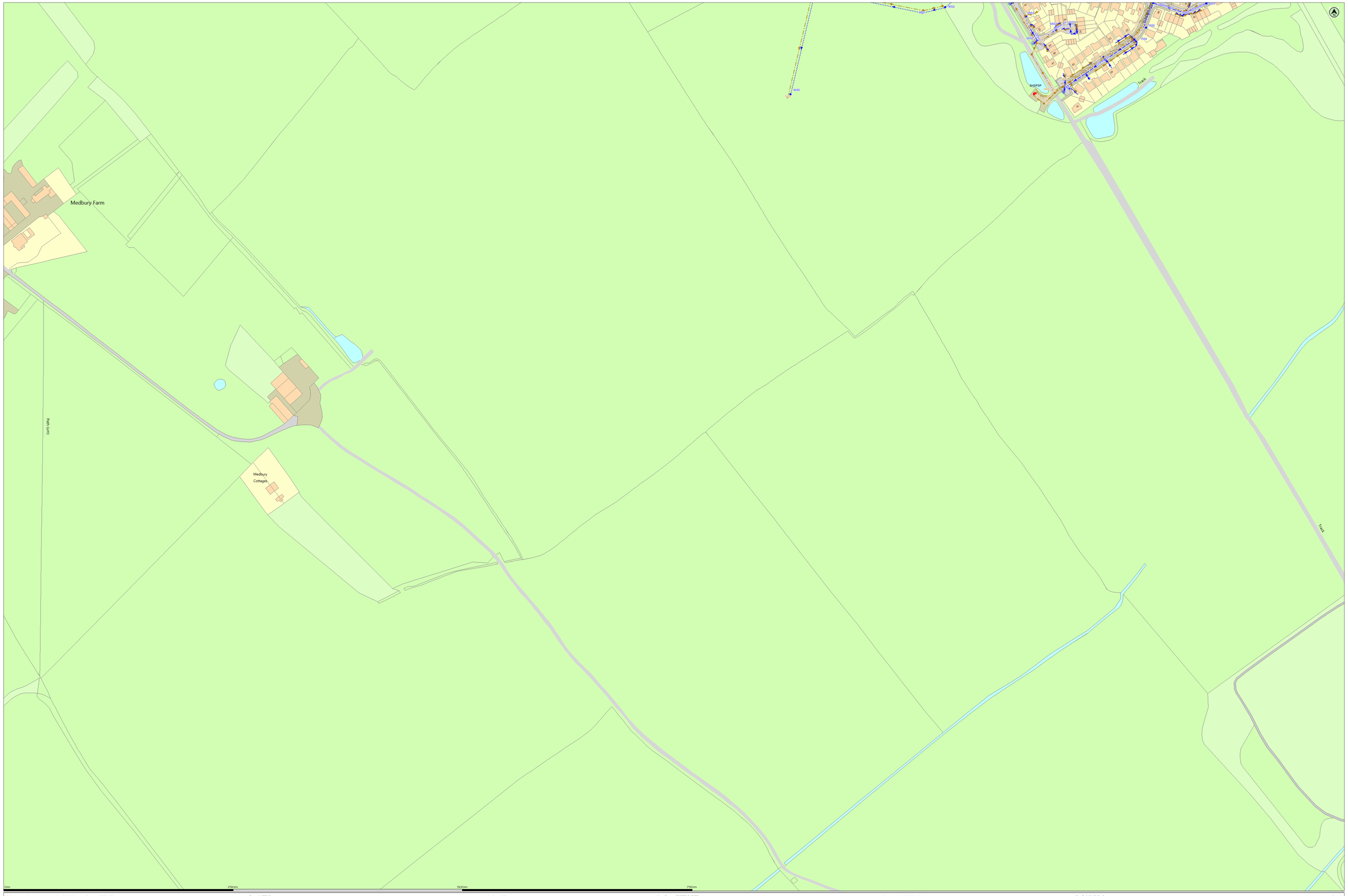
Area 2

love every drop anglianwater

Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert
2100	507279	247102	F	-	-	-
2101	507276	247121	F	-	-	-
2401	507278	247477	F	25.5	21.78	3.72
2605	507279	246638	F	32.55	30.25	2.3
2606	507287	246625	F	32.61	30.36	2.25
2702	507279	246716	F	35.57	34.67	0.9
2703	507300	246679	F	34.61	33.07	1.54
2903	507280	246942	F	40.772	37.952	2.82
2904	507280	246931	F	40.73	38.06	2.67
3000	507360	247069	F	-	-	-
3002	507328	247086	F	-	-	-
3003	507324	247094	F	-	-	-
3004	507331	247080	F	-	-	-
3005	507331	247072	F	-	-	-
3100	507394	247185	F	-	-	-
3101	507370	247173	F	-	-	-
3102	507387	247152	F	40.336	35.691	4.645
3103	507335	247127	F	-	-	-
3104	507368	247177	F	-	-	-
3105	507366	247182	F	-	-	-
3106	507364	247187	F	-	-	-
3200	507360	247299	F	34.95	32.49	2.46
3201	507399	247226	F	39.79	34.04	5.75
3300	507339	247373	F	-	-	-
3301	507329	247367	F	-	-	-
3400	507315	247426	F	-	-	-
3600	507313	246651	F	-	-	-
3601	507322	246631	F	-	-	-
3602	507327	246630	F	-	-	-
3603	507375	246650	F	-	-	-
3604	507302	246677	F	33.67	31.51	2.16
3605	507306	246678	F	-	-	-
3606	507299	246663	F	33.44	31.07	2.37
3700	507393	246789	F	-	-	-
3801	507392	246881	F	-	-	-
3802	507363	246854	F	-	-	-
3803	507381	246815	F	-	35.489	-
3804	507391	246819	F	37.489	35.863	1.626
3901	507337	246966	F	40.704	37.524	3.18
3902	507395	246993	F	40.702	37.102	3.6
3903	507378	246903	F	-	-	-
3904	507338	246911	F	-	-	-
3905	507386	246989	F	-	-	-
4000	507488	247065	F	-	-	-
4001	507401	247099	F	40.595	38.39	2.205
4002	507460	247096	F	-	-	-
4003	507462	247091	F	-	-	-
4004	507463	247088	F	-	-	-
4005	507465	247085	F	-	-	-
4100	507405	247161	F	-	-	-
4101	507442	247178	F	39.38	35.24	4.14
4102	507436	247174	F	39.473	35.413	4.06
4103	507456	247142	F	40.396	36.661	3.735
4200	507412	247232	F	36.998	34.148	2.85
4600	507449	246674	F	-	-	-
4601	507492	246689	F	34.54	33.34	1.2
4602	507489	246697	F	34.72	33.44	1.28
4700	507420	246732	F	-	-	-
4701	507444	246773	F	36.08	34.45	1.63
4702	507465	246726	F	34.87	33.65	1.22
4703	507470	246715	F	34.65	33.59	1.06
4704	507496	246712	F	-	-	-
4801	507426	246891	F	-	-	-
4802	507420	246833	F	37.839	36.264	1.575
4803	507436	246831	F	37.787	36.663	1.124
4804	507494	246860	F	38.848	36.048	2.8
4805	507485	246856	F	38.703	36.29	2.413
4806	507467	246848	F	38.41	36.854	1.556
4901	507447	246928	F	-	-	-
4902	507417	246950	F	-	-	-
4903	507417	246957	F	-	-	-
4904	507455	246931	F	-	-	-
5000	507534	247030	F	-	-	-
5001	507590	247056	F	-	-	-
5007	507538	247023	F	-	-	-
5100	507537	247108	F	-	-	-
5101	507576	247126	F	-	-	-
5102	507516	247176	F	-	-	-
5103	507531	247192	F	-	-	-
5200	507583	247242	F	-	-	-
5201	507592	247222	F	-	-	-
5202	507550	247206	F	-	-	-
5203	507587	247209	F	-	-	-
5204	507589	247202	F	-	-	-
5400	507595	247434	F	-	-	-
5401	508588	247473	F	-	-	-
5501	508573	247514	F	-	-	-
5700	507542	246720	F	34.955	33.812	1.143
5701	507508	246789	F	37.394	34.841	2.553
5702	507577	246788	F	37.157	35.862	1.295
5703	507535	246763	F	36.335	35.052	1.283
5704	507527	246751	F	36.012	34.317	1.695
5705	507545	246713	F	44.3	-	-
5706	507505	246717	F	-	-	-
5800	507507	246801	F	37.616	35	2.616
5801	507512	246819	F	37.979	35.223	2.756
5802	507516	246829	F	38.188	35.343	2.845
5803	507538	246846	F	38.753	36.511	2.242
5804	507562	246881	F	39.714	37.593	2.121
5805	507551	246852	F	39.05	36.847	2.203
5806	507561	246848	F	39.034	37.046	1.988
5807	507522	246850	F	38.645	35.667	2.978
5808	507585	246871	F	-	-	-
5809	507577	246887	F	-	-	-
5810	507554	246889	F	-	-	-
5811	507549	246887	F	-	-	-
5812	507546	246875	F	-	-	-
5813	507534	246879	F	-	-	-
6000	507685	247027	F	-	-	-
6001	507636	247077	F	-	-	-
6002	507641	247085	F	-	-	-
6003	507656	247054	F	-	-	-
6004	507646	247076	F	-	-	-
6005	507671	247062	F	-	-	-
6006	507686	247072	F	-	-	-
6007	507696	247073	F	-	-	-
6100	507632	247106	F	-	-	-
6101	507637	247115	F	-	-	-
6102	507666	247124	F	-	-	-
6103	507610	247142	F	-	-	-
6104	507616	247140	F	-	-	-
6105	507628	247115	F	-	-	-
6106	507688	247190	F	-	-	-
6107	507638	247179	F	-	-	-
6108	507611	247176	F	-	-	-
6109	507602	247172	F	-	-	-
6200	507688	247220	F	-	-	-
6201	507650	247253	F	-	-	-
6202	507661	247267	F	-	-	-
6203	507612	247254	F	-	-	-
6204	507674	247204	F	-	-	-
6205	507661	247216	F	-	-	-
6206	507642	247225	F	-	-	-
6207	507618	247228	F	-	-	-
6300	507700	247352	F	-	-	-
6301	507686	247356	F	-	-	-
6301	508648	247387	F	-	-	-
6302	507671	247385	F	-	-	-
6303	507646	247306	F	-	-	-
6304	507643	247318	F	-	-	-
6305	507632	247334	F	-	-	-
6306	507622	247360	F	-	-	-
6307	507643	247369	F	-	-	-
6308	507658	247376	F	-	-	-
6400	507695	247487	F	-	-	-
6401	507691	247497	F	-	-	-
6402	507627	247450	F	-	-	-
6403	507642	247454	F	-	-	-
6404	507649	247459	F	-	-	-
6405	507660	247463	F	-	-	-
6406	507674	247469	F	-	-	-
6407	507692	247477	F	-	-	-
6408	507662	247407	F	-	-	-
6409	507662	247416	F	-	-	-
6410	507667	247427	F	-	-	-
6411	507670	247437	F	-	-	-
6412	507667	247449	F	-	-	-
6500	507677	247516	F	-	-	-
6503	507659	247510	F	-	-	-
6800	507614	246884	F	-	-	-
7000	507728	247020	F	-	-	-
7001	507737	247087	F	-	-	-
7002	507712	247022	F	-	-	-
7100	507726	247148	F	-	-	-
7101	507722	247168	F	-	-	-
7102	507706	247137	F	-	-	-
7200	507708	247287	F	-	-	-
7201	507735	247299	F	-	-	-
7300	507754	247308	F	-	-	-
7301	507772	247318	F	-	-	-
7301	508712	247306	F	-	-	-
7302	507791	247330	F	-	-	-
7303	507783	247350	F	-	-	-
7304	507774	247369	F	-	-	-
7305	507763	247389	F	-	-	-
7306	507715	247339	F	-	-	-
7307	507710	247349	F	-	-	-
7400	507744	247423	F	-	-	-
7401	507724	247460	F	-	-	-
7402	507724	247472	F	-	-	-
7403	507706	247478	F	-	-	-
7404	507729	247478	F	-	-	-
2662	507289	246617	S	-	-	-
2663	507279	246636	S	32.57	31.15	1.42
3651	507385	246651	S	-	-	-
3652	507340	246632	S	-	-	-
3653	507315	246683	S	-	-	-
3751	507368	246707	S	-	-	-
3851	507376	246820	S	-	-	-
3853	507390	246816	S	37.462	35.938	1.524
3854	507386	246814	S	46.4	44.975	1.425
3951	507339	246901	S	-	-	-
4651	507451	246676	S	43.65	42.447	1.203
4752	507412	246743	S	-	-	-
4753	507412	246728	S	-	-	-
4754	507421	246740	S	44.53	43.642	0.888
4755	507500	246749	S	35.7	32.75	2.95
4756	507494	246744	S	35.44	32.81	2.63
4757	507483	246730	S	35.13	32.86	2.27
4758	507470	246725	S	34.84	32.9	1.94
4759	507448	246771	S	36.01	33.82	2.19
4851	507420	246830	S	37.809	36.209	1.6
4852	507431	246829	S	37.754	36.509	1.245
4853	507494	246857	S	38.887	36.487	2.4
4854	507467	246845	S	38.365	36.917	1.448
4855	507484	246853	S	38.653	36.983	1.67
5008	507540	247023	S	-	-	-
5050	507537	247030	S	-	-	-
5051	507570	247046	S	-	-	-
5052	507599	247059	S	-	-	-
5053	507512	247096	S	-	-	-
5150	507512	247174	S	-	-	-
5151	507530	247194	S	-	-	-
5152	507536	247186	S	-	-	-
5153	507593	247188	S	-	-	-
5154	507545	247110	S	-	-	-
5155	507578	247125	S	-	-	-
5250	507582	247238	S	-	-	-
5251	507551	247209	S	-	-	-
5252	507569	247210	S	-	-	-
5253	507586	247210	S	-	-	-
5254	507588	247223	S	-	-	-
5255	507586	247203	S	-	-	-
5450	507590	247433	S	-	-	-
5451	507573	247452	S	-	-	-
5452	507569	247471	S	-	-	-
5453	507581	247486	S	-	-	-
5454	507598	247494	S	-	-	-
5651	507505	246697	S	44.03	42.279	1.751
5751	507543	246722	S	34.97	33.548	1.422
5752	507510	246790	S	37.357	35.223	2.134
5753	507534	246766	S	36.422	34.847	1.575
5754	507559	246781	S	36.837	35.542	1.295
5755	507576	246790	S	37.102	35.896	1.206
5756	507527	246754	S	36.23	34.223	2.007
5757	507594	246731	S	44	41.609	2.391
5758	507546	246715	S	34.92	32.54	2.38
5759	507539	246713	S	34.9	32.55	2.35
5760	507518	246711	S	34.94	32.62	2.32
5851	507509	246801	S	37.589	35.468	2.121
5852	507515	246820	S	37.983	35.849	2.134
5853	507518	246828	S	38.139	35.961	2.178
5854	507554	246853	S	39.08	37.416	1.664
5855	507564	246877	S	39.631	38.082	1.549
5856	507539	246844	S	38.765	37.063	1.702
5857	507525	246847	S	38.598	36.185	2.413
6050	507686	247026	S	-	-	-
6051	507635	247076	S	-	-	-
6052	507641	247080	S	-	-	-
6053	507660	247038	S	-	-	-
6054	507655	247052	S	-	-	-
6055	507645	247073	S	-	-	-
6056	507672	247060	S	-	-	-
6057	507687	247069	S	-	-	-
6058	507698	247071	S	-	-	-
6150	507640	247177	S	-	-	-
6151	507624	247176	S	-	-	-
6152	507613	247175	S	-	-	-
6153	507601	247169	S	-	-	-
6154	507691	247189	S	-	-	-
6155	507630	247106	S	-	-	-
6156	507635	247117	S	-	-	-
6157	507667	247127	S	-	-	-
6158	507609	247138	S	-	-	-
6159	507615	247137	S	-	-	-
6160	507625	247118	S	-	-	-
6161	507607	247159	S	-	-	-
6162	507626	247186	S	-	-	-
6250	507671	247269	S	-	-	-
6251	507652	247245	S	-	-	-
6252	507691	247210	S	-	-	-
6253	507606	247247	S	-	-	-
6254	507619	247229	S	-	-	-
6255	507665	247215	S	-	-	-
6256	507674	247207	S	-	-	-
6257	507641	247227	S	-	-	-
6258	507653	247295	S	-	-	-
6350	507690	247352	S	-	-	-
6351	507681	247370	S	-	-	-
6352	507672	247389	S	-	-	-
6353	507649	247303	S	-	-	-
6354	507645	247317	S	-	-	-
6355	507636	247331	S	-	-	-
6356	507632	247340	S	-	-	-
6357	507623	247362	S	-	-	-
6358	507640	247370	S	-	-	-
6359	507655	247377	S	-	-	-
6450	507693	247487	S	-	-	-
6451	507687	247498	S	-	-	-
6452	507609	247496	S	-	-	-
6454	507663	247409	S	-	-	-
6455	507664	247417	S	-	-	-
6456	507670	247427	S	-	-	-
6457	507672	247441	S	-	-	-
6458	507662	247461	S	-	-	-
6459	507678	247468	S	-	-	-
6460	507695	247476	S	-	-	-
6461	507608	247442	S	-	-	-
6462	507629	247453	S	-	-	-
6463	507644	247457	S	-	-	-
6464	507650	247462	S	-	-	-
6550	507675	247517	S	-	-	-
6552	507633	247503	S	-	-	-
6553	507649	247507	S	-	-	-
6554	507657	247511	S	-	-	-
6751	507645	246723	S	43.645	41.471	2.174
6752	507651	246710	S	43.005	41.432	1.573
6850	507653	246878	S	-	-	-
6950	507690	246906	S	-	-	-
7050	507735	247086	S	-	-	-
7051	507726	247017	S	-	-	-
7052	507702	247023	S	-	-	-
7053	507720	247019	S	-	-	-
7054	507718	247092	S	-	-	-
7055	507720	247084	S	-	-	-
7056	507717	247037	S	-	-	-
7150	507722	247151	S	-	-	-
7151	507727	247131	S	-	-	-
7152	507701	247139	S	-	-	-
7250	507705	247283	S	-	-	-
7251	507739	247298	S	-	-	-
7350	507754	247304	S	-	-	-
7351	507767	247312	S	-	-	-
7352	507789	247326	S	-	-	-
7353	507783	247347	S	-	-	-
7354	507771	247371	S	-	-	-
7355	507755	247398	S	-	-	-
7356	507727	247319	S	-	-	-
7357	507713	247348	S	-	-	-
7358	507706	247354	S	-	-	-
7450	507741	247424	S	-	-	-
7451	507722	247462	S	-	-	-
7452	507718	247471	S	-	-	-
7453	507705	247476	S	-	-	-
7454	507728	247481	S	-	-	-
7950	507715	246938	S	-	-	-



Date: 14/05/19

Scale: 1:1250

Map Centre: 506676,246087

Data updated: 30/04/19

Our Ref: 311242 - 3

Wastewater Plan A0

Foul Sewer		Outfall*		Sewage Treatment Works	
Surface Sewer					
Combined Sewer		Inlet*		Public Pumping Station	
Final Effluent					
Rising Main*		Manhole*		Decommissioned Pumping Station	
Private Sewer*					
Decommissioned Sewer*					

*(Colour denotes effluent type)

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Area 3

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Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert
0400	507090	246473	F	31.33	29.07	2.26
0401	507079	246462	F	31.17	28.56	2.61
0502	507071	246528	F	31.56	29.51	2.05
0503	507093	246541	F	31.72	29.74	1.98
0504	507065	246515	F	31.54	29.41	2.13
1400	507107	246485	F	31.24	28.75	2.49
1501	507186	246544	F	31.68	28.99	2.69
1502	507175	246531	F	31.57	28.93	2.64
1503	507110	246543	F	31.74	29.95	1.79
2500	507232	246562	F	31.87	29.84	2.03
7400	506800	246469	F	-	-	-
9500	506947	246563	F	-	-	-
9501	506969	246568	F	-	-	-
0550	507072	246530	S	31.59	30.34	1.25
0552	507092	246542	S	31.75	30.51	1.24
0553	507057	246555	S	31.88	30.53	1.35
1451	507102	246479	S	31.31	29.93	1.38
1553	507198	246571	S	31.94	30.27	1.67
1554	507177	246531	S	31.56	30.06	1.5
1555	507187	246545	S	31.62	30.09	1.53
1557	507108	246544	S	31.76	30.65	1.11
2550	507232	246561	S	31.82	30.59	1.23
2551	507256	246571	S	32	30.89	1.11
8450	506803	246472	S	-	-	-
9551	506947	246560	S	-	-	-
9552	506971	246567	S	-	-	-

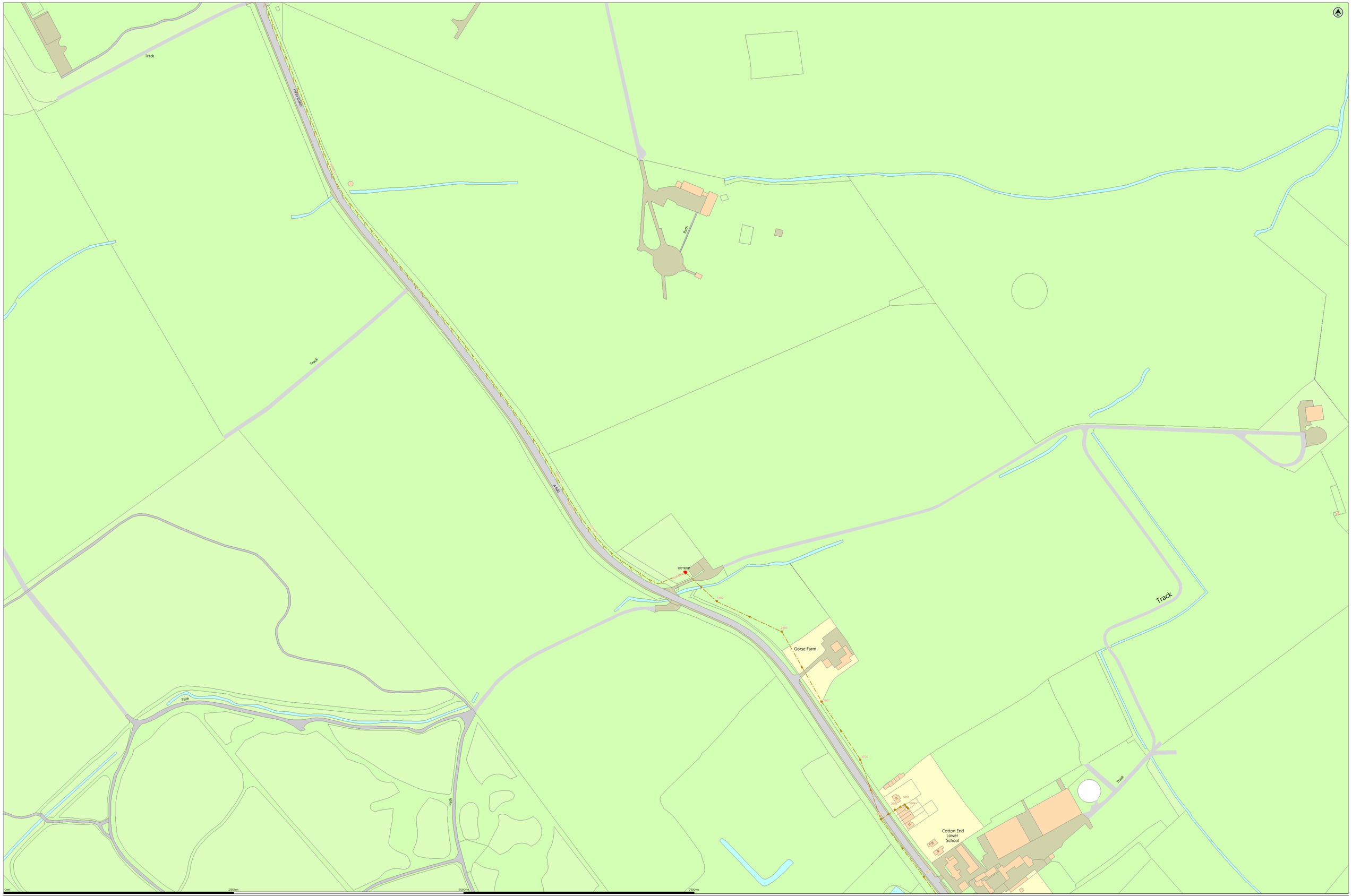
Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert



Date: 14/05/19

Scale: 1:1250

Map Centre: 508122,246081

Data updated: 30/04/19

Our Ref: 311242 - 4

Wastewater Plan A0

Foul Sewer	Outfall*	Sewage Treatment Works	
Surface Sewer			
Combined Sewer			
Final Effluent	Inlet*	Public Pumping Station	
Rising Main*			
Private Sewer*	Manhole*	Decommissioned Pumping Station	
Decommissioned Sewer*		*(Colour denotes effluent type)	

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Area 4

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Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert
1900	508166	245915	F	-	-	-
2800	508237	245882	F	-	-	-
2801	508280	245806	F	-	-	-
3600	508344	245678	F	-	-	-
3601	508391	245615	F	-	-	-
3602	508360	245688	F	-	-	-
3603	508371	245694	F	-	-	-
3604	508374	245689	F	-	-	-
3700	508322	245742	F	-	-	-

Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert

E. Preliminary Drainage Strategy

PROPOSED GROUND LEVEL = 30.3m AOD (APPROX. 1.5m GROUND RAISING)

PROPOSED GROUND LEVEL = 30.0m AOD (APPROX. 1.0m GROUND RAISING)

PROPOSED GROUND LEVEL = 28.8mAOD (APPROX. 0.7m GROUND RAISING)

PROPOSED GROUND LEVEL = 30.1m AOD (APPROX. 0.7m GROUND RAISING)

PROPOSED GROUND LEVEL = 30.0m AOD (APPROX. 0.2m GROUND RAISING)

CATCHMENT 1

BASIN 1

1:2500 0 50m 100m

1:1 0 10 20 30 40 50

KEY

- SITE BOUNDARY
- CATCHMENT BOUNDARY
- PROPOSED SURFACE WATER CONNECTION
- PROPOSED SWALE
- PROPOSED DETENTION BASIN (DRY)
- MAINTENANCE BUFFER
- PROPOSED GRAVITY FOUL DRAINAGE ROUTES
- PROPOSED FOUL PUMPING STATION
- EXISTING FOUL PUMPING STATION

Rev	Date	Description	By
P04	27.07.20	RED LINE BOUNDARY UPDATED	CH
P03	05.05.20	RED LINE BOUNDARY UPDATED	CH
P02	24.04.20	DRAINAGE STRATEGY AMENDED	CH
P01	08.04.20	PRELIMINARY	CH

Amendments

Project

CARDINGTON RETAINED LAND

Title

PRELIMINARY DRAINAGE STRATEGY

Client

Gallagher Developments Group Ltd

Waterman

Pickfords Wharf Clink Street London SE1 9DG

t 020 7928 7888

mail@watermangroup.com www.watermangroup.com

Status

PRELIMINARY

Designed By	Checked By	Waterman Ref
CH	DO	WIE15662
Drawn By	**Date**	**Scales @ A3**
CH	APRIL 2020	1:2500

Project - Originator - Volume - Level - Type - Role - Number	Revision
15662-WIE-ZZ-XX-DR-92001	P04

File Path C:\Modelling Files and Work\Jobs\WIE15662 - Cardington\109 - Cardington Retained Land\7_CAD\92_Drainage\

168147-1_OSM, 28446, A3-Wat-BS-S, Retained_Land_RLB

F. Surface Water Runoff Calculations

CALCULATIONS

Company:	WIE	Office:	London
Sheet No:	1 of 3	Project No:	WIE15662
By	C Henderson	Date	28.07.20
Checked:	D O'Donovan	Date	28.07.20

Project Title: **Cardington Retained Land**
Calculations Title: **Surface Water Management - Summary Sheet**

LOCATION	CALCULATIONS	OPTIONS

Surface water at the Site will be managed in accordance with latest guidance and industry best practice, i.e. surface water discharge restricted to the greenfield runoff rate.

Existing surface water discharge regime:

Greenfield land discharging into watercourses at the greenfield runoff rate

Proposed surface water discharge regime:

Restrict to 4 l/s/ha of impermeable area for the 1 in 100 year event + 40% climate change as requested by the Bedfordshire and River Ivel Internal Drainage Board

Discharge rate = 4.0 l/s/ha
applied to the impermeable for each catchment

Initial attenuation estimates

Catchment	Area (ha)	Effective Area (ha)*	Discharge Rate (l/s)	Attenuation (m^3)**
1	8.11	6.24	25.0	4955

*Includes 70% Percentage Impermeable Area (PIMP) and 10% uban creep allowance as per Bedford Borough Council requirement, total PIMP 77%.

**The total storage required for the entire site has been calculated then pro-rated down to the effective area for each catchment

CALCULATIONS

Company:	WIE	Office:	London
Sheet No:	2 of 3	Project No:	WIE15662
By	C Henderson	Date	28.07.20
Checked:	D O'Donovan	Date	28.07.20

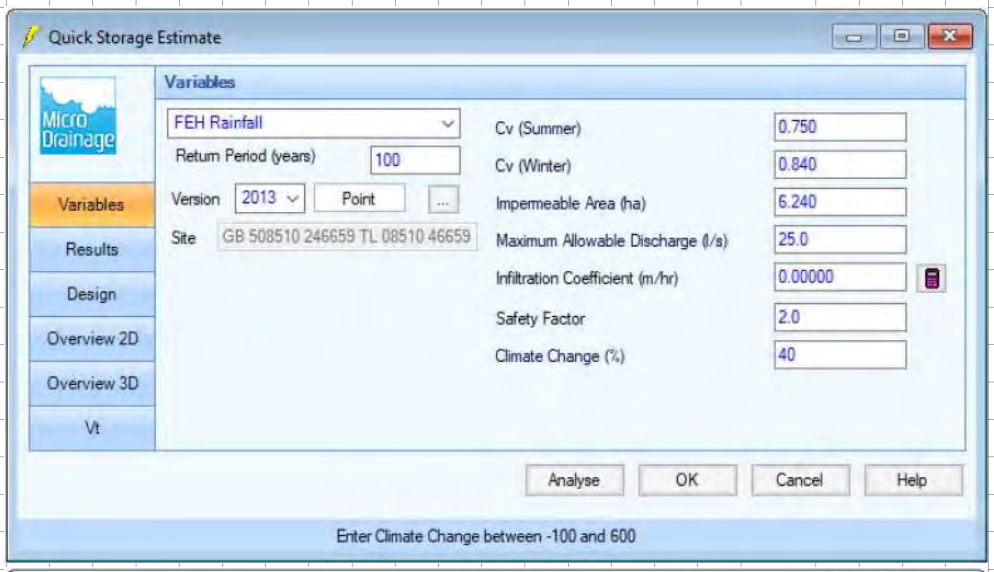
Project Title: **Cardington Retained Land**

Calculations Title: **Preliminary Surface Water Attenuation Volume - Greenfield Rate**

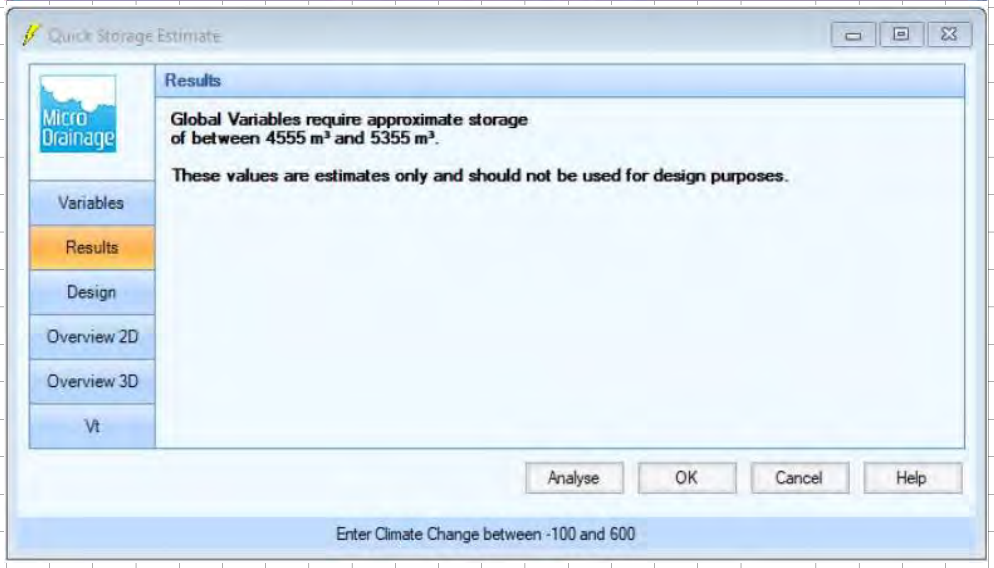
LOCATION	CALCULATIONS	OPTIONS

In order to calculate the volume of surface water attenuation required for the Site, Windes Microdrainage version 2018.1, Source Control module, Quick Storage Estimate has been used. The input and output data for which are shown below;

Input:



Output:



As Windes Quick Storage Estimate provides a range of attenuation volumes it is considered that an average value of the range is suitable for preliminary design sizing.

Minimum:	4,555	m^3		
Maximum:	5,355	m^3	Preliminary Estimate:	**4955** **m^3**

CALCULATIONS

Company:	WIE	Office:	London
Sheet No:	3 of 3	Project No:	WIE15662
By	C Henderson	Date	28.07.20
Checked:	D O'Donovan	Date	28.07.20

Project Title: **Cardington Retained Land**

Calculations Title: **Greenfield Runoff Rate (IoH)**

LOCATION	CALCULATIONS	OPTIONS

In orer to calculate the rate of surface water discharge from the permeable portin of the site, the Windes Microdrainage version 2018.1 Source Control module has been utilised. Rural runoff has been calculated using the IoH 124 Methodology. The input and output data for which are shown below;

Waterman Group		Page 1
Pickfords Wharf Clink Street London, SE1 9DG		Micro Drainage
Date 02/04/2020 14:25 File	Designed by CSCH3 Checked by	
Innovyze	Source Control 2019.1	

IH 124 Mean Annual Flood

Input

Return Period (years)	100	Soil	0.400
Area (ha)	50.000	Urban	0.000
SAAR (mm)	547	Region Number	Region 5

Results	l/s
QBAR Rural	127.5
QBAR Urban	127.5
Q100 years	453.8
Q1 year	110.9
Q2 years	113.9
Q5 years	164.4
Q10 years	211.0
Q20 years	266.5
Q25 years	288.3
Q30 years	306.3
Q50 years	362.3
Q100 years	453.8
Q200 years	534.1
Q250 years	559.6
Q1000 years	734.3

Q1	110.9	l/s	2.2	l/s/ha
Qbar (1 in 2.333)	**127.5**	**l/s**	**2.5**	**l/s/ha**
1 in 100	453.8	l/s	9.0	l/s/ha

Attenuation Design
WIE15662 - Cardington Retained Land
28.07.20

STORAGE REQUIRED PER CATCHMENT	Catchment 1	4955	m^3

DETENTION BASIN 1		
Area of base	1800.0	m^2
Perimeter of base	190.0	m
Depth of storage	2.00	m
Gradient of sides	1 in	4
Volume	**5120**	**m^3**

TOTAL STORAGE PER CATCHMENT	5120	m^3

UK and Ireland Office Locations