Redrow Homes Plc

Land at Little Bushey Lane, Bushey

Rebuttal Flood Risk Proof of Evidence

680462 Rebuttal PoE

LDE
CIVILS | STRUCTURES | HYDROLOGY
an RSK company

APRIL 2023

Town and Country Planning Act 1990 (as amended)

Section 78 (including an appeal under section 78 as applied by the regulations made under section 220

Appellant: Redrow Homes Plc

APPEAL REFERENCE: APP/N1920/W/23/3314268 - Land East Of Little Bushey Lane And North Of The Squirrels

LPA REFERENCE: 22/1071/OUT

Application for residential development (up to 310 units) with access from Little Bushey Lane, and land reserved for primary school, community facilities and mobility hub (Class E) along with car parking, drainage and earthworks to facilitate drainage, open space and all ancillary and enabling works. (Outline Application with Appearance, Landscaping, Layout and Scale Reserved).

1. Introduction

1.1 This rebuttal proof of evidence (‘rebuttal’) has been prepared in direct response to the points raised in the Lead Local Flood Authority Proof of Evidence Dealing With Matters Relating To Flood Risk & Sustainable Drainage.

1.2 This rebuttal has been prepared on the same terms as my proof of March 2023 and it remains that the opinions expressed are my true and professional opinions, given in accordance with the guidance of the professional institution.

2. Rebuttal

Planning Policy Context

2.1 The LLFA note that the LPA should be satisfied that the sequential test has been suitably applied. This is a planning matter to be addressed. The submitted Flood Risk Assessment March 2023 (Core Document D7) demonstrates that flood risk has been a material consideration in designing the layout for the site including the proposed flood mitigation. As a result of this, it has been demonstrated that the development can be located in an area of low flood risk for the lifetime of the development without increasing flood risk offsite, this is in accordance with the requirements of Paragraph 159 and 167 of the NPPF.

Proposed Development and Flood Risk

2.2 The LLFA Evidence (**paragraphs 3.2.1-3.2.5)** correctly notes the difference between surface water flood risk to the site from overland flow paths and the surface water falling onto the site. It is agreed with the LLFA that surface water flow paths flow through the site, some of which originate off site.

2.3 The point raised in **paragraph 3.2.6** of the LLFA Evidence is correct, the figure referenced does incorrectly state the Main River is an land drainage ditch, this is a typographical error. This information had been noted and the submitted Flood Risk Assessment, March 2023 (Core Document D7) and correctly refers to the river as a Main River. This point does not alter the assessment, nor impact on the risk of flooding at the site. It also had no bearing on the query being raised at the time which was to confirm the status of each water features on with and related specifically to the drainage ditch crossing the site southwest to northeast.

2.4 The LLFA Evidence **paragraph 3.2.7** notes that not all information was submitted to the LLFA at the time of the enquiry as to whether the ditch constituted an ordinary watercourse. It is our view that the mapping and accompanying text submitted was adequate as the basis for the enquiry as it contained all the information required to confirm the status of each water body on site. The response received at the time from the LLFA, which clearly stated that the ditch was not an ordinary watercourse, was also reflected in the mapping of ordinary watercourses in Hertsmere Borough Council's Strategic Flood Risk Assessment, which did not show the ditch to be an ordinary watercourse, as such can be considered to be nothing more than a drainage ditch under riparian ownership.

2.5 With regard to the Thames Water surface water sewer shown to discharge to the rear of No. 24 Wayside Avenue, the LLFA note that the sewer records 'clearly show a Thames Water surface outfall discharging to the watercourse from the upstream urban residential area' (**Appendix A**). This is incorrect as the records do not show a connection to a watercourse (**Figure 2.1**). This is a private property and the point of discharge has not been confirmed, however a small 150mm diameter pipe was seen discharging to the site from the rear fence of this property during a site inspection (Figure 2.2). Notwithstanding this point, the flow from this 150mm outfall has been considered in the hydraulic model with the rainfall from the contributing catchment being accounted for in the model and the location of the proposed swale to collect and convey this flow being located to account for this. The swale utilised in the model has sufficient capacity to convey the flow from the upstream catchment, including the flow from this outfall pipe.

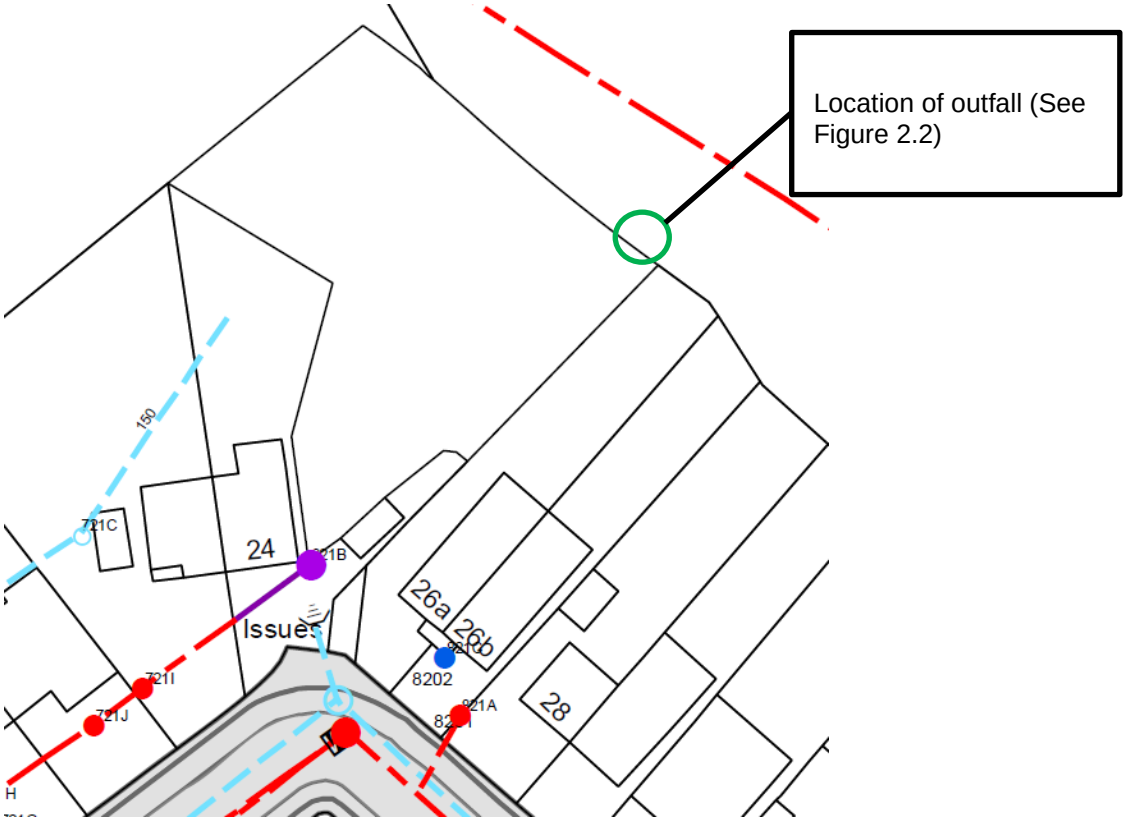

Figure 2.1 Thames Water Sewer extract (see Appendix A for full record)

Figure 2.2 Outfall pipe from rear of No. 24 Wayside Road (Location shown circled in green in Figure 2.1)

2.6 Paragraph 3.2.11 of the LLFA Evidence suggests that an assessment of the watercourses has not been correctly assessed. This is disputed as a full detailed pre and post development overland flow model has been produced. This model does not just consider the flows on the site, but also the inflows from upstream. The LLFA Evidence states that the masterplan produced does not include sufficient detail on the buffers for the watercourses. However, the requirement for appropriate easements is included in the submitted Flood Risk Assessment (section 5.4) Core Document D7. The location of the watercourses shown on the masterplan have been carefully considered to collect flows from offsite and to maintain gradients to ensure onwards conveyance without impacting areas offsite. The ditch diversion design will be refined at detailed design stage with the model being re-run to fully represent any changes (this can be secured through planning condition). These design details will be carried out in conjunction with ecologists to ensure maximum ecological benefit can be provided, as a minimum this will show some minor meanders in the channel and different bank sloping.

2.7 The LLFA Evidence **paragraph 3.2.12** notes that only the model outputs have been reviewed. No request has been received for the model files and it is not usual practice that full model files are reviewed by the LLFA when a detailed model assessment has been provided. Details of the assumptions used in the model are included in section 4.5 of the submitted FRA, Core Document D7.

2.8 It is unclear what additional flows are referred to in **paragraph 3.2.13** of the LLFA proof. It is confirmed that the pluvial overland flow model takes into account the whole upstream catchment of the site, as well as the site itself and the contributing area for the Thames Water surface water sewer. As such any reasonable inflows into the model have been accounted for. The flow associated with the Main River has not directly been accounted for the in the model. The model is an overland flow model for the surface water flow routing, and as such the pluvial overland flow model takes into account the whole upstream catchment of the site. The floodplains associated with the Main River are downslope of the development parcels of the site, the gradient of the site would mean that the backwater effect is negligible and does not impact on the overland flow routing through the site. In addition, it is usual practice to account for flows in the fluvial model based on downstream catchments, as such it is likely that the inflow to the fluvial model includes the flow from the site and therefore this would constitute in double counting of the rainfall contributing to the fluvial model. It can also be confirmed that outflows from the site surface water attenuation basins (based on the drainage strategy) have been included as outfalls into the ditches to fully represent the post development situation more accurately.

2.9 The ground levels data used is based on LiDAR as stated in the submitted FRA, Core Document D7, this allows for the whole catchment to be reasonably represented in the model. A comparison between the LiDAR and the levels based on a triangulated topographic survey for the site show the LiDAR used and the topographic survey data to be comparable and suitable for use (**Figure 2.3 – 2.5**). These figures show how the LiDAR ground levels and the topographic ground levels data are a suitable fit with no significant variation in the 2 datasets, as such the use of LiDAR for the site and catchment wide modelling is suitable and fit for purpose.

Figure 2.3 LiDAR vs Topo – section 1

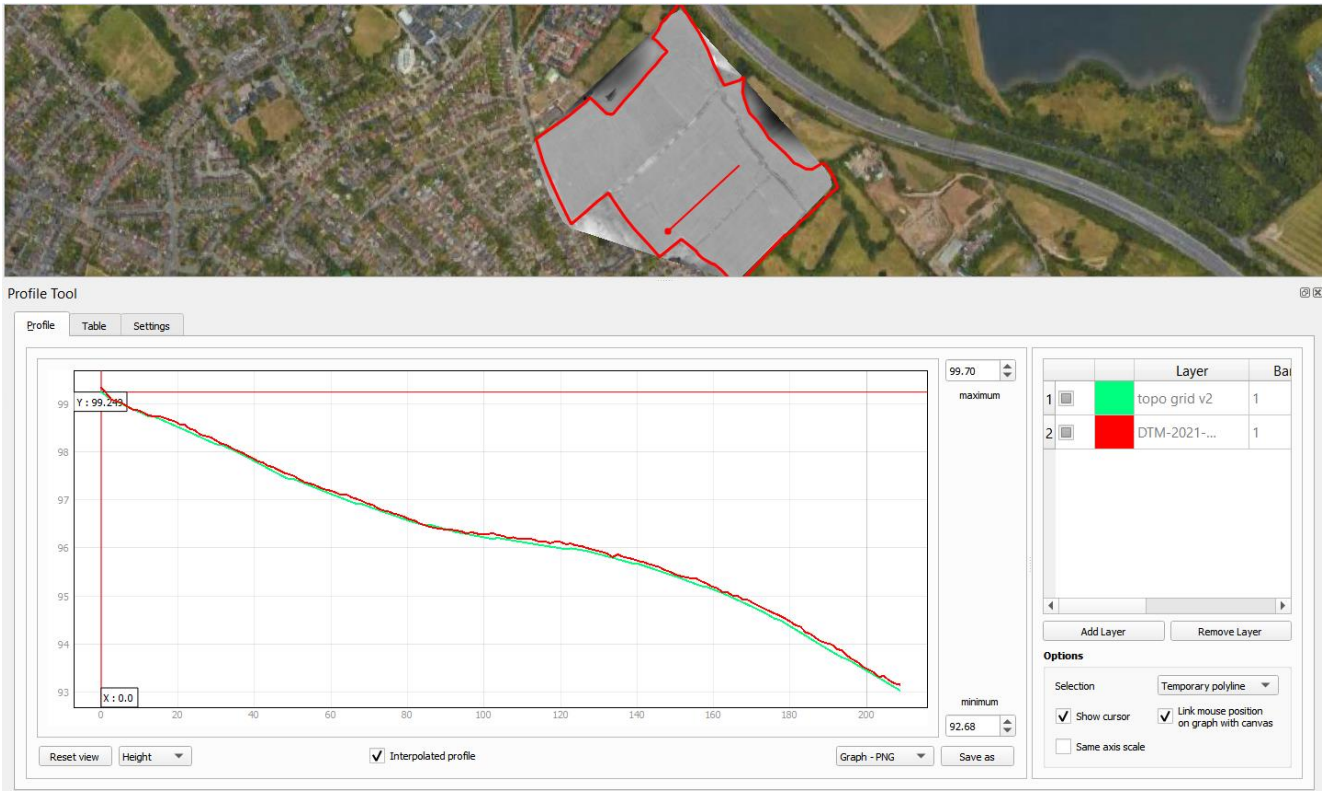

Figure 2.4 LiDAR vs Topo – section 2

Figure 2.5 LiDAR vs Topo – section 3

2.10 The model parameter showing the development parcels being raised by 1m above the surrounding areas is to ensure these development parcels remain above the flow routing areas, this is considered an overestimation of likely future ground levels and it is not intended that these will be the final design levels of the parcels. It is only in the post development model where these ground modifications have occurred. The LLFA (para 3.2.15 of the Evidence) note that these ground levels impact on the existing surface water flows, this is not the case where the existing flows have been modelled based on existing ground levels. Once floor and development levels are established at reserved matters the model will be re-run to fully represent the proposed development, this can be secured via a condition. At outline application stage, the pluvial model as produced is sufficient to represent the masterplan to ensure sufficient space has been allocated for the flood mitigation measures and that the proposals can be delivered without increasing flood risk to the development or offsite.

2.11 As previously stated, the flows from the contributing catchment from the Thames Water sewer have been accounted for in the model with the receiving ditch, sized and located to collect and convey this flow. The Thames Water sewer is shown to be a 150mm dia pipe, this corresponds with the outfall pipe located to the rear of No. 24 Wayside Avenue, the ditch diversions are currently shown to be approx. 3.5m in width and 0.5m in depth (The width is based on a 1:3 side slope and 0.5m depth). Based on these parameters the modelling shows the ditch diversions have sufficient capacity to convey the flow from this pipe and the upstream catchment whilst offering a significant increase in cross section from the current ditch receiving flows from this sewer (**Figure 2.6**).

Figure 2.6 – Ditch receiving flow from the Thames Water sewer.

2.12 **Paragraph 3.2.17** of the LLFA Evidence queries the use of a single rainfall profile. The FEH (Flood Estimation Handbook) data used to generate the rainfall profile is based on the catchment descriptors and critical rainfall intensity and duration for the catchment. Whilst it is not disputed that different rainfall profiles occur, the selected dataset is based on what is critical for the catchment for a range of return periods based on the industry standard software and techniques.

2.13 The model output oscillations are noted. It is suggested in the LLFA Evidence that the Mesh Cells have not be properly represented for the pre and post development models. It is confirmed that the grid used is the same for both model runs. There is no clear area where flood risk is shown to be increased offsite. There is a small area modelled which is from an adjacent catchment where the site cannot have an impact, and a similar situation is shown. The model files have been submitted to the software developer (Jacobs) for review with some minor amendments suggested in the model runs, these have been carried out and show a similar situation with the oscillations. Given the local topography, for example where the Thames Water sewer issues onto the site, the ground levels are 1m+ higher than the site levels, as such, the works proposed on the watercourses on site could not impact upstream. As previously stated the proposed ditch diversions are sized to convey the flow from upstream and will be further refined once the scheme details develop. It can be clearly seen on the downstream sections that there is a consistent reduction in flooding as a result of the development (Figure 2.7 below – taken from Figure 4.26 of the FRA, Core Document D7). The green hatching to the north show the downstream areas of the site where flood depths has been reduced from the pre-development scenario)

Figure 2.6 – Flood depth comparison from pre and post development modelling)

2.14 The LLFA Evidence (**paragraph 3.2.4**) references previous flooding incidences on Little Bushey Lane. RSK note that Little Bushey Lane is located up-gradient of the site. Therefore, the proposed development on the site has very limited potential to impact any existing issues on this road. However, the mitigation proposals do allow for existing flows from upstream to be maintained through the site and therefore will not increase the flood risk to these area, as demonstrated by the surface water flood risk modelling exercise.

Site Surface Water Drainage and SuDS

2.15 It is accepted that further details on the proposed surface water drainage scheme can be secured through condition as stated in the LLFA Evidence **paragraph 4.1.2**.

2.16 It is confirmed that FEH 13 data has been used in the submitted drainage strategy.

2.17 The Cv value of 0.84 is the default value in the MicroDrainage software and deemed suitable for the surface water drainage strategy at this stage. The development areas used to generate the attenuation volumes are based on a high level masterplan and would include areas of soft landscaping and gardens for example, these areas are typically not positively drained and would allow for some natural infiltration into the topsoils. The strategy as proposed at this stage of the design does not allow for any attenuation in the pipe network or manholes, as such can be seen as a conservative estimate of the attenuation required. A full detailed drainage design will be required once the scheme has been developed further, it is standard practice to secure this requirement through planning condition. At this stage the full system will be appropriately modelled, submitted to and approved by the LLFA prior to commencement on site. The Appellants have previously submitted draft conditions for review.

2.18 It can be confirmed that the overland flow routing and the site surface water drainage systems are shown to be isolated systems with the overland flow swales diverting flow away from the attenuation features. Therefore no additional storage volume is required within the SuDS features to accommodate overland flows from offsite.

2.19 As stated above a full detailed design of the drainage system will be required, which will be designed to adoptable standards, this will require surcharged outfalls to be considered. The

basins are located on ground located above the 1000 year flood extent, as such the head of water in the basin will ensure flows towards the watercourse will occur in flood situations. As the flow rates are reduced from the predevelopment rates in extreme rainfall events, this results in a reduction in offsite flood risk.

3. Conclusion

3.1 The Environment Agency do not hold an objection on flood risk or drainage grounds to the application.

3.2 The submitted FRA has demonstrated that the development of the site can be carried out in accordance with the requirements of the NPPF and in adopting the sequential approach all of the more vulnerable built development has been located in the areas of the site which lie in areas of low flood risk (from all sources) with no off site impacts as a result of the development.

3.3 It is disputed that the flood risk has not been fully represented by the submitted FRA. The assessment provides sufficient detail and reassurance that the scheme can be delivered whilst considering the flood risk not only to the proposed development but also off site.

3.4 The upstream inflows have been appropriately considered within the model produced. The post development modelling demonstrates flows through site can be delivered without increasing flood risk. Further details on the swales will be provided as the scheme develops and additional modelling to represent this will be required, this can be secured via planning condition. These additional details will provide detail on construction and dimensions, flow capacity, ecological benefits, maintenance schedules and will be submitted to approved by the relevant parties prior to commencement on site.

3.5 The proposed surface water drainage system for the site has been designed to restrict offsite flow to the QBAR greenfield rate, thus reducing offsite flow rates for rainfall events in excess of this, with the basins sized to accommodate the 1 in 100 year plus climate change rainfall event including a subsequent 30 year rainfall event. A suitably worded planning condition is appropriate to secure the additional surface water design details required by the LLFA, including use of the latest rainfall data and climate change allowances.

APPENDIX A
THAMES WATER SEWER RECORDS

Asset location search

Property Searches

RSK Land And Development Engineering Ltd
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HEMEL HEMPSTEAD
HP3 9RT

Search address supplied Land of Little Bushey Lane
Little Bushey Lane
Bushey
WD23 4SB

Your reference 133982

Our reference ALS/ALS Standard/2020_4275724

Search date 13 October 2020

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW
DX 151280 Slough 13

searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

0845 070 9148

Asset location search

Property Searches

Search address supplied: Land of Little Bushey Lane, Little Bushey Lane, Bushey, WD23 4SB

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

The following records were searched in compiling this report: - the map of public sewers & the map of waterworks. Thames Water Utilities Ltd (TWUL) holds all of these.

This searchprovides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0845 070 9148, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

Waste Water Services

Please provide a copy extract from the public sewer map.

The following quartiles have been printed as they fall within Thames' sewerage area:

TQ1495SW
TQ1495SE
TQ1495NW
TQ1495NE
TQ1595SW

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

The following quartiles have not been printed as they contain no assets:

TQ1595NW

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an ‘as constructed’ record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

Asset location search

Property Searches

Following examination of our statutory maps, Thames Water has been unable to find any plans of water mains within this area. If you require a connection to the public water supply system, please write to:

New Connections / Diversions
Thames Water
Network Services Business Centre
Brentford
Middlesex
TW8 0EE

Tel: 0845 850 2777
Fax: 0207 713 3858
Email: developer.services@thameswater.co.uk

The following quartiles have not been printed as they are out of Thames' water catchment area. For details of the assets requested please contact the water company indicated below:

TQ1595NW	Affinity Water
TQ1495SW	Affinity Water
TQ1495SE	Affinity Water
TQ1495NW	Affinity Water
TQ1495NE	Affinity Water
TQ1595SW	Affinity Water

Affinity Water Ltd
Tamblin Way
Hatfield
AL10 9EZ

Tel: 0345 3572401

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Asset location search

Property Searches

Payment for this Search

A charge will be added to your suppliers account.

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, budget estimates, diversions, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Clean Water queries

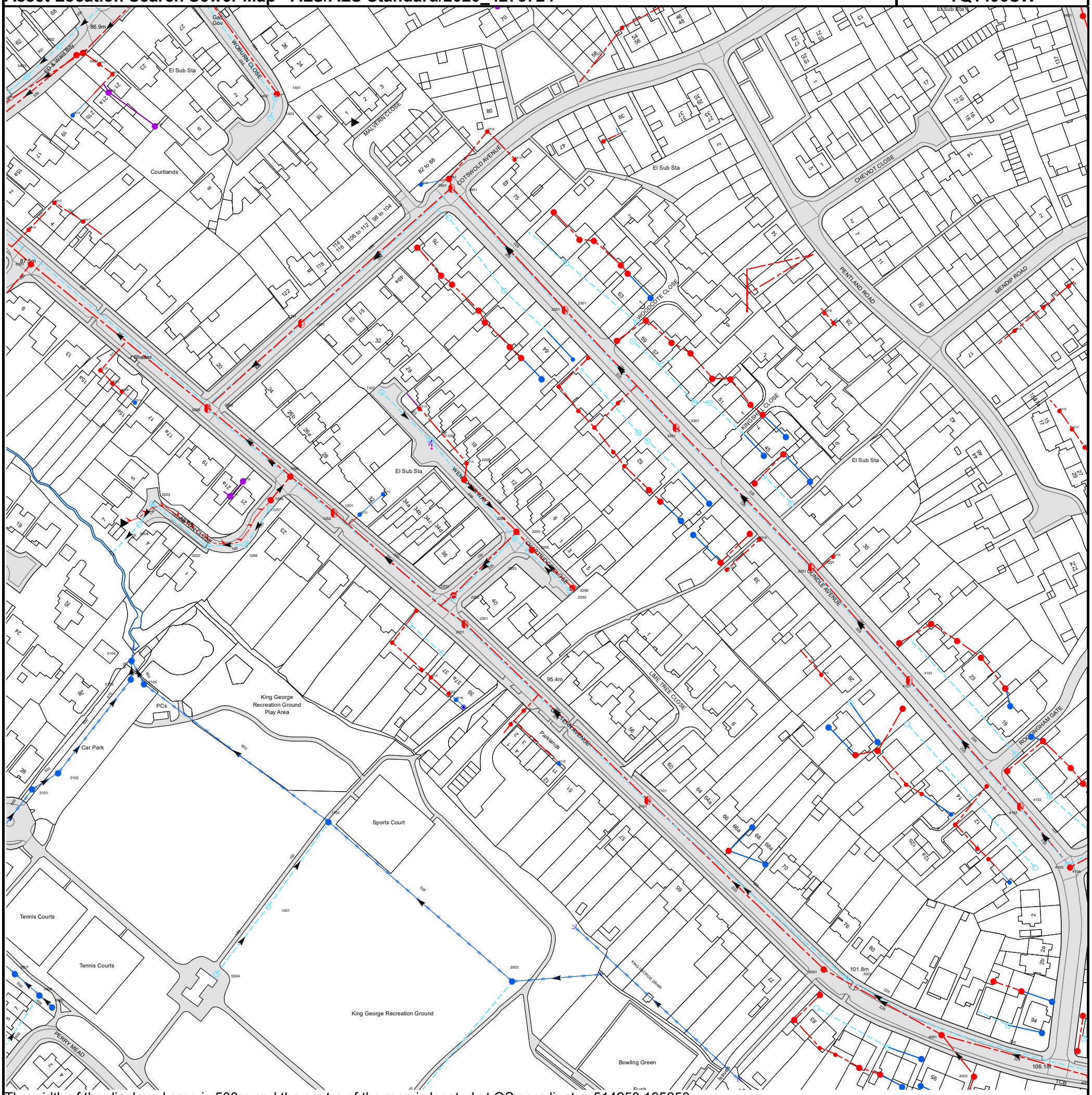
Should you require any advice concerning clean water operational issues or clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Asset Location Search Sewer Map - ALS/ALS Standard/2020_4275724

TQ1495SW



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 514250,195250

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

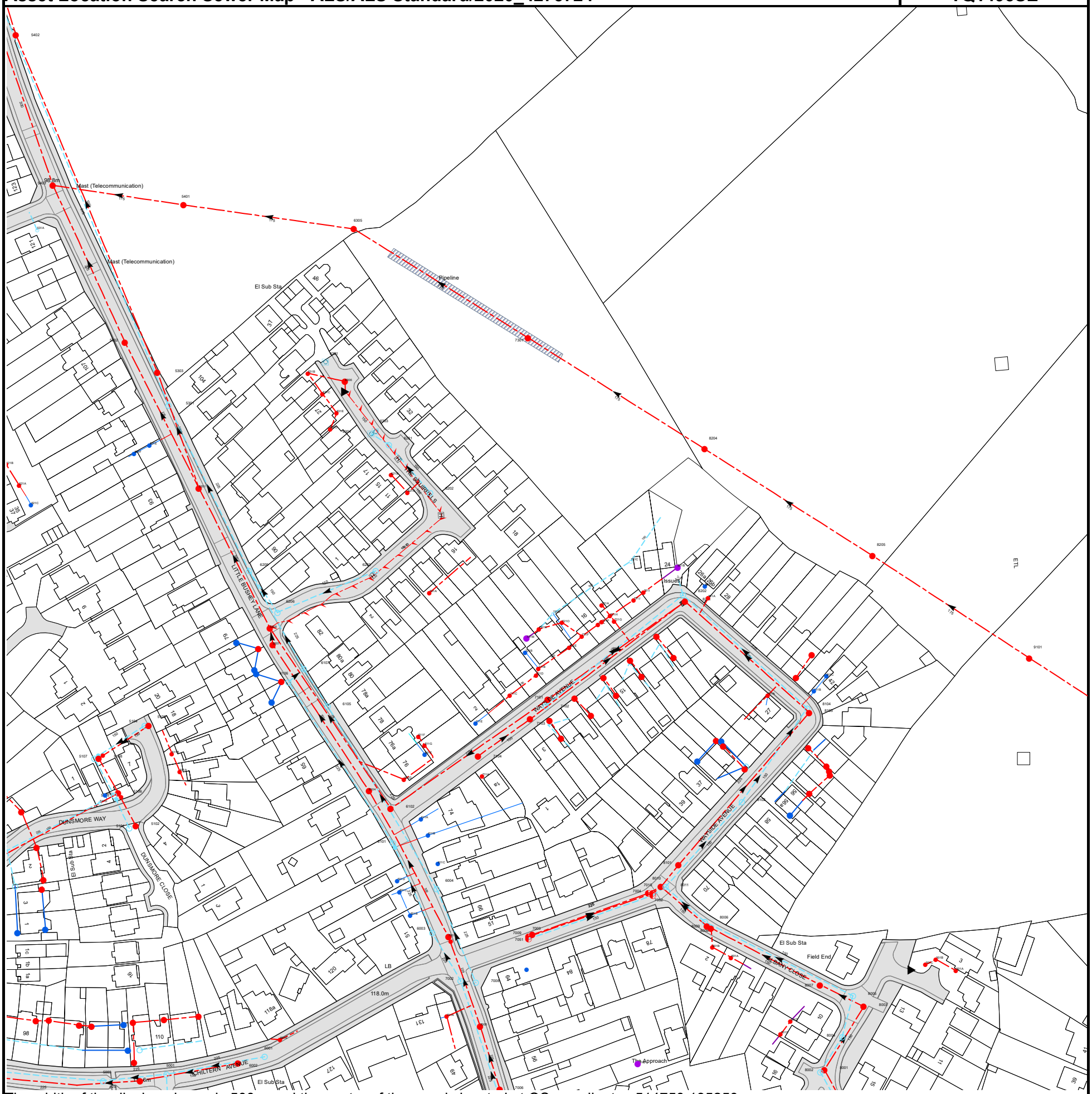
Manhole Reference	Manhole Cover Level	Manhole Invert Level
421A	n/a	n/a
431F	n/a	n/a
431E	n/a	n/a
23EA	n/a	n/a
13AE	n/a	n/a
23CC	n/a	n/a
23CD	n/a	n/a
24AF	n/a	n/a
24AE	n/a	n/a
2451	93.87	92.09
2401	93.87	92.08
141A	n/a	n/a
2403	93.88	92.48
241D	n/a	n/a
241B	n/a	n/a
241E	n/a	n/a
241A	n/a	n/a
241C	n/a	n/a
0403	86.48	84.03
031E	n/a	n/a
0301	87.27	83.92
041C	n/a	n/a
0402	86.93	84.15
041A	n/a	n/a
0401	86.88	83.75
0404	86.89	80.02
031F	n/a	n/a
041F	n/a	n/a
041E	n/a	n/a
041B	n/a	n/a
041D	n/a	n/a
1403	90.15	88.95
1402	89.87	88.51
1401	89.77	88.11
431D	n/a	n/a
431A	n/a	n/a
431B	n/a	n/a
4401	98.71	95.98
4402	98.99	97.31
23DD	n/a	n/a
33BA	n/a	n/a
23CG	n/a	n/a
33BB	n/a	n/a
23EI	n/a	n/a
23EE	n/a	n/a
23CH	n/a	n/a
23DE	n/a	n/a
33BC	n/a	n/a
23CI	n/a	n/a
33BD	n/a	n/a
23ED	n/a	n/a
23CF	n/a	n/a
331A	n/a	n/a
23DJ	n/a	n/a
23CJ	n/a	n/a
23CE	n/a	n/a
331B	n/a	n/a
2351	97.22	95.52
23DA	n/a	n/a
2301	97.22	95.49
23BJ	n/a	n/a
23EG	n/a	n/a
23DB	n/a	n/a
23DC	n/a	n/a
23CA	n/a	n/a
23CB	n/a	n/a
321B	n/a	n/a
32BF	n/a	n/a
32BH	n/a	n/a
32BE	n/a	n/a
32CC	n/a	n/a
32CA	n/a	n/a
32BD	n/a	n/a
22BE	n/a	n/a
32BC	n/a	n/a
32BA	n/a	n/a
32CB	n/a	n/a
22BD	n/a	n/a
32BJ	n/a	n/a
32BB	n/a	n/a
22BC	n/a	n/a
22BF	n/a	n/a
32AJ	n/a	n/a
23EH	n/a	n/a
3351	100.07	97.38
23DG	n/a	n/a
3301	100.07	97.34
33AI	n/a	n/a
23DF	n/a	n/a
33AJ	n/a	n/a
231A	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
33BF	n/a	n/a
33BG	n/a	n/a
1102	92.26	91.52
1201	92.7	89.62
1252	92.7	91.35
121D	n/a	n/a
1302	94.94	94.16
121C	n/a	n/a
12BA	n/a	n/a
12BC	n/a	n/a
12BB	n/a	n/a
131A	n/a	n/a
11AD	n/a	n/a
1202	95.21	93.89
111A	n/a	n/a
1251	95.2	93.91
12BG	n/a	n/a
211A	n/a	n/a
2203	94.2	92.18
2202	94.2	92.81
211B	n/a	n/a
2251	94.5	92.9
2206	95.37	93.68
2201	94.5	91.12
221A	n/a	n/a
211C	n/a	n/a
2204	95.54	93.32
2205	95.55	92.67
211D	n/a	n/a
31BF	n/a	n/a
31BH	n/a	n/a
31BG	n/a	n/a
2151	97.45	95.99
2101	97.45	94.16
41DG	n/a	n/a
211E	n/a	n/a
31AE	n/a	n/a
31AD	n/a	n/a
31AG	n/a	n/a
31AF	n/a	n/a
41FE	n/a	n/a
41DH	n/a	n/a
31AH	n/a	n/a
4151	101.52	99.72
4101	101.52	99.7
311A	n/a	n/a
42AF	n/a	n/a
2252	n/a	n/a
2256	n/a	n/a
321D	n/a	n/a
3251	101.06	99.06
3201	101.06	99.03
32BG	n/a	n/a
321A	n/a	n/a
2253	n/a	n/a
2255	n/a	n/a
41DF	n/a	n/a
42AD	n/a	n/a
41DE	n/a	n/a
41DC	n/a	n/a
42AE	n/a	n/a
41DB	n/a	n/a
41CH	n/a	n/a
41DD	n/a	n/a
41DA	n/a	n/a
41CI	n/a	n/a
41CF	n/a	n/a
40DC	n/a	n/a
41CJ	n/a	n/a
41EE	n/a	n/a
4102	103.06	101.31
4152	103.06	101.36
41CE	n/a	n/a
41FA	n/a	n/a
41CD	n/a	n/a
41EB	n/a	n/a
4103	104.13	102.06
4104	104.18	101.87
41CC	n/a	n/a
41CB	n/a	n/a
41EA	n/a	n/a
0101	92.54	91.11
0102	91.58	89.62
031D	n/a	n/a
031C	n/a	n/a
031B	n/a	n/a
0103	91.01	89.03
0104	90.33	88.68
031A	n/a	n/a
0204	n/a	87.55
0105	90.81	88.97
0203	n/a	87.6
0202	n/a	87.7

Manhole Reference	Manhole Cover Level	Manhole Invert Level
0352	90.46	89.34
0302	90.46	87.66
121A	n/a	n/a
121B	n/a	n/a
1258	n/a	89.1
1001	93.21	92.31
1257	n/a	89.95
1255	n/a	89.9
1256	n/a	n/a
1351	93.79	91.09
1301	93.79	91.21
40DA	n/a	n/a
4003	104.04	100.64
4002	106.77	103.22
40CG	n/a	n/a
40BD	n/a	n/a
40BI	n/a	n/a
4001	103.92	100.08
40CD	n/a	n/a
40CE	n/a	n/a
40BC	n/a	n/a
40CA	n/a	n/a
40CB	n/a	n/a
40CC	n/a	n/a
2003	95.84	94.6
0004	95.3	94.55
30BA	n/a	n/a
30BD	n/a	n/a
30AJ	n/a	n/a
30BB	n/a	n/a
3001	101.63	97.37
30AI	n/a	n/a
3002	101.93	100.48
30AH	n/a	n/a
40BG	n/a	n/a
40CH	n/a	n/a
40BF	n/a	n/a
0005	96.3	95.3
0006	95.87	95
0007	95.57	94.6

Asset Location Search Sewer Map - ALS/ALS Standard/2020_4275724

TQ1495SE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 514750,195250

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NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
521B	n/a	n/a
521C	n/a	n/a
521A	n/a	n/a
801C	n/a	n/a
801D	n/a	n/a
6201	100.21	98.92
6304	99.88	n/a
6303	99.91	n/a
631D	n/a	n/a
631E	n/a	n/a
5301	99.84	98.46
631C	n/a	n/a
6306	99.13	95.93
631B	n/a	n/a
5303	99.59	94.3
6301	98.68	n/a
5302	99.12	97.23
531A	n/a	n/a
6305	97.88	97.26
5401	99.57	96.9
5403	99.04	96.73
5402	98.91	93.73
9101	104.36	101.5
81AG	n/a	n/a
81BG	n/a	n/a
721B	n/a	n/a
721E	n/a	n/a
721M	n/a	n/a
72AC	n/a	n/a
721F	n/a	n/a
721N	n/a	n/a
721L	n/a	n/a
721O	n/a	n/a
721P	n/a	n/a
721G	n/a	n/a
721H	n/a	n/a
721D	n/a	n/a
721A	n/a	n/a
8201	105.03	103.81
721J	n/a	n/a
821A	n/a	n/a
8202	105.11	103.29
721I	n/a	n/a
821C	n/a	n/a
821B	n/a	n/a
721C	n/a	n/a
8205	102.85	101.07
8204	100.1	n/a
7301	98.33	97.75
611G	n/a	n/a
611F	n/a	n/a
5103	106.06	104.94
5104	106.08	104.91
6105	107.25	106.22
61BB	n/a	n/a
6106	106.13	104.78
61BE	n/a	n/a
61BC	n/a	n/a
61BD	n/a	n/a
6107	105.86	104.12
62BC	n/a	n/a
5207	104.91	102.98
62BB	n/a	n/a
5208	104.42	102.49
6206	104.03	102
621A	n/a	n/a
6209	103.1	101.85
6203	103.07	102.24
621C	n/a	n/a
6202	101.51	100.05
5201	101.03	98.41
621B	n/a	n/a
521F	n/a	n/a
521E	n/a	n/a
50DH	n/a	n/a
50DE	n/a	n/a
601B	n/a	n/a
601C	n/a	n/a
50DF	n/a	n/a
50DI	n/a	n/a
601D	n/a	n/a
50DG	n/a	n/a
51AJ	n/a	n/a
6101	113.15	111.13
611B	n/a	n/a
5101	107.38	105.84
5102	107.61	105.72
611A	n/a	n/a
51BA	n/a	n/a
6102	111.61	103.03

Manhole Reference	Manhole Cover Level	Manhole Invert Level
511D	n/a	n/a
5105	106.62	102.49
511C	n/a	n/a
5106	106.67	102.17
6104	110.4	106.69
611D	n/a	n/a
511A	n/a	n/a
5107	106.04	102.8
5108	106.09	102.53
611E	n/a	n/a
511B	n/a	n/a
6003	116.82	115.39
6004	115.28	113.97
611C	n/a	n/a
7007	116.69	112.55
711E	n/a	n/a
7104	109.74	109.3
711A	n/a	n/a
711C	n/a	n/a
7051	116.67	115.23
7009	116.67	114.75
7103	108.17	106.87
7003	116.64	115.18
711D	n/a	n/a
711B	n/a	n/a
7102	107.76	106.73
7101	107.58	103.42
71CC	n/a	n/a
71CB	n/a	n/a
71CA	n/a	n/a
71BJ	n/a	n/a
71BI	n/a	n/a
71BH	n/a	n/a
71BG	n/a	n/a
71BF	n/a	n/a
7004	114.44	112.55
7052	114.49	113.11
7010	114.49	112.62
8010	114.02	112.36
8011	113.97	112.45
8101	113.2	111.93
81BJ	n/a	n/a
8006	115.42	113.82
8009	115.49	113.76
8008	115.63	113.84
801B	n/a	n/a
81CA	n/a	n/a
81CG	n/a	n/a
81CB	n/a	n/a
801A	n/a	n/a
8102	110.38	108.73
81CC	n/a	n/a
81CF	n/a	n/a
811A	n/a	n/a
81DH	n/a	n/a
81BH	n/a	n/a
8104	107.34	105.02
81EC	n/a	n/a
8103	107.47	105.39
81DI	n/a	n/a
811B	n/a	n/a
811C	n/a	n/a
81EB	n/a	n/a
81EA	n/a	n/a
81DJ	n/a	n/a
5002	110.9	107.52
5003	109.62	107.83
5001	111.77	110.07
50CE	n/a	n/a
50CB	n/a	n/a
50CJ	n/a	n/a
50BH	n/a	n/a
50BI	n/a	n/a
50BG	n/a	n/a
50CD	n/a	n/a
50CA	n/a	n/a
50BJ	n/a	n/a
50CF	n/a	n/a
7006	120.71	118.27
8002	119.84	118.31
8001	119.73	117.03
701B	n/a	n/a
8004	118.78	117.19
7005	118.99	116.43
701A	n/a	n/a
8003	118.02	116.22
8005	117.97	116.58
8007	117.68	115.79
7008	118.31	117.06
7002	117.93	117.25
901A	n/a	n/a
70BC	n/a	n/a
901C	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
901B	n/a	n/a
50CG	n/a	n/a
6002	114.46	111.25
6001	115.32	113.71
601E	n/a	n/a

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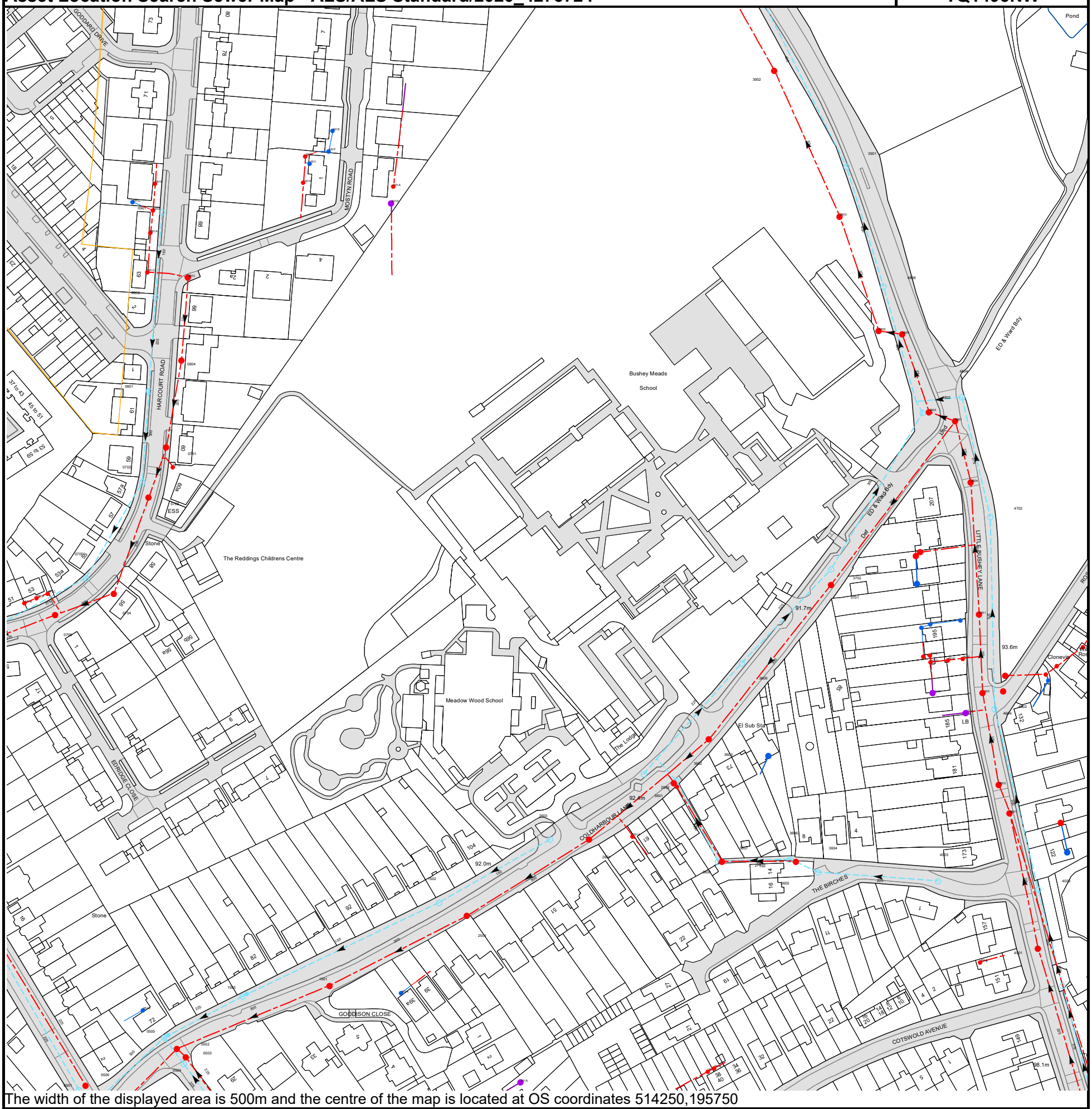
Asset Location Search Sewer Map - ALS/ALS Standard/2020_4275724

TQ1495NW



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 514250,195750

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NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
461D	n/a	n/a
461E	n/a	n/a
461F	n/a	n/a
47AH	n/a	n/a
471C	n/a	n/a
47AI	n/a	n/a
47AJ	n/a	n/a
47BA	n/a	n/a
4806	90.68	88.59
4803	89.8	88.55
0802	84.11	82.9
4806	90.72	89.15
0803	84.38	81.34
081C	n/a	n/a
081A	n/a	n/a
3903	89.42	87.77
0901	84.75	83.37
091C	n/a	n/a
191D	n/a	n/a
091D	n/a	n/a
191A	n/a	n/a
091B	n/a	n/a
3901	90.07	88.52
3902	88.36	86.92
2601	92.41	88.18
2603	92.59	90.53
261A	n/a	n/a
3601	92.55	89.23
3602	92.54	91.24
2602	92.72	90.94
36BG	n/a	n/a
3603	92.22	88.46
3609	92.3	90.36
0706	81.84	80.2
071A	n/a	n/a
071B	n/a	n/a
0704	82.56	80.36
071C	n/a	n/a
3701	91.6	88.91
47BC	n/a	n/a
0705	82.34	81.07
3702	91.72	89.95
47BD	n/a	n/a
47BE	n/a	n/a
0703	82.94	80.65
0702	83.01	81.76
071D	n/a	n/a
0701	83.16	80.8
0801	83.44	82.21
0804	83.6	81.12
4802	91.06	89.41
4805	84.98	82.53
461C	n/a	n/a
4801	91.16	89.36
4804	91.2	89.82
461A	n/a	n/a
4804	91.64	89.92
4701	93.3	91.38
4605	94.13	92.02
4702	92.25	90.65
4602	94.33	93.17
4603	95.08	93.14
4604	94.43	n/a
46BD	n/a	n/a
4601	95.24	93.23
46BA	n/a	n/a
46BB	n/a	n/a
46AJ	n/a	n/a
46BH	n/a	n/a
46BG	n/a	n/a
47AE	n/a	n/a
471A	n/a	n/a
251A	n/a	n/a
351A	n/a	n/a
351B	n/a	n/a
151A	n/a	n/a
1501	88.92	86.01
2501	91.82	87.91
1502	91.85	89.85
3604	94.18	92.49
3607	n/a	n/a
3608	n/a	n/a
3605	94.02	91.91
3606	93.95	92.32
0501	86.11	84.24
0506	86.19	n/a
051A	n/a	n/a
0505	87.19	84.54
0502	87.02	84.62
0504	87	85.84

Manhole Reference	Manhole Cover Level	Manhole Invert Level
0503	86.99	85.43
1503	87.83	85.39
4504	97.85	96.49
451A	n/a	n/a
4501	97.15	95.35
4502	96.35	95.29
4503	95.54	93.46
191H	n/a	n/a
191I	n/a	n/a
191G	n/a	n/a
191F	n/a	n/a
191E	n/a	n/a

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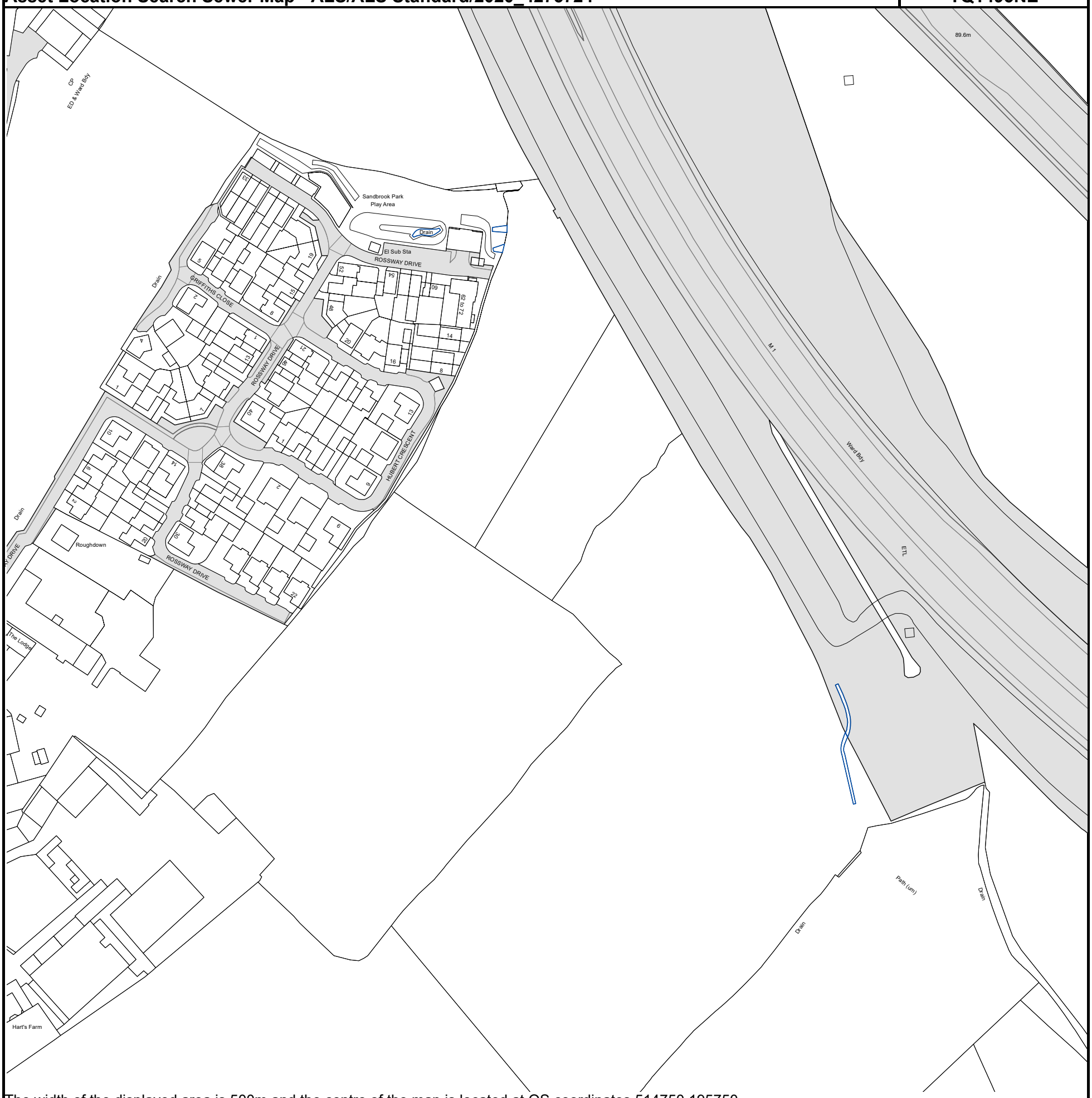
Asset Location Search Sewer Map - ALS/ALS Standard/2020_4275724

TQ1495NE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 514750,195750

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NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
n/a	n/a	n/a

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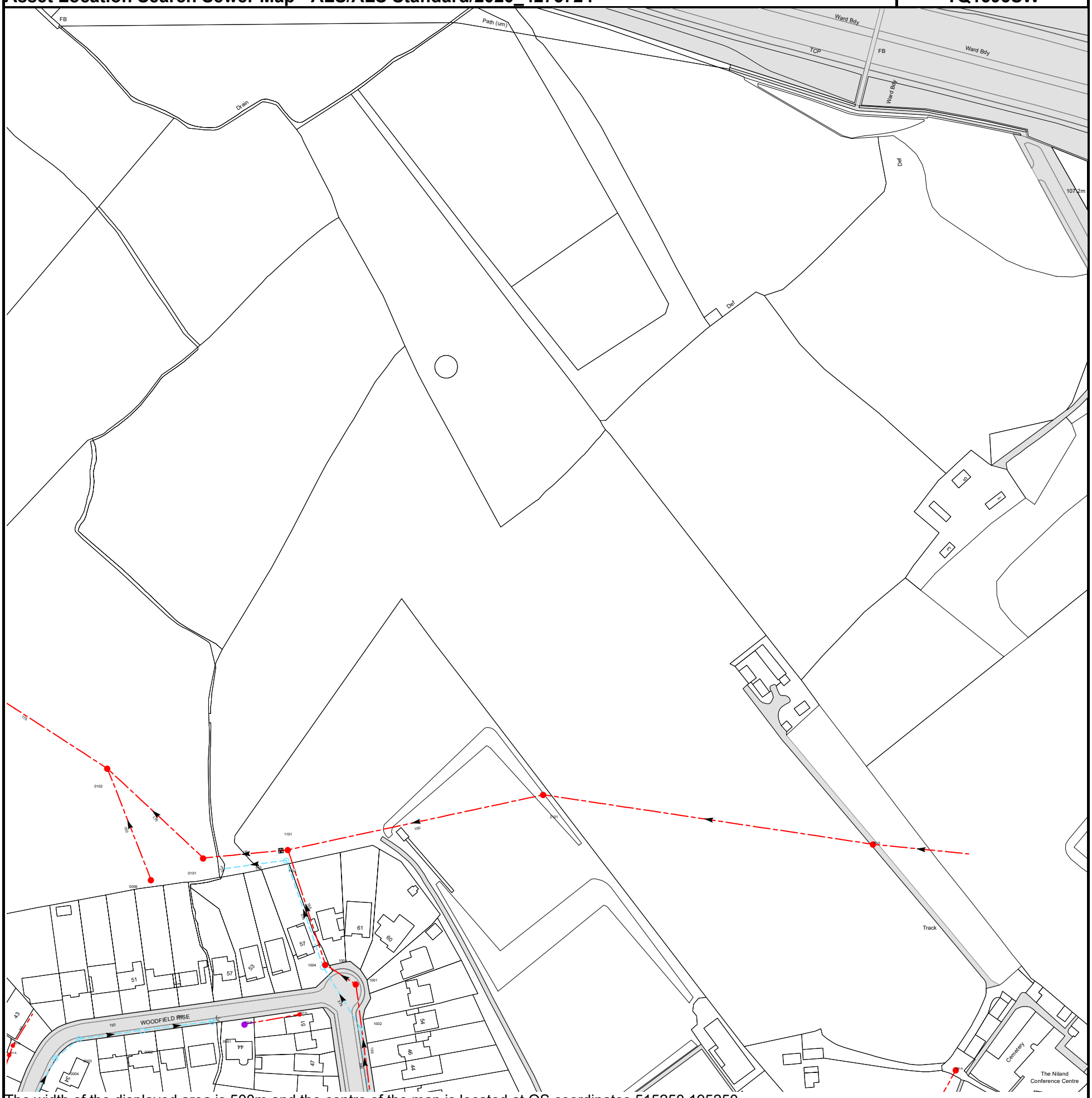
Asset Location Search Sewer Map - ALS/ALS Standard/2020_4275724

TQ1595SW



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 515250,195250

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NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
0004	112.77	111.41
001A	n/a	n/a
001B	n/a	n/a
0003	111.39	110.24
0002	109.32	108.45
1002	111.53	110.25
101B	n/a	n/a
0001	107.98	107.3
101A	n/a	n/a
1001	111.16	109.92
1004	111.12	109.83
1003	111.13	109.42
0006	105.44	104.34
1101	107.69	106.43
0101	107.01	104.61
1102	107.51	105.9
2101	110.28	108.58
0102	103.79	101.99
401A	n/a	n/a
311A	n/a	n/a

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ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

- Trunk Surface Water
- Storm Relief
- Vent Pipe
- Proposed Thames Surface Water Sewer
- Gallery
- Surface Water Rising Main
- Sludge Rising Main
- Vacuum
- Trunk Foul
- Trunk Combined
- Bio-solids (Sludge)
- Proposed Thames Water Foul Sewer
- Foul Rising Main
- Combined Rising Main
- Proposed Thames Water Rising Main

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

- Air Valve
- Dam Chase
- Fitting
- Meter
- Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

- Control Valve
- Drop Pipe
- Ancillary
- Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

- Outfall
- Undefined End
- Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

- Public/Private Pumping Station
- Change of characteristic indicator (C.O.C.I.)
- Invert Level
- Summit

Areas

Lines denoting areas of underground surveys, etc.

- Agreement
- Operational Site
- Chamber
- Tunnel
- Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

- Foul Sewer
- Combined Sewer
- Culverted Watercourse
- Surface Water Sewer
- Gulley
- Proposed
- Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plans are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
5) 'na' or '0' on a manhole level indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.

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All sales are made in accordance with Thames Water Utilities Limited (TWUL) standard terms and conditions unless previously agreed in writing.

1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment 14 days from due date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service, or will be held to be invalid.
4. Thames Water does not accept post-dated cheques-any cheques received will be processed for payment on date of receipt.
5. In case of dispute TWUL`s terms and conditions shall apply.
6. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
7. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
8. A charge may be made at the discretion of the company for increased administration costs.

A copy of Thames Water's standard terms and conditions are available from the Commercial Billing Team (cashoperations@thameswater.co.uk).

We publish several Codes of Practice including a guaranteed standards scheme. You can obtain copies of these leaflets by calling us on 0800 316 9800

If you are unhappy with our service you can speak to your original goods or customer service provider. If you are not satisfied with the response, your complaint will be reviewed by the Customer Services Director. You can write to her at: Thames Water Utilities Ltd. PO Box 492, Swindon, SN38 8TU.

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Ways to pay your bill

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Call **0845 070 9148** quoting your invoice number starting CBA or ADS / OSS	Account number **90478703** Sort code **60-00-01** A remittance advice must be sent to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.** or email **ps.billing@thameswater.co.uk**	By calling your bank and quoting: Account number **90478703** Sort code **60-00-01** and your invoice number	Made payable to '**Thames Water Utilities Ltd**' Write your Thames Water account number on the back. Send to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW** or by DX to **151280 Slough 13**

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