

FRA/DW/0325/R1

FLOOD RISK ASSESSMENT

Dering Industrial Estate

Dering Way

Gravesend

Kent, DA12 2FP

November 2025 | JRM



FRA/DW/0325/R1

Flood Risk Assessment

Site Address

No./Name	Dering Industrial Estate
Street	Dering Way
Ward	Gravesend (Riverside)
Borough/City	Gravesham
Region	KENT
Postcode	DA12 2FP
Easting	566542
Northing	173942
LPA Ref	GSM

Submission Details

Report Dated	16 th October 2025
Revision No. & Date	REV 1 (20 th November 2025)
Site Visit Made	N/A
Report by	J R Mustafa S BSc (Hons) Langleys Chartered Surveyors

Application Details

Project Reference	DW/0325
Proposal Description	Application under S.73 of the Town and Country Planning Act 1990 to vary condition 2 (Approved Plans) of planning permission 20160114 to allow for the retrospective variation of the plot layout.
Application Type	Section 73 (Variation of Planning Condition)
Submission Method	Electronically via the Planning Portal
Planning Portal Reference	PP – 13 83 38 26
LPA Reference Number	20250258
On behalf of the Applicants	Cowland Ltd.
Site Owner (if Different)	N/A

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1.0 Executive Summary

1.1 Introduction

1.1.1 Langleys Chartered Surveyors has been commissioned to prepare this Flood Risk Assessment ('FRA') on behalf of Cowland Limited to support a Planning Application under S.73 of the Town and Country Planning Act 1990 proposing to 'vary condition 2 (Approved Plans) of planning permission 20160114 to allow for the retrospective variation of the plot layout' at the application site, Dering Industrial Estate (DA12 2FP).

1.1.2 This document updates the 2016 Flood Risk Assessment (prepared by UK Flood Risk Ltd) in line with the Environment Agency's 2025 request for an updated review, following release of new flood modelling data (EA Product 6, Thames Tidal Downriver Breach Model 2018).

1.1.3 The assessment confirms:

- The site remains defended by the Thames tidal defences.
- The proposed use continues to be Less Vulnerable (B8 Storage/Distribution).
- No buildings of significant volume are proposed—plots comprise open hardstanding and occasional small kiosk-style offices.
- Updated EA Product 6 depth data show slightly greater inundation depths than in 2016, but these do not alter the overall flood risk classification.
- The existing Flood Risk Management Strategy remains appropriate and compliant with the NPPF (2023) and the Flood Risk & Coastal Change PPG (2024).

1.2 Purpose

1.2.1 The Environment Agency (EA) requested an updated FRA for Dering Industrial Estate, noting that the 2016 assessment pre-dated the 2018 Product-6 modelling and subsequent TE2100 updates. This amendment reviews new EA data and policy to confirm whether the conclusions of the 2016 FRA remain valid.

2.0 General description of the site and the proposals

2.1 Site description and relevant planning history

- 2.1.1 The application site is Dering Industrial Estate, Dering Way, Gravesend, Kent, DA12 2FP (formerly Land between Comma Oil and Southern Water Treatment Works, Dering Way, Gravesend, Gravesham; Easting: 566542, Northing: 173942).
- 2.1.2 The site lies within an established industrial estate at the terminus of Dering Way and bounded by existing commercial plots (east and west), and a railway line (north). The land is entirely within a defended tidal floodplain (Flood Zone 3 – Tidal). The nearest watercourse to the land is the River Thames.
- 2.1.3 A copy of the site plan is provided in **Appendix 4**. It is a 1.21 ha industrial site with permission for five independent B8 Use class plots (A, B, C, D and E) under application refs.20160114 '*Change of use of land to Use Class B8 Storage and Distribution together with formation of new access road*', and 20180988 '*Application for approval of condition 11 attached to planning permission reference no. 20160114 relating to the details of the sustainable surface water drainage scheme for the site*'. The site topography at present is relatively level.

2.2 Proposal

- 2.2.1 Permission is now sought to vary **Condition 2 (approved plans)** of planning permission **20160114** to allow for:
1. Minor changes to the scale and siting of the approved B8 use class Plots (A, B, C, D and E), which are in part retrospective and informed by the current layouts of occupied Plots A and B;
 2. Re-siting the approved shared central roadway via the existing security gate adjacent to Plot B. The central roadway would now be shared solely by Plots B, C, D and E with Plot A retaining independent gated access from the approved access road, as built.

- 2.2.2 And simultaneously allow for following variations shown on the drawings that may be considered as 'minor':
3. Some changes to the siting of installations within each plot (e.g. septic tank, refuse points, noticeboards) to better suit the proposed layout;
 4. Some changes to the siting of slot drains and storm water attenuation sites to better suit the proposed layout.
- 2.2.3 Layout drawings of the proposal are provided in **Appendix 5, 6 and 7**.
- 2.2.4 There are no basements or sensitive receptors; all operations remain at or above existing ground levels.
- 2.2.5 The development therefore continues to represent a Less Vulnerable use as defined in the Flood Risk and Coastal Change PPG.

3.0 Data Sources & Relevant Planning Policy Guidance

3.1 Data Sources

3.1.1 This FRA utilises the following Data Sources:

- Environment Agency Product 6 – Thames Tidal Downriver Breach Inundation Modelling (2018).
- EA Flood Map for Planning (September 2025 extract).
- Site topographic survey (approved 2016).

3.2 National Planning Policy Framework

3.2.1 National planning policy is set out in the **National Planning Policy Framework (NPPF)** most recently revised in May 2021. This document sets out planning policies and guidance relating to development planning, including applications for sites or developments that are exposed to or may exacerbate an existing flood risk, or may create a new one. The NPPF sets out planning and policies relating to flood risks to developments using a sequential characterisation of risk based on planning zones and the Environment Agency's Flood Maps.

3.2.2 The requirement for site-specific Flood Risk Assessments (FRAs) is established by the National Planning Policy Framework (NPPF, July 2021 as amended):

- Paragraph 167 of the NPPF states that *'All plans should apply a sequential, risk-based approach to the location of development (...) Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk...'*
- Paragraph 168 (b) further states that: *'development should only be allowed in areas at risk of flooding where (...) it is demonstrated that (...) the development is appropriately flood resistant and resilient, it incorporates sustainable drainage systems (...) and any residual risk can be safely managed, including by emergency planning; and it gives priority to the use of sustainable drainage'*

systems'. It also states that the development should remain safe for its lifetime, and not increase flood risk elsewhere.

- Footnote 55 of Para.168 states that an FRA is required for developments that are:
 - Within Flood Zones 2 or 3, or
 - Have an area greater than 1 hectare in Flood Zone 1, or
 - Are located in Critical Drainage Areas as identified by the Environment Agency.

3.3 Flood Risk and Coastal Change Planning Practice Guidance (PPG)

3.3.1 The Flood Risk and Coastal Change PPG supports the NPPF by guiding local planning authorities, developers and consultants on how to:

- Assess, avoid, manage and mitigate flood risk;
- Apply Sequential and Exception Tests appropriately, in accordance with the vulnerability classification of the proposal;
- Integrate climate change resilience into planning decisions;
- Use Flood Risk Assessments (FRAs) to inform sustainable site design and layout.

3.3.2 According to the PPG, a site-specific FRA is required to be provided for planning applications for developments in England when:

- The site is in Flood Zones 2 or 3 (rivers or sea);
- The site is in Flood Zone 1 but:
 - Has an area that is greater than 1 hectare;
 - Affects critical drainage areas;
 - Involves increased vulnerability (e.g. hospitals, homes);
 - Could cause surface water run-off or drainage issues.

- The development may be affected by sources of flooding other than rivers or sea (e.g. surface water, reservoirs or groundwater).

3.4 Environment Agency Guidance (2023-2024)

3.4.1 The Environment Agency's current guidance on site-specific FRAs and climate change allowances has been considered, including:

- Peak rainfall and river flow uplift applicable to the Thames River Basin District;
- Requirements to assess flood risk from all sources, including surface water, sewer flooding and residual risk from defence failure;
- Reference to the TE2100 Plan and standard of protection provided by the Thames tidal defences.

3.5 Local Policy and Strategic Guidance

3.5.1 Policy CS18 'Climate Change' of Gravesham Local Plan Core Strategy (2014) requires development to minimise flood risk and to demonstrate that appropriate flood resilient measures and appropriate SuDS strategies will be implemented as part of the development.

3.5.2 The Kent County Council Lead Local Flood Authority (LLFA) guidance on sustainable drainage has also been considered throughout this FRA and the surface water strategy that is proposed.

4.0 Flood Risk Assessment

4.1

4.1 Risk of Tidal/Fluvial Flooding

- 4.1.1 This is the primary risk to the site with the tidal/fluvial flood risk source being the River Thames.
- 4.1.2 Per the 2016 FRA, the EA Flood Maps (see **Appendix 1**) show that the site lies within Flood Zone 3 and thereby has a high probability of flooding without the employment of flood defences. Nevertheless, the site is in an area that benefits from flood defences and the risk of overtopping during extreme events is low.
- 4.1.3 The updated Environment Agency (EA) Product-6 modelling outputs for the Thames Tidal Downriver Breach Inundation (2018) have been reviewed for the application site. This replaces the previous analysis undertaken using the HR Wallingford tool (2016). Flood depths have been extracted across the site footprint using the EA tidal model for both baseline (2005) and future (2115) climate change epochs. The results are summarised in Table 1 on the following page and provided in **Appendix 3**.

Findings

- 4.1.4 Flood levels have risen overall compared with 2016 due to refined 2D hydraulic modelling, LiDAR terrain updates, and TE2100 climate change allowances.
- 4.1.5 The earlier Flood Risk Assessment (2016) used a national calculator produced by HR Wallingford to estimate flood levels. Since then, the Environment Agency has created much more detailed tidal flood modelling for the Thames Estuary (2018), which uses the latest topographic data, improved climate change allowances and more precautionary assumptions about how flood defences could fail. This newer modelling shows generally deeper flooding on the site than was estimated before. The updated figures therefore replace the older ones and should now be used to guide floor levels, access arrangements and emergency planning.

Table 1 Tidal Flood Event Projected Depths (2016 and current data values)

Event	Return period	Mean Depth (m)	Max Depth (m)	Source
2016 FRA (HR Wallingford)	0.5% AEP (1 in 200 year event)	1.14 – 1.25	N/A	Indicative values from HR Wallingford tool
EA Product 6 (2005 Epoch)	0.5% AEP (1 in 200 year event - defended)	1.49	2.80	TE2100 2005/200 dp Depth Grid
2016 FRA (HR Wallingford)	0.5% AEP (+ CC - defended)	2.0 – 2.1	N/A	Indicative values from HR Wallingford tool
EA Product 6 (2115 Epoch + CC)	0.5% AEP (+ CC - defended)	2.05	3.36	TE2100 2005/200 dp Depth Grid
2016 FRA (HR Wallingford)	0.1% AEP (1 in 1000 year event)	2.37 – 2.48	N/A	Indicative values from HR Wallingford tool
EA Product 6 (2005 Epoch)	0.1% AEP (1 in 1000 year event - defended)	1.73	3.04	TE2100 2005/1000 dp Depth Grid
EA Product 6 (2115 Epoch + CC)	0.1% AEP (+CC - defended)	2.13	3.44	TE2100 2005/1000 dp Depth Grid

4.1.6 The updated EA Product-6 data indicates that modelled flood depths across the site are generally higher than those identified in the 2016 FRA, particularly for the defended 0.5% AEP event and the climate change scenario. Under the 200-year event, depths are now around 1.49–2.80m (compared with 1.14–1.25m previously), while the climate change 200-year event shows depths of approximately 2.05–3.36m (compared with 2.0–2.1m previously).

4.1.7 The 1000-year event mean depths are found to be lower than the previous results (1.73m for the 0.1% AEP event compared with 2.37-2.48m). This discrepancy arises from methodological differences. The HR Wallingford

Tool provides point based indicative water levels that were applied to the site in 2016, whereas the EA Product 6 outputs derive from a high-resolution two-dimensional hydraulic model using LiDAR and defence data. Product 6 therefore models flow paths and local ponding explicitly. As a result, Product 6 commonly records higher local maxima in breach scenarios but can show lower site-wide mean depths where the inundation is more spatially variable. For planning purposes we adopt the Product 6 values (mean over the site footprint and maximum local cells) as these represent the most recent, spatially explicit EA modelling and are the recommended basis for FRA conclusions and mitigation strategies.

- 4.1.8 These outputs reflect advances in tidal modelling and the incorporation of the Thames Estuary 2100 climate change allowances. The findings should be used to inform finished floor levels, emergency planning and safe access/egress arrangements for the site.

4.2 Risk of Surface Water Flooding

- 4.2.1 The risk of surface water flooding is generally 'low' for both the current and +CC scenarios, although the Flood Maps reveal that should flooding occur, most of the site would likely experience flood depths of c.900mm (3ft) in both cases (see **APX 1.Q/R/S/T**). This reflects the findings of the original FRA.

4.3 Risk of Groundwater Flooding

- 4.3.1 There are no recorded incidents of groundwater flooding at the site. The risk of groundwater flooding at the site remains very low.

4.4 Risk of flooding from Sewers

- 4.4.1 There are no known historic events of sewer flooding on or near the site. There is therefore a low residual flood risk only.

4.5 Risk of flooding from Reservoirs and Artificial Bodies

- 4.5.1 The site is not at risk of flooding from a reservoir or artificial body of water (see **APX 1.U**).

5.0 Flood Risk Management Strategy

5.1 Overview

5.1.1 The site benefits from existing Thames tidal defences. The EA Product 6 outputs confirm residual flood risk under breach conditions only.

5.1.2 To minimise damage and enable quick recovery and clean up after a flood event, it is proposed that several flood resilient measures will be implemented to minimise damage and to enable quick recovery and clean up after the flooding event. These are broadly the same as those previously approved and are as follows:

- Maintain surface levels at existing AOD with no raising or loss of floodplain storage;
- Provide secure anchoring for storage containers on Plot B to prevent displacement during inundation;
- Store potential pollutants (e.g. fuels, oils) above predicted flood levels in bunded containers;
- Maintain clear internal access routes for safe egress towards Dering Way;
- Implement a site-specific Flood Response Plan registered with the EA Flood Warning Service;
- Maintain drainage channels and gullies to prevent surface water ponding

5.1.3 These measures accord with national guidance for “Less Vulnerable” uses in Flood Zone 3 defended areas and are proportionate given that all development remains open at ground level.

5.2 Site layout and use

5.2.1 The use of the land remains unchanged from that approved under the original consent; this application merely adjusts the internal layout of the plots which are to remain in open storage / yard use. There are no vulnerable residential or commercial occupiers.

- 5.2.2 It is possible that future occupiers of sites will wish to install small site offices in small portocabin-style temporary structures or containers. These should be sited on the highest ground available within their plot and on a raised plinth to minimise risk of damage from flood events. It is advised that these are raised a minimum of 1.8m above finished ground level to provide sufficient protection from the 0.1%AEP (defended) and lower events based on mean flood depth values.

5.3 Flood resilient operation

- 5.3.1 Storage containers will be ground anchored/secured to prevent flotation or movement. This can be achieved with simple Shipping Container twist-lock anchors.
- 5.3.2 Hazardous or polluting materials (e.g. fuels, oils etc.), if stored, will be kept in sealed or bunded containers above the flood level, per the original permission. It is recommended that a self-contained bunded storage unit such as the Morse Solent Spill Control Bunded Storage Cabinet², or equivalent, is provided on each site subject to operational requirement. Where small quantities of hazardous materials are needed to be stored on site (e.g. lubricants or cleaning agents), portable spill kits and absorbent granules should also be kept within the unit for use in minor incidents. These would be kept in the same location as the bunded cabinet. The detailed site layout plan provided shows the suggested locations of these containers within each plot.
- 5.3.3 Vehicle parking and external yard areas must be accepted to be sacrificial during flood events (this may be contractually agreed in tenancy agreements should Plots D and E be let), with site management responsible for evacuation on receipt of EA Flood Warnings.

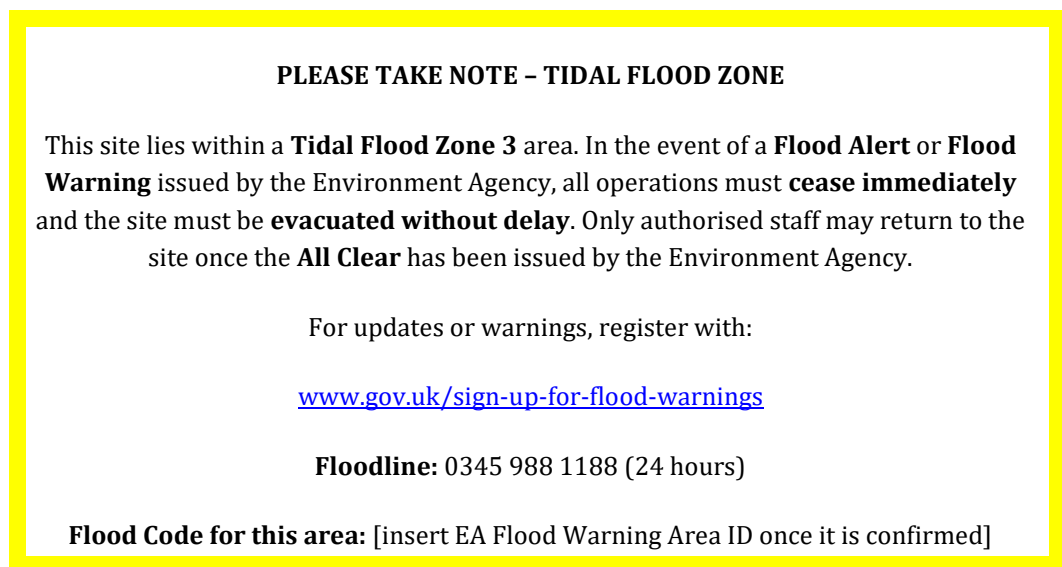
5.4 Access and safety

- 5.4.1 Modelled flood depths under the 0.5% AEP (1 in 200 year) defended tidal event exceed 2 m across the site, rising further under climate change allowances. Safe access during such events can, therefore, not be relied upon.

² This unit provides fully sealed secondary containment with a 110% bund capacity in accordance with the Control of Pollution (Oil Storage) (England) Regulations 2001. It is weather resistant, lockable and designed to prevent escape of contaminants in the event of overtopping or inundation.

- 5.4.2 Instead, the strategy is to register the site with the EA Flood Warning Service and to evacuate in advance of a predicted event, per the original permission.
- 5.4.3 Signage will be erected on site to inform occupiers that the site lies within a tidal flood zone and that operations must cease during a Flood Warning. This signage will be provided at the entrance of each Plot and will read as follows:

Figure 1 Example Warning Signage



Note: print on waterproof, rigid A3 signs with yellow borders.

5.5 Drainage and pollution control

Wheel washing

- 5.5.1 Wheel washing apparatus will be installed by the entrances of Plots D and E upon necessity by any future tenant (i.e. on the signing of lease that will see the use of these plots for storage of articulated vehicles as planned, wheel washing apparatus will be installed per the drawings).

Surface Water Runoff Treatment

- 5.5.2 Details relating to the treatment of surface water runoff were approved under conditions application 20180988 (dated 1st November 2018) and involved the attachment of a silt box, vortex separator and filter (including oil inception) to the drainage network. The same is proposed now, as described (in order) below.

1. Runoff is directed to the slot drains via gentle gradient to tarmac surfacing.
2. Upon entering the drainage channel, runoff will first pass through a **silt box** to remove any large objects/particles.
3. Runoff then passes into a **vortex separator** such as the Hydro First Defense³. This and the previous step will prevent the tank from silting up and provide additional treatment prior to the final step (filtration).
4. Runoff is then discharged into the **attenuation tank** before being released at a controlled rate using a Hydrobrake Optimum⁴ or similar discharge control apparatus to the outflow pipes.
5. Before discharging into the existing dykes, runoff will pass through a **high performance filter including oil separators**, such as the Hyro Up-Flow⁵. This should provide a sufficient final treatment for remaining hydrocarbons, TSS and metals.

5.5.3 In addition to the above, yard surfacing, boundary dykes, wheel washing units where present), vortex separator and attenuation tanks will be maintained to ensure surface water and tidal waters do not wash contaminants offsite.

Summary

5.5.4 This treatment train will effectively remove sediment, intercept oils and filter water before discharging to the receiving watercourses. It is consistent with the approved strategy for drainage and satisfies para.187 of the NPPF by effectively preventing contamination of controlled waters, and optimal protection against pollution in accordance with the relevant policy guidance.

5.6 Emergency Planning

5.6.1 A Flood Response Plan will be maintained, including named responsible persons, procedures for securing containers and evacuating vehicles, and arrangements for post-event clean-up and reinstatement. The plan will be reviewed annually and updated in liaison with the EA/LLFA where necessary.

5.6.2 A draft **Flood Response Plan** has been supplied in **Appendix 2**.

³ https://hydro-int.com/sites/default/files/fd_ss_b_2203_0.pdf (Accessed 20.11.2025)

⁴ https://hydro-int.com/en/hydro-brake-optimum?language_content_entity=en (Accessed 20.11.2025)

⁵ <https://www.hydro-int.com/en/products/flo-filter> (Accessed 20.11.2025)

5.7 Policy Accordance

- 5.7.1 This strategy accords with all tiers of relevant planning policy:
- 5.7.2 *National Planning Policy Framework (NPPF, 2023 update)*: Paragraphs 159–169 require that development in flood risk areas is safe, resilient and does not increase risk elsewhere. The development is water-compatible / less vulnerable (B8 open storage) and is supported subject to an FRA. The FRA demonstrates resilience, evacuation planning, pollution prevention and no off-site flood risk, in compliance with the NPPF.
- 5.7.3 *Flood Risk and Coastal Change PPG*: This requires site-specific FRAs to consider flood warning, evacuation and residual risk where defences could be overtopped or breached. The proposed strategy is aligned with this guidance.
- 5.7.4 *The Thames Estuary 2100 Plan (TE2100, 2020 update)* identifies the long-term flood risk strategy for the estuary. The FRA uses the TE2100 climate change allowances (Product-6 modelling) and explicitly manages residual breach risk, fully in line with TE2100 objectives.
- 5.7.5 *The Kent Local Flood Risk Management Strategy* seeks to reduce flood risk through resilience, partnership and sustainable drainage. The proposed measures (SuDS, pollution control, resilience and management planning) are consistent with this.
- 5.7.6 *Policy CS18 (Climate Change, Flooding and Water Management) of Gravesham Borough Council's Core Strategy (2014)* requires development to reduce flood risk and demonstrate resilience where located in flood risk zones. The FRA shows how the use is compatible, resilient, and safeguarded by management and emergency planning. Further Development Management Policies encourage SuDS, pollution prevention, and operational mitigation. The proposed drainage and resilience measures meet these criteria.

6.0 Conclusion

6.1 The updated assessment confirms that:

- 1) The site remains well defended from tidal flooding.
- 2) Flood depths have increased since 2016 but the overall risk classification is unchanged.
- 3) The proposed layout and use remain compatible with NPPF and EA policy.
- 4) The existing management strategy adequately mitigates residual risk to the layout as it is proposed to be varied.

6.2 Accordingly, this Flood Risk Assessment (Amendment 2025) satisfies the Environment Agency's request for updated information and demonstrates that the proposed s.73 amendment presents no additional flood risk to people, property or the environment.

6.3 If any element of this document is found to be unacceptable or needing improvement, please contact me as soon as possible so that we may come to a proactive conclusion by way of amendments or further reasonable negotiations prior to a decision being issued.

Janine R. Mustafa, BSc (Hons)
Town Planning Consultant
Langleys Chartered Surveyors
20th November 2025

PROFESSIONAL DISCLAIMER

This **Flood Risk Assessment** has been prepared by Langleys Chartered Surveyors (LCS Surveyors Ltd) solely for the purposes of supporting a planning application for development at **Dering Industrial Estate, Dering Way, Gravesend**. It has been prepared in accordance with current national and local planning policy and the Environment Agency data available at the time of writing.

The assessment is based on information obtained from third party sources, including the Environment Agency, and layout plans informed by the client. While every reasonable effort has been made to verify the accuracy of this information, Langleys Chartered Surveyors (LCS Surveyors Ltd) cannot guarantee its completeness or that conditions on site will remain as described herein.

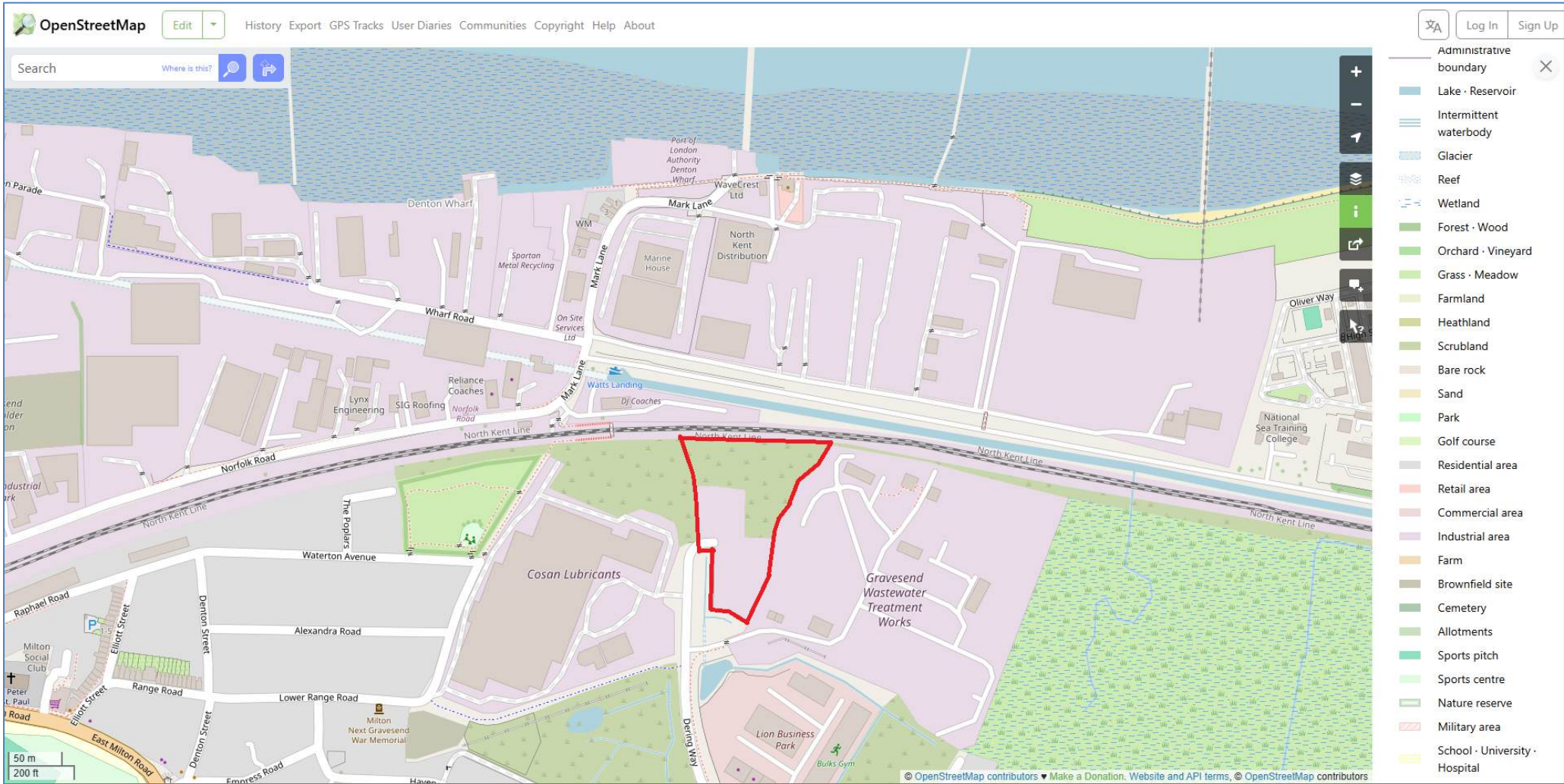
This report should not be relied upon for any purpose other than for which it was commissioned. No responsibility or liability is accepted by Langleys Chartered Surveyors (LCS Surveyors Ltd) or the author for errors or omissions in the data supplied, nor for any loss, damage or consequence arising from reliance on this report or its contents, including any changes in data, policy or site circumstances occurring after its issue.

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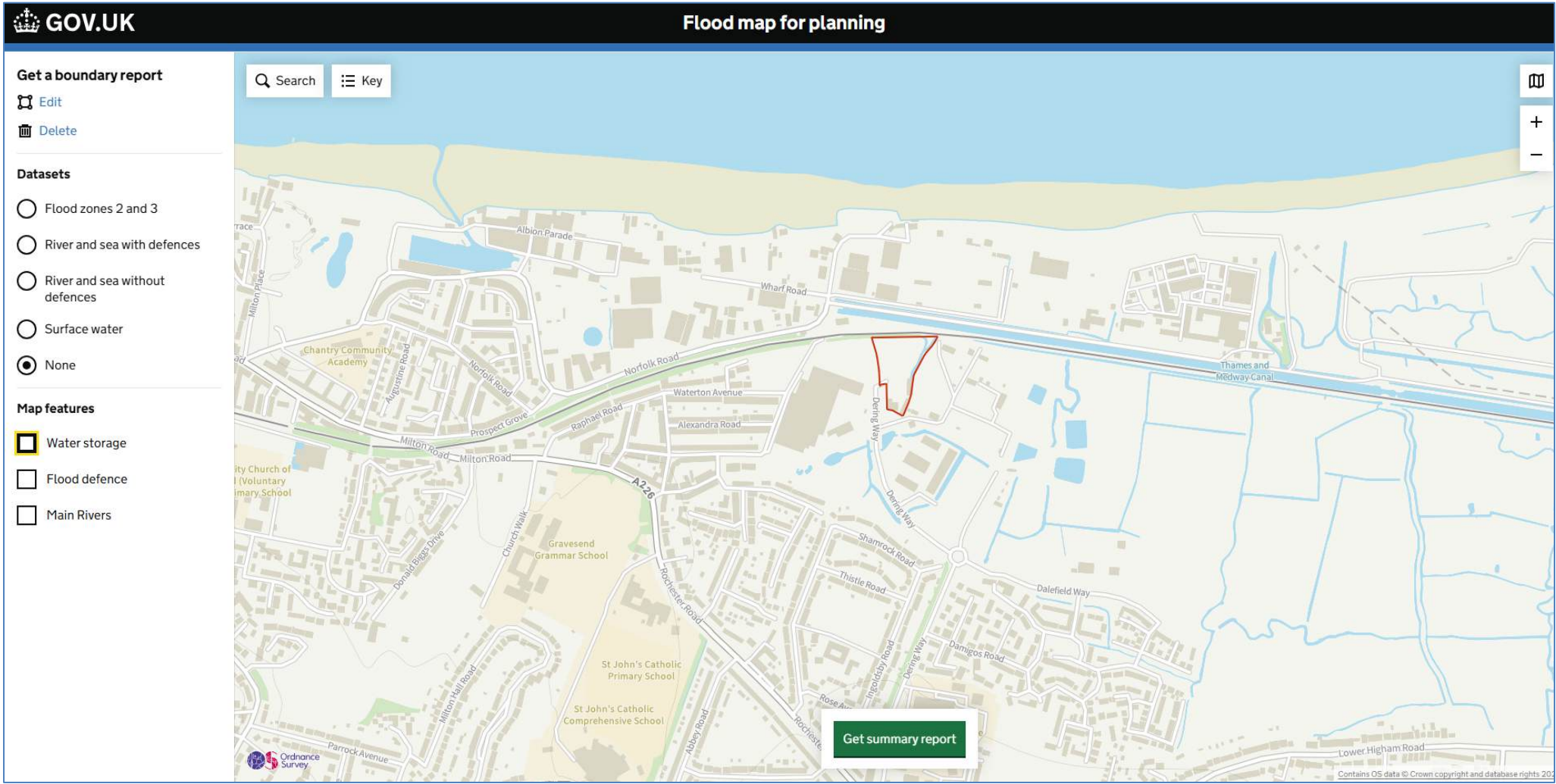
APPENDIX 1.A

Map	Source
<u>SITE LOCATION</u>	OpenStreetMap, Obtained 18.07.25



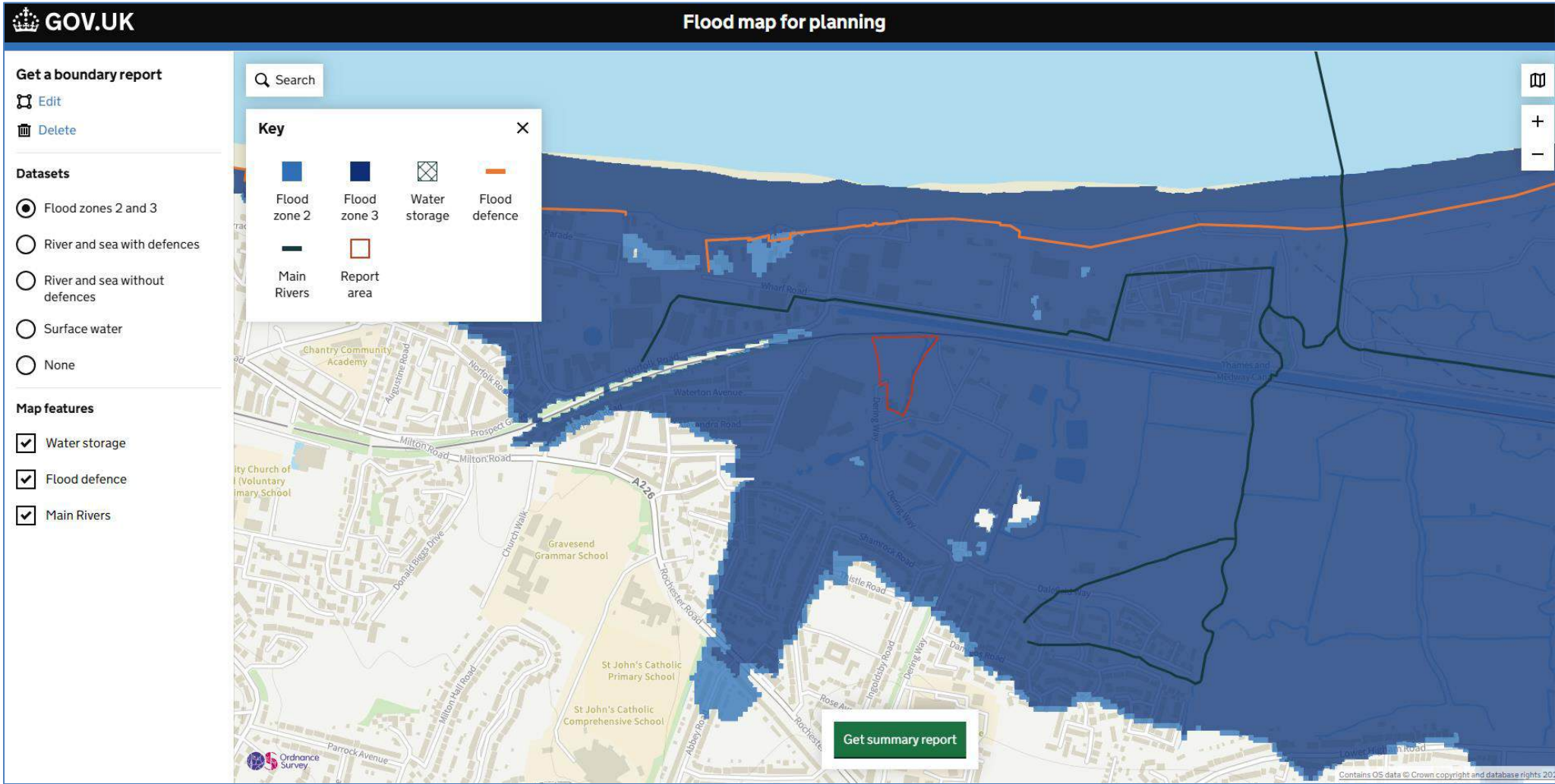
APPENDIX 1.B

Map	Source
<u>SITE LOCATION</u>	Environment Agency, Obtained 18.07.25



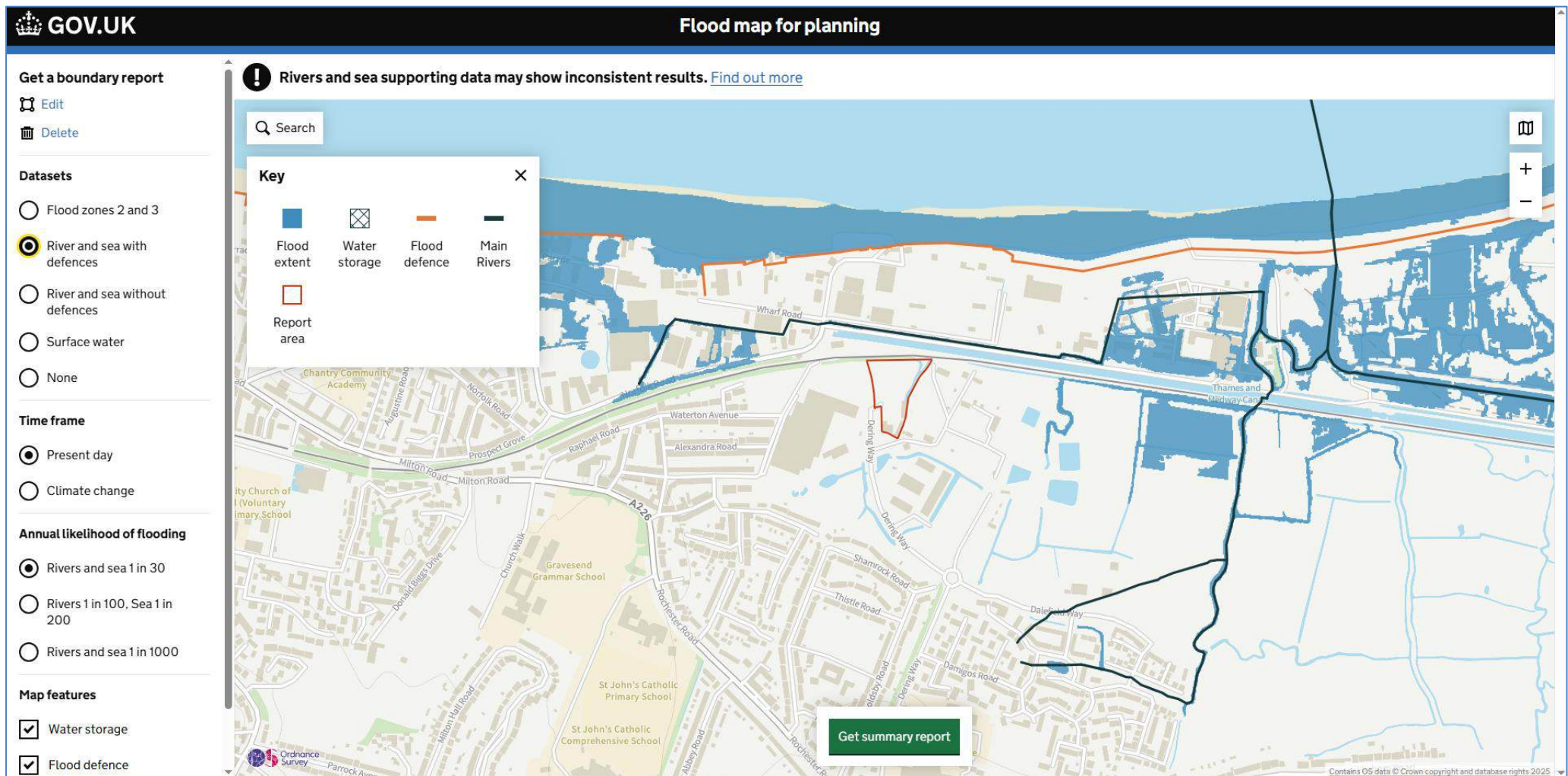
APPENDIX 1.C

Map	Source
<u>FLOOD ZONE EXTENTS</u>	Environment Agency, Obtained 18.07.25



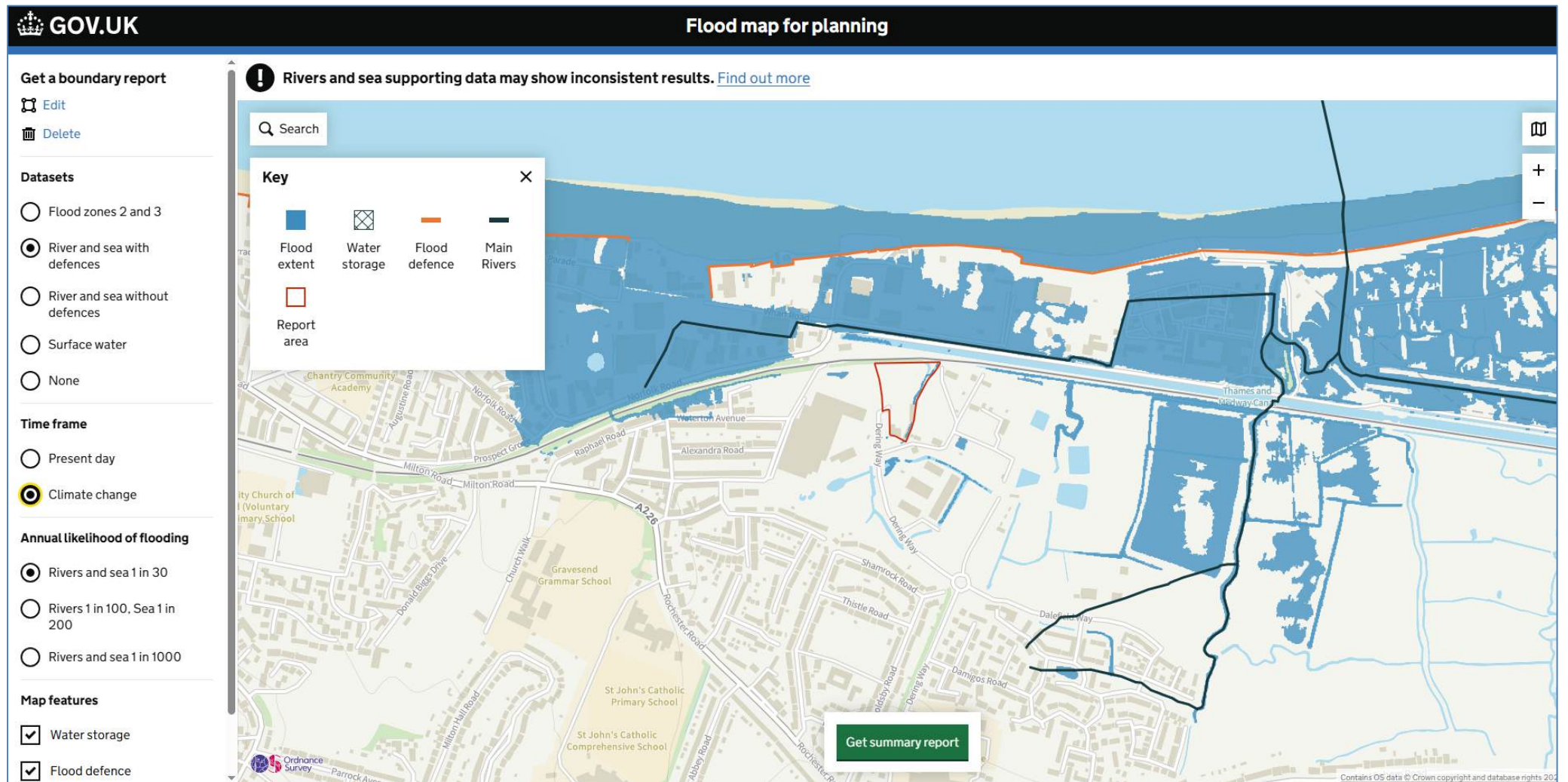
APPENDIX 1.D

Long Term Flood Risk	Condition	Scenario	Event	Source
<u>RIVERS OR THE SEA</u> (Extent of Flooding)	DEFENDED	PRESENT DAY	1 IN 30 EVENT	Environment Agency, Obtained 18.07.25



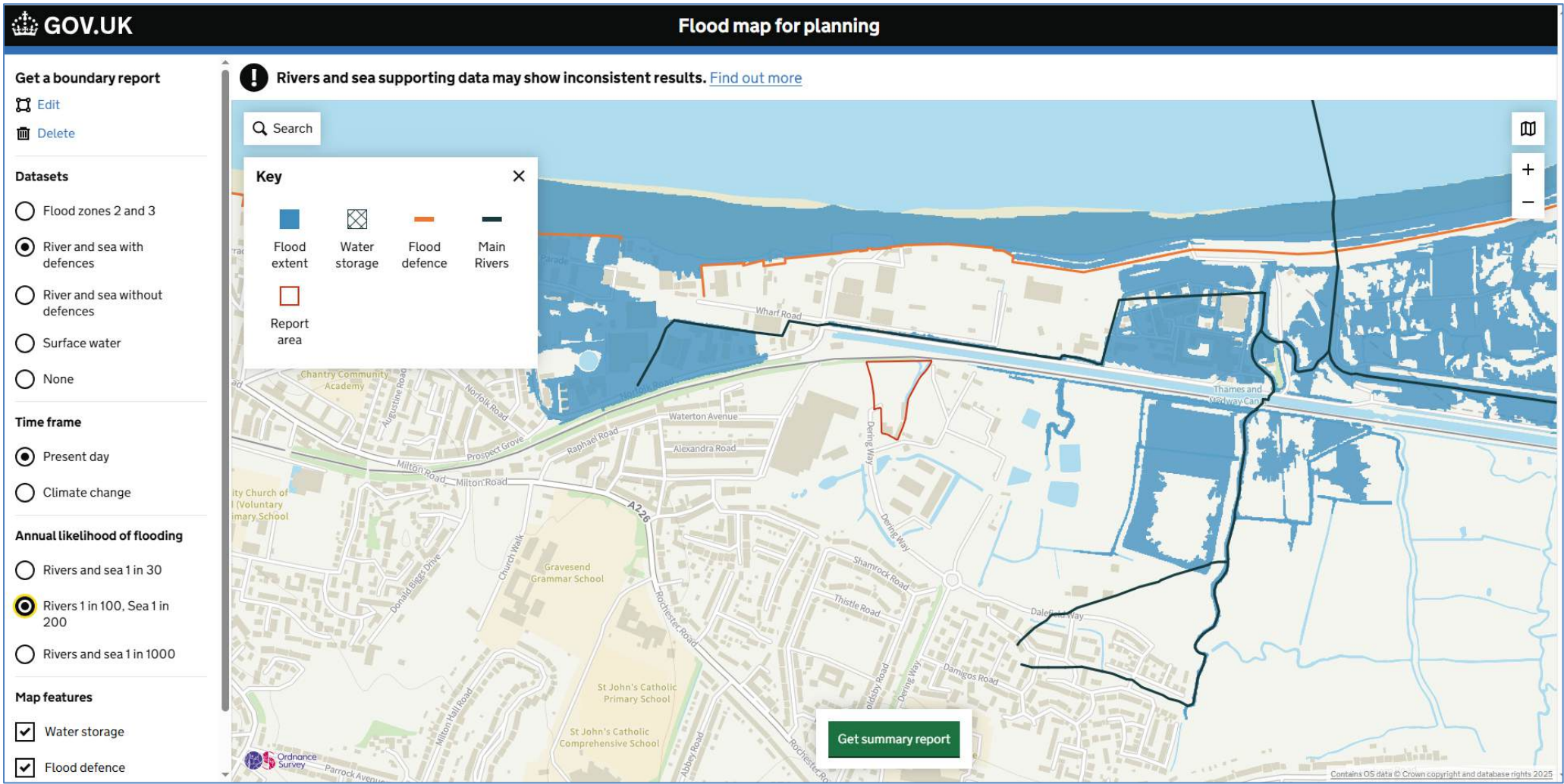
APPENDIX 1.E

Long Term Flood Risk	Condition	Scenario	Event	Source
<u>RIVERS OR THE SEA</u> (Extent of Flooding)	DEFENDED	+ CLIMATE CHANGE	1 IN 30 EVENT	Environment Agency, Obtained 18.07.25



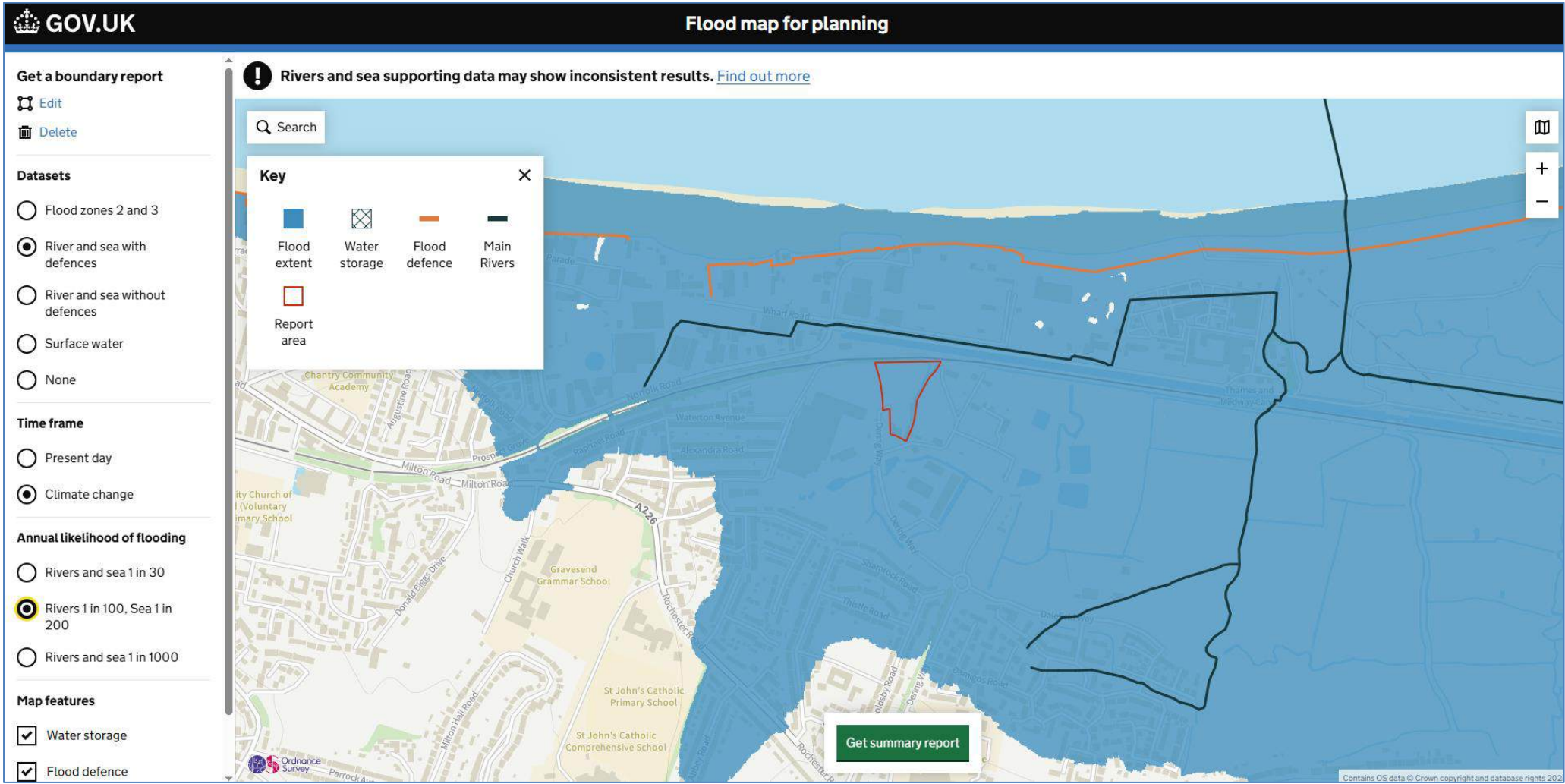
APPENDIX 1.F

Long Term Flood Risk	Condition	Scenario	Event	Source
RIVERS OR THE SEA (Extent of Flooding)	DEFENDED	PRESENT DAY	RIVERS - 1 IN 100 SEA - 1 IN 200	Environment Agency, Obtained 18.07.25



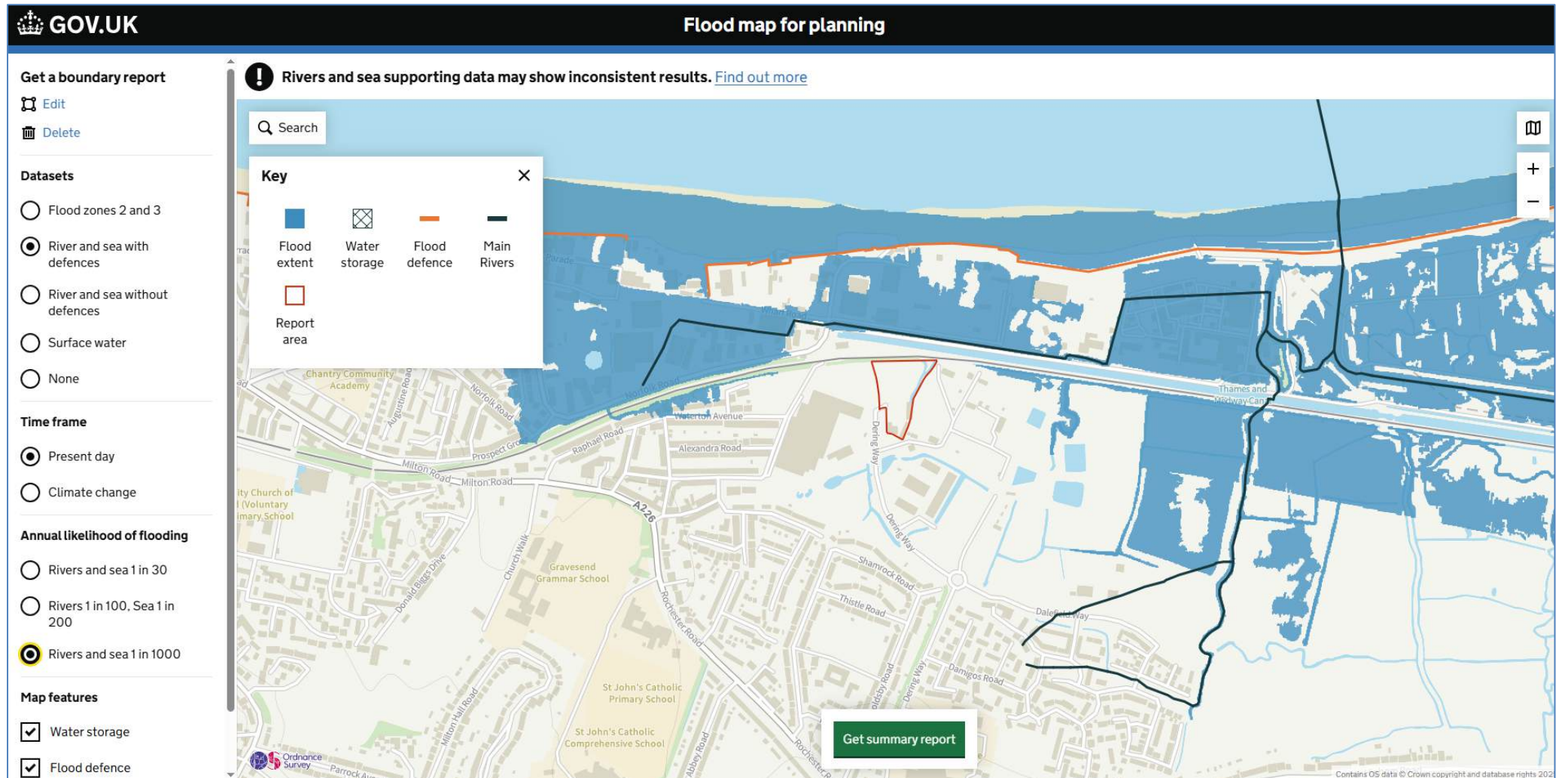
APPENDIX 1.G

Long Term Flood Risk	Condition	Scenario	Event	Source
RIVERS OR THE SEA (Extent of Flooding)	DEFENDED	+ CLIMATE CHANGE	RIVERS - 1 IN 100 SEA - 1 IN 200	Environment Agency, Obtained 18.07.25



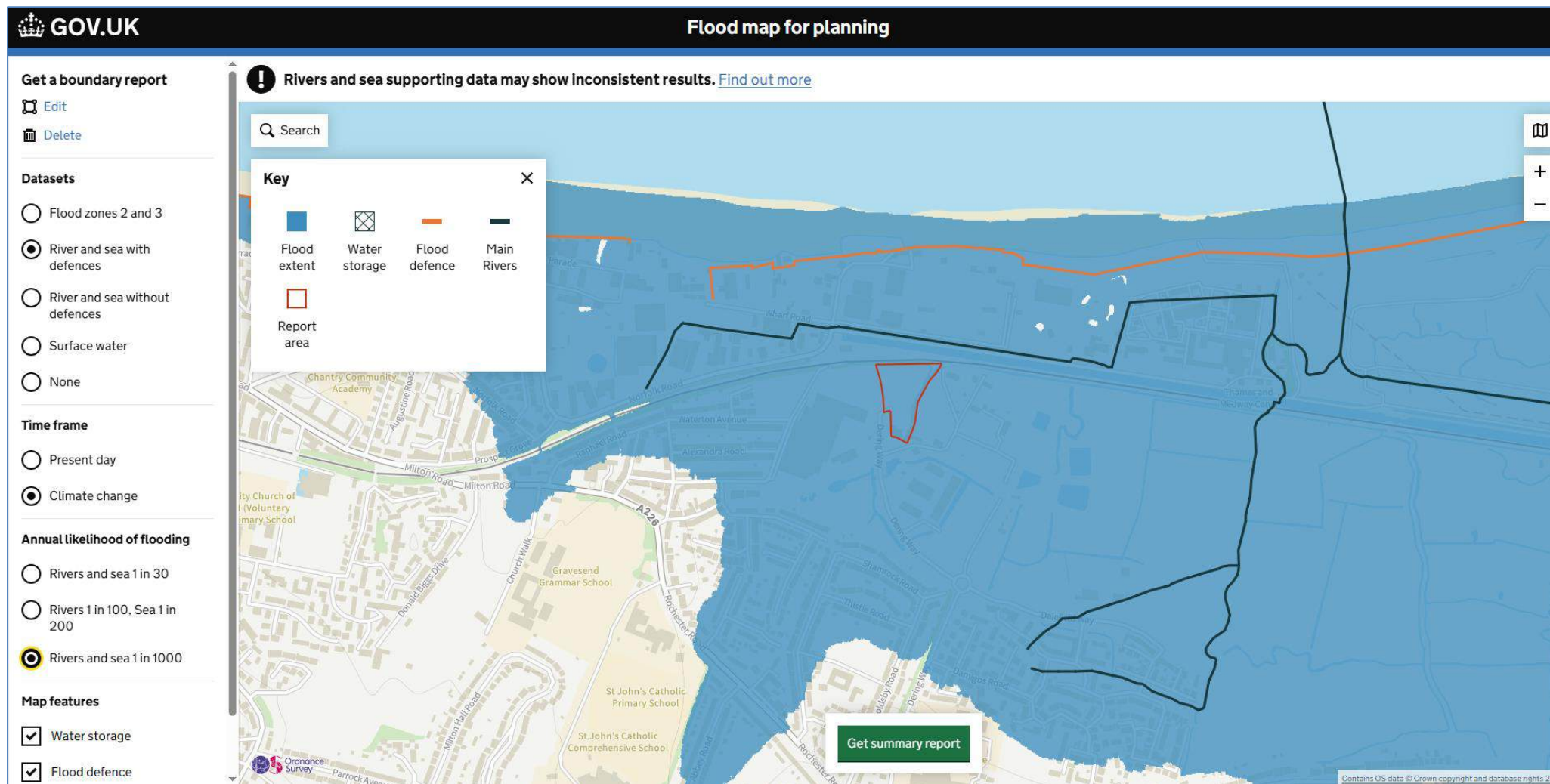
APPENDIX 1.H

Long Term Flood Risk	Condition	Scenario	Event	Source
<u>RIVERS OR THE SEA</u> (Extent of Flooding)	DEFENDED	PRESENT DAY	1 IN 1000	Environment Agency, Obtained 18.07.25



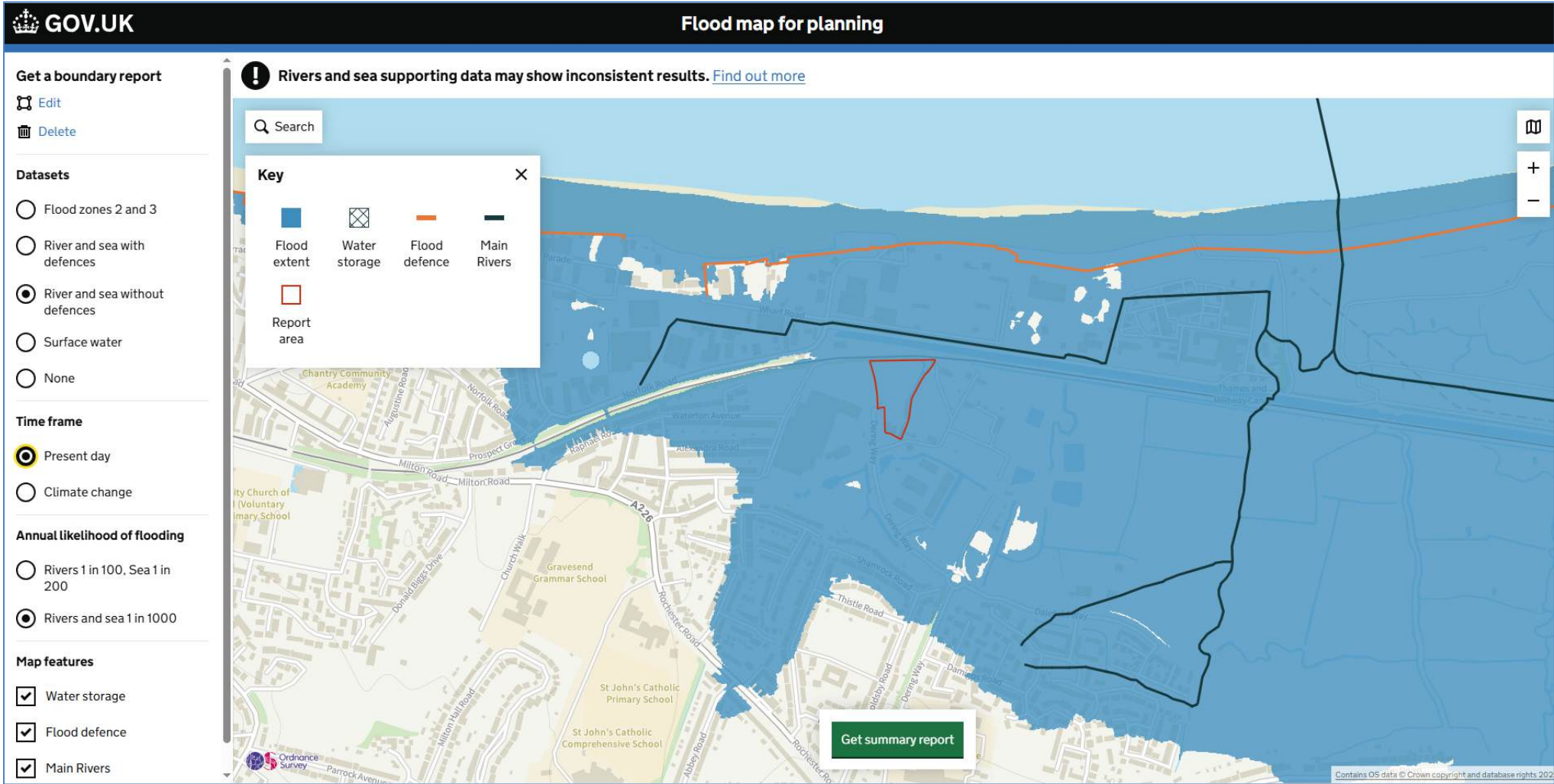
APPENDIX 1.I

Long Term Flood Risk	Condition	Scenario	Event	Source
<u>RIVERS OR THE SEA</u> (Extent of Flooding)	DEFENDED	+ CLIMATE CHANGE	1 IN 1000	Environment Agency, Obtained 18.07.25



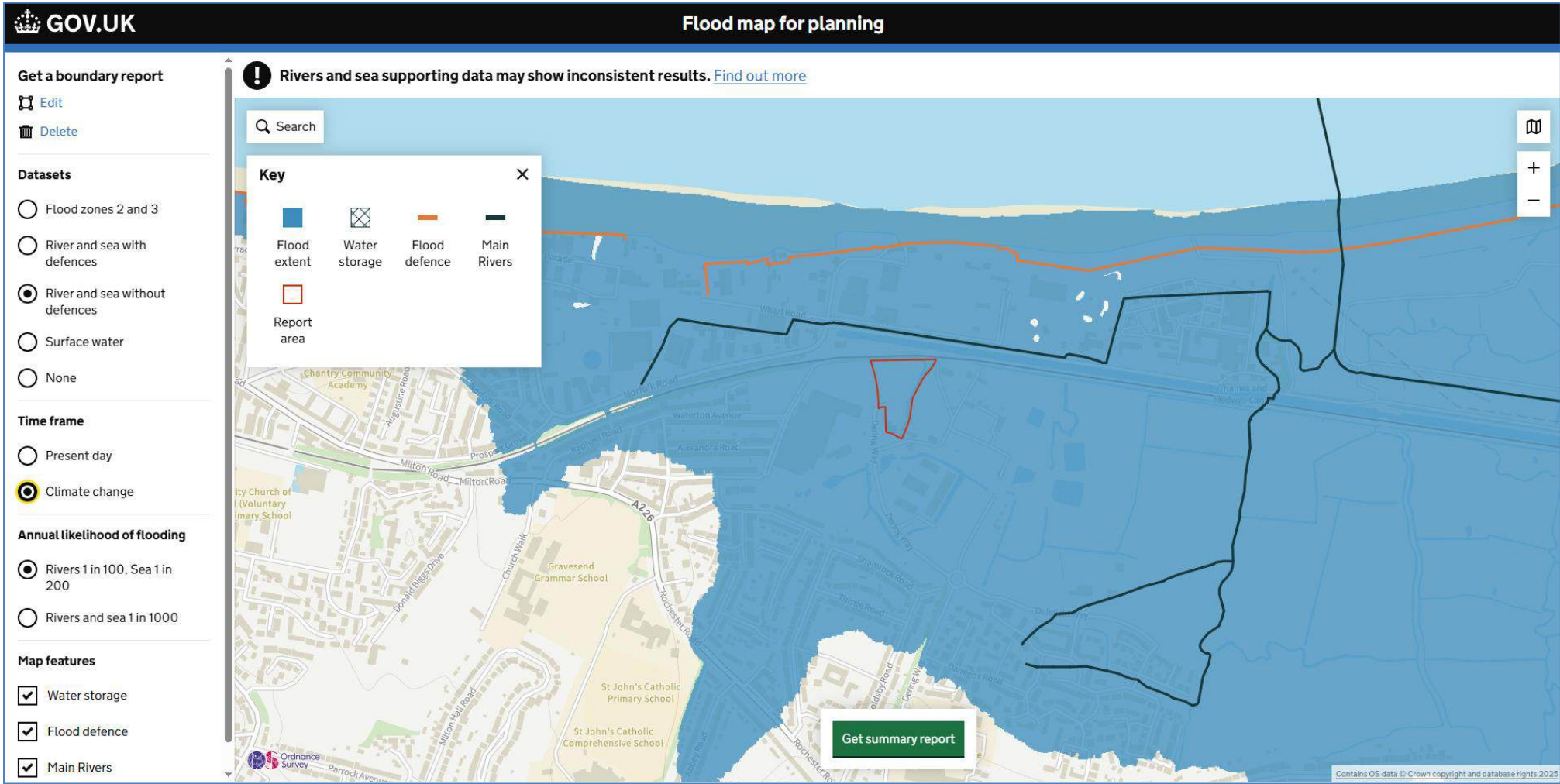
APPENDIX 1.J

Long Term Flood Risk	Condition	Scenario	Event	Source
RIVERS OR THE SEA (Extent of Flooding)	UNDEFENDED	PRESENT DAY	RIVERS - 1 IN 100 SEA - 1 IN 200	Environment Agency, Obtained 18.07.25



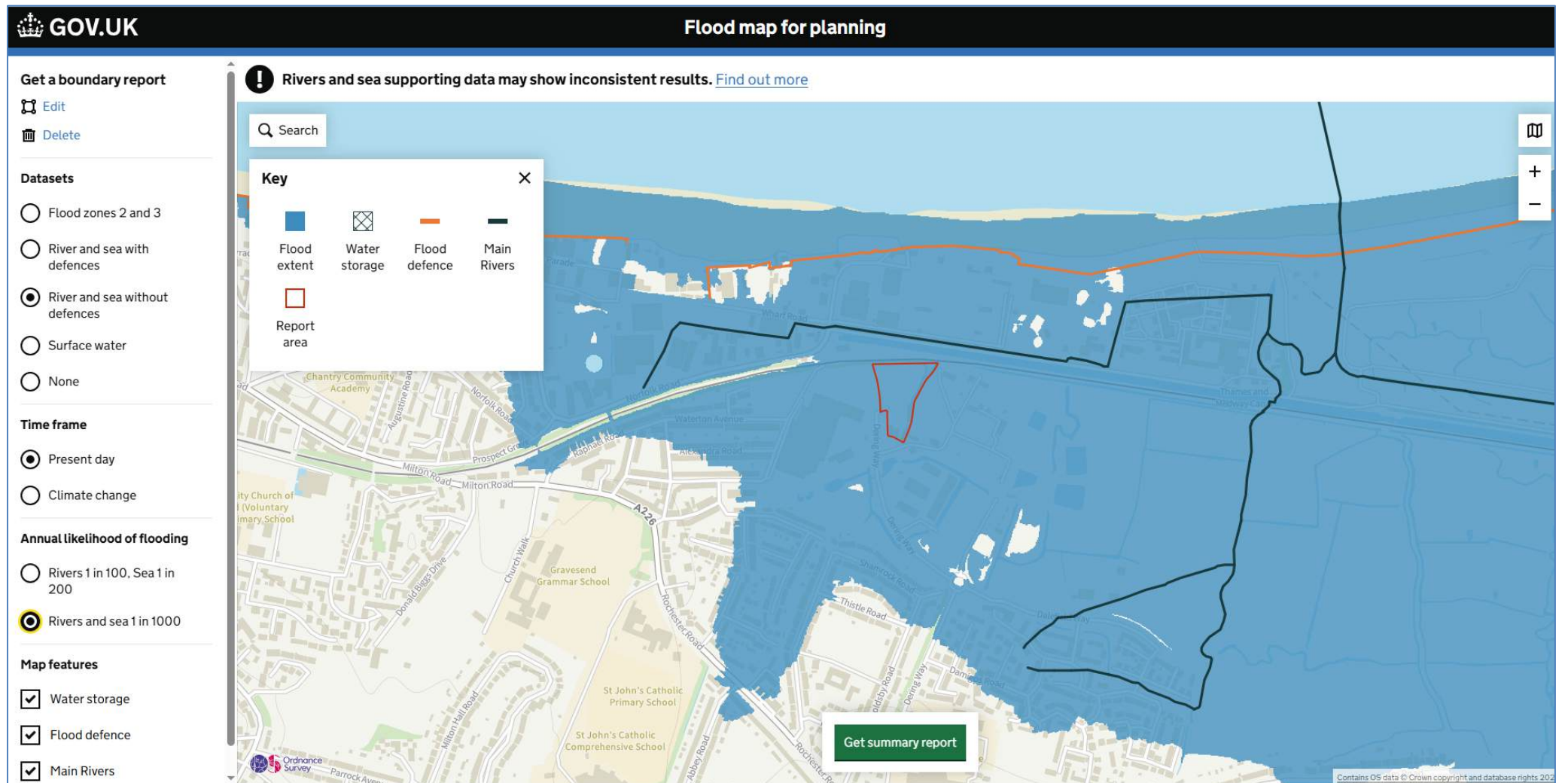
APPENDIX 1.K

Long Term Flood Risk	Condition	Scenario	Event	Source
RIVERS OR THE SEA (Extent of Flooding)	UNDEFENDED	+ CLIMATE CHANGE	RIVERS - 1 IN 100 SEA - 1 IN 200	Environment Agency, Obtained 18.07.25



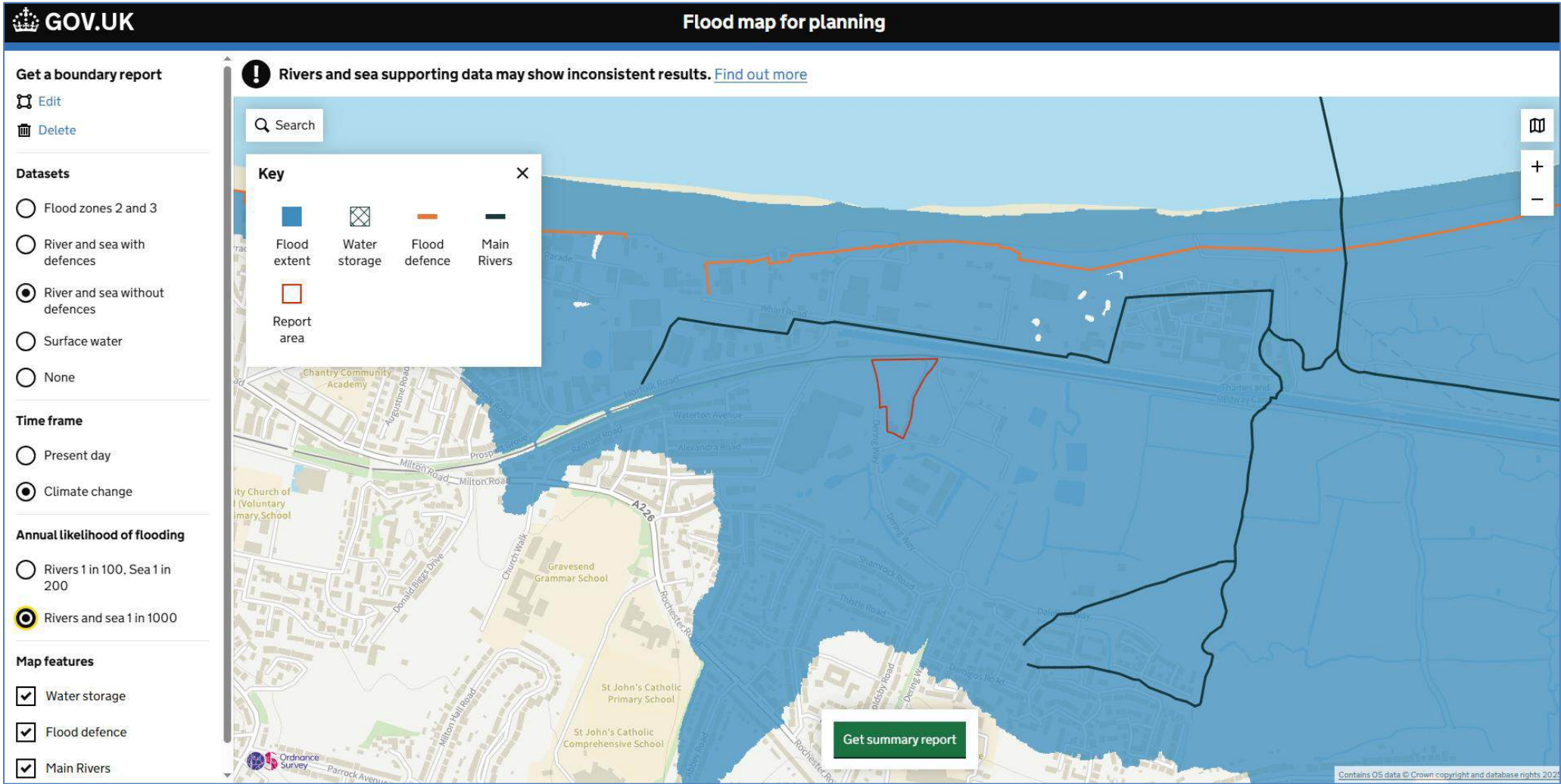
APPENDIX 1.L

Long Term Flood Risk	Condition	Scenario	Event	Source
<u>RIVERS OR THE SEA</u> (Extent of Flooding)	UNDEFENDED	PRESENT DAY	1 IN 1000	Environment Agency, Obtained 18.07.25



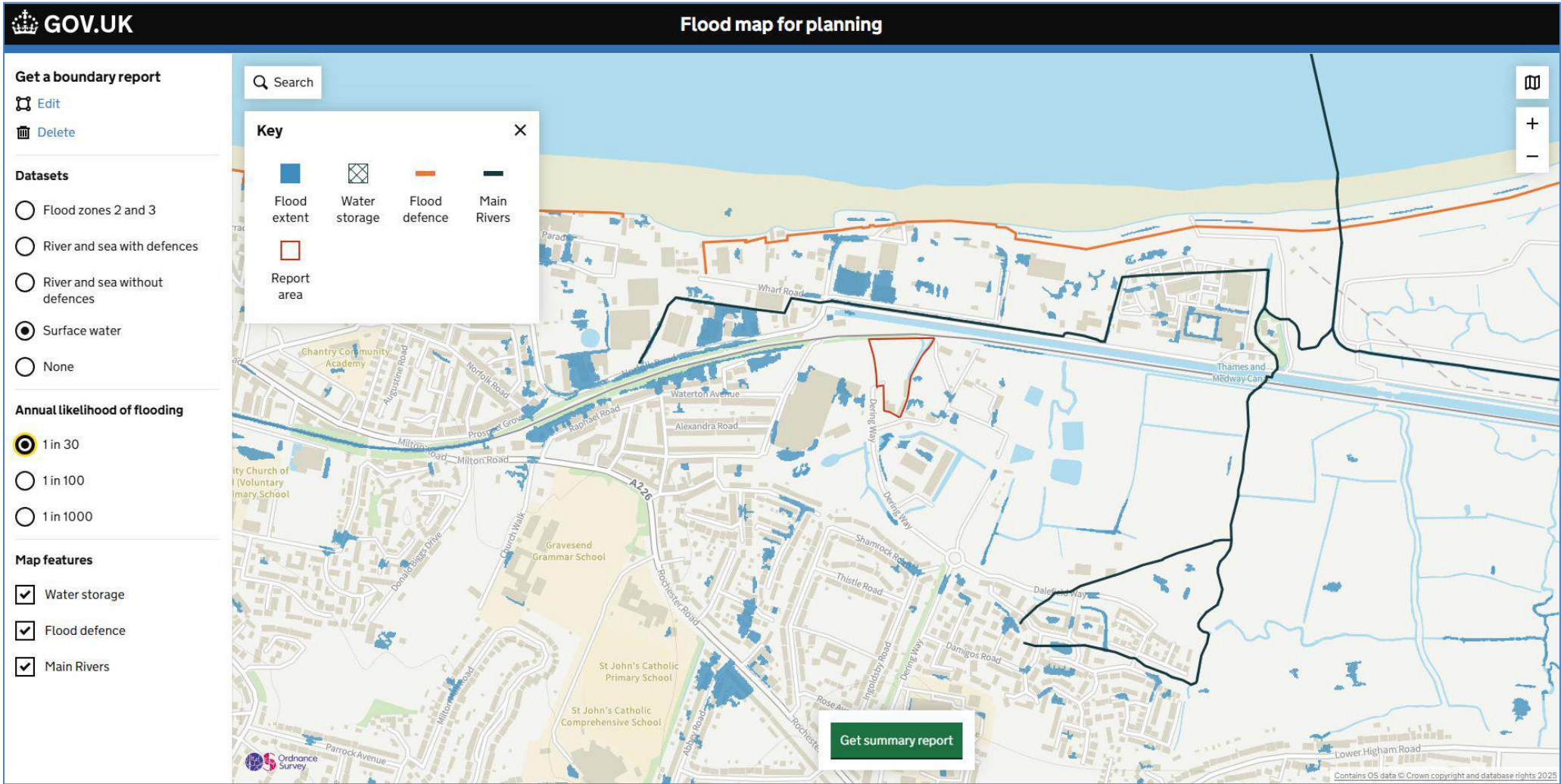
APPENDIX 1.M

Long Term Flood Risk	Condition	Scenario	Event	Source
RIVERS OR THE SEA (Extent of Flooding)	UNDEFENDED	+ CLIMATE CHANGE	1 IN 1000	Environment Agency, Obtained 18.07.25



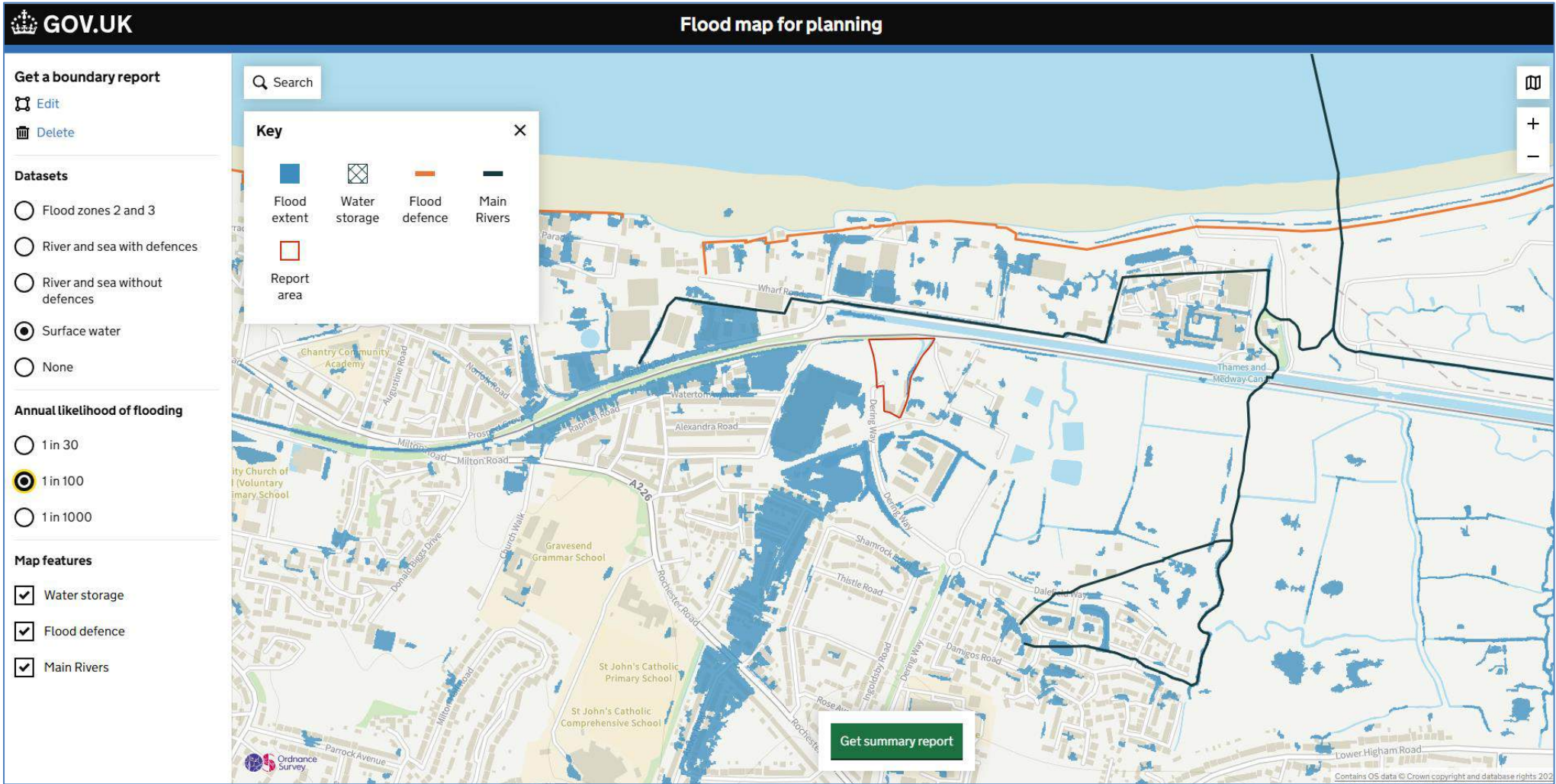
APPENDIX 1.N

Long Term Flood Risk	Event	Source
<u>SURFACE WATER</u> (Extent of Flooding)	1 IN 30	Environment Agency, Obtained 18.07.25



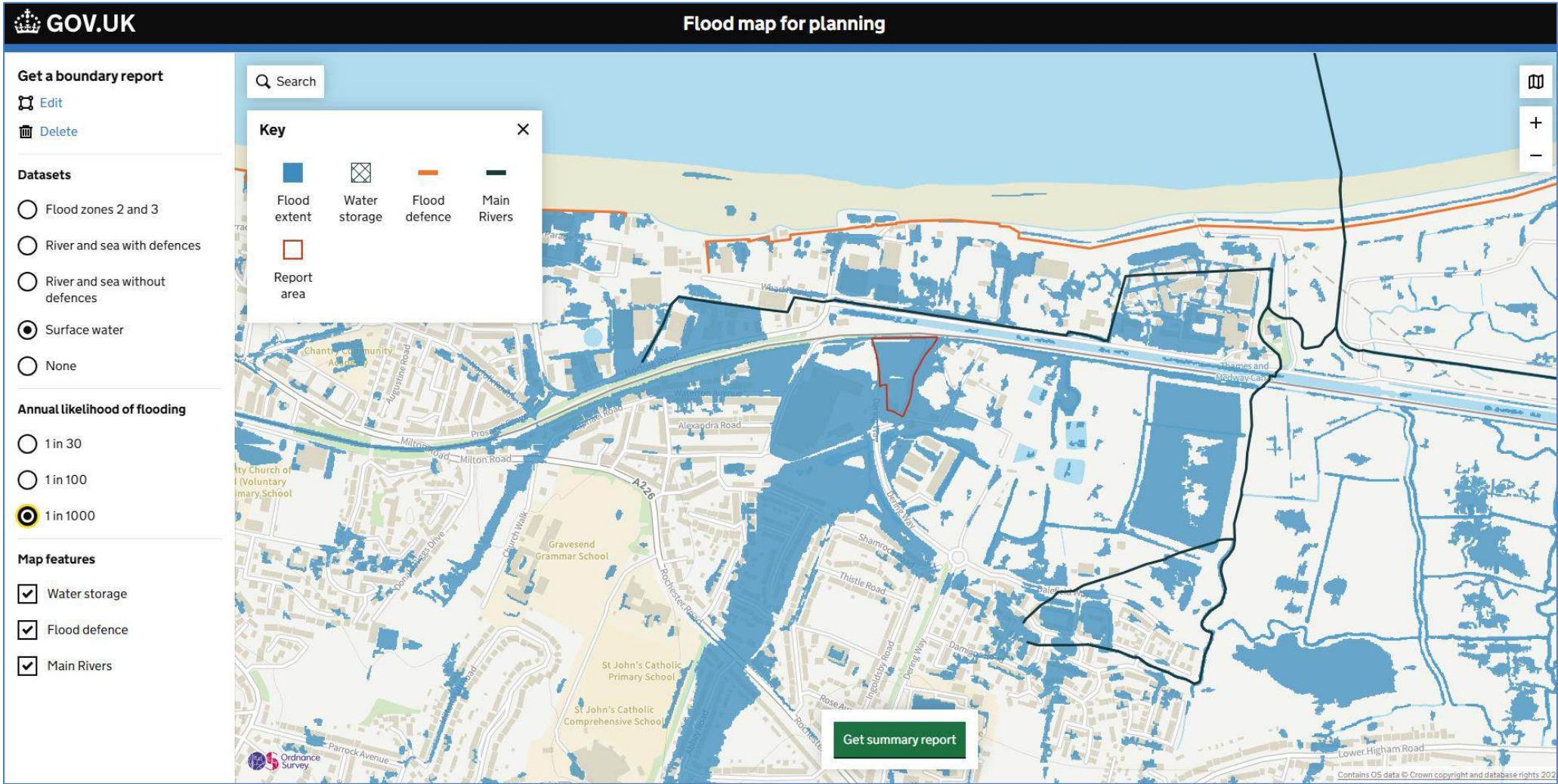
APPENDIX 1.0

Long Term Flood Risk	Event	Source
<u>SURFACE WATER</u> (Extent of Flooding)	1 IN 100	Environment Agency, Obtained 18.07.25



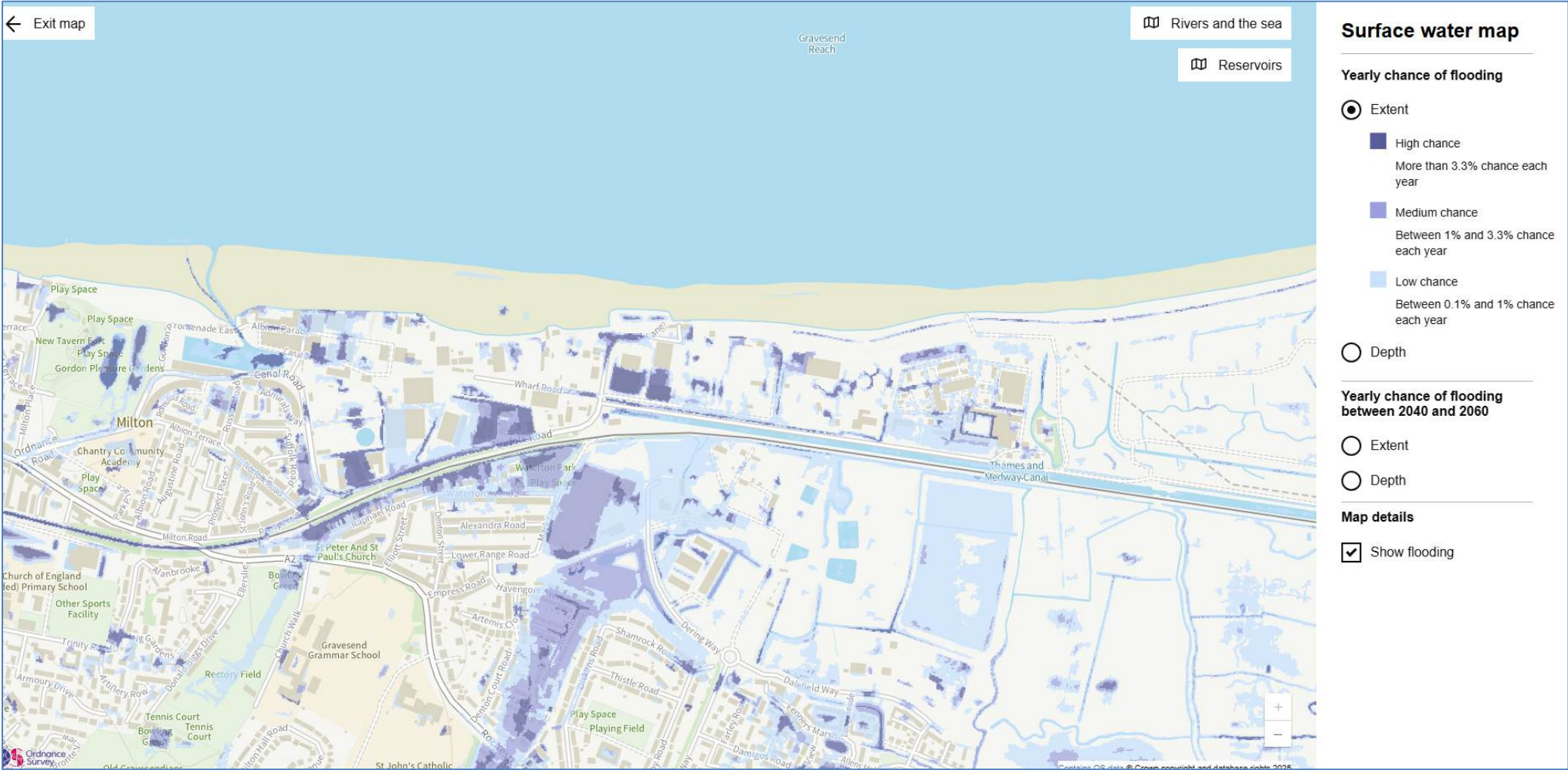
APPENDIX 1.P

Long Term Flood Risk	Event	Source
<u>SURFACE WATER</u> (Extent of Flooding)	1 IN 1000	Environment Agency, Obtained 18.07.25



APPENDIX 1.Q

Long Term Flood Risk	Event	Source
<u>SURFACE WATER</u> (Extent of Flooding)	YEARLY CHANCE OF FLOODING (CURRENT DATE)	Environment Agency, Obtained 03.10.25



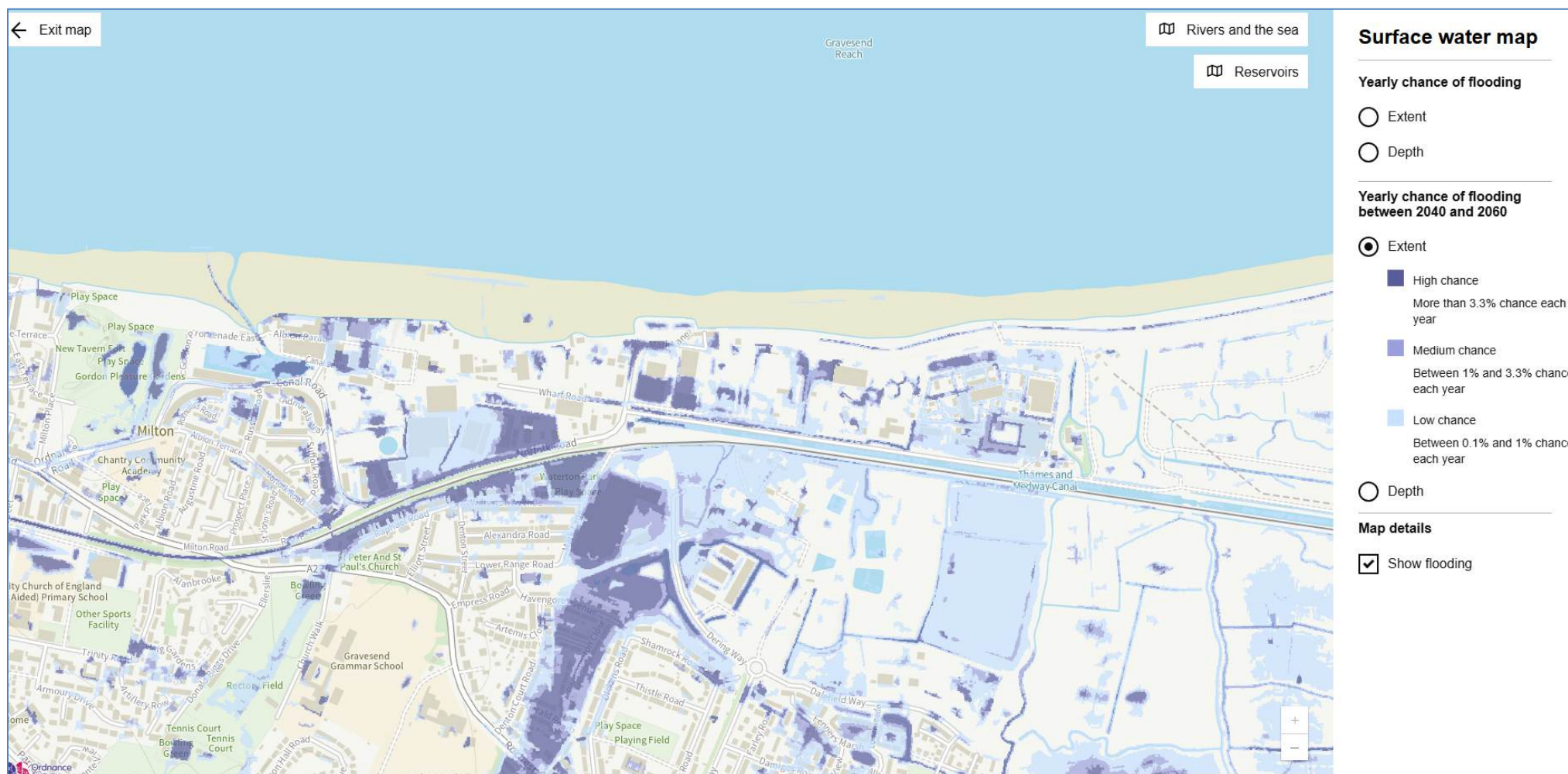
APPENDIX 1.R

Long Term Flood Risk	Event	Source
<u>SURFACE WATER</u> (Depth of Flooding)	YEARLY CHANCE OF FLOODING (CURRENT DATE) UP TO GIVEN DEPTHS	Environment Agency, Obtained 03.10.25 https://check-long-term-flood-risk.service.gov.uk/map#

	Surface water flood depth				Legend
	To 20cm (8 inches)	To 30cm (1 foot)	To 60cm (2 foot)	To 90cm (3 foot)	
Map Images for current climate					Surface water map Yearly chance of flooding ☐ Extent ☒ Depth High chance More than 3.3% chance each year Medium chance Between 1% and 3.3% chance each year Low chance Between 0.1% and 1% chance each year Yearly chance of flooding between 2040 and 2060 ☐ Extent ☐ Depth Map details ☒ Show flooding
Summary	Each year, there is a <u>low chance</u> (between 0.1% and 1%) that <u>the majority of the site will flood to a depth of 30cm (1ft) or more.</u>	Each year, there is a <u>low chance</u> (between 0.1% and 1%) that <u>the majority of the site will flood to a depth of 30cm (1ft) or more.</u>	Each year, there is a <u>low chance</u> (between 0.1% and 1%) that <u>the majority of the site will flood to a depth of 60cm (2ft) or more.</u>	Each year, there is a <u>low chance</u> (between 0.1% and 1%) that <u>the majority of the site will flood to a depth of 90cm (3ft) or more.</u>	

APPENDIX 1.S

Long Term Flood Risk	Event	Source
<u>SURFACE WATER</u> (Extent of Flooding)	YEARLY+CC CHANCE OF FLOODING (2040- 2060)	Environment Agency, Obtained 03.10.25



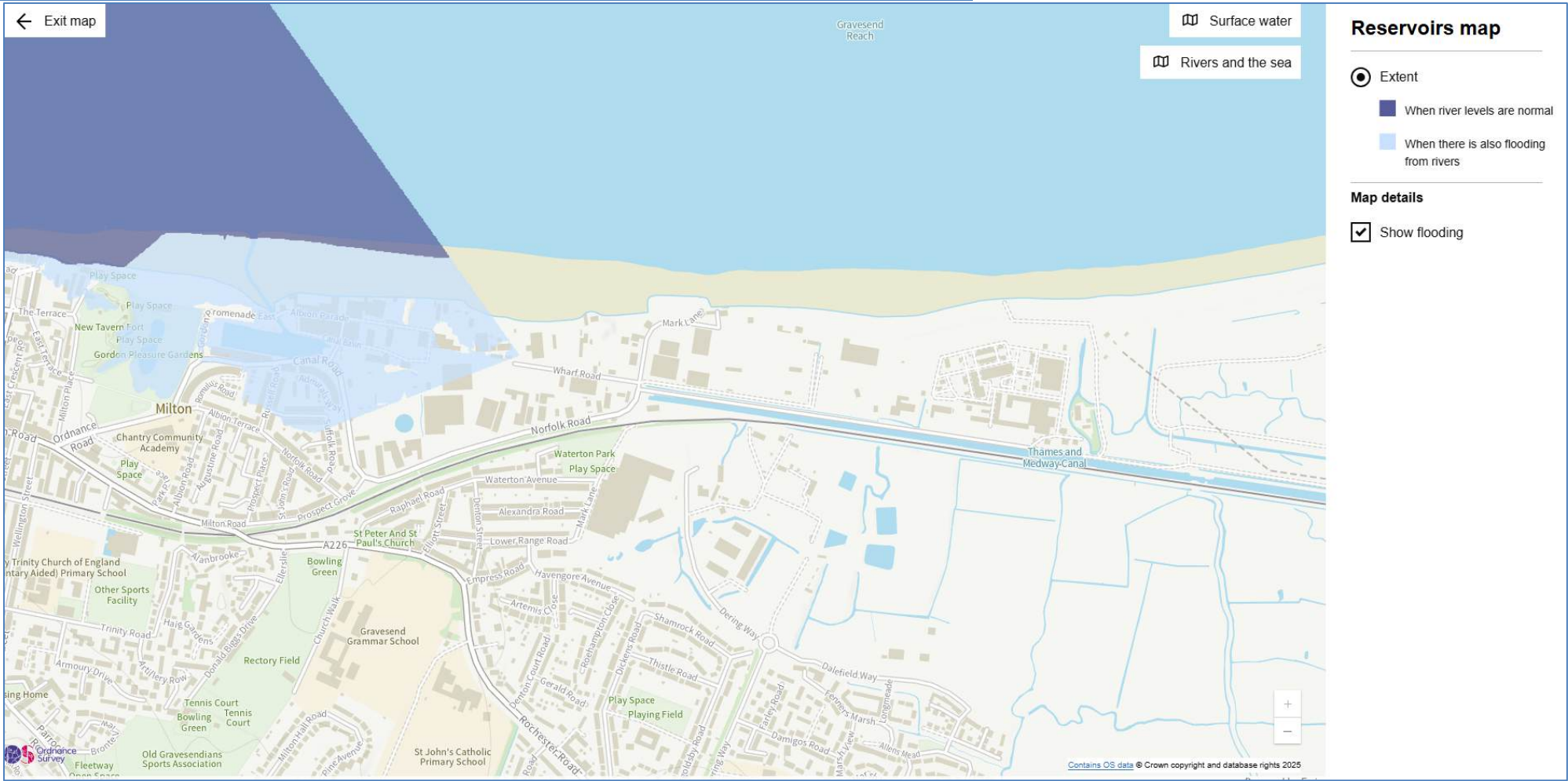
APPENDIX 1.T

Long Term Flood Risk	Event	Source	Source	Source
<u>SURFACE WATER</u> (Depth of Flooding)	YEARLY+CC CHANCE OF FLOODING (2040-2060) UP TO GIVEN DEPTHS	Environment Agency, Obtained 03.10.25 https://check-long-term-flood-risk.service.gov.uk/map#	Environment Agency, Obtained 03.10.25 https://check-long-term-flood-risk.service.gov.uk/map#	Environment Agency, Obtained 03.10.25 https://check-long-term-flood-risk.service.gov.uk/map#

	Surface water flood depth				Legend
	To 20cm (8 inches)	To 30cm (1 foot)	To 60cm (2 foot)	To 90cm (3 foot)	
Map Images for future climate 2040-2060 (CC)					Surface water map Yearly chance of flooding Extent Depth High chance More than 3.3% chance each year Medium chance Between 1% and 3.3% chance each year Low chance Between 0.1% and 1% chance each year Yearly chance of flooding between 2040 and 2060 Extent Depth Map details ☒ Show flooding
Summary	Each year, there is a <u>low chance</u> (between 0.1% and 1%) that <u>the majority of the site will flood to a depth of 30cm (1ft) or more</u>, and a <u>medium chance</u> of flooding to this depth along the eastern dykes. Comparison: The situation is observed to demonstrate a minor uplift in total site coverage and medium chance of flooding to boundary dykes (these do not constitute part of the developed area).	Each year, there is a <u>low chance</u> (between 0.1% and 1%) that <u>the majority of the site will flood to a depth of 30cm (1ft) or more</u>. Some small areas along the eastern dykes have a <u>medium chance</u> of flooding to this depth. Comparison: The situation is observed to demonstrate a minor uplift in total site coverage and medium chance of flooding to boundary dykes (these do not constitute part of the developed area).	Each year, there is a <u>low chance</u> (between 0.1% and 1%) that <u>the majority of the site will flood to a depth of 60cm (2ft) or more</u>. Comparison: The situation is observed to demonstrate a minor uplift in total site coverage, primarily to the upper (northern) part of the land is observed.	Each year, there is a <u>low chance</u> (between 0.1% and 1%) that <u>the majority of the site will flood to a depth of 90cm (3ft) or more</u>. Comparison: The situation is observed to be much the same as the current climate with some increased chance of flooding to the northern and central parts of the land.	

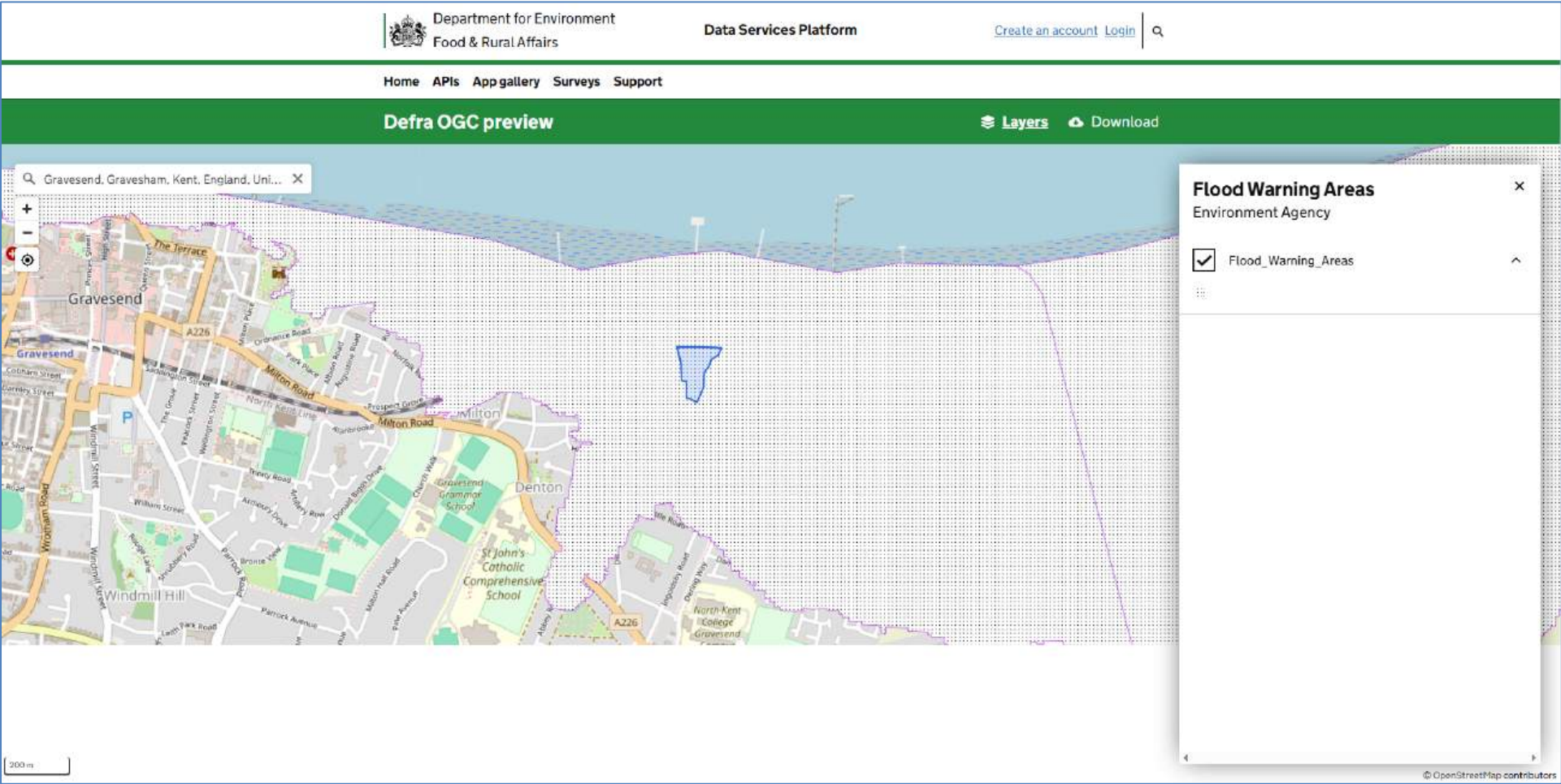
APPENDIX 1.U

Long Term Flood Risk	Event	Source
RESERVOIR (Extent of Flooding)	YEARLY CHANCE OF FLOODING (CURRENT DATE)	Environment Agency, Obtained 03.10.25 https://check-long-term-flood-risk.service.gov.uk/map#



APPENDIX 1.V

Map	Source
OGC MAP SHOWING EA FLOOD WARNING AREA AND SITE LOCATION	DEFRA, Obtained 18.07.25



Flood Response Plan

FRP/DW/0325

DERING INDUSTRIAL ESTATE, DERING WAY, GRAVESEND, KENT, DA12 2FP

BY JANINE MUSTAFA, LANGLEYS CHARTERED SURVEYORS

DATED: 08.10.2025

1.0 Purpose

1.1 The purpose of this Plan is:

1. To provide a clear procedure for site users if the Environment Agency issues a flood warning for the Gravesend area, including the application site, and
2. to minimise risk of life, property, and the environment.

2.0 Flood Warning Service

2.1 The Environment Agency provides a free flood warning service for this area. The relevant warning areas include the Lower Thames and North Kent Marshes (Tidal) region.

Table 1 Flood Alert Levels and Action Requirements

Type of Alert	Meaning	Action Required
Flood Alert	Flooding is possible – be prepared	Monitor EA updates and review readiness to suspend operations. Check that vehicles and containers can be relocated to a location outside of the flood plain, or to higher ground within the site.
Flood Warning	Flooding is expected – immediate action required	Cease operations. Implement evacuation and secure hazardous materials.
Severe Flood Warning	Severe flooding, danger to life	Evacuate immediately. Contact Emergency Services if assistance is needed.
All Clear	Flood warnings no longer in force	Return to site only when declared safe by EA.

2.2 To register the following link and telephone service may be used:

www.gov.uk/sign-up-for-flood-warnings

Floodline: 0345 988 1188

3.0

Flood Response Responsibilities

3.1

The following roles and responsibilities will be allocated:

Table 2

Roles and Responsibilities

Role	Responsibilities (short list)
Site Manager / Lead Tenant	- Maintain the flood response plan - Organisation and coordination of flood procedures; - Register to EA Flood Warning Service; - coordinate evacuations; - Reviewing the FMP and FRP; - Site safety procedures in the event of a flood; - Hold a set of keys for both main gates so that they may be locked by this individual in the event of a Flood Warning.
Tenants / Occupiers	- Maintain updated emergency contact details; - Ensure staff are familiar with flood procedures; - Relocate vehicles and equipment when warnings are issued; - Maintain FRA signage.
Contractors / Visitors	- Comply with instructions from the Site Manager; - Leave the site promptly upon notification of a flood warning.

3.2

Prime responsibilities lie with the **Site Manager/Lead Tenant**, who will be named in the Flood Response Plan Responsibility Statement (Page 7). They will be responsible for the following tasks:

1.

Registering the site with EA’s flood warning service;

2. Maintain the FRA and FMP, including the availability of at least one hard copy in a secure location at the site that is known by the tenants of each rented plot;
3. Organising and communicating flood procedures (including evacuation procedures to site tenants);
4. Routinely reviewing the FMP in accordance with the Review Sheet provided on page 7 and initiating any necessary amendments to it;
5. Ensuring that all necessary equipment is available and installed on site in accordance with the FRA (e.g. container ground anchors; bunded containers for hazardous materials, etc.);
6. On receipt of a Flood Warning, communicating with all tenants to evacuate the site within 30 minutes of a flood warning being received;
7. Visit the site within 1 hour of the flood warning being received and:
 - a. check that all plot gates have been closed
 - b. check that the site has been fully evacuated. If not, ensure that all persons leave the site immediately via the main gates on Dering Way.
 - c. Lock the main gates to prevent re-entry and then leave the site;
 - d. Do not return to the site until the All Clear has been issued by the Environment Agency.

3.3 The **managers of each plot** will be responsible for the following tasks once a flood warning is communicated to them:

1. Cease all loading/unloading and vehicle movements;
2. Shut down electrical equipment and secure any fuel storage within bunded containers;

- 3. Move vehicles, plant, and portable materials to higher ground or the access road, or outside of the flood zone if possible/safe to do so.
- 4. Ensure that all persons leave the site immediately via the main gates on Dering Way.
- 5. Close plot gate to prevent re-entry.
- 6. Confirm all staff are accounted for, or that their plot is completely empty before leaving. Once safely evacuated, communicate this to the Site Manager/Lead Tenant.
- 7. Do not return to the site until the Environment Agency issues an All Clear, communicated via the Site Manager/Lead Tenant.

5.0 Emergency Contacts

5.1 The following emergency contacts should be referred to:

Table 3 Emergency contacts for flood events

Organisation	Contact	Purpose
Environment Agency Floodline	0345 988 1188	Flood warnings and advice
Emergency Services	999	Life-threatening emergencies
Gravesham Borough Council	01474 564422	Local flood response coordination
Langleys Chartered Surveyors	0208 298 1707	Information regarding this document
Utility Providers	Refer to site contracts	Disconnection of power/gas/water if required

2. Storage of Plan and Training

- 6.1 At least one copy of this Flood Response Plan must be kept in a secure location on each Plot in addition to the Site Manager's own copy. Each tenant must also keep an electronic copy of this document in a digital location that is may be accessed quickly and easily.
- 6.2 All staff members working at the site should receive annual familiarisation training.
- 6.3 Flood signage must remain legible and in place at all site entrances. This will be the responsibility of the tenants.

7.0 Review

- 7.1 This plan should be reviewed annually or following any major changes to the site layout, occupancy or Environment Agency flood warning procedure.

8.0 Further information

- 8.1 Should you find this document to be insufficient or require further information, please contact Janine Mustafa of this office at you earliest convenience.

janine@langleyscs.co.uk / 0208 298 1707

Flood Management Plan Responsibility Statement

Flood Management Plan Responsibility Statement

The **Site Manager** or **Lead Tenant** is responsible for the regular:

- 1. Registering the site with Environment Agency’s Flood Warning Service;
- 2. Maintenance of this hard copy of the FMP;
- 3. Organising and coordinating flood procedures with and to all tenants and staff members at Dering Industrial Estate;
- 4. Routinely managing evacuations in accordance with, and recording them in the Flood Warning Record Sheet;
- 5. Routinely reviewing the FMP and FRA and initiating any necessary amendments to them;
- 6. Ensuring that all necessary equipment is available and installed on site in accordance with the FRA and check on an annual basis, recording defects;

If the Site Manager or Lead Tenant is unable to enact these duties they should be carried out by a **reliable full time staff member** that is based at the site.

Declarations

I, _____
(the Site Manager or Lead Tenant
– delete as appropriate)
acknowledge the above
responsibilities.

Signed: _____

Dated: _____

I, _____
will carry out the above
responsibilities if this person is
unable to do so.

Signed: _____

Dated: _____

Plot: _____

Job Title: _____

Flood Warning Record Sheet

FLOOD WARNING RECEIVED			
Warning Level	Date	Time	By (Name)
			Print: _____ Sign: _____
EVACUATION PROCEDURE			
Timestamp and sign below once the following actions have been enacted.			
<i>Note: EA Tidal flood warnings are <u>normally</u> issued 3-12 hours before flooding is expected.</i>			
Action		Time	Signature
Within 30 minutes of Flood Warning being received, communicate warning and procedure to site tenants. Log all dialogue.	Plot A Tenant		
	Plot B Tenant		
	Plot C Tenant		
	Plot D Tenant		
	Plot E Tenant		
Within 1 hour of Flood Warning being received, check evacuation and lock up the site:	Ensure that the site has been fully evacuated.		
	Ensure that all gates on site are shut.		
	Ensure that the main gates are shut and locked.		

Continues overleaf.

P.T.O

Flood Warning Record Sheet

ALL CLEAR PROCEDURE			
Timestamp and sign below once the following actions have been enacted.			
Action		Time	Signature
1. Liaise with the Environment Agency Floodline (0345 988 1188) and confirm whether flooding was recorded in the site's grid cell or catchment. Log all dialogue.			
2. Liaise with Kent County Council (03000 41 81 81, or via email: floodandwatermanagement@kent.gov.uk) to check for any recorded surface water or drain flooding reports within the site or vicinity. Log all dialogue.			
3. Check condition of the site from a safe vantage point, ideally via CCTV (if installed).			
4. If safe, communicate to all tenants that the site may be re-entered. Unlock main gates if necessary.	Plot A Tenant		
	Plot B Tenant		
	Plot C Tenant		
	Plot D Tenant		
	Plot E Tenant		

END.

EA Product-6 Outputs — Site-Footprint Analysis

Site: Dering Industrial Estate, Dering Way, Gravesend, Kent, DA12 2FP

Data source: Environment Agency Product-6 (GeoTIFF grids), received August 2025

Data provided under Environment Agency Conditional Licence.

Site polygon approximated from layout plan (DRAW/DW/0325/001).

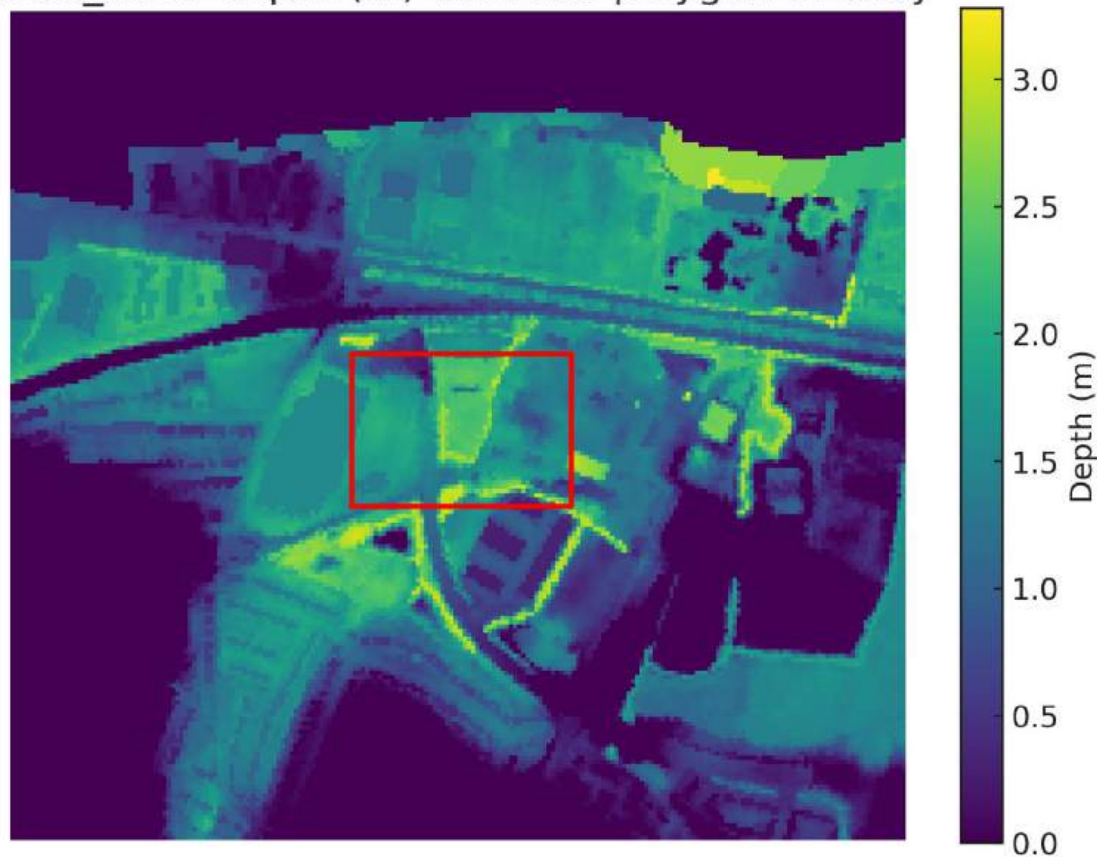
A1. Site-wide statistics (site polygon approximation)

Scenario	Mean depth (m)	Max depth (m)	Mean velocity (m/s)	Max hazard (Z)	Sample cells
2005/1000	1.727	3.038	0.612	3.590	1961
2005/200	1.489	2.800	0.562	3.330	1961
2115/1000	2.129	3.438	0.584	3.770	1961
2115/200	2.045	3.355	0.564	3.670	1961

A2. Maps (Site polygon overlay)

2005_1000_depth_map_sitepoly.png

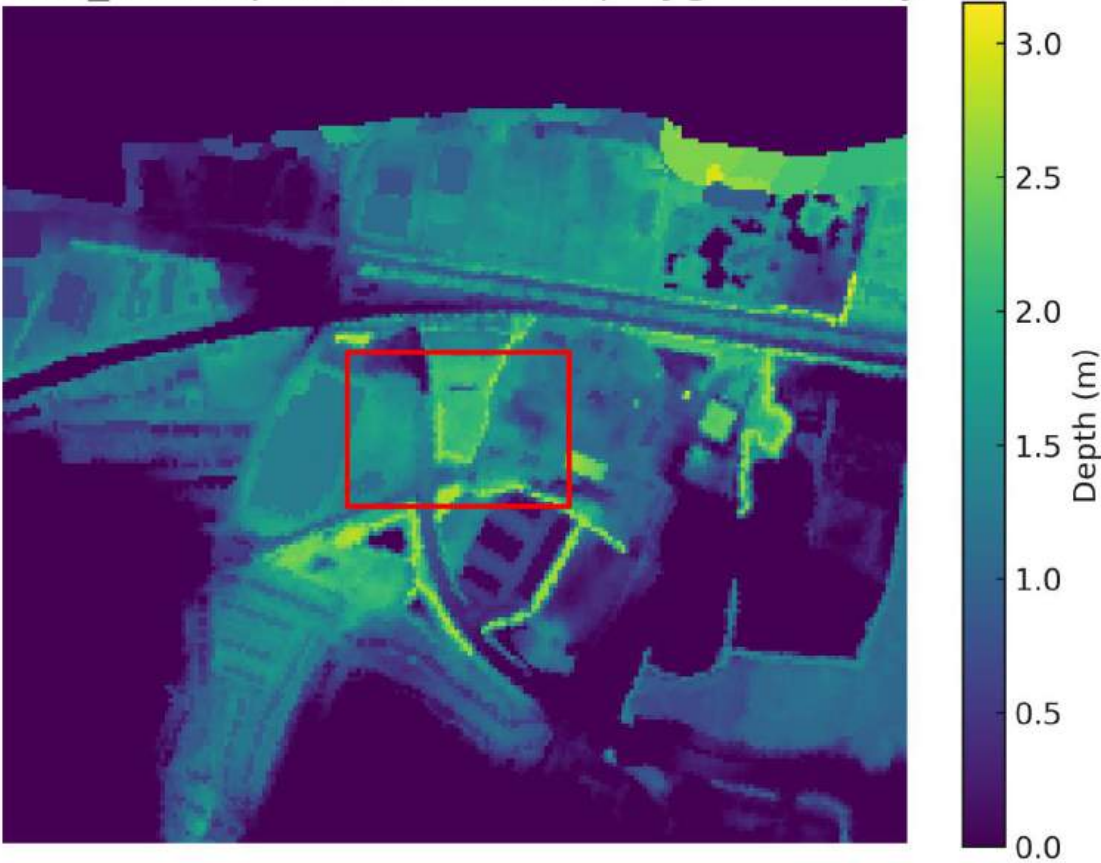
2005_1000 depth (m) with site polygon overlay



Site polygon shown in red. Source: Environment Agency Product-6 GeoTIFFs.

2005_200_depth_map_sitepoly.png

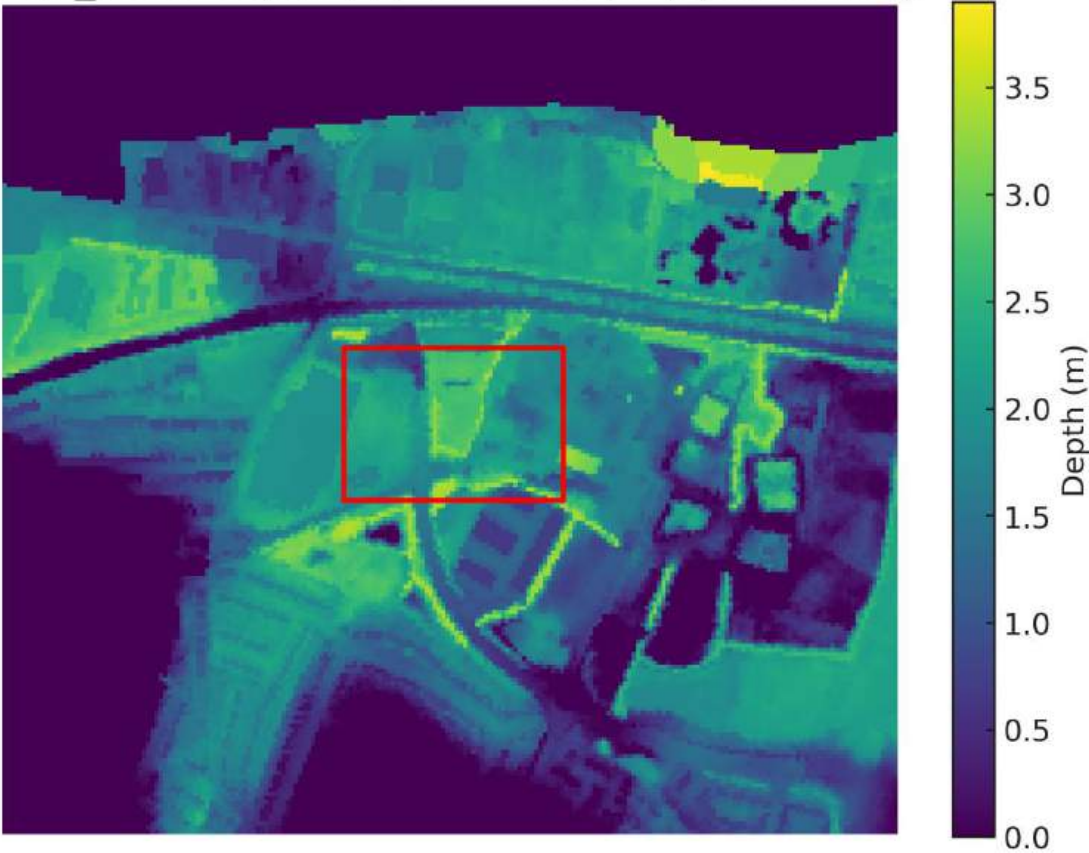
2005_200 depth (m) with site polygon overlay



Site polygon shown in red. Source: Environment Agency Product-6 GeoTIFFs.

2115_1000_depth_map_sitepoly.png

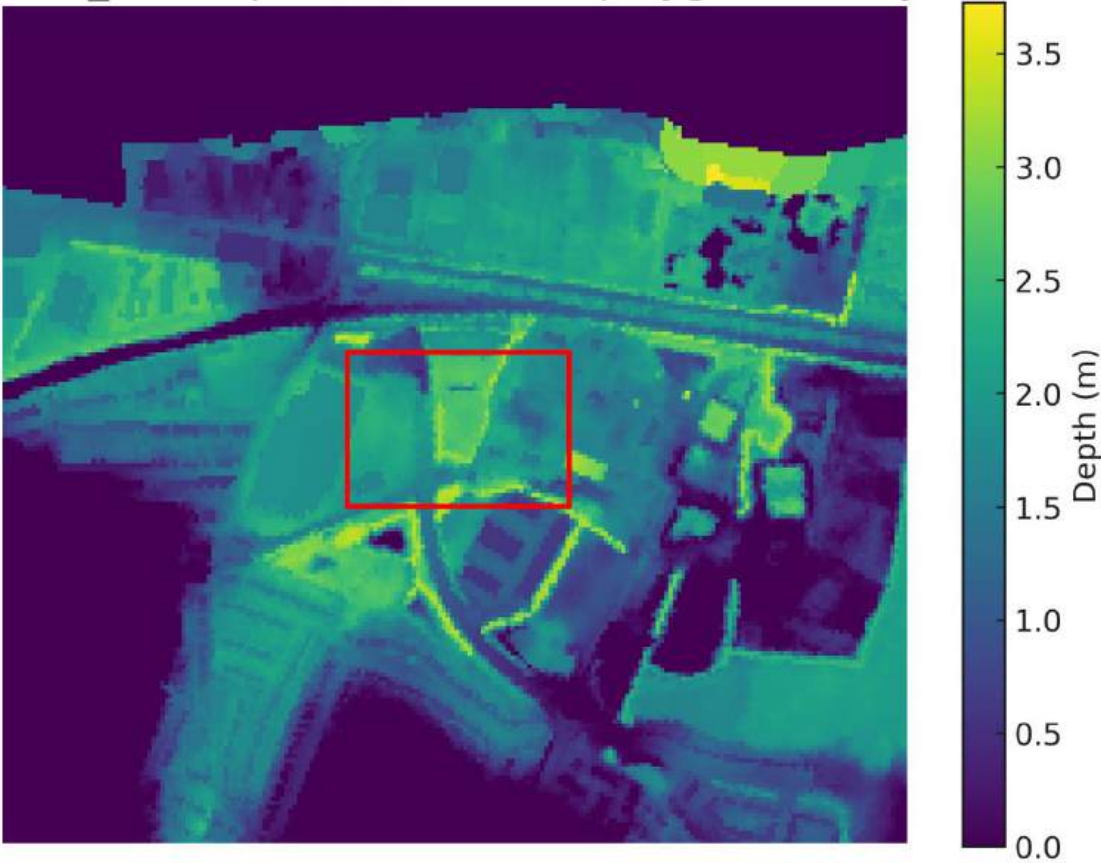
2115_1000 depth (m) with site polygon overlay



Site polygon shown in red. Source: Environment Agency Product-6 GeoTIFFs.

2115_200_depth_map_sitepoly.png

2115_200 depth (m) with site polygon overlay



Site polygon shown in red. Source: Environment Agency Product-6 GeoTIFFs.

A3. Comparison and interpretation

Mean Depths and Epoch Comparison

- 2005 0.5% AEP (2005_200): mean depth = 1.489 m
- 2115 0.5% AEP (2115_200): mean depth = 2.045 m
- Change (2115_200 - 2005_200): 0.556 m

Interpretation:

The EA Product-6 outputs indicate the site is modelled to be significantly inundated during the modelled tidal events.

Mean and maximum depths across the site polygon are presented above and should be used to inform finished floor levels, safe access and egress assessments and emergency planning.

Peak velocities and hazard indices are also provided to indicate areas where pedestrian risk may be elevated during extreme events.

Please Note This drawing has been supplied to supersede approved drawing DRAW/DW/0216/PLP (Proposed Layout Plan) of consent 20160114.

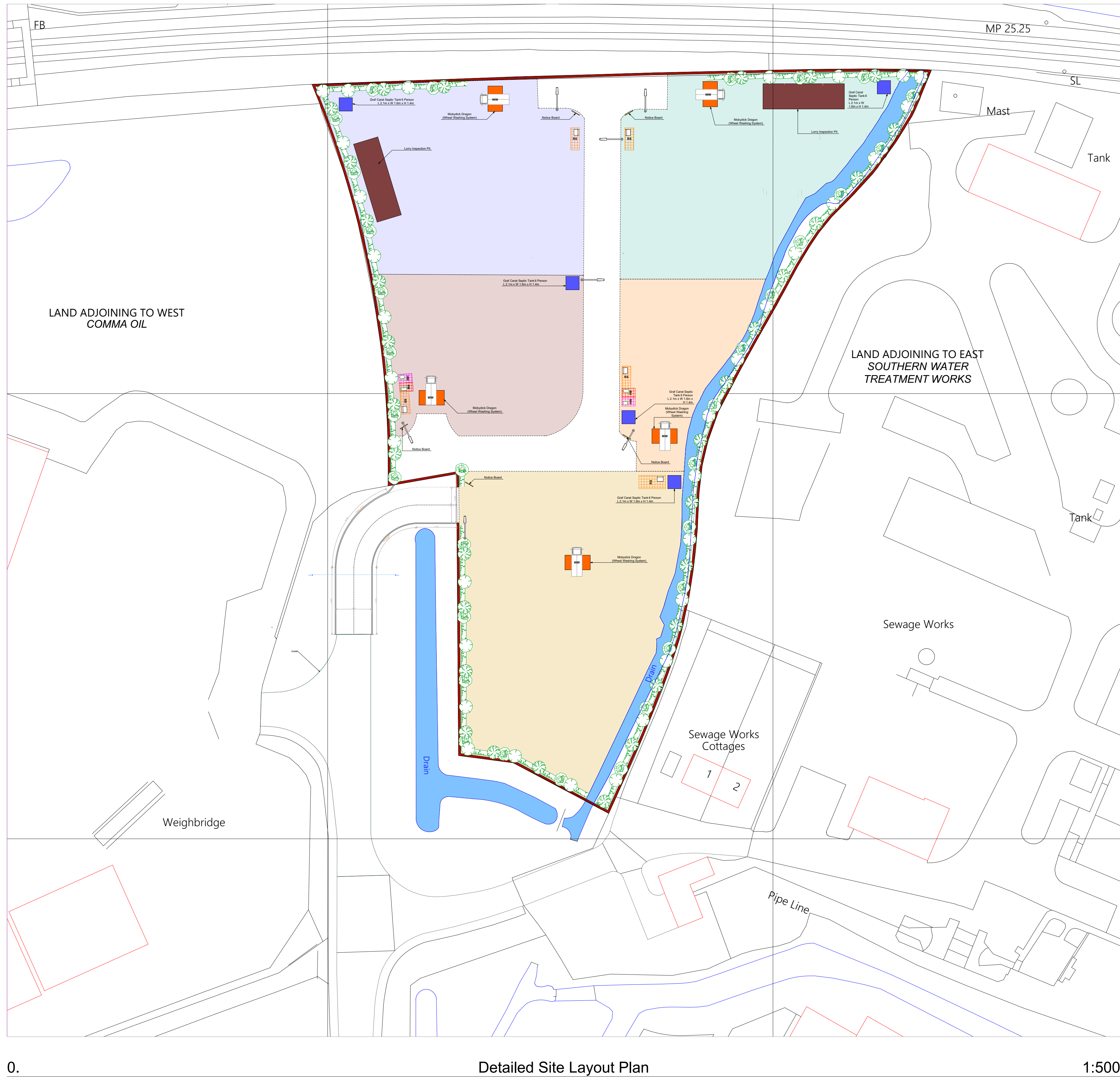
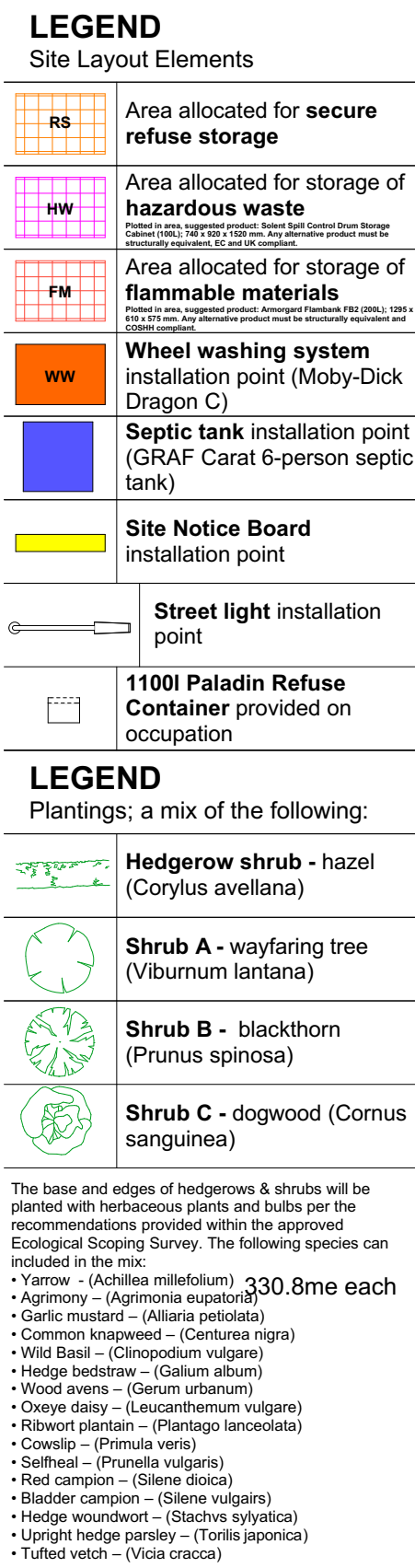


0. Proposed Site Layout Plan 1:500



LANGLEY HOUSE, 249 BROADWAY, BEXLEYHEATH, KENT DA6 8DB	Site Address Dering Industrial Estate, Dering Way, Gravesend, Kent, DA12 2FP Formerly: 'Land between Comma Oil and Southern Water Treatment Works, Dering Way Gravesend, Gravesham'	Drawing Type PLANNING	Proposal Application under S.73 of the Town and Country Planning Act 1990 to vary condition 2 (Approved Plans) of planning permission 20160114 to allow for the retrospective variation of the plot layout.	Drawing Description Proposed Site Layout Plan	Revision Number 2	For the Client: Cowland Ltd.	NOTES 1. All measurements taken by this office on the following dates: MAY 2024: External site survey (by H. MUSTAMANNICK-ACI A&L). 2. Measurements of neighbouring buildings, where these have been found to be relevant for decisions. None have been found to be publicly accessible drawings submitted to the Local Planning Authority within the past 10 years. These drawings were printed to scale and dimensioned by hand using a scale bar before being to others. In these instances, structural details are representational rather than exact. 3. Where it is to be noted and to the requirements and satisfaction of the Local Authority. These drawings are for planning purposes only. 4. Responsibility is not accepted for errors made by others in scaling from this drawing. All construction information should be cross checked on the site. 5. All discrepancies and change of design requests by authorities should be reported to the surveyor immediately. 6. All drawings to be read in conjunction with the proper specifications with all notes printed out in accordance with the latest British Standards and codes of practice. Planning drawings are not to be used for the purpose of building & installation regulations. 7. It is assumed that all works will be carried out by a competent contractor working, where applicable, to an approved method statement. 8. It is the contractor's responsibility to notify the Building Control and get approval before any work commences. 9. It is the contractor's responsibility to determine if any wall is load bearing. 10. The copyright of this drawing belongs to Langley's Chartered Surveyors Ltd.
Drawn By: Janine R. Mustafa BSc Hons janine@langleyscs.co.uk	Project Reference DRAW / DW / 0325	Drawing Reference DRAW / DW / 0325 / 001 / R2		Scale 1:500 @ A1 As specified below each drawing	Date 27 / 02 / 2025	Revision Date 11 / 12 / 2025	
						Local Authority Gravesham Borough Council	

Please Note This drawing has been supplied to supersede approved drawing DRAW/DW/0216/DET (Detailed Proposed Site Plan) of consent 20160114.



WW - Wheel Washing Systems

Moby-Dick Dragon Wheel Washing System
<https://www.mobydick.com/gb/wheel-washing/tailormade-line/dragon-2/>
<https://3.imimg.com/data3/BV/XY/MY/-14578254/mobydick-dragon-wheel-washing-systems.pdf>
 The following system is proposed to be installed on each plot prior to their tenancy, providing that there is a requirement for such a system by virtue of the nature of that occupancy.

Note: I am advised that the current occupiers of Plots A and B (Storage Cow Limited and Optimus Limited) do not require the installation of a wheel washing system as these are fairly "clean" by nature being scaffold and general storage yards. Neither operation gives rise to dust or muck accumulation within their plots. Neither do their current operations require provision of flammable or hazardous waste storage areas. The position of wheelwashing systems and specialist waste storage areas on these plots as shown in the drawing are sited in the best position for future occupiers that may require such installations and should therefore be used to inform the layout of them for future tenants per their own requirements and business structure.

MayDick Dragon

MayDick Dragon

Ready for operation in 2 hours:

44 per pending No. PCT/CH03056035

The Wheelwashing System for lighter soiling of the truck wheels

Description of operation:
The MayDick Dragon is a compact, efficient Wheel Washing System for operation on intermediate axle and low axle, and for anything appropriate for the vehicle. It is suitable for permanent or mobile applications and can be used at any location, where the degree of back wheel soiling is not too heavy or where there are dust control issues.

- Ready for operation in 2 hours
- Water usage 320 cm³ ± 1% complete revolution
- Integrated water recycling

The operating truck enters the wash cycle automatically as a trailer drive.

The wheels are washed incrementally both from the sides and underneath as the truck drives slowly through.

The water sprays from across the "wings" of the Dragon back to the recycling tank where it is treated ready for the next truck.

0106

Spraying unit for all wheel sizes

0107

Spraying gun for heavy-duty cleaning

0108

Rolling wheel for heavy-duty cleaning

0109

Rolling wheel for heavy-duty cleaning

Assembly Plan:

Weight:

without SC = 2300 kg

with SC = 2700 kg

Consent bearing

with the frame

Weighting

MayDick Control

and the frame

without SC 1.5 G W

with SC 1.5 G W

with SC 1.5 G W

with SC 1.5 G W

with SC 1.5 G W

Footprint/docking system:

MayDick Control (optional)

Consent bearing

with the frame

Weighting

MayDick Control

and the frame

without SC 1.5 G W

with SC 1.5 G W

with SC 1.5 G W

with SC 1.5 G W

with SC 1.5 G W

with SC 1.5 G W

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info@maydick.ch
www.maydick.ch

Right reserved without notice

Right reserved without notice

Septic Tanks

Graf Carat 6-person Septic Tank
<https://www.grafuk.co.uk/product/carat-septic-tank/>
 The following system is proposed to be installed on each plot prior to their tenancy, providing that there is a requirement for such a system by virtue of the nature of that occupancy.

[illegible]

1100 litre Wheeled Paladin Bin with roll top lid

Plastor 1100l Paladin
<https://www.plastor.co.uk/waste-and-recycling-bins/large-wheeled-bins/1100-litre-wheeled-bin-with-4-wheels-and-roll-top-lid/>



Each plot will be provided with one of these refuse containers in the allocated position prior to their tenancy.

100 LITRE WHEELED BIN WITH 4 WHEELS AND ROLL TOP LID

100 LITRES

RAW RESIDUES

These 4 wheeled large bins with roll top lid design, are ideal for the collection of raw refuse and garden waste and compacted household refuse suitable for most applications. Roll top lid contains home or bulky waste.

Product Details: 2 years warranty on 3 years bin

- Dimensions: 1400 x 600 x 1000mm
- Capacity: 100 litres
- Load capacity: 500 kg
- Wheeling: 40 kg
- Material: 4000
- Colours: Green, grey, red and white
- Features: 200mm casters with reinforced wheel housing
- Compostable: No, Recycled: 80%
- Life: 10 years, maintenance-free spring mechanism for opening lid
- Use: Use automatically releases the spring pressure after closing. Prevents sudden lid opening and damage to contents
- Ergonomic handles on the sides
- Reinforced construction
- Water asymmetrical tensioning system
- 20mm connector with horizontal sliding
- Centrally positioned wheel axle using
- Smooth surface for easy manoeuvring
- Can be emptied from rear and loading vehicle using crane and trolley system

Quantity per pallet: 10 to 13000 from which we can give you a pallet for delivery

[illegible]



0. Surface Water Dispersal Plan 1:500



LANGLEY HOUSE, 249 BROADWAY,
BEXLEYHEATH, KENT DA6 8DB

Drawn By: Janine R. Mustafa BSc Hons
janine@langleyscs.co.uk

Site Address
**Dering Industrial Estate, Dering Way, Gravesend,
Kent, DA12 2FP**
Formerly: 'Land between Comus Oil and Southern Water Treatment Works, Dering Way
Gravesend, Gravesham'

Project Reference
DRAW / DW / 0325

Drawing Type
PLANNING

Drawing Reference
DRAW / DW / 0325 / 003 / R2

Proposal
**Application under S.73 of the Town and Country
Planning Act 1990 to vary condition 2 (Approved
Plans) of planning permission 20160114 to allow
for the retrospective variation of the plot layout.**

Drawing Description
Proposed Surface Water Management Plan

Scale
1:100 / 1:500 @ A1
As specified below each drawing

Date
03 / 03 / 2025

Revision Number
2

Revision Date
11 / 12 / 2025

For the Client:
Cowland Ltd.

Local Authority
Gravesham Borough Council

NOTES

1. The requirements taken by this office on the following dates: MAY 2024: External site survey (by A. MUSTAFAS) 02/04/24.
2. Measurements of neighbouring buildings, where these have been found to be relevant for drainage, have been taken from publicly accessible drawings submitted to the Local Planning Authority within the past 10 years. These drawings were printed to scale and dimensioned by hand using a scale bar before being drawn. In these instances, structural details are representative rather than exact.
3. Where it is the client's or the requirements and consultation of the Local Authority. These drawings are for planning purposes only.
4. Responsibility is not accepted for errors made by others in reading from this drawing. All construction information should be cross checked on the site.
5. All discrepancies and change of design requests by authorities should be reported to the surveyor immediately.
6. All drawings to be used in conjunction with the proper specification with all relevant contract works, where applicable, to be approved method statement.
7. It is assumed that all works will be carried out by a competent contractor working, where applicable, to the approved method statement.
8. It is the contractor's responsibility to notify the Building Control and get approval before any work commences.
9. It is the contractor's responsibility to determine if any wall is load bearing.
10. The copyright of this drawing belongs to Langley's Chartered Surveyors Ltd.

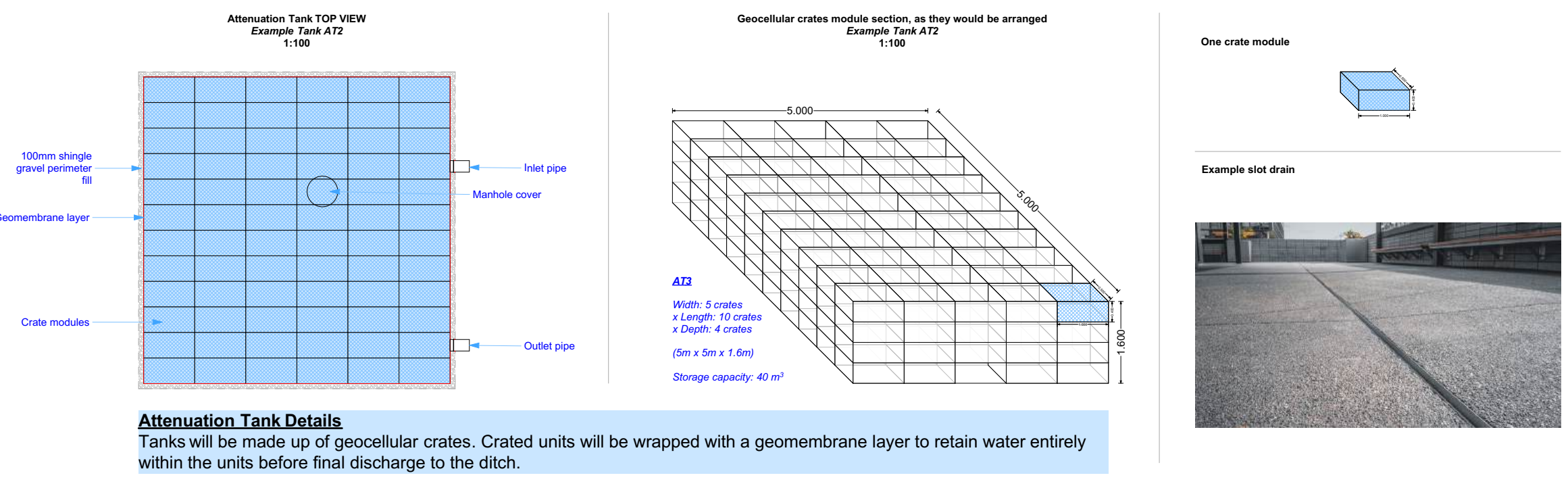
BOX A Site Drainage / SuDS Details (1:100)

Per the details approved under consent 20160114, all hardstanding, including roadways, will be surfaced with an impermeable material (proposed: Tarmac Toproc SY or similar). Comprehensive Surface Water Drainage details were confirmed under application 20180988 and proposed the attenuation of a calculated total of 430.7m³ surface water runoff in six attenuation tanks within the application site before discharging into the existing ditch that runs along the eastern boundary of the site. This remains appropriate for the site and has been adapted to the proposed layout. Per the approved Surface Water Drainage Strategy (3809 SWDS by Ambiental Ltd.) the following attenuation and treatment stages are proposed, with a full example sequence provided in Sections PS-A, PS-B and PS-C below.

STAGE 1: In-Plot Surface Water Management Proposals:
Surface water runoff will be directed to slot/channel drains via gently sloping hardsurfing. Runoff will first pass through a silt box and then a vortex separator before discharging into a geocellular attenuation tank (Tanks AT1-5). The outlet pipes from these will, again, be attached with a hydrobrake or similar water velocity limiting device, restricting flows to 0.9l/s.

STAGE 2: Central Attenuation:
Tanks AT1-5 will discharge to AT6, located attenuation in the shared access road. The outlet pipe from this will be attached with a hydrobrake or similar water velocity limiting device, restricting flows to 0.9l/s. Finally, runoff will pass through a high-performance filter including oil interceptor, such as the Hydro Up Flow.

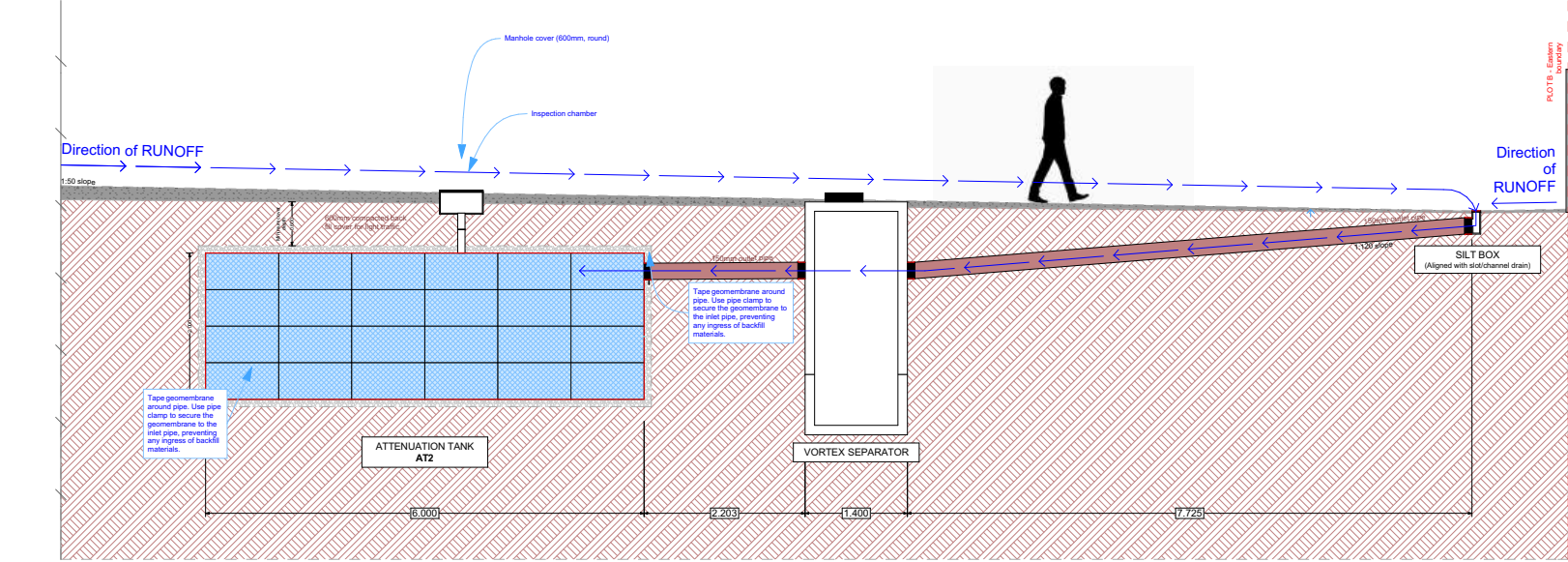
STAGE 3: Final Discharge:
Clean water will be discharged into the Eastern Ditch.



Section PS-A (1:100): Drainage connection 'Stage 1' at Plot B, showing:

- Runoff, directed toward the drain running along the eastern boundary of the plot via 1:50 sloping impermeable hardstanding;
- Runoff passes through in-drain silt box;
- Runoff enters Vortex Separator unit;
- Runoff discharges into Attenuation Tank (AT2).

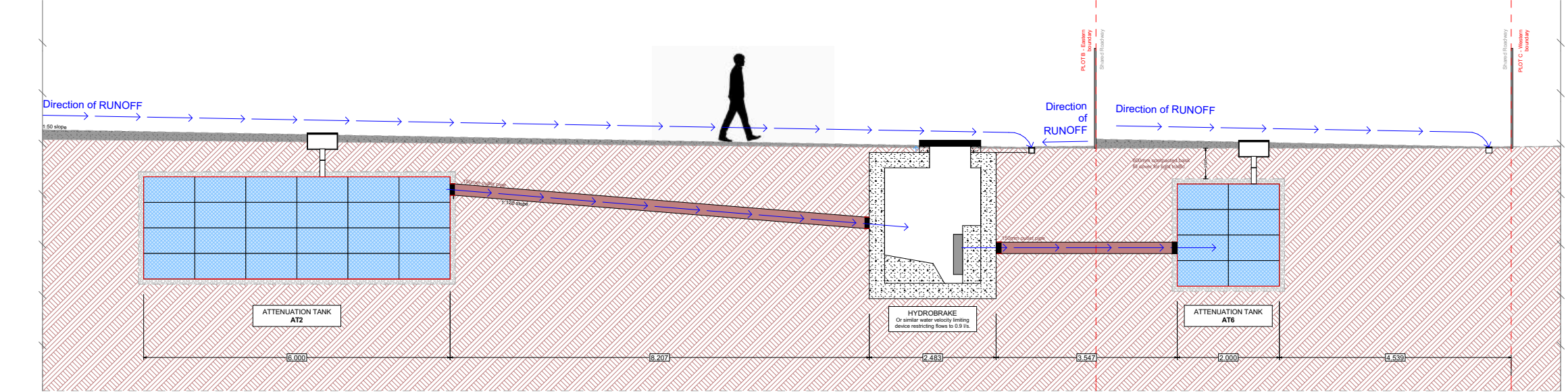
See Section PS-B to continue.



Section PS-B (1:100): Drainage connection 'Stages 1 & 2' at Plot B / the Shared Roadway, showing:

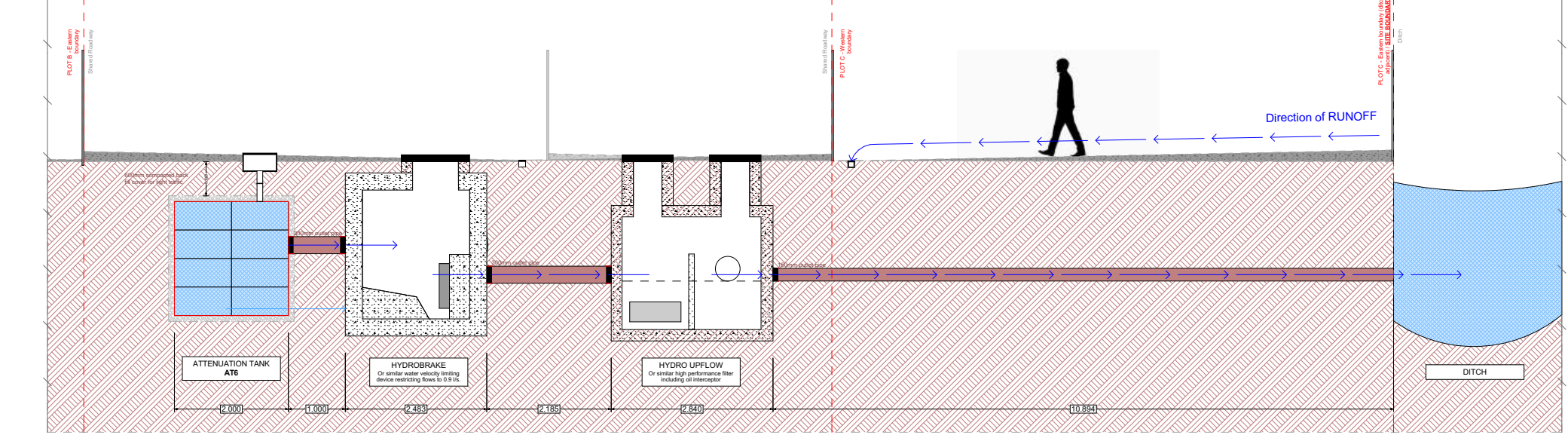
- Runoff discharges from AT2 via outlet pipe and then to a velocity limiting device such as the Hydrobrake;
- Water discharges into Tank AT6 at a controlled speed of 0.9l/s.

See Section PS-C to continue.



Section PS-C (1:100): Drainage connection 'Stages 2 & 3' from the Shared Roadway to the Eastern Ditch, showing:

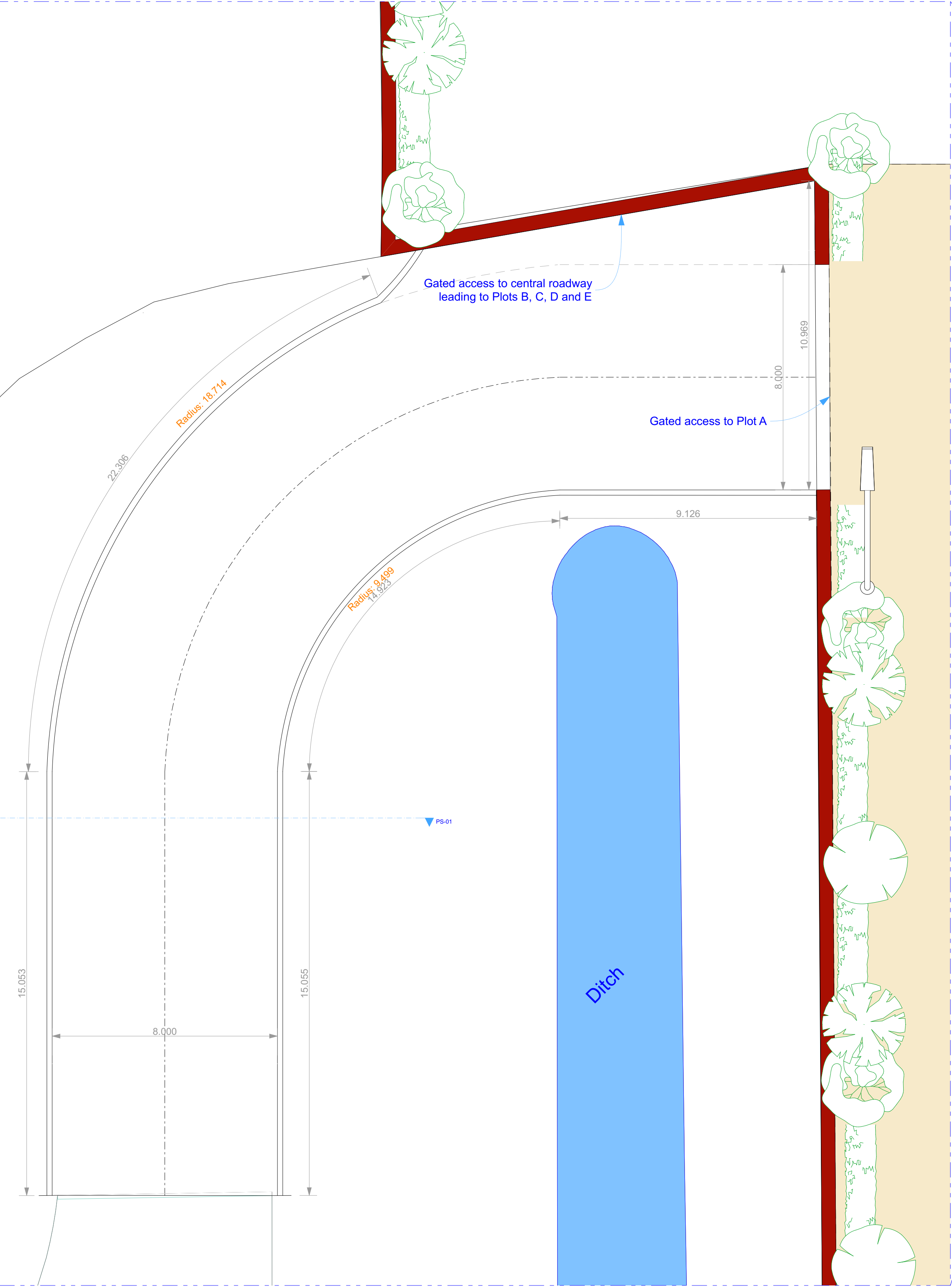
- Runoff discharges from AT6 via outlet pipe and then to a velocity limiting device such as the Hydrobrake;
- Water discharges into Tank AT6 at a controlled speed of 0.9l/s to a high performance filter including oil interceptor (such as the Hydro Up Flow - shown)
- Clean water is discharged into Eastern Ditch.



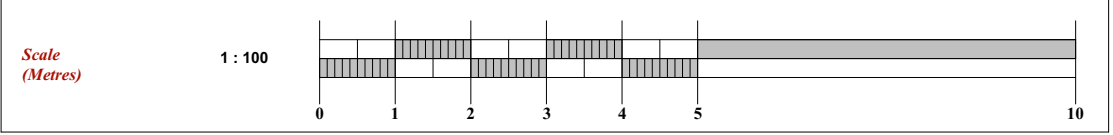
Please Note This drawing has been supplied to supersede approved drawings DRAW/DW/0216/SWDP (Surface Water Dispersal Plan) and Appendix D 'Proposed SuDS Measures' (Drawing) of the SuDS Strategy Report of consent 20160114 and corresponds with Drawings 3809-DR01 and 3809-DR02 supplied by Ambiental (Approved ref. 20180988)

Refer to Drawing 005 for further details.

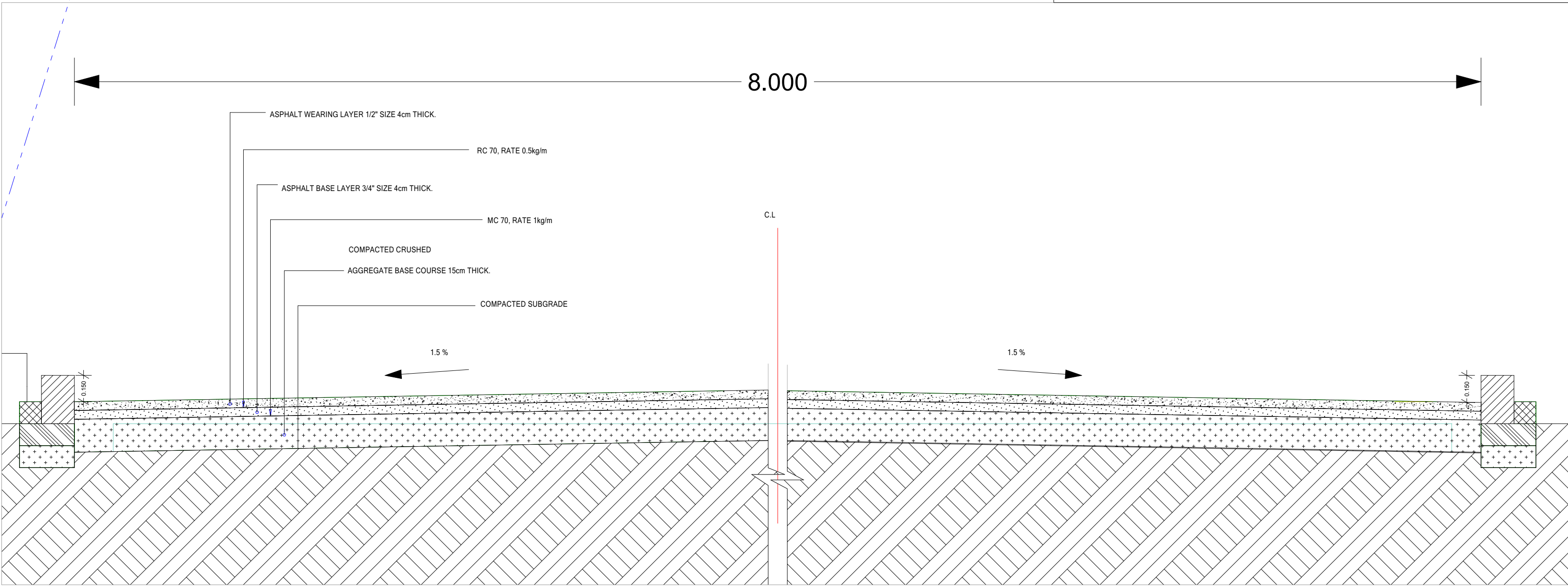
LEGEND Drainage	
	Direction of runoff waterflow (1 degree slope)
	Managed direction of runoff entering system
	Proposed new slot/channel drain
	New pipework (150 or 300mm as shown)
	Silt Box (in drain)
	Proposed new manhole to tanks
	Attenuation Tanks
	Vortex Separator
	Velocity Restrictor
	New pipework (150 or 300mm as shown)
	Proposed new manhole to tanks
	High-performance filter including oil interceptor



0. Access Road Detail Plan 1:100



0. Site Plan 1:1000



PS-01 Proposed Building Section - Access Road (as approved and built) (1) 1:20

Please Note This drawing has been supplied to supersede approved drawing DRAW/DW/0216/AR (Access Road Technical Drawing) of consent 20160114.



LANGLEY HOUSE, 249 BROADWAY, BEXLEYHEATH, KENT DA6 8DB	Site Address Dering Industrial Estate, Dering Way, Gravesend, Kent, DA12 2FP Formerly: 'Land between Comma Oil and Southern Water Treatment Works, Dering Way Gravesend, Gravesham'	Drawing Type PLANNING	Proposal Application under S.73 of the Town and Country Planning Act 1990 to vary condition 2 (Approved Plans) of planning permission 20160114 to allow for the retrospective variation of the plot layout.	Drawing Description Access Road Technical Drawing	Revision Number 2	For the Client: Cowland Ltd.	NOTES 1. The measurements taken by this office on the following dates: MAY 2024: External site survey (by V. KUSTANOVSKA-ACI) and 2. Measurements of neighbouring buildings, where these have been found to be relevant for planning. None have been found to be relevant for planning. 3. All drawings are to be prepared and to the requirements and specifications of the Local Authority. These drawings are for planning purposes only. 4. Responsibility is not accepted for errors made by others in reading from this drawing. All construction information should be cross checked on the site. 5. All discrepancies and change of design requests by authorities should be reported to the surveyor immediately. 6. All drawings are to be prepared in accordance with the proper specifications with all works carried out in accordance with the latest British Standards and codes of practice. Planning drawings are not to be used for the purpose of building & residential regulations. 7. It is assumed that all works will be carried out by a competent contractor working, where applicable, to an approved method statement. 8. It is the contractor's responsibility to determine if any wall is load bearing. 9. It is the contractor's responsibility to determine if any wall is load bearing. 10. The copyright of this drawing belongs to Langley's Chartered Surveyors Ltd.
Drawn By: Janine R. Mustafa BSc Hons janine@langleyscs.co.uk	Project Reference DRAW / DW / 0325	Drawing Reference DRAW / DW / 0325 / 004 / R2		Scale 1: 20 / 1:100 / 1:1000 @ A1 As specified below each drawing	Date 04 / 05 / 2025	Revision Date 11 / 12 / 2025	

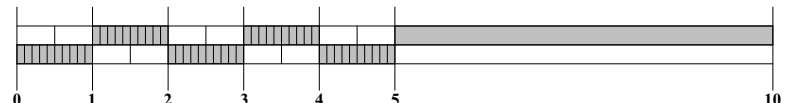
A large rectangular area with a blue grid pattern, labeled '23,000' on the left and '2,000' at the top. The grid consists of 23 columns and 1,000 rows, totaling 23,000 cells. The grid is bordered by a red line. The label '23,000' is positioned to the left of the grid, and the label '2,000' is positioned above the grid.

8,000

7,000

Figure 10: Typical detail of a wall and floor junction. The diagram shows a cross-section of a wall and floor assembly. The wall is 200mm thick and has a 600mm compacted backfill for light traffic. A 100mm thick concrete slab is shown above the wall. A blue arrow indicates the direction of traffic flow. The floor is 100mm thick and has a 600mm compacted backfill for light traffic. The wall is 200mm thick and has a 600mm compacted backfill for light traffic.

1 : 100



Adapted from approved drawing 3809-DR01

Tank Calculations															
Summary		Tank Dimensions									Cell Dimensions*				
		Width		Depth		Height		Capacity (m³)		Distribution of Attenuation across Site		Reflecting the Polymer core module (Polycon)			
Tank Ref		(m)	No. Crates	(m)	No. Crates	(m)	No. Crates	Minimum required	Allocated	Exceedance	North (Plot A-D)	179.2 m²	Width (m)	5	
Plot A	A71	8	8	8	16	1.6	4	113.9	115.7	1.3		26.5%	Depth (m)	0.8	
Plot B	A72	7	7	4	12	1.6	4	68.8	67.2	6.4		187.2 m²	Height (m)	0.7	
Plot C	A73	5	5	5	10	1.6	4	36.2	40.0	3.8		22.9%	Volume (m³)		
Plot D	A74	8	8	7	14	1.6	4	66.7	69.9	2.9	South (Plot A-F)	115.2 m²	Total storage volume required (m³) = Ambient-Lite, (factor to 20180660 - Surface Water Drainage Storage) + 5% uplift		
Plot E	A75	8	8	7	14	1.6	4	81.8	89.9	7.8		59.1%			
Plot A76	A76	2	2	23	46	1.6	4	73.2	73.6	0.4	East	73.8 m²			
								Totals	425.5	476.2	22.7		17.0%	462.6 m³	
Attenuation Tank Storage Details (Deriving Vapour)		Attenuation Tank Details							Distribution of Attenuation across Site						
Tank Ref		Plot Area (Programmed)		Tank Capacity		North (Plot A-D)		Middle (Plot B-C)		South (Plot A-F)		East			
		m²	%	m³	%	m²	%	m²	%	m²	%	m²	%		
Plot A	A71	2962.69	26.3%	113.92	26.3%	113.92		26.3%							
Plot B	A72	1576.96	14.1%	68.84	14.1%			96.84		22.5%					
Plot C	A73	942.90	8.4%	36.20	8.4%										
Plot D	A74	2295.96	20.1%	66.68	20.1%					168.51		39.1%			
Plot E	A75	2129.91	19.0%	81.62	19.0%							73.22	17.0%		
Plot F	A76	1326.90	12.0%	73.22	17.0%							73.22	17.0%		
Total		11227.66	100.0%	452.56	100.0%	113.92		26.3%		96.84		22.5%			
										Site Area, not including dike		11196.00		100.0%	
										Total Attenuation Volume required across whole of site (Ambient-Lite)		433.70		516.0%	
										Plus five per cent uplift		492.24		105.9%	
Design Detail		Attenuation Tank Details							Cell Dimensions*						
Tank Capacity		Minimum No. Cell Units Required**		Tank Dimensions											
		No. Reserved		Depth											
Tank Ref		m²	%	No.	Width	Calc.	RoundUp	Height							
Plot A	A71	113.92	26.5%	099.69	578	8	1.6	1.6							
Plot B	A72	68.84	16.1%	263.22	391	6	1.6	1.6							
Plot C	A73	36.20	8.4%	181.08	281	5	1.6	1.6							
Plot D	A74	66.69	20.1%	432.45	434	6	1.6	1.6							
Plot E	A75	81.62	20.0%	620.86	499	6	1.6	1.6							
Plot F	A76	73.22	17.0%	366.19	366	2	1.6	1.6							
Total		452.50	100.0%												

* Dimensions based on the Polymer core module by Polycon



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Project: Surface Water Drainage Strategy (SWDS)
Prepared for: Mr B Cowland
Reference: 3809 SWDS
Date: June 2018
Version: Final v1.0

Document Issue Record

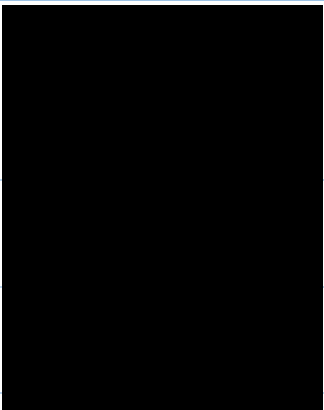
Project: Surface Water Drainage Strategy (SWDS)

Prepared for: Mr B Cowland

Reference: 3809 SWDS

Site Location: The proposal site is the land between the Comma Oil and Treatment works, Gravesend, Kent, DA12 2QX

Proposed Development: The proposal consists of an area of land, for change of use to Use Class B8 Storage and Distribution together with formation of new access road.

Consultant		Date	Signature
Author	Erfan Ahmad Bojidar Boiadjiev	19/06/2018	
Document Check	Thea Powell	19/06/2018	
Authorisation	Mark Naumann	20/06/2018	

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1. Introduction

- 1.1 Ambiental have been appointed to provide the Surface Water Drainage Strategy (SWDS), in respect of a planning application for the proposed development at the land between the Comma Oil and Treatment works Gravesend, Kent DA12 2QX. See Figure 1 below.

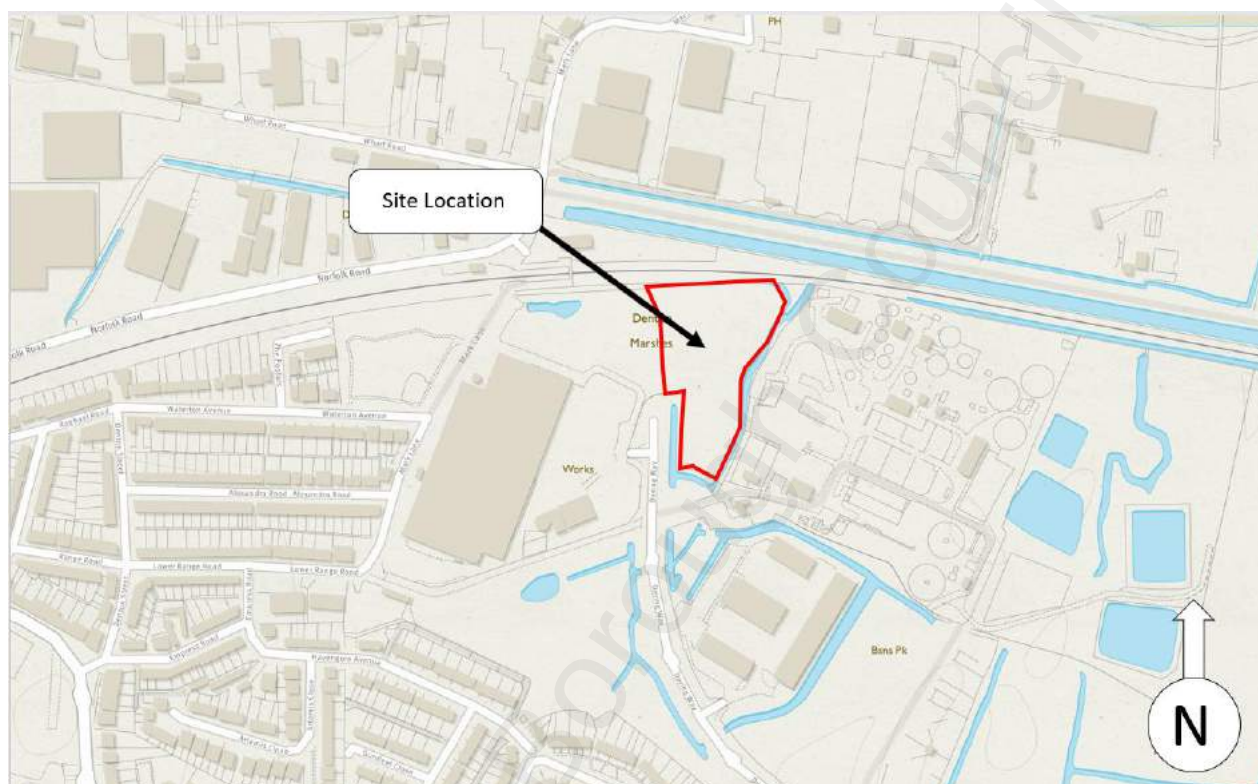


Figure 1: Site Location (Source: OS)

Development Proposal

- 1.2 The total area of the site is approximately 12100m² (1.210ha). The existing site contains 3340m² (0.334ha) of shingle which is assumed to be impermeable and 8760m² (0.876ha) of grass cover.
- 1.3 The proposed consists of change of use to class B8 storage and distribution together with formation of new access road. This drainage strategy considers the site without the proposed new access road in compliance with condition 11 of the planning notice. This study is based on the plans provided see Appendix 1.

Need for Study

- 1.4 The purpose of this assessment is to demonstrate that the development proposal outlined above can be satisfactorily accommodated without worsening flood risk for the area and without placing the development itself at risk of flooding, as per National guidance provided within the National Planning Policy Framework (NPPF) and the Gravesham Borough Council Guidance in their role as Lead Local Flood Authority (LLFA).

2. Development Description and Site Area

- 2.1 The proposed development site consists of the land between the Comma Oil and Treatment works Gravesend, Kent DA12 2QX. The existing site contains 3340m² (0.334ha) of shingle which is assumed to be impermeable and 8760m² (0.876ha) of grass cover. See Figure 2 below.



Figure 2: Wider Location Map. (Source: Google Earth)

- 2.2 In accordance with the proposed development drawing, Figure 3, the proposed development site will cause impermeable areas to increase post-development, this means the surface runoff will be increased as a result of the proposed development.
- 2.3 The proposed consists of change of use to class B8 storage and distribution together with formation of new access road. This drainage strategy considers the site without the proposed new access road in compliance with condition 11 of the planning notice. This study is based on the plans provided see Appendix 1.
- 2.4 A railway line bounds the site to the north with commercial property to the north of this. East of the site is a water treatment plant and to the west the Comma Oil commercial property.
- 2.5 The client has provided a topographic survey of the site dated c. 2004. Approximate topographic levels of the site are shown to range between 2.28mAOD to 3.60mAOD. A general fall to the south is observed. There is a ditch around the east and to part of the south of the site. See proposed and existing layout plans in Appendix 1.



Figure 3: Proposed plan layout of the site

- 2.6 Based on plans provided, the impermeable area will increase by approximately 8760m² (0.876ha) post development.
- 2.7 The proposed development is increasing impermeable areas on site, and therefore the additional runoff generated from the site will need to be managed through the incorporation of SuDS into the development proposals.

Existing Drainage Infrastructure and Nearby Watercourses

- 2.8 The existing site appears to be shingle and grass greenfield. The site is undeveloped and information regarding the location of existing drainage infrastructure close to the site has not been provided to Ambiental at the time of writing.
- 2.9 There are existing surface water ditches to the south and east of the site and these are proposed to be utilised for discharge of surface water as defined in this drainage strategy.

Existing Ground Conditions

- 2.10 The site's bedrock geology has been identified by the British Geological Survey's public mapping model as the Lewes Nodular chalk formation, Seaford chalk formation and Newhaven chalk Formation (undifferentiated) - Chalk.
- 2.11 Furthermore, the Superficial deposit records has been held by the BGS public mapping and has shown as alluvium - clay, silt, sand and peat.

2.12 Soil infiltration tests have not been provided at the time of writing of the report. As such the closest BGS boreholes to the site have been selected to assess the soil conditions, see Figure 4.

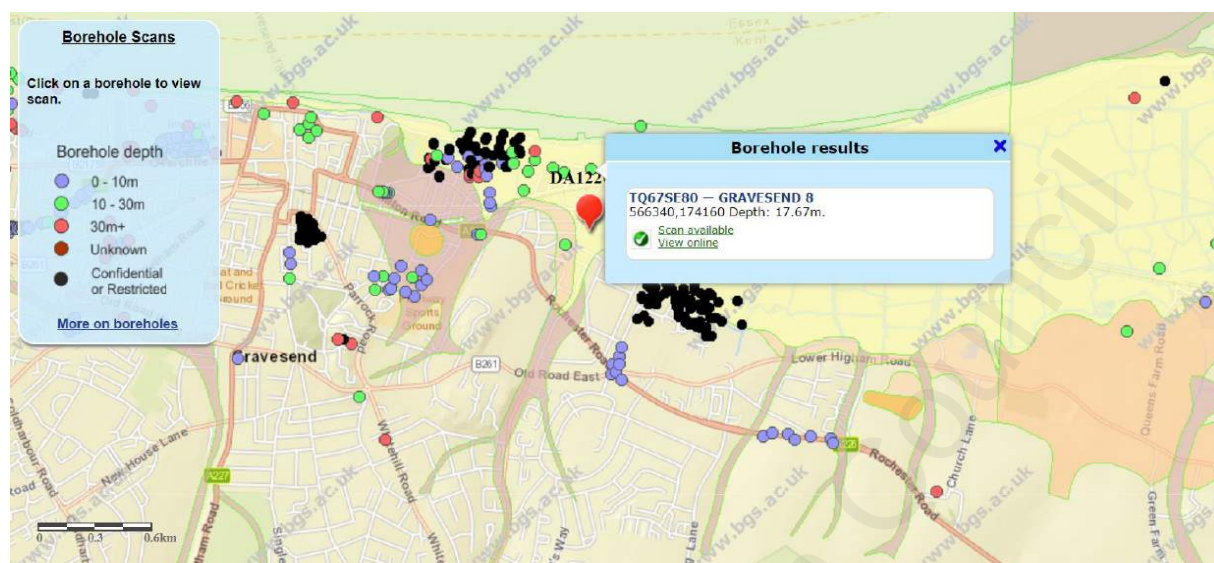


Figure 4: Location of available boreholes around the site

2.13 Based on the selected boreholes, the geology formation layers are shown in Table 1 as following:

Depth(m)	Borehole TQ67SE80 description
0.0-1.0	Made ground: soil, clay wood and brick
1.0 – 1.6	Soft light brown mottled clay
1.6 – 3.0	Black silt
3.0 – 6.7	Very soft dark grey silty organic clay

Table 1: Borehole encountered various layers at different depth (Source: BGS)

2.14 Based on the boreholes, the ground formation would be categorised as a mixture of clay, black silt and dark grey silty organic clay. **This type of soil is generally deemed to have poor infiltration rates. As such, infiltration has been disregarded from this strategy.** It is recommended that infiltration tests are carried out at detailed design stage to obtain a better understanding of the ground conditions and on the suitability of the SuDS systems proposed.

2.15 The Groundwater map shows the site to be located outside of groundwater source protection zones and also identified that the Groundwater Vulnerability at the site is over a Major Aquifer high (Figure 5 below).

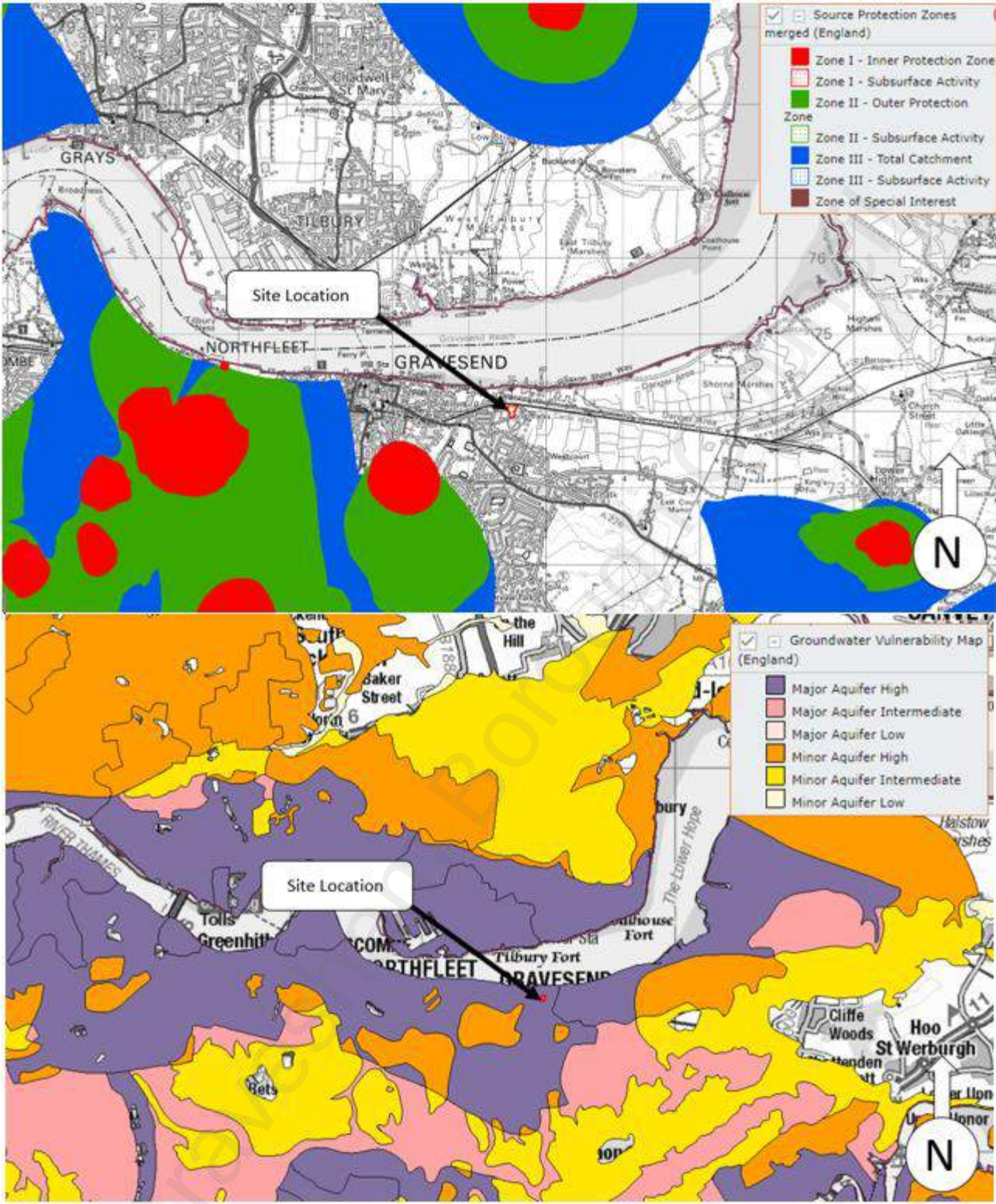


Figure 5: EA Groundwater Source Protection Zones Map (Source: Magic map)

3. SuDS Assessment

3.1 The SuDS management hierarchy is set out as follows:

SuDS Drainage Hierarchy			
		Suitability	Comment
	Infiltration	-	Anticipated poor infiltration rates.
	Discharge to Surface Water	✓	Nearby ditch
	Discharge to Surface Water Sewer, Highway Drain or another Drainage System	-	
	Discharge to Combined Sewer	-	
	Discharge to a foul sewer (should not be considered as a possible option)	-	

Table 2: SuDS Hierarchy

3.2 The use of various SuDS measures to reduce and control surface water flows have been considered for the proposed development area as follows:

“Development should utilise sustainable urban drainage systems (SUDS) unless there are practical reasons for not doing so, and should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible in line with the following drainage hierarchy:

1. Store rainwater for later use,
2. Use infiltration techniques, such as porous surfaces in non-clay areas,
3. Attenuate rainwater in ponds or open water features for gradual release,
4. Attenuate rainwater by storing in tanks or sealed water features for gradual release,
5. Discharge rainwater direct to a watercourse,
6. Discharge rainwater to a surface water sewer/drain.
7. Discharge rainwater to the combined sewer.

Drainage should be designed and implemented in ways that deliver other policy objectives of this Plan, including water use efficiency and quality, biodiversity, amenity and recreation”.

3.3 The suitability of SuDS components has been assessed (based on Table 3 below) and deemed appropriate to be used in the following SuDS management train.

Suitability of SuDS Components		
SuDS Component	Description	Suitability
Infiltrating SuDS	Infiltration can contribute to reducing runoff rates and volumes while supporting baseflow and groundwater recharge processes. The suitability and infiltration rate depends on the permeability of the surrounding soils	x
Permeable Pavement	Pervious surfaces can be used in combination with aggregate sub-base and/or geocellular/modular storage to attenuate and/or infiltrate runoff from surrounding surfaces and roofs. Liners can be used where ground conditions are not suitable for infiltration	x
Green Roofs	Green Roofs provide areas of visual benefit, ecological value, enhanced building performance and the reduction of surface water runoff. They are generally more costly to install and maintain than conventional roofs but can provide many long-term benefits and reduce the on-site storage volumes	x
Rainwater Harvesting	Rainwater Harvesting is the collection of rainwater runoff for use. It can be collected from roofs or other impermeable area, stored, treated (where required) and then used as a supply of water for domestic, commercial and industrial properties	x
Swales	Swales are designed to convey, treat and attenuate surface water runoff and provide aesthetic and biodiversity benefits. They can replace conventional pipework as a means of conveying runoff, however space constraints of some sites can make it difficult incorporating them into the design	x
Rills and Channels	Rills and Channels keep runoff on the surface and convey runoff along the surface to downstream SuDS components. They can be incorporated into the design to provide a visually appealing method of conveyance, they also provide effectiveness in pre-treatment removal of silts	✓
Bioretention Systems	Bioretention systems can reduce runoff rates and volumes and treat pollution through the use of engineer soils and vegetation. They are particularly effective in delivering interception, but can also be an attractive landscape feature whilst providing habitat and biodiversity	x
Retention Ponds and Wetlands	Ponds and Wetlands are features with a permanent pool of water that provide both attenuation and treatment of surface water runoff. They enhance treatment processes and have great amenity and biodiversity benefits. Often a flow control system at the outfall controls the rates of discharge for a range of water levels during storm events	x
Detention Basins	Detention Basins are landscaped depressions that are usually dry except during and immediately following storm events, and can be used as a recreational or other amenity facility. They generally appropriate to manage high volumes of surface water from larger sites such as a neighbourhoods	x
Geocellular Systems	Attenuation storage tanks are used to create a below-ground void space for the temporary storage of surface water before infiltration, controlled release or use. The inherent flexibility in size and shape means they can be tailored to suit the specific characteristics and requirements of any site	✓
Proprietary Treatment Systems	Proprietary treatment systems are manufactured products that remove specific pollutants from surface water runoff. They are especially useful where site constraints preclude the use of other methods and can be useful in reducing the maintenance requirements of downstream SuDS	✓
Filter Drains and Filter Strips	Filter drains are shallow trenches filled with stone, gravel that create temporary subsurface storage for the attenuation, conveyance and filtration of surface water runoff. Filter strips are uniformly graded and gently sloping strips of grass or dense vegetation, designed to treat runoff from adjacent impermeable areas by promoting sedimentation, filtration and infiltration	x

Table 3: Suitability of SuDS Components

- 3.4 It has been indicated in Table 3 above, that several SuDS components are deemed appropriate to be used in the following SuDS management train.
- 3.5 Drainage should be designed to accommodate and dispose of runoff from storms, up to and including the 1:100 year +20% climate change for the commercial site event without flooding. A 20% climate change allowance is in compliance with the EA's requirements for developments with a commercial lifetime (2040 to 2069)

- 3.6 Proper maintenance includes inspection and cleaning of collection systems, filters, throttles, valves and pumps.
- 3.7 The proposed SuDS train management provides a betterment over the existing situation by managing attenuation and long-term storage volumes.

4. Surface Water Drainage Strategy

- 4.1 In order to mitigate flood risk posed by the proposed development, adequate control measures are required to be considered. This will ensure that surface water runoff is dealt with at source and the flood risk on/off site is not increased over the lifetime of the development.
- 4.2 In accordance with the provided plans for the proposed development, the impervious area across the site have been calculated to increase post-development. As such, it is required to control surface water runoff from new developments through the use of Sustainable Drainage Systems (SuDS).

Runoff rates

- 4.3 Greenfield runoff rates have been calculated using the Institute of Hydrology Report 124 (Marshall and Bayliss, 1994), as recommended in the CIRIA 753 'The SUDS Manual'. See calculations in Appendix 3, Calculations.
- 4.4 According to the plans provided by the client, the site area of 1.21ha has been used to calculate a Greenfield Runoff Rate. The Greenfield Runoff Rate (Q_{BAR}) has been calculated as 2.6l/s, the 1 in 100 greenfield runoff rate – 8.4l/s during a 1 in 100 year flood event.
- 4.5 As per condition 11 of the planning notice, greenfield runoff rate is to be retained post development. A runoff rate equivalent to Q_{BAR} has been selected as the peak runoff limiting rate post development as shown in.

SURFACE WATER DISCHARGE RATES SUMMARY					
	Impermeable Area (ha)	Discharge Rates (l/s)			
		Q _{BAR}	1 year	30 years	100 years
Greenfield Site	0	2.6	2.2	6.0	8.4
Proposed peak runoff limiting rate	1.21		2.6	2.6	2.6

Table 4: Surface Water Discharge Rates Summary

Interception Storage

- 4.6 Given the commercial nature of the site and low water usage of the proposed development interception and re-use of the first 5mm rainfall is not viable on site.

Long Term Storage

- 4.7 For the purposes of this report runoff rates have been reduced by limiting post development flows to Q_{BAR}. As such no further consideration of long-term storage is required.

Attenuation Storage

- 4.8 Attenuation storage is needed to temporarily store water during periods when the runoff rates from the development site exceed the allowable discharge rates or possible infiltration rates from the site.
- 4.9 Rainfall depths for the 1 in 1, 1 in 30, and 1 in 100 years return period plus climate change allowance were produced using Microdrainage software in order to estimate the largest volume, critical storm, for typical storm durations for the proposed site limiting the discharge rate up to a rate of 2.6 l/s
- 4.10 As per the Kent County Council Drainage and Planning Policy Statement:

The drainage system must be designed to operate without any flooding occurring during any rainfall event up to (and including) the critical 1 in 30 year storm (3.33% AEP). The system must also be able to accommodate the rainfall generated by events of varying durations and intensities up to (and including) the critical, climate change adjusted 1 in 100 year storm (1% AEP) without any on-site property flooding and without exacerbating the off-site flood-risk. Sufficient steps are to be taken to ensure that any surface flows between the 1 in 30 and 1 in 100 year events are retained on site. The choice of where these volumes are accommodated may be within the drainage system itself or within other areas designated within the site for conveyance and storage.

- 4.11 As such, the primary proposal, includes storing the 1 in 30 year runoff from the site within an attenuation tank system below ground. The required total attenuation volume for this event has been calculated to be 487.5m³. See Appendix 3 for calculations and Appendix 4, drawing 3809-DR01 for the proposed drainage layout.
- 4.12 Additionally, the runoff from the difference between the 1 in 30 and 1 in 100 year + climate change allowance is proposed to be stored on site above ground with proposed surface levels designed for this purpose.
- 4.13 Drawing 3809-DR02 demonstrates the extent of the 1 in 100 year + climate change allowance event and the proposed storage available above ground. The additional above ground required storage for the 1 in 100 year + climate change allowance is the total "Flooded Volume" result taken from Microdrainage. This required storage has been calculated to be 260.8m³. The designed surface levels provide 280.9m³ storage. See Appendix 4, drawing 3809-DR02.
- 4.14 Any assets that would be susceptible to flooding, **especially any hazardous materials**, should be located outside the flood extent shown in 3809-DR02 or raised above plinths. This could be achieved by relocating any such assets in a different area or raising any such assets above the indicated flood depth with an additional freeboard of 0.15m.
- 4.15 An alternative approach to the above (should the client not wish to locate assets susceptible to flooding), would be place all attenuation storage for the 1 in 100 year + climate change allowance underground. This approach requires 806.7m³ according to the proposed network calculation shown in Appendix 3.
- 4.16 Thus, both the primary and the alternative approaches meet with the minimum standards required by the DEFRA - Non-statutory technical standards for sustainable drainage systems (March 2015) to

manage flood risk within the development up to the 1 in 100 year rainfall event including an allowance for climate change.

Design Exceedance

- 4.17 In the event of drainage system failure under extreme rainfall events or blockage, flooding may occur within the site. In the event of the development's drainage system failure, the runoff flow will be dictated by topography on the site. This will not impact on the site or nearby structure. Design of external ground levels will need to be finalised further detailed design stage to finalise these routes, but some indicative flow paths have been indicated on the outline drawings.

5. Water Quality

- 5.1 Adequate treatment must be delivered to the water runoff to remove pollutants through SuDS devices, which are able to provide pollution mitigation. In England and Wales, where the discharge is to protected groundwater (Source Protection Zones), the SuDS Manual, details that additional treatment is required to protect the groundwater in the instance of and unexpected pollution event or poor maintenance in these areas. These additional measures should form a robust treatment train that sufficiently protects the groundwater, but only applies if the site is within a Source Protection Zone (SPZ) 1 or considered to have a high pollution hazard level (as defined in Table 4.3 of the SuDS Manual). The site is located outside Source Protection Zone.
- 5.2 Adequate treatment must be delivered to the water runoff to remove pollutants through SuDS devices, which are able to provide pollution mitigation. Pollution Hazards and the SuDS Mitigation have been indexed in the specialized literature CIRIA 753 'The SUDS Manual'. This is determined by the following restriction:

$$\text{Total SuDS Mitigation Index} \geq \text{Pollution Hazard Index}$$

- 5.3 The Pollution Hazard Indices are summarized in Table 5 – Summary of Pollution Hazard Indices for different Land Use below (reference: Table 2'6.2. CIRIA SuDS Manual 2015)

POLLUTION HAZARD INDICES FOR DIFFERENT LAND USE CLASSIFICATIONS				
LAND USE	Pollution Hazard Level	Total suspended Solids (TSS)	Metals	Hydrocarbons
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled , sorted, used or manufactured; industrial sites; trunk roads and motorways	High	0.8 ²	0.8 ²	0.9 ²

Table 5: Summary of Pollution hazard Indices for different Land Use.

- 5.4 The contamination risk associated with this site is considered to be high. As such the following treatment trains is deemed suitable for the site:

- Runoff from the channels would first pass through a trashbox/siltbox to help remove any large objects from the runoff.
- Before entering any attenuation tank, all runoff is proposed to pass through a Hydro First Defense or a similar vortex separator. Seven of these vortex separators have been proposed. These should protect the geocellular attenuation tank for silting up and provide additional treatment prior to the final treatment from the site.
- Prior to discharge into the ditch, all runoff is proposed to pass through a Hydro Up-Flow or a similar high performance filter including oil interception. This should provide sufficient final treatment of the hydrocarbons, TSS and metals.

5.5 This treatment train provides sediment removal, oil interception and filtration of water prior to discharge to the receiving watercourse.

6. Adoption and Maintenance

6.1 All on-site SuDS and drainage systems will be privately maintained. A long term maintenance regime should be agreed with the site owners before adoption. In addition to a long term maintenance regime, it is recommended that all drainage elements implemented on the site should be inspected following the first rainfall event post construction and monthly for the first quarter following construction, see Table 6.

Proposed Schedule of Maintenance for Below Ground Drainage				
Item	Visual Inspection	Cleanse / De-sludge	CCTV Survey	Comments
Surface Water Drainage System (pipework, chambers, etc.)	5 years	10 years	10 years	Cleansing to be carried as necessary
Gullies/Channels	1 year	1 year	N/A	Cleansing to be carried as necessary
Geocellular Tanks	Yearly	As required	5 years	Remove sediment from pre-treatment structures; Inspect inside of the tank for sediment build-up and remove as necessary.

Table 6: Proposed Schedule of Maintenance for Below Ground Drainage

6.2 The proprietary treatment systems should be maintained in compliance with the manufacturer's recommendations.

7. Conclusions

- 6.3 This study has been undertaken in accordance with the principles set out in NPPF. We can conclude, that providing the developer adheres to the conditions advised in this report, the proposals can be implemented without increasing flood risk within the locality in accordance with the objectives set by the Kent County Council Drainage and Planning Policy Statement.
- 6.4 The site is 1.21ha in size and is proposed to be impermeable post development.
- 6.5 A peak runoff rate equal to the greenfield runoff rate Q_{bar} has been selected, equal to 2.6l/s for all events up to and including 1 in 100 year + 20% climate change allowance.
- 6.6 The primary proposal, includes storing the 1 in 30 year runoff from the site within an attenuation tank system below ground. The required total attenuation volume for this event has been calculated to be 487.5m³. Additionally, the runoff above the 1 in 30 rainfall up to the 1 in 100 year + 20% CC is proposed to be stored on site above ground with external levels designed for this purpose. The required storage has been calculated to be 260.8m³. The designed external surface provides 280.9m³, and as such the design is considered suitable.
- 6.7 Any assets that would be susceptible to flooding, **especially any hazardous materials**, should be located outside the flood extent shown in 3809-DR02 or raised above plinths. This could be achieved by relocating any such assets in a different area or raising any such assets above the indicated flood depth with an additional freeboard of 0.15m.
- 6.8 An alternative approach to the above (should the client not wish to locate assets susceptible to flooding), would be place all attenuation storage for the 1 in 100 year + 20% CC underground. This approach requires 806.7m³ according to the proposed network calculation shown in Appendix 3.
- 6.9 The contamination risk associated with this site is considered to be high. As such the following treatment trains is deemed suitable for the site:
- Runoff from the channels would first pass through a trashbox/siltbox to help remove any large objects from the runoff.
 - Before entering any attenuation tank, all runoff is proposed to pass through a Hydro First Defense or a similar vortex separator. Seven of these vortex separators have been proposed. These should protect the geocellular attenuation tank for silting up and provide additional treatment prior to the final treatment from the site.
 - Prior to discharge into the ditch, all runoff is proposed to pass through a Hydro Up-Flow or a similar high performance filter. This should provide sufficient final treatment of the hydrocarbons, TSS and metals.
- 6.10 All on-site SuDS and drainage systems will be privately maintained. A long term maintenance regime should be implemented the site owners as outlined in this report. In addition to a long term maintenance regime, it is recommended that all drainage elements implemented on the site should be inspected following the first rainfall event post construction and monthly for the first quarter following construction.

Following the guidelines contained within NPPF, the proposed development type is considered to be suitable for the lifetime of the development.

The findings and recommendations of this report are for the use of the client who commissioned the assessment, and no responsibility or liability can be accepted for the use of the report or its findings by any other person or for any other purpose.

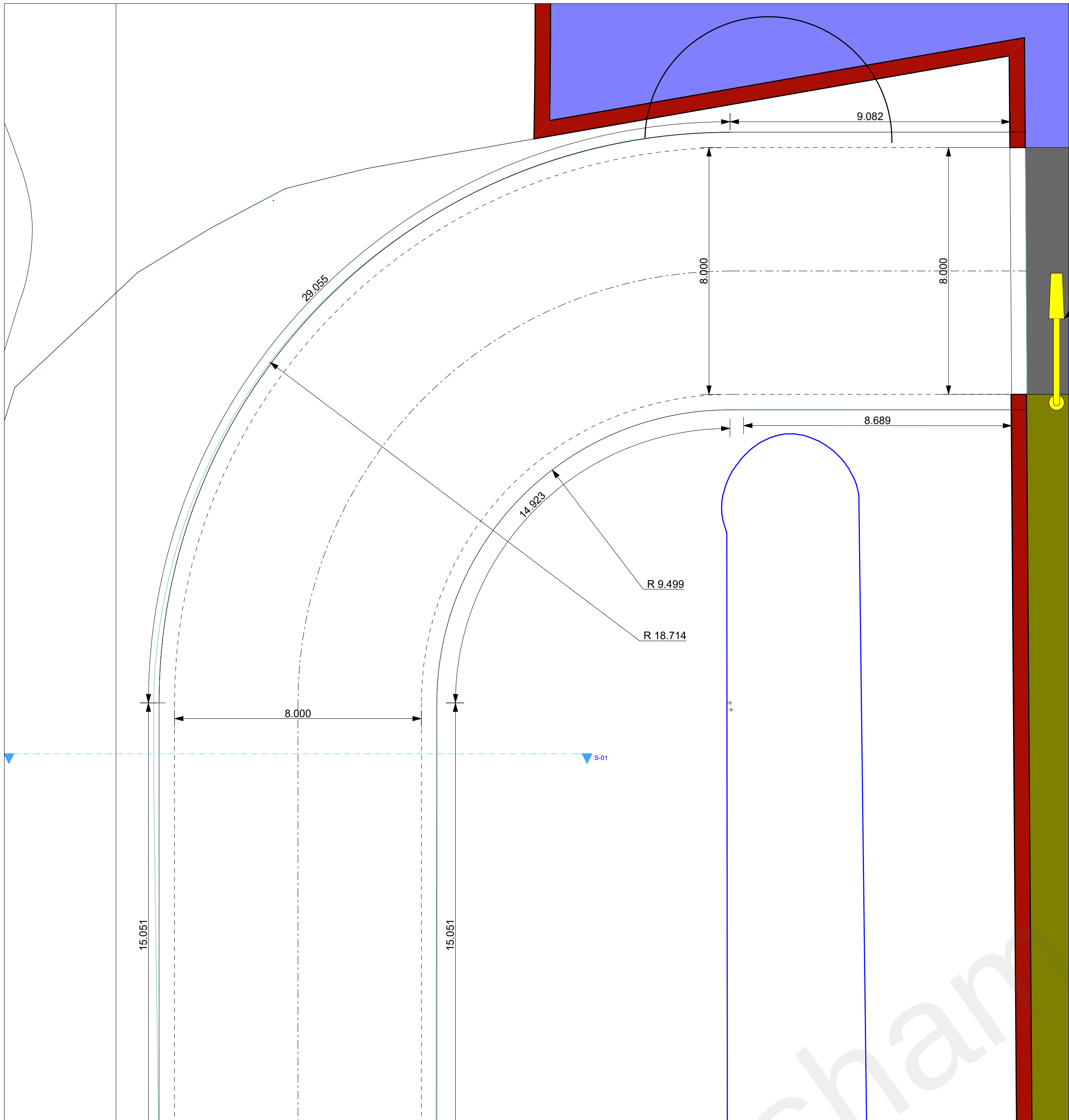
Ambiental Environmental Assessments Ltd.

June 2018

Gravesham Borough Council

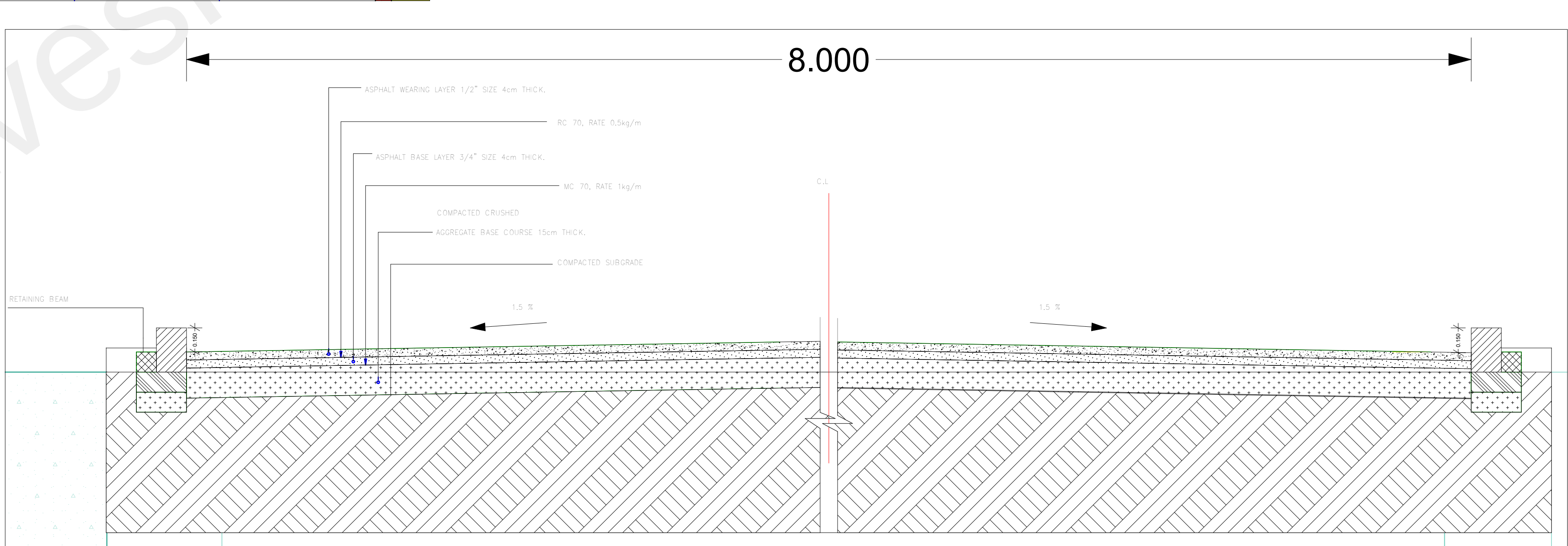
Appendix 1 – Supporting Information

Gravesham Borough Council



Access Road Layout

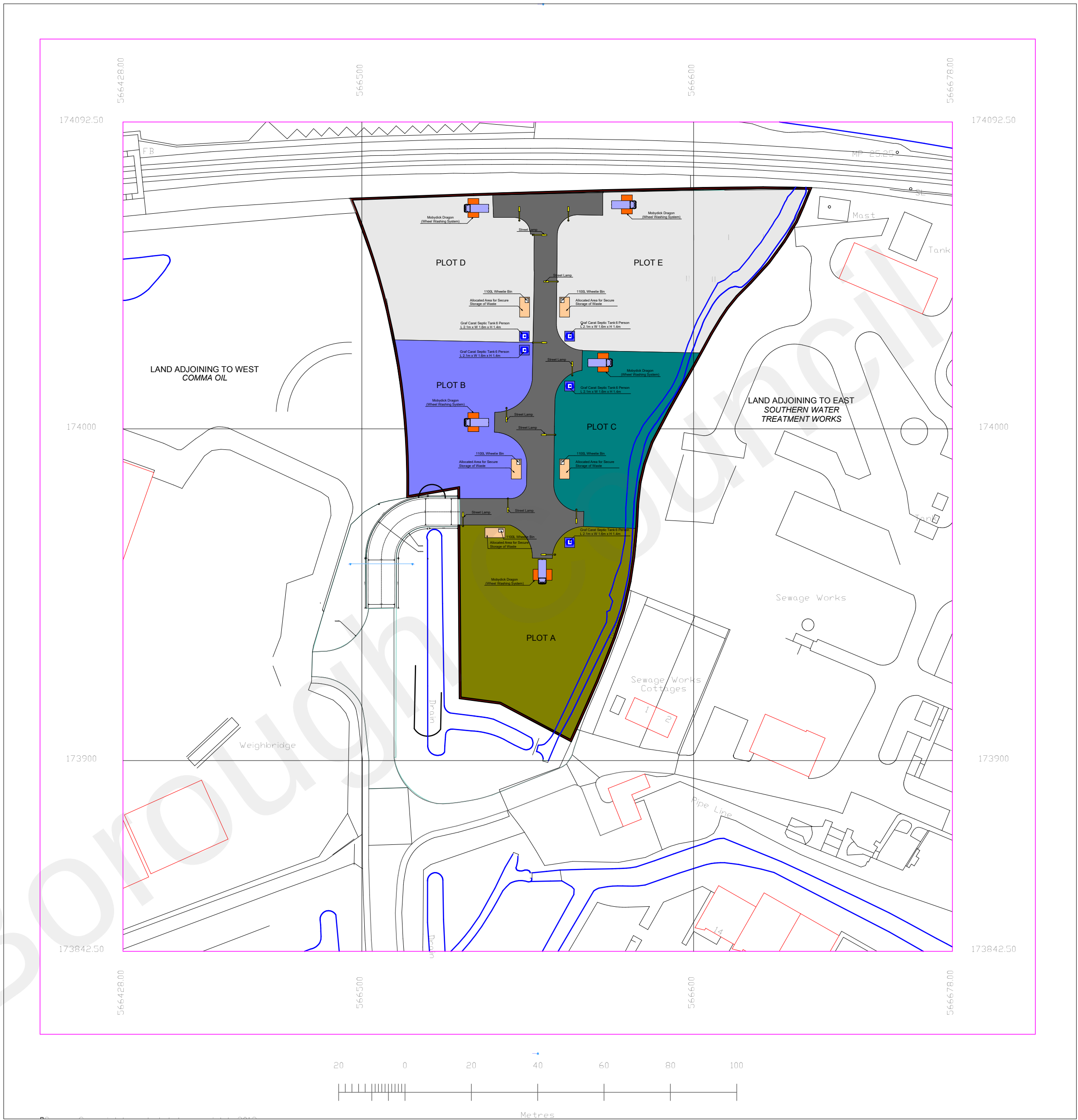
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S-01

Access Road Section

1:20



0.

Site Location Plan

1:1000

LANGLEYS CHARTERED SURVEYORS
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nader@langleyscs.co.uk

Site
Land at Dering Way, Gravesend,
Gravesham, Kent
DA12 2QX

Proposal Description

20110

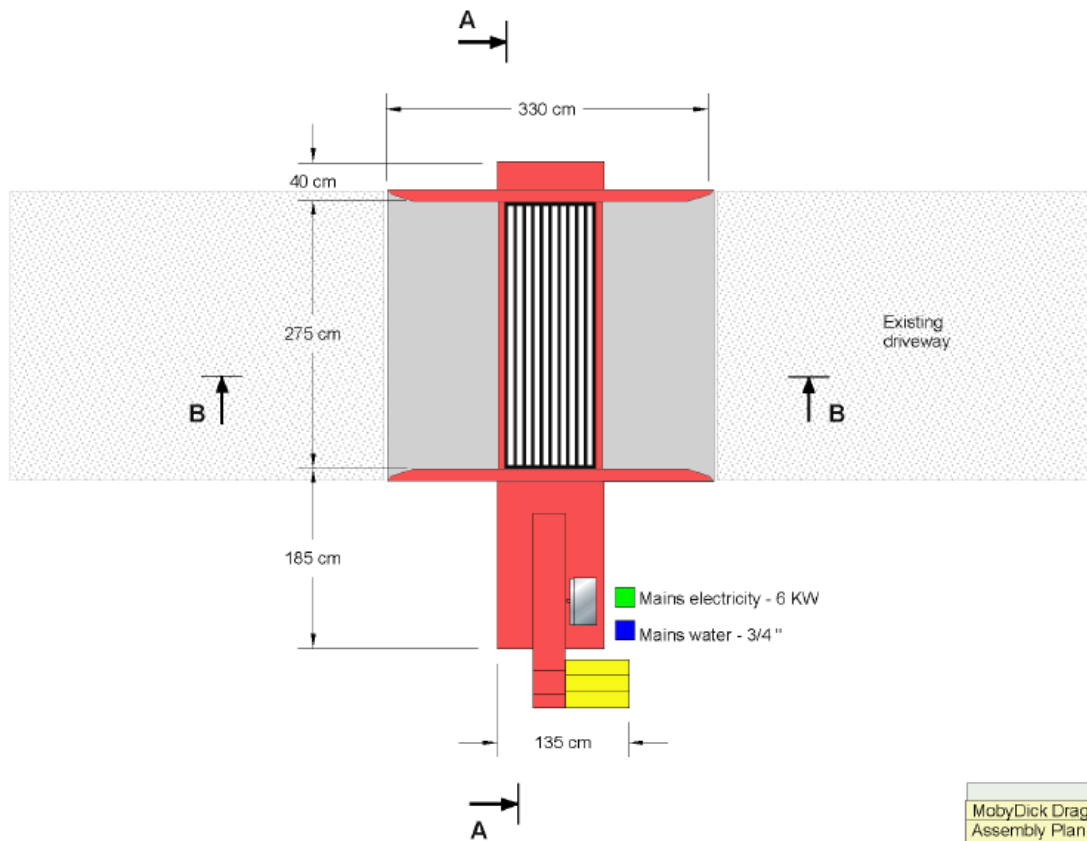
Drawing
Access Road Technical Drawing

Client / Applicant
PC Properties International
Scale @ A1 All measurements taken onsite
See Individual Drawings

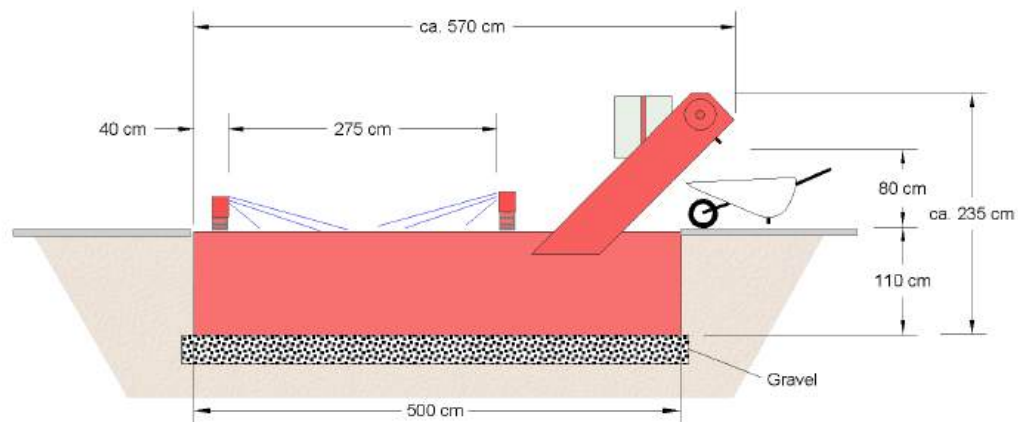
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DRAW/DW/0216/AR
Drawn By
Langleys Design & Development Team

Date
30/09/2015
Rev. Number
Rev. Date
Page #
LPA
GRV

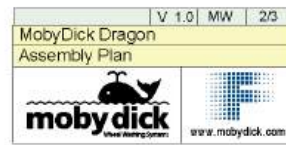
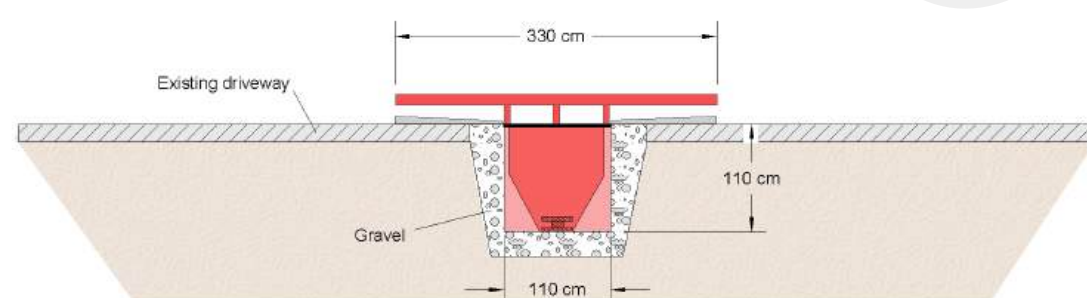
1 x MobiDick Dragon (E) Wheel Washing System On each Plot
<http://uk.mobydick.com/wheel-washing-systems/?L=9>



SECTION A - A



SECTION B - B

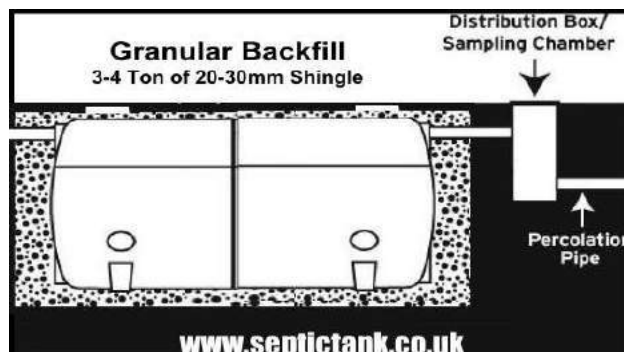
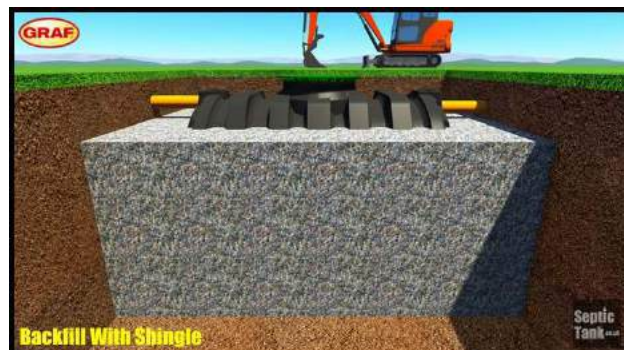


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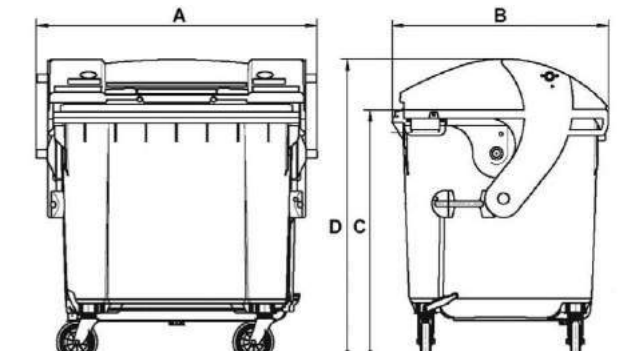
Site Location Plan

1:500

1 x GRAF Carat Septic Tank 6 Person
On each Plot
<http://shop.septictank.co.uk/septic-tanks/graf-carat-septic-tank-6-person>



1 X EXTRA LARGE WHEELED BIN (1100 LITRE) WITH 4 WHEELS AND ROLL TOP LID ON EACH PLOT
<http://www.plastor.co.uk/content/extra-large-wheeled-bin-1100-litre-4-wheels-and-roll-top-lid>



Technical Data	Content	External dimensions (mm)	Internal dimensions (mm)	Material	Weight (kg)	Available colours
MSR 1100	1100	1285	1115	HDPE	440	Grey (RAL 7001), Green (RAL 6002), Yellow (RAL 1021), Red (RAL 3002)

LANGLEYS
CHARTERED SURVEYORS

Notes & Comments

Surface Rain Water Dispersal :
All Hard Standing surfaces including roadways will incorporate permeable TARMACADAM or Other ASPHALT Surfacing to allow RW to Dispers naturally.

There will be no requirement for surface rain water distribution through conventional piped drainage systems.

Recommended site capping to include the following.

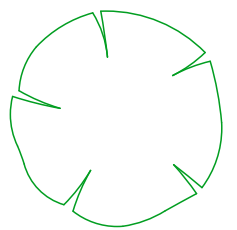
<http://www.tarmac.com/solutions/aggregates-asphalt/ultiflow/>

Planting Legend :

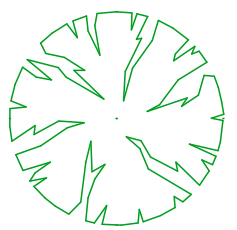
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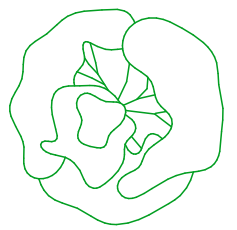
1- Tree (A)



1- Tree (B)



1- Tree (C)



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nader@langleyscs.co.uk

Site
Land at Dering Way, Gravesend,
Gravesham, Kent
DA12 2QX

Proposal Description

20110

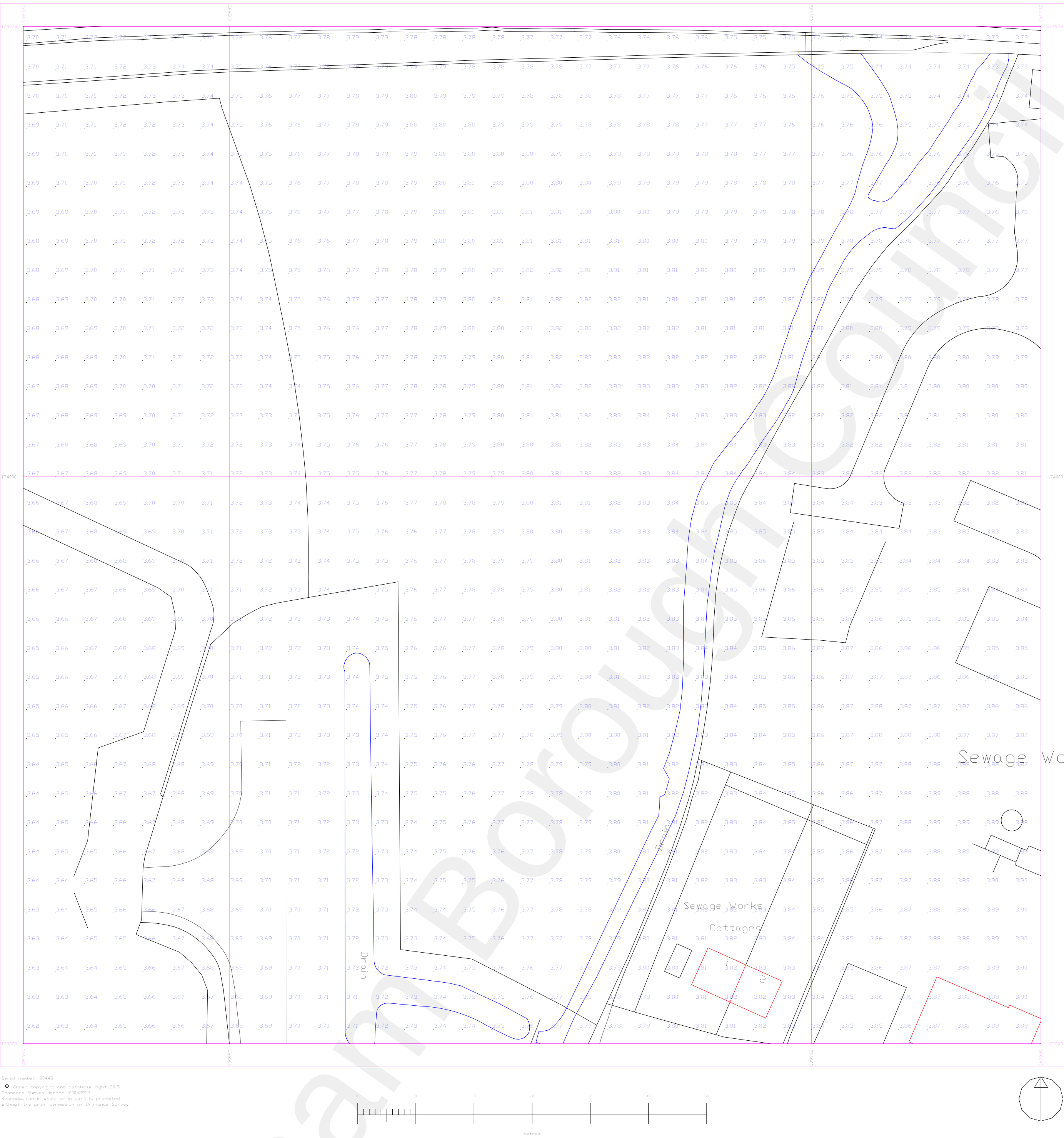
Drawing
Access Road Technical Drawing

Client/Applicant
PC Properties International
Scale @ A1 All measurements taken onsite
See Individual Drawings

Drawing Reference
DRAW/DW/0216/AR
Drawn By
Langleys Design & Development Team

Date
30/09/2015
Rev. Number
Rev. Date
Page #
LPA
GRV

Ordnance Survey
Ukmapcentre.com



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Ground Level Plan for Land at Dering Way

1:500

LANGLEYSCS

CHARTERED SURVEYORS

LANGLEY HOUSE

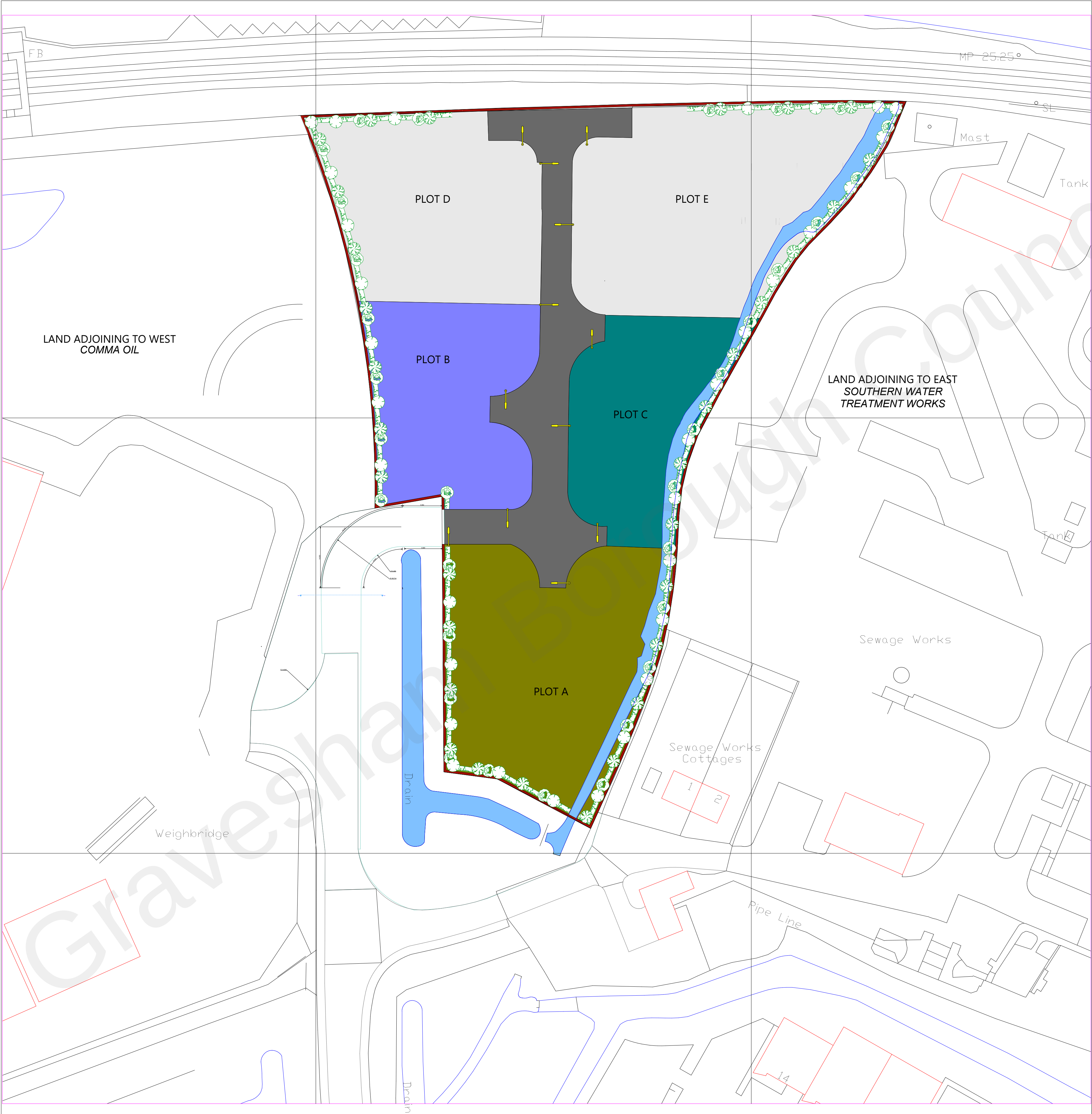
249 BROADWAY, BEXLEYHEATH

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Site Address		Proposal Description	Drawing		Drawing Reference		For Client / Applicant
Land at Dering Way, Gravesend, Gravesham, Kent, DA12 2QX		20110	Access Road Technical Drawing		DRAW/DW/0216/AR		Mr. B. Cowland MOOLANDS
Project Reference		Date	Paper Sheet Size	Scale	Drawing Type	Revision Number	Local Planning Authority
GRV		29/10/2015	A1	1:500	PLANNING		Gravesham Borough Council



0.

Site Plan

1:500

LANGLEYS
CHARTERED SURVEYORS

Notes & Comments

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nader@langleysecs.co.uk

Site
Land at Dering Way, Gravesend,
Gravesend, Kent
DA12 2QX

Proposal Description

Change of use of land to Use Class B8 Storage and
Distribution together with formation of new access road
(Resubmission of Application 20110473).

Drawing
Proposed Layout Plan and Site Split
(as approved under application 20110473)

Client/Applicant
PC Properties International

Scale @ A1 All measurements taken onsite
1:500

Drawing Reference
DRAW/DW/0216/PLP

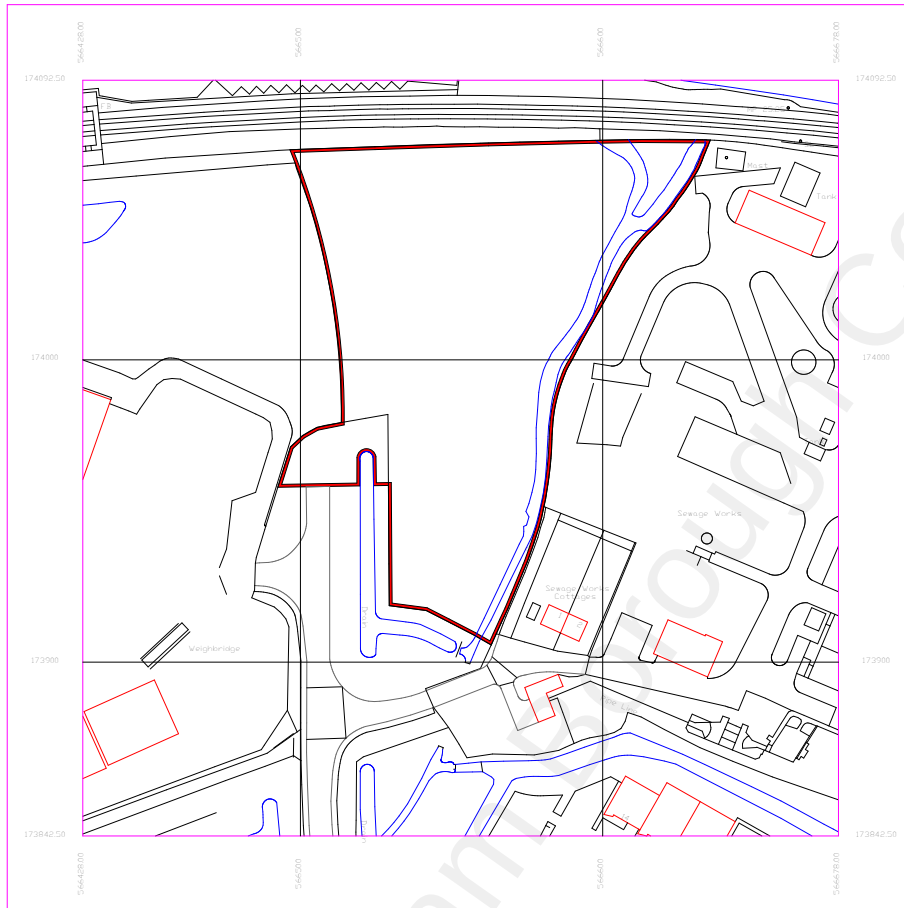
Drawn By
Langleys Design &
Development Team

Date
09/12/2015

Rev. Number
Rev. Date

Page #
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1:2500

Site Location Plan

1

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nader@langleyscs.co.uk

Site			
Land at Dering Way, Gravesend, Gravesend, Kent DA12 2QX			
Proposal Description			
Construction of the Vehicle Access to the site from Dering Way			
Drawing			
Site Location Plan			
Client/Applicant		Scale @ A4	
PC Properties International		1 : 2500 @ A4	
Drawing Reference		Drawn By	
		Langleys Design & Development Team	
Date	Rev. Number	Page #	LPA
17/11/2016	Rev. Date		

LANGLEYS

CHARTERED SURVEYORS

PLANNING & DESIGN DEPT.

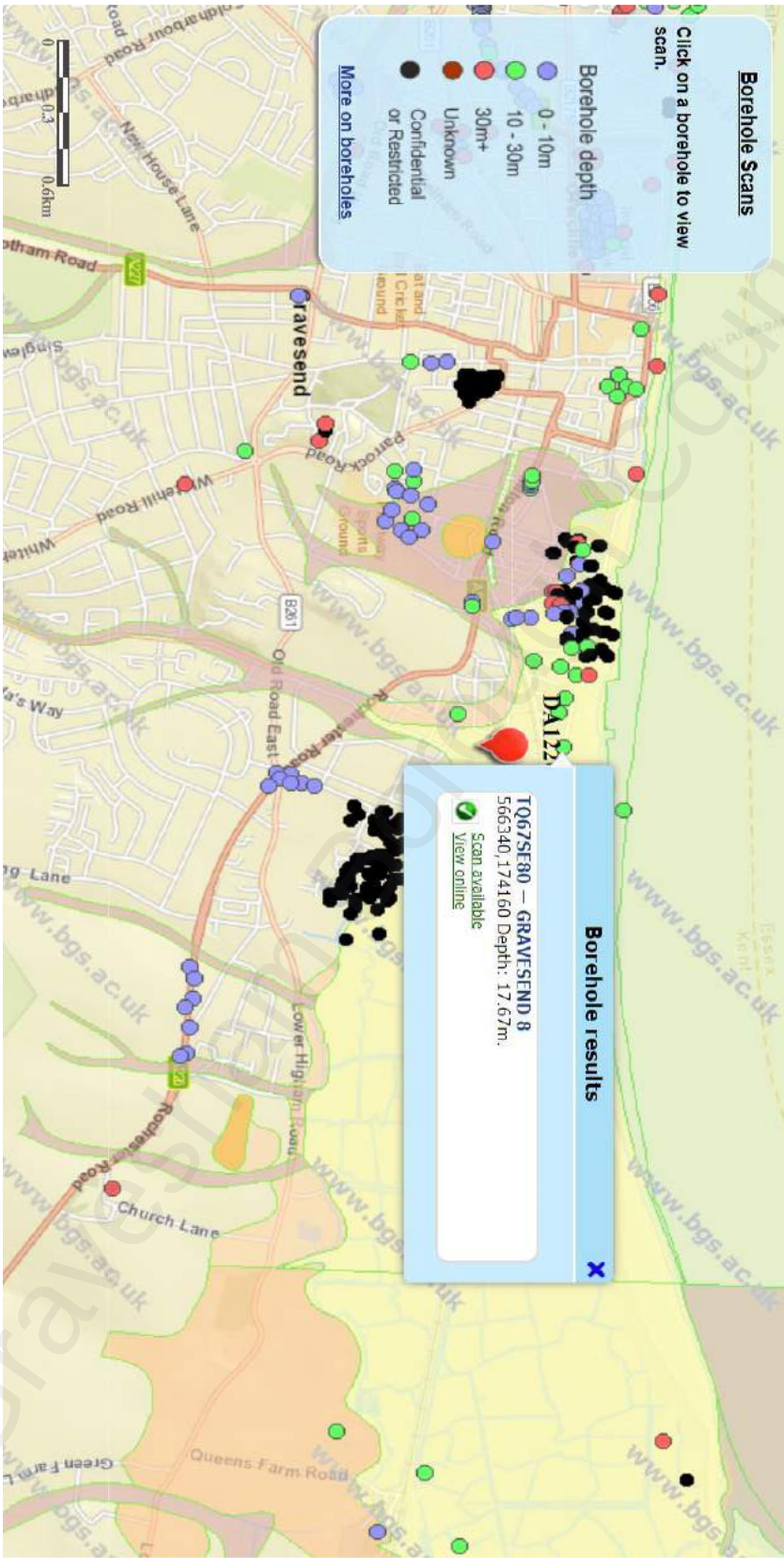


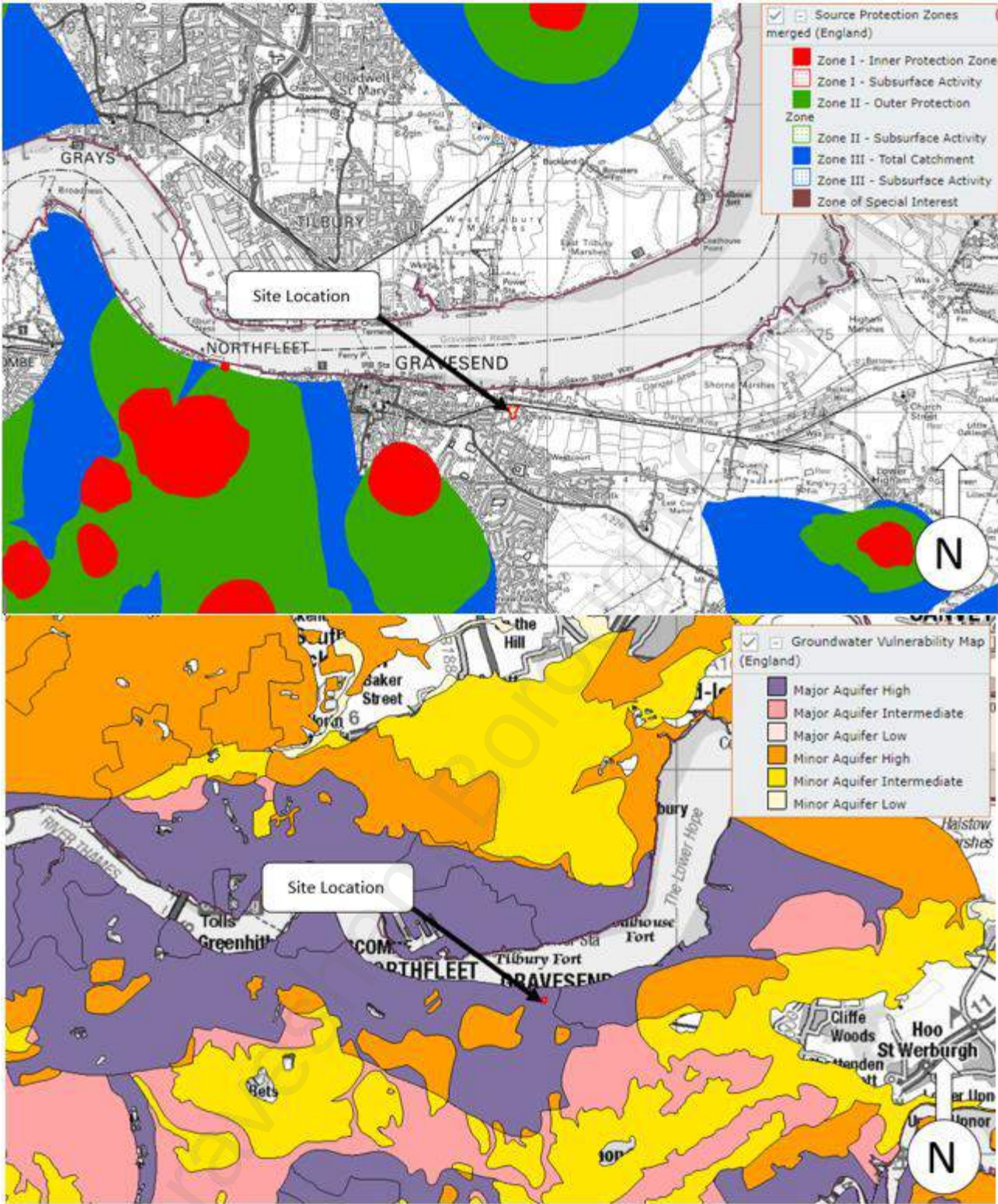
Full Application *for* Change of Use (Resubmission of: 20110473)

FRA/DW/0216

Land between Comma Oil and Southern Water Treatment Works, Dering Way, Gravesend,
Gravesham, KENT

Appendix 2 – Site Geology Maps





Appendix 3 – Calculations

Gravesham Borough Council

AEA - Ambiantal		Page 1
Science Park Square Brighton East Sussex	Moolands Proposed network Primary - 1in30 Underground	
Date 19/06/2018 10:49 File 3809_NETWORK_V6_NO_HYDR...	Designed by BB Checked by MN	
XP Solutions	Network 2016.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes AM_Stand Manhole Sizes AM_Stand

FSR Rainfall Model - England and Wales

Return Period (years)	100	Add Flow / Climate Change (%)	20
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio R	0.429	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	80	Min Design Depth for Optimisation (m)	0.600
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	1.00
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	500
Volumetric Runoff Coeff.	0.750		

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.429	4-8	0.750	8-12	0.031

Total Area Contributing (ha) = 1.210

Total Pipe Volume (m³) = 34.695

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	2.758	0.018	150.0	0.200	4.00	0.0	0.600	o	300	Pipe/Conduit	
1.001	5.575	0.058	95.4	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	12.885	0.128	100.7	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	4.252	0.019	222.0	0.284	4.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL E (m)	I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	80.00	4.04	1.955	0.200	0.0	0.0	8.7	1.28	90.6	52.0
1.001	80.00	4.09	1.937	0.200	0.0	0.0	8.7	1.61	113.8	52.0
1.002	80.00	4.31	1.878	0.200	0.0	0.0	8.7	1.00	17.7«	52.0
2.000	80.00	4.07	1.906	0.284	0.0	0.0	12.3	1.05	74.3	73.8

AEA - Ambiental										Page 2	
Science Park Square Brighton East Sussex					Moolands Proposed network Primary - lin30 Underground						
Date 19/06/2018 10:49 File 3809_NETWORK_V6_NO_HYDR...					Designed by BB Checked by MN						
XP Solutions					Network 2016.1						
Network Design Table for Storm											
PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
2.001	7.687	0.035	216.9	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.002	15.465	0.101	153.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.000	3.019	0.018	167.7	0.072	4.00	0.0	0.600	o	225	Pipe/Conduit	
3.001	14.396	0.065	222.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	40.865	0.000	0.0	0.000	0.00	0.0	0.600	o	800	Pipe/Conduit	
4.000	4.452	0.029	152.6	0.156	4.00	0.0	0.600	o	225	Pipe/Conduit	
4.001	5.869	0.039	150.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.002	15.509	0.018	861.6	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.004	5.364	0.000	0.0	0.000	0.00	0.0	0.600	o	800	Pipe/Conduit	
5.000	2.274	0.010	225.0	0.165	4.00	0.0	0.600	o	300	Pipe/Conduit	
5.001	5.546	0.025	225.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
5.002	12.976	0.035	370.7	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.005	10.980	0.000	0.0	0.000	0.00	0.0	0.600	o	800	Pipe/Conduit	
6.000	4.245	0.103	41.2	0.072	4.00	0.0	0.600	o	150	Pipe/Conduit	
Network Results Table											
PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	
2.001	80.00	4.19	1.887	0.284	0.0	0.0	12.3	1.06	75.2	73.8	
2.002	80.00	4.51	1.851	0.284	0.0	0.0	12.3	0.81	14.3	73.8	
3.000	80.00	4.05	1.900	0.072	0.0	0.0	3.1	1.01	40.0	18.7	
3.001	80.00	4.32	1.815	0.072	0.0	0.0	3.1	0.87	34.7	18.7	
1.003	80.00	6.91	1.750	0.556	0.0	0.0	24.1	0.28	142.1	144.6	
4.000	80.00	4.07	1.836	0.156	0.0	0.0	6.8	1.06	42.0	40.6	
4.001	80.00	4.16	1.807	0.156	0.0	0.0	6.8	1.07	42.4	40.6	
4.002	80.00	4.93	1.768	0.156	0.0	0.0	6.8	0.33	5.9	40.6	
1.004	80.00	7.23	1.750	0.712	0.0	0.0	30.9	0.28	142.1	185.1	
5.000	80.00	4.04	1.820	0.165	0.0	0.0	7.1	1.04	73.8	42.9	
5.001	80.00	4.12	1.810	0.165	0.0	0.0	7.1	1.04	73.8	42.9	
5.002	80.00	4.54	1.785	0.165	0.0	0.0	7.1	0.52	9.1	42.9	
1.005	80.00	7.88	1.750	0.877	0.0	0.0	38.0	0.28	142.1	228.0	
6.000	80.00	4.04	1.882	0.072	0.0	0.0	3.1	1.57	27.8	18.7	
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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
7.000	1.843	0.009	208.6	0.261	4.00	0.0	0.600	o	375	Pipe/Conduit	
7.001	6.446	0.020	324.9	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
7.002	3.930	0.046	85.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
7.003	9.796	0.065	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
6.001	3.563	0.029	125.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.006	21.729	0.145	149.9	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
7.000	80.00	4.02	1.919	0.261	0.0	0.0	11.3	1.25	138.1	67.9
7.001	80.00	4.13	1.910	0.261	0.0	0.0	11.3	1.00	110.4	67.9
7.002	80.00	4.18	1.890	0.261	0.0	0.0	11.3	1.42	56.3«	67.9
7.003	80.00	4.38	1.844	0.261	0.0	0.0	11.3	0.82	14.5«	67.9
6.001	80.00	4.43	1.779	0.333	0.0	0.0	14.4	1.17	46.4«	86.6
1.006	80.00	8.32	1.750	1.210	0.0	0.0	52.4	0.82	14.5«	314.6

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.200	0.200	0.200
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.000	0.000	0.000
2.000	-	-	100	0.284	0.284	0.284
2.001	-	-	100	0.000	0.000	0.000
2.002	-	-	100	0.000	0.000	0.000
3.000	-	-	100	0.072	0.072	0.072
3.001	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
4.000	-	-	100	0.156	0.156	0.156
4.001	-	-	100	0.000	0.000	0.000
4.002	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
5.000	-	-	100	0.165	0.165	0.165
5.001	-	-	100	0.000	0.000	0.000
5.002	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.000	0.000	0.000
6.000	-	-	100	0.072	0.072	0.072
7.000	-	-	100	0.261	0.261	0.261
7.001	-	-	100	0.000	0.000	0.000
7.002	-	-	100	0.000	0.000	0.000
7.003	-	-	100	0.000	0.000	0.000
6.001	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				1.210	1.210	1.210

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
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1.006		2.824	1.605	0.000	0	0
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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	6
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

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<u>Simulation Criteria for Storm</u> <table><tr><td>Rainfall Model</td><td>FSR</td><td>Profile Type</td><td>Summer</td></tr><tr><td>Return Period (years)</td><td>100</td><td>Cv (Summer)</td><td>0.750</td></tr><tr><td>Region</td><td>England and Wales</td><td>Cv (Winter)</td><td>0.840</td></tr><tr><td>M5-60 (mm)</td><td>20.000</td><td>Storm Duration (mins)</td><td>30</td></tr><tr><td>Ratio R</td><td>0.429</td><td></td><td></td></tr></table>			Rainfall Model	FSR	Profile Type	Summer	Return Period (years)	100	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	20.000	Storm Duration (mins)	30	Ratio R	0.429		
Rainfall Model	FSR	Profile Type	Summer																			
Return Period (years)	100	Cv (Summer)	0.750																			
Region	England and Wales	Cv (Winter)	0.840																			
M5-60 (mm)	20.000	Storm Duration (mins)	30																			
Ratio R	0.429																					
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Online Controls for Storm

Hydro-Brake Optimum® Manhole: 7, DS/PN: 1.002, Volume (m³): 0.6

Unit Reference	MD-SHE-0052-9000-0400-9000
Design Head (m)	0.400
Design Flow (l/s)	0.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	52
Invert Level (m)	1.878
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.400	0.9
Flush-Flo™	0.116	0.9
Kick-Flo®	0.270	0.8
Mean Flow over Head Range	-	0.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.9	1.200	1.5	3.000	2.2	7.000	3.4
0.200	0.9	1.400	1.6	3.500	2.4	7.500	3.5
0.300	0.8	1.600	1.7	4.000	2.5	8.000	3.6
0.400	0.9	1.800	1.8	4.500	2.7	8.500	3.7
0.500	1.0	2.000	1.9	5.000	2.8	9.000	3.8
0.600	1.1	2.200	1.9	5.500	3.0	9.500	3.9
0.800	1.2	2.400	2.0	6.000	3.1		
1.000	1.4	2.600	2.1	6.500	3.2		

Hydro-Brake Optimum® Manhole: 10, DS/PN: 2.002, Volume (m³): 0.8

Unit Reference	MD-SHE-0052-9000-0400-9000
Design Head (m)	0.400
Design Flow (l/s)	0.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	52
Invert Level (m)	1.851
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

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Hydro-Brake Optimum® Manhole: 10, DS/PN: 2.002, Volume (m³): 0.8

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.400	0.9
Flush-Flo™	0.116	0.9
Kick-Flo®	0.270	0.8
Mean Flow over Head Range	-	0.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.9	1.200	1.5	3.000	2.2	7.000	3.4
0.200	0.9	1.400	1.6	3.500	2.4	7.500	3.5
0.300	0.8	1.600	1.7	4.000	2.5	8.000	3.6
0.400	0.9	1.800	1.8	4.500	2.7	8.500	3.7
0.500	1.0	2.000	1.9	5.000	2.8	9.000	3.8
0.600	1.1	2.200	1.9	5.500	3.0	9.500	3.9
0.800	1.2	2.400	2.0	6.000	3.1		
1.000	1.4	2.600	2.1	6.500	3.2		

Hydro-Brake Optimum® Manhole: 16, DS/PN: 7.002, Volume (m³): 1.6

Unit Reference	MD-SHE-0052-9000-0400-9000
Design Head (m)	0.400
Design Flow (l/s)	0.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	52
Invert Level (m)	1.890
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.400	0.9
Flush-Flo™	0.116	0.9
Kick-Flo®	0.270	0.8
Mean Flow over Head Range	-	0.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.9	0.300	0.8	0.500	1.0	0.800	1.2
0.200	0.9	0.400	0.9	0.600	1.1	1.000	1.4

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Hydro-Brake Optimum® Manhole: 16, DS/PN: 7.002, Volume (m³): 1.6

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
1.200	1.5	2.400	2.0	5.000	2.8	8.000	3.6
1.400	1.6	2.600	2.1	5.500	3.0	8.500	3.7
1.600	1.7	3.000	2.2	6.000	3.1	9.000	3.8
1.800	1.8	3.500	2.4	6.500	3.2	9.500	3.9
2.000	1.9	4.000	2.5	7.000	3.4		
2.200	1.9	4.500	2.7	7.500	3.5		

Hydro-Brake Optimum® Manhole: 6, DS/PN: 1.006, Volume (m³): 7.4

Unit Reference	MD-SHE-0078-2600-0930-2600
Design Head (m)	0.930
Design Flow (l/s)	2.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	78
Invert Level (m)	1.750
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.930	2.6
Flush-Flo™	0.280	2.6
Kick-Flo®	0.585	2.1
Mean Flow over Head Range	-	2.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.2	1.200	2.9	3.000	4.5	7.000	6.7
0.200	2.5	1.400	3.1	3.500	4.8	7.500	6.9
0.300	2.6	1.600	3.3	4.000	5.1	8.000	7.1
0.400	2.5	1.800	3.5	4.500	5.4	8.500	7.3
0.500	2.4	2.000	3.7	5.000	5.7	9.000	7.5
0.600	2.1	2.200	3.9	5.500	5.9	9.500	7.7
0.800	2.4	2.400	4.0	6.000	6.2		
1.000	2.7	2.600	4.2	6.500	6.4		

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<u>Storage Structures for Storm</u> <u>Cellular Storage Manhole: 7, DS/PN: 1.002</u> Invert Level (m) 1.878 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>155.0</td><td>0.0</td><td>0.451</td><td>0.0</td><td>0.0</td></tr><tr><td>0.450</td><td>155.0</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: 10, DS/PN: 2.002</u> Invert Level (m) 1.851 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>245.0</td><td>0.0</td><td>0.451</td><td>0.0</td><td>0.0</td></tr><tr><td>0.450</td><td>245.0</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: 14, DS/PN: 4.002</u> Invert Level (m) 1.768 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>130.0</td><td>0.0</td><td>0.451</td><td>0.0</td><td>0.0</td></tr><tr><td>0.450</td><td>130.0</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: 4, DS/PN: 5.002</u> Invert Level (m) 1.785 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>145.0</td><td>0.0</td><td>0.451</td><td>0.0</td><td>0.0</td></tr><tr><td>0.450</td><td>145.0</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: 16, DS/PN: 7.002</u> Invert Level (m) 1.890 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	155.0	0.0	0.451	0.0	0.0	0.450	155.0	0.0				Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	245.0	0.0	0.451	0.0	0.0	0.450	245.0	0.0				Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	130.0	0.0	0.451	0.0	0.0	0.450	130.0	0.0				Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	145.0	0.0	0.451	0.0	0.0	0.450	145.0	0.0			
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																																																																					
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<u>Cellular Storage Manhole: 16, DS/PN: 7.002</u> <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>270.0</td><td>0.0</td><td>0.451</td><td>0.0</td><td>0.0</td></tr><tr><td>0.450</td><td>270.0</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: 6, DS/PN: 1.006</u> Invert Level (m) 1.750 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>100.0</td><td>0.0</td><td>0.451</td><td>0.0</td><td>0.0</td></tr><tr><td>0.450</td><td>100.0</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Volume Summary (Static)</u> Length Calculations based on True Length <table><tr><th>Pipe Number</th><th>USMH Name</th><th>Manhole Volume (m³)</th><th>Pipe Volume (m³)</th><th>Storage Structure Volume (m³)</th><th>Total Volume (m³)</th></tr><tr><td>1.000</td><td>5</td><td>0.000</td><td>0.174</td><td>0.000</td><td>0.174</td></tr><tr><td>1.001</td><td>6</td><td>0.266</td><td>0.352</td><td>0.000</td><td>0.618</td></tr><tr><td>1.002</td><td>7</td><td>0.292</td><td>0.222</td><td>66.312</td><td>66.826</td></tr><tr><td>2.000</td><td>8</td><td>0.000</td><td>0.279</td><td>0.000</td><td>0.279</td></tr><tr><td>2.001</td><td>9</td><td>0.271</td><td>0.501</td><td>0.000</td><td>0.772</td></tr><tr><td>2.002</td><td>10</td><td>0.299</td><td>0.268</td><td>104.815</td><td>105.382</td></tr><tr><td>3.000</td><td>10</td><td>0.000</td><td>0.108</td><td>0.000</td><td>0.108</td></tr><tr><td>3.001</td><td>9</td><td>0.357</td><td>0.560</td><td>0.000</td><td>0.918</td></tr><tr><td>1.003</td><td>8</td><td>0.000</td><td>20.541</td><td>0.000</td><td>20.541</td></tr><tr><td>4.000</td><td>14</td><td>0.000</td><td>0.165</td><td>0.000</td><td>0.165</td></tr><tr><td>4.001</td><td>15</td><td>0.243</td><td>0.209</td><td>0.000</td><td>0.453</td></tr><tr><td>4.002</td><td>14</td><td>0.275</td><td>0.269</td><td>55.616</td><td>56.160</td></tr><tr><td>1.004</td><td>12</td><td>0.000</td><td>2.696</td><td>0.000</td><td>2.696</td></tr><tr><td>5.000</td><td>3</td><td>0.000</td><td>0.140</td><td>0.000</td><td>0.140</td></tr><tr><td>5.001</td><td>15</td><td>0.252</td><td>0.350</td><td>0.000</td><td>0.601</td></tr><tr><td>5.002</td><td>4</td><td>0.273</td><td>0.224</td><td>62.033</td><td>62.530</td></tr><tr><td>1.005</td><td>5</td><td>0.000</td><td>5.067</td><td>0.000</td><td>5.067</td></tr><tr><td>6.000</td><td>22</td><td>0.000</td><td>0.070</td><td>0.000</td><td>0.070</td></tr><tr><td>7.000</td><td>15</td><td>0.000</td><td>0.137</td><td>0.000</td><td>0.137</td></tr><tr><td>7.001</td><td>20</td><td>0.923</td><td>0.579</td><td>0.000</td><td>1.503</td></tr><tr><td>7.002</td><td>16</td><td>1.000</td><td>0.120</td><td>115.511</td><td>116.631</td></tr><tr><td>7.003</td><td>17</td><td>0.258</td><td>0.163</td><td>0.000</td><td>0.421</td></tr><tr><td>6.001</td><td>22</td><td>0.247</td><td>0.094</td><td>0.000</td><td>0.341</td></tr><tr><td>1.006</td><td>6</td><td>2.258</td><td>0.368</td><td>42.782</td><td>45.408</td></tr><tr><td colspan="2">Total</td><td>7.215</td><td>33.656</td><td>447.068</td><td>487.940</td></tr></table>						Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	270.0	0.0	0.451	0.0	0.0	0.450	270.0	0.0				Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	100.0	0.0	0.451	0.0	0.0	0.450	100.0	0.0				Pipe Number	USMH Name	Manhole Volume (m³)	Pipe Volume (m³)	Storage Structure Volume (m³)	Total Volume (m³)	1.000	5	0.000	0.174	0.000	0.174	1.001	6	0.266	0.352	0.000	0.618	1.002	7	0.292	0.222	66.312	66.826	2.000	8	0.000	0.279	0.000	0.279	2.001	9	0.271	0.501	0.000	0.772	2.002	10	0.299	0.268	104.815	105.382	3.000	10	0.000	0.108	0.000	0.108	3.001	9	0.357	0.560	0.000	0.918	1.003	8	0.000	20.541	0.000	20.541	4.000	14	0.000	0.165	0.000	0.165	4.001	15	0.243	0.209	0.000	0.453	4.002	14	0.275	0.269	55.616	56.160	1.004	12	0.000	2.696	0.000	2.696	5.000	3	0.000	0.140	0.000	0.140	5.001	15	0.252	0.350	0.000	0.601	5.002	4	0.273	0.224	62.033	62.530	1.005	5	0.000	5.067	0.000	5.067	6.000	22	0.000	0.070	0.000	0.070	7.000	15	0.000	0.137	0.000	0.137	7.001	20	0.923	0.579	0.000	1.503	7.002	16	1.000	0.120	115.511	116.631	7.003	17	0.258	0.163	0.000	0.421	6.001	22	0.247	0.094	0.000	0.341	1.006	6	2.258	0.368	42.782	45.408	Total		7.215	33.656	447.068	487.940
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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	6
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.429
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)		0.0	
Analysis Timestep	2.5 Second Increment (Extended)		
DTS Status		OFF	
DVD Status		ON	
Inertia Status		ON	

Profile(s)

Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440	Summer and Winter	
Return Period(s) (years)		1, 30, 100	
Climate Change (%)		0, 0, 20	

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	5	15 Summer	1	+0%				
1.001	6	15 Summer	1	+0%	30/15 Summer	100/60 Winter		
1.002	7	360 Winter	1	+0%	1/240 Winter	100/60 Winter		
2.000	8	15 Winter	1	+0%				
2.001	9	15 Winter	1	+0%	30/15 Summer	100/120 Summer		
2.002	10	960 Winter	1	+0%	1/240 Winter	100/60 Winter		
3.000	10	15 Summer	1	+0%				
3.001	9	960 Winter	1	+0%	30/60 Winter			
1.003	8	960 Winter	1	+0%				
4.000	14	15 Winter	1	+0%				
4.001	15	960 Winter	1	+0%	30/15 Summer	100/240 Winter		
4.002	14	960 Winter	1	+0%	1/120 Winter			
1.004	12	960 Winter	1	+0%				
5.000	3	15 Winter	1	+0%				
5.001	15	960 Winter	1	+0%	30/15 Summer			
5.002	4	960 Winter	1	+0%	1/240 Winter			
1.005	5	960 Winter	1	+0%				
6.000	22	960 Winter	1	+0%				
7.000	15	15 Winter	1	+0%				

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Water		Surcharged		Flooded		Pipe		Status	Level Exceeded
		Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)				
1.000	5	2.105	-0.150	0.000	0.50		30.6		OK*		
1.001	6	2.086	-0.150	0.000	0.50		30.5		OK		13
1.002	7	2.040	0.012	0.000	0.05		0.8	SURCHARGED			13
2.000	8	2.099	-0.107	0.000	0.70		42.7		OK*		
2.001	9	2.086	-0.101	0.000	0.76		42.4		OK		12
2.002	10	2.030	0.029	0.000	0.04		0.6	SURCHARGED			12
3.000	10	1.994	-0.131	0.000	0.37		11.0		OK*		
3.001	9	1.963	-0.077	0.000	0.02		0.7		OK		
1.003	8	1.963	-0.587	0.000	0.00		1.8		OK*		
4.000	14	1.988	-0.073	0.000	0.79		23.7		OK*		
4.001	15	1.964	-0.067	0.000	0.05		1.5		OK		8
4.002	14	1.964	0.046	0.000	0.07		0.3	SURCHARGED			
1.004	12	1.963	-0.587	0.000	0.00		2.0		OK*		
5.000	3	1.966	-0.154	0.000	0.41		25.0		OK*		
5.001	15	1.964	-0.146	0.000	0.03		1.6		OK		
5.002	4	1.964	0.029	0.000	0.04		0.4	SURCHARGED			
1.005	5	1.963	-0.587	0.000	0.00		2.2		OK*		
6.000	22	1.963	-0.069	0.000	0.04		0.7		OK*		
7.000	15	2.115	-0.179	0.000	0.36		39.0		OK*		

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
7.001	20	15 Winter	1	+0%	30/15 Summer	100/240 Summer		
7.002	16	480 Winter	1	+0%	30/60 Winter	100/240 Winter		
7.003	17	960 Winter	1	+0%	30/30 Winter			
6.001	22	960 Winter	1	+0%	30/30 Winter	100/240 Summer		
1.006	6	960 Winter	1	+0%	1/120 Summer	100/120 Winter		

			Water Surcharged Flooded			Pipe		Level	
PN	US/MH Name	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status	Exceeded
7.001	20	2.111	-0.174	0.000	0.55		38.7	OK	10
7.002	16	2.036	-0.079	0.000	0.02		0.6	OK	2
7.003	17	1.965	-0.029	0.000	0.05		0.6	OK	
6.001	22	1.963	-0.041	0.000	0.04		1.3	OK	10
1.006	6	1.963	0.063	0.000	0.19		2.6	SURCHARGED	11

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**30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm**

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	6
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.429
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	0.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)

Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440	Summer and Winter
Return Period(s) (years)	1, 30, 100	
Climate Change (%)	0, 0, 20	

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	5	240 Winter	30	+0%				
1.001	6	960 Winter	30	+0%	30/15 Summer	100/60 Winter		
1.002	7	960 Winter	30	+0%	1/240 Winter	100/60 Winter		
2.000	8	30 Winter	30	+0%				
2.001	9	960 Winter	30	+0%	30/15 Summer	100/120 Summer		
2.002	10	960 Winter	30	+0%	1/240 Winter	100/60 Winter		
3.000	10	240 Winter	30	+0%				
3.001	9	960 Winter	30	+0%	30/60 Winter			
1.003	8	960 Winter	30	+0%				
4.000	14	60 Winter	30	+0%				
4.001	15	960 Winter	30	+0%	30/15 Summer	100/240 Winter		
4.002	14	960 Winter	30	+0%	1/120 Winter			
1.004	12	960 Winter	30	+0%				
5.000	3	240 Winter	30	+0%				
5.001	15	960 Winter	30	+0%	30/15 Summer			
5.002	4	960 Winter	30	+0%	1/240 Winter			
1.005	5	960 Winter	30	+0%				
6.000	22	120 Winter	30	+0%				
7.000	15	15 Winter	30	+0%				

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Water		Surcharged		Flooded		Pipe		Status	Level Exceeded
		Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)				
1.000	5	2.255	0.000	0.000	0.20		12.2	SURCHARGED*			
1.001	6	2.309	0.072	0.000	0.07		4.1	SURCHARGED			13
1.002	7	2.309	0.281	0.000	0.05		0.7	SURCHARGED			13
2.000	8	2.206	0.000	0.000	1.27		77.6	SURCHARGED*			
2.001	9	2.733	0.546	0.000	0.16		8.8	SURCHARGED			12
2.002	10	2.819	0.818	0.000	0.05		0.6	SURCHARGED			12
3.000	10	2.125	0.000	0.000	0.15		4.4	SURCHARGED*			
3.001	9	2.264	0.224	0.000	0.05		1.5	SURCHARGED			
1.003	8	2.264	-0.286	0.000	0.01		2.7	OK*			
4.000	14	2.061	0.000	0.000	0.93		27.7	SURCHARGED*			
4.001	15	2.266	0.234	0.000	0.11		3.3	SURCHARGED			8
4.002	14	2.266	0.348	0.000	0.13		0.6	SURCHARGED			
1.004	12	2.264	-0.286	0.000	0.00		2.7	OK*			
5.000	3	2.120	0.000	0.000	0.16		10.1	SURCHARGED*			
5.001	15	2.335	0.225	0.000	0.07		3.3	SURCHARGED			
5.002	4	2.353	0.418	0.000	0.12		1.0	SURCHARGED			
1.005	5	2.264	-0.286	0.000	0.01		2.9	OK*			
6.000	22	2.032	0.000	0.000	0.37		7.5	SURCHARGED*			
7.000	15	2.294	0.000	0.000	0.89		95.5	SURCHARGED*			

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
7.001	20	1440 Winter	30	+0%	30/15 Summer	100/240 Summer		
7.002	16	1440 Winter	30	+0%	30/60 Winter	100/240 Winter		
7.003	17	960 Winter	30	+0%	30/30 Winter			
6.001	22	960 Winter	30	+0%	30/30 Winter	100/240 Summer		
1.006	6	960 Winter	30	+0%	1/120 Summer	100/120 Winter		

		Water Surcharged Flooded					Pipe		
PN	US/MH Name	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status	Level Exceeded
7.001	20	2.288	0.002	0.000	0.05		3.8	SURCHARGED	10
7.002	16	2.288	0.173	0.000	0.02		0.6	SURCHARGED	2
7.003	17	2.265	0.271	0.000	0.05		0.6	SURCHARGED	
6.001	22	2.265	0.261	0.000	0.07		2.0	SURCHARGED	10
1.006	6	2.265	0.365	0.000	0.19		2.6	SURCHARGED	11

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	6
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.429
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	0.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)

Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440	Summer and Winter
Return Period(s) (years)	1, 30, 100	
Climate Change (%)	0, 0, 20	

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	5	60 Winter	100	+20%				
1.001	6	480 Winter	100	+20%	30/15 Summer	100/60 Winter		
1.002	7	480 Winter	100	+20%	1/240 Winter	100/60 Winter		
2.000	8	60 Winter	100	+20%				
2.001	9	960 Winter	100	+20%	30/15 Summer	100/120 Summer		
2.002	10	1440 Summer	100	+20%	1/240 Winter	100/60 Winter		
3.000	10	60 Winter	100	+20%				
3.001	9	1440 Winter	100	+20%	30/60 Winter			
1.003	8	120 Winter	100	+20%				
4.000	14	60 Winter	100	+20%				
4.001	15	1440 Winter	100	+20%	30/15 Summer	100/240 Winter		
4.002	14	1440 Winter	100	+20%	1/120 Winter			
1.004	12	120 Winter	100	+20%				
5.000	3	60 Winter	100	+20%				
5.001	15	360 Winter	100	+20%	30/15 Summer			
5.002	4	1440 Winter	100	+20%	1/240 Winter			
1.005	5	120 Winter	100	+20%				
6.000	22	60 Winter	100	+20%				
7.000	15	60 Winter	100	+20%				

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Status	Level
		Level (m)	Depth (m)	Volume (m³)			Flow (l/s)		Exceeded
1.000	5	2.255	0.000	0.000	0.91		56.0	SURCHARGED*	
1.001	6	2.912	0.676	35.155	0.19		11.4	FLOOD	13
1.002	7	2.912	0.884	0.350	0.07		1.1	FLOOD	13
2.000	8	2.206	0.000	0.000	1.29		79.5	SURCHARGED*	
2.001	9	2.906	0.719	59.472	0.16		9.1	FLOOD	12
2.002	10	2.908	0.907	0.071	0.07		1.0	FLOOD	12
3.000	10	2.125	0.000	0.000	0.66		19.8	SURCHARGED*	
3.001	9	2.692	0.652	0.000	0.05		1.6	SURCHARGED	
1.003	8	2.550	0.000	0.000	0.03		12.8	SURCHARGED*	
4.000	14	2.061	0.000	0.000	1.42		42.5	SURCHARGED*	
4.001	15	2.692	0.661	24.869	0.12		3.5	FLOOD	8
4.002	14	2.692	0.774	0.000	0.68		3.1	SURCHARGED	
1.004	12	2.550	0.000	0.000	0.01		9.2	SURCHARGED*	
5.000	3	2.120	0.000	0.000	0.75		46.1	SURCHARGED*	
5.001	15	2.694	0.584	0.000	0.24		11.8	SURCHARGED	
5.002	4	2.708	0.773	0.000	0.40		3.3	SURCHARGED	
1.005	5	2.550	0.000	0.000	0.03		13.1	SURCHARGED*	
6.000	22	2.032	0.000	0.000	0.94		18.8	SURCHARGED*	
7.000	15	2.294	0.000	0.000	0.65		69.4	SURCHARGED*	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.
7.001	20	1440 Winter	100	+20%	30/15 Summer	100/240 Summer		
7.002	16	1440 Winter	100	+20%	30/60 Winter	100/240 Winter		
7.003	17	1440 Winter	100	+20%	30/30 Winter			
6.001	22	1440 Winter	100	+20%	30/30 Winter	100/240 Summer		
1.006	6	1440 Winter	100	+20%	1/120 Summer	100/120 Winter		

			Water Surcharged Flooded			Pipe			
PN	US/MH Name	Level (m)	Depth (m)	Volume (m³)	Flow / Overflow Cap.	Flow (l/s)	Flow (l/s)	Status	Level Exceeded
7.001	20	2.773	0.488	46.811	0.08		5.9	FLOOD	10
7.002	16	2.774	0.659	0.018	0.02		0.6	FLOOD	2
7.003	17	2.694	0.700	0.000	0.05		0.6	SURCHARGED	
6.001	22	2.692	0.688	39.234	0.06		1.9	FLOOD	10
1.006	6	2.692	0.792	54.749	0.19		2.6	FLOOD	11

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes AM_Stand Manhole Sizes AM_Stand

FSR Rainfall Model - England and Wales

Return Period (years)	100	Add Flow / Climate Change (%)	20
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio R	0.429	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	80	Min Design Depth for Optimisation (m)	0.600
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	1.00
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	500
Volumetric Runoff Coeff.	0.750		

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.429	4-8	0.750	8-12	0.031

Total Area Contributing (ha) = 1.210

Total Pipe Volume (m³) = 34.695

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	2.758	0.018	150.0	0.200	4.00	0.0	0.600	o	300	Pipe/Conduit	
1.001	5.575	0.058	95.4	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	12.885	0.128	100.7	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	4.252	0.019	222.0	0.284	4.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL E (m)	I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	80.00	4.04	1.955	0.200	0.0	0.0	8.7	1.28	90.6	52.0
1.001	80.00	4.09	1.937	0.200	0.0	0.0	8.7	1.61	113.8	52.0
1.002	80.00	4.31	1.878	0.200	0.0	0.0	8.7	1.00	17.7«	52.0
2.000	80.00	4.07	1.906	0.284	0.0	0.0	12.3	1.05	74.3	73.8

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
7.000	1.843	0.009	208.6	0.261	4.00	0.0	0.600	o	375	Pipe/Conduit	
7.001	6.446	0.020	324.9	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
7.002	3.930	0.046	85.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
7.003	9.796	0.065	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
6.001	3.563	0.029	125.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.006	21.729	0.145	149.9	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
7.000	80.00	4.02	1.919	0.261	0.0	0.0	11.3	1.25	138.1	67.9
7.001	80.00	4.13	1.910	0.261	0.0	0.0	11.3	1.00	110.4	67.9
7.002	80.00	4.18	1.890	0.261	0.0	0.0	11.3	1.42	56.3«	67.9
7.003	80.00	4.38	1.844	0.261	0.0	0.0	11.3	0.82	14.5«	67.9
6.001	80.00	4.43	1.779	0.333	0.0	0.0	14.4	1.17	46.4«	86.6
1.006	80.00	8.32	1.750	1.210	0.0	0.0	52.4	0.82	14.5«	314.6

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.200	0.200	0.200
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.000	0.000	0.000
2.000	-	-	100	0.284	0.284	0.284
2.001	-	-	100	0.000	0.000	0.000
2.002	-	-	100	0.000	0.000	0.000
3.000	-	-	100	0.072	0.072	0.072
3.001	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
4.000	-	-	100	0.156	0.156	0.156
4.001	-	-	100	0.000	0.000	0.000
4.002	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
5.000	-	-	100	0.165	0.165	0.165
5.001	-	-	100	0.000	0.000	0.000
5.002	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.000	0.000	0.000
6.000	-	-	100	0.072	0.072	0.072
7.000	-	-	100	0.261	0.261	0.261
7.001	-	-	100	0.000	0.000	0.000
7.002	-	-	100	0.000	0.000	0.000
7.003	-	-	100	0.000	0.000	0.000
6.001	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				1.210	1.210	1.210

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
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1.006		2.824	1.605	0.000	0	0
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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	6
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

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Brighton	Proposed network																					
East Sussex	Alternative - all underground																					
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Simulation Criteria for Storm <table><tr><td>Rainfall Model</td><td>FSR</td><td>Profile Type</td><td>Summer</td></tr><tr><td>Return Period (years)</td><td>100</td><td>Cv (Summer)</td><td>0.750</td></tr><tr><td>Region</td><td>England and Wales</td><td>Cv (Winter)</td><td>0.840</td></tr><tr><td>M5-60 (mm)</td><td>20.000</td><td>Storm Duration (mins)</td><td>30</td></tr><tr><td>Ratio R</td><td>0.429</td><td></td><td></td></tr></table>			Rainfall Model	FSR	Profile Type	Summer	Return Period (years)	100	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	20.000	Storm Duration (mins)	30	Ratio R	0.429		
Rainfall Model	FSR	Profile Type	Summer																			
Return Period (years)	100	Cv (Summer)	0.750																			
Region	England and Wales	Cv (Winter)	0.840																			
M5-60 (mm)	20.000	Storm Duration (mins)	30																			
Ratio R	0.429																					
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Online Controls for Storm

Hydro-Brake Optimum® Manhole: 7, DS/PN: 1.002, Volume (m³): 0.6

Unit Reference	MD-SHE-0052-9000-0400-9000
Design Head (m)	0.400
Design Flow (l/s)	0.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	52
Invert Level (m)	1.878
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.400	0.9
Flush-Flo™	0.116	0.9
Kick-Flo®	0.270	0.8
Mean Flow over Head Range	-	0.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.9	1.200	1.5	3.000	2.2	7.000	3.4
0.200	0.9	1.400	1.6	3.500	2.4	7.500	3.5
0.300	0.8	1.600	1.7	4.000	2.5	8.000	3.6
0.400	0.9	1.800	1.8	4.500	2.7	8.500	3.7
0.500	1.0	2.000	1.9	5.000	2.8	9.000	3.8
0.600	1.1	2.200	1.9	5.500	3.0	9.500	3.9
0.800	1.2	2.400	2.0	6.000	3.1		
1.000	1.4	2.600	2.1	6.500	3.2		

Hydro-Brake Optimum® Manhole: 10, DS/PN: 2.002, Volume (m³): 0.8

Unit Reference	MD-SHE-0052-9000-0400-9000
Design Head (m)	0.400
Design Flow (l/s)	0.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	52
Invert Level (m)	1.851
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

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Hydro-Brake Optimum® Manhole: 10, DS/PN: 2.002, Volume (m³): 0.8

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.400	0.9
Flush-Flo™	0.116	0.9
Kick-Flo®	0.270	0.8
Mean Flow over Head Range	-	0.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.9	1.200	1.5	3.000	2.2	7.000	3.4
0.200	0.9	1.400	1.6	3.500	2.4	7.500	3.5
0.300	0.8	1.600	1.7	4.000	2.5	8.000	3.6
0.400	0.9	1.800	1.8	4.500	2.7	8.500	3.7
0.500	1.0	2.000	1.9	5.000	2.8	9.000	3.8
0.600	1.1	2.200	1.9	5.500	3.0	9.500	3.9
0.800	1.2	2.400	2.0	6.000	3.1		
1.000	1.4	2.600	2.1	6.500	3.2		

Hydro-Brake Optimum® Manhole: 16, DS/PN: 7.002, Volume (m³): 1.6

Unit Reference	MD-SHE-0052-9000-0400-9000
Design Head (m)	0.400
Design Flow (l/s)	0.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	52
Invert Level (m)	1.890
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.400	0.9
Flush-Flo™	0.116	0.9
Kick-Flo®	0.270	0.8
Mean Flow over Head Range	-	0.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.9	0.300	0.8	0.500	1.0	0.800	1.2
0.200	0.9	0.400	0.9	0.600	1.1	1.000	1.4

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Hydro-Brake Optimum® Manhole: 16, DS/PN: 7.002, Volume (m³): 1.6

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
1.200	1.5	2.400	2.0	5.000	2.8	8.000	3.6
1.400	1.6	2.600	2.1	5.500	3.0	8.500	3.7
1.600	1.7	3.000	2.2	6.000	3.1	9.000	3.8
1.800	1.8	3.500	2.4	6.500	3.2	9.500	3.9
2.000	1.9	4.000	2.5	7.000	3.4		
2.200	1.9	4.500	2.7	7.500	3.5		

Hydro-Brake Optimum® Manhole: 6, DS/PN: 1.006, Volume (m³): 7.4

Unit Reference	MD-SHE-0078-2600-0930-2600
Design Head (m)	0.930
Design Flow (l/s)	2.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	78
Invert Level (m)	1.750
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.930	2.6
Flush-Flo™	0.280	2.6
Kick-Flo®	0.585	2.1
Mean Flow over Head Range	-	2.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.2	1.200	2.9	3.000	4.5	7.000	6.7
0.200	2.5	1.400	3.1	3.500	4.8	7.500	6.9
0.300	2.6	1.600	3.3	4.000	5.1	8.000	7.1
0.400	2.5	1.800	3.5	4.500	5.4	8.500	7.3
0.500	2.4	2.000	3.7	5.000	5.7	9.000	7.5
0.600	2.1	2.200	3.9	5.500	5.9	9.500	7.7
0.800	2.4	2.400	4.0	6.000	6.2		
1.000	2.7	2.600	4.2	6.500	6.4		

AEA - Ambiantal		Page 9																																																																								
Science Park Square Brighton East Sussex	Moolands Proposed network Alternative - all underground																																																																									
Date 19/06/2018 10:47 File 3809_NETWORK_V7_OPTION2...	Designed by BB Checked by MN																																																																									
XP Solutions	Network 2016.1																																																																									
Storage Structures for Storm Cellular Storage Manhole: 7, DS/PN: 1.002 Invert Level (m) 1.878 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>250.0</td><td>0.0</td><td>0.451</td><td>0.0</td><td>0.0</td></tr><tr><td>0.450</td><td>250.0</td><td>0.0</td><td></td><td></td><td></td></tr></table> Cellular Storage Manhole: 10, DS/PN: 2.002 Invert Level (m) 1.851 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>410.0</td><td>0.0</td><td>0.451</td><td>0.0</td><td>0.0</td></tr><tr><td>0.450</td><td>410.0</td><td>0.0</td><td></td><td></td><td></td></tr></table> Cellular Storage Manhole: 14, DS/PN: 4.002 Invert Level (m) 1.768 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>160.0</td><td>0.0</td><td>0.451</td><td>0.0</td><td>0.0</td></tr><tr><td>0.450</td><td>160.0</td><td>0.0</td><td></td><td></td><td></td></tr></table> Cellular Storage Manhole: 4, DS/PN: 5.002 Invert Level (m) 1.785 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>230.0</td><td>0.0</td><td>0.451</td><td>0.0</td><td>0.0</td></tr><tr><td>0.450</td><td>230.0</td><td>0.0</td><td></td><td></td><td></td></tr></table> Cellular Storage Manhole: 16, DS/PN: 7.002 Invert Level (m) 1.890 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	250.0	0.0	0.451	0.0	0.0	0.450	250.0	0.0				Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	410.0	0.0	0.451	0.0	0.0	0.450	410.0	0.0				Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	160.0	0.0	0.451	0.0	0.0	0.450	160.0	0.0				Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	230.0	0.0	0.451	0.0	0.0	0.450	230.0	0.0			
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<u>Cellular Storage Manhole: 16, DS/PN: 7.002</u> <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>350.0</td><td>0.0</td><td>0.451</td><td>0.0</td><td>0.0</td></tr><tr><td>0.450</td><td>350.0</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: 6, DS/PN: 1.006</u> Invert Level (m) 1.750 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>390.0</td><td>0.0</td><td>0.451</td><td>0.0</td><td>0.0</td></tr><tr><td>0.450</td><td>390.0</td><td>0.0</td><td></td><td></td><td></td></tr></table> <u>Volume Summary (Static)</u> Length Calculations based on True Length <table><tr><th>Pipe Number</th><th>USMH Name</th><th>Manhole Volume (m³)</th><th>Pipe Volume (m³)</th><th>Storage Structure Volume (m³)</th><th>Total Volume (m³)</th></tr><tr><td>1.000</td><td>5</td><td>0.000</td><td>0.174</td><td>0.000</td><td>0.174</td></tr><tr><td>1.001</td><td>6</td><td>0.266</td><td>0.352</td><td>0.000</td><td>0.618</td></tr><tr><td>1.002</td><td>7</td><td>0.292</td><td>0.222</td><td>106.954</td><td>107.469</td></tr><tr><td>2.000</td><td>8</td><td>0.000</td><td>0.279</td><td>0.000</td><td>0.279</td></tr><tr><td>2.001</td><td>9</td><td>0.271</td><td>0.501</td><td>0.000</td><td>0.772</td></tr><tr><td>2.002</td><td>10</td><td>0.299</td><td>0.268</td><td>175.405</td><td>175.972</td></tr><tr><td>3.000</td><td>10</td><td>0.000</td><td>0.108</td><td>0.000</td><td>0.108</td></tr><tr><td>3.001</td><td>9</td><td>0.357</td><td>0.560</td><td>0.000</td><td>0.918</td></tr><tr><td>1.003</td><td>8</td><td>0.000</td><td>20.541</td><td>0.000</td><td>20.541</td></tr><tr><td>4.000</td><td>14</td><td>0.000</td><td>0.165</td><td>0.000</td><td>0.165</td></tr><tr><td>4.001</td><td>15</td><td>0.243</td><td>0.209</td><td>0.000</td><td>0.453</td></tr><tr><td>4.002</td><td>14</td><td>0.275</td><td>0.269</td><td>68.451</td><td>68.994</td></tr><tr><td>1.004</td><td>12</td><td>0.000</td><td>2.696</td><td>0.000</td><td>2.696</td></tr><tr><td>5.000</td><td>3</td><td>0.000</td><td>0.140</td><td>0.000</td><td>0.140</td></tr><tr><td>5.001</td><td>15</td><td>0.252</td><td>0.350</td><td>0.000</td><td>0.601</td></tr><tr><td>5.002</td><td>4</td><td>0.273</td><td>0.224</td><td>98.398</td><td>98.894</td></tr><tr><td>1.005</td><td>5</td><td>0.000</td><td>5.067</td><td>0.000</td><td>5.067</td></tr><tr><td>6.000</td><td>22</td><td>0.000</td><td>0.070</td><td>0.000</td><td>0.070</td></tr><tr><td>7.000</td><td>15</td><td>0.000</td><td>0.137</td><td>0.000</td><td>0.137</td></tr><tr><td>7.001</td><td>20</td><td>0.923</td><td>0.579</td><td>0.000</td><td>1.503</td></tr><tr><td>7.002</td><td>16</td><td>1.000</td><td>0.120</td><td>149.736</td><td>150.856</td></tr><tr><td>7.003</td><td>17</td><td>0.258</td><td>0.163</td><td>0.000</td><td>0.421</td></tr><tr><td>6.001</td><td>22</td><td>0.247</td><td>0.094</td><td>0.000</td><td>0.341</td></tr><tr><td>1.006</td><td>6</td><td>2.258</td><td>0.368</td><td>166.849</td><td>169.474</td></tr><tr><td colspan="2">Total</td><td>7.215</td><td>33.656</td><td>765.792</td><td>806.663</td></tr></table>						Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	350.0	0.0	0.451	0.0	0.0	0.450	350.0	0.0				Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	390.0	0.0	0.451	0.0	0.0	0.450	390.0	0.0				Pipe Number	USMH Name	Manhole Volume (m³)	Pipe Volume (m³)	Storage Structure Volume (m³)	Total Volume (m³)	1.000	5	0.000	0.174	0.000	0.174	1.001	6	0.266	0.352	0.000	0.618	1.002	7	0.292	0.222	106.954	107.469	2.000	8	0.000	0.279	0.000	0.279	2.001	9	0.271	0.501	0.000	0.772	2.002	10	0.299	0.268	175.405	175.972	3.000	10	0.000	0.108	0.000	0.108	3.001	9	0.357	0.560	0.000	0.918	1.003	8	0.000	20.541	0.000	20.541	4.000	14	0.000	0.165	0.000	0.165	4.001	15	0.243	0.209	0.000	0.453	4.002	14	0.275	0.269	68.451	68.994	1.004	12	0.000	2.696	0.000	2.696	5.000	3	0.000	0.140	0.000	0.140	5.001	15	0.252	0.350	0.000	0.601	5.002	4	0.273	0.224	98.398	98.894	1.005	5	0.000	5.067	0.000	5.067	6.000	22	0.000	0.070	0.000	0.070	7.000	15	0.000	0.137	0.000	0.137	7.001	20	0.923	0.579	0.000	1.503	7.002	16	1.000	0.120	149.736	150.856	7.003	17	0.258	0.163	0.000	0.421	6.001	22	0.247	0.094	0.000	0.341	1.006	6	2.258	0.368	166.849	169.474	Total		7.215	33.656	765.792	806.663
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Appendix 4 – Proposed Surface Water Drainage Strategy Layout

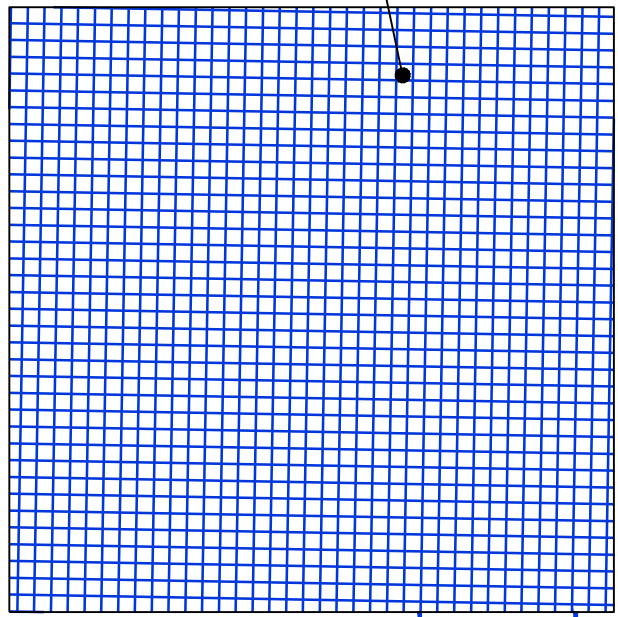
Gravesham Borough Council

Disused Ditch to be Reinstated

Ditch to be Reinstated

Disused Ditch to be Reinstated

GEOCELLULAR TANK,
PERMAVOID OR SIMILAR SUITABLY RATED FOR
PROVIDED COVER AND ANTICIPATED LOADS,
TO PROVIDE 66.2m³ STORAGE.
AREA: 240m²
THICKNESS: 0.450m
IL: 1.851
MIN COVER DEPTH: 0.548m



HYDRO FIRST DEFENSE
OR SIMILAR VORTEX
SEPARATOR
TRASHBOX /SILTBOX
ON OUTLET
IL: 1.948

HYDROBRAKE OR
SIMILAR LIMITING
FLOWS TO 0.9l/s
CL: 2.795
IL: 1.800

GEOCELLULAR TANK,
PERMAVOID OR SIMILAR SUITABLY RATED FOR
PROVIDED COVER AND ANTICIPATED LOADS,
TO PROVIDE 55.6m³ STORAGE.
AREA: 130m²
THICKNESS: 0.450m
IL: 1.768
MIN COVER DEPTH: 0.480m

HYDRO FIRST
DEFENSE OR
SIMILAR VORTEX
SEPARATOR
TRASHBOX /SILTBOX
ON OUTLET
IL: 1.836

HYDROBRAKE OR
SIMILAR LIMITING
FLOWS TO 0.9l/s
CL: 2.667
IL: 1.760

HYDRO UP-FLOW
OR SIMILAR HIGH
PERFORMANCE
FILTER

HYDRO FIRST
DEFENSE OR
SIMILAR VORTEX
SEPARATOR

HYDROBRAKE OR
SIMILAR LIMITING
FLOWS TO 0.9l/s
CL: 2.621
IL: 1.728

Street Lamp

Street Lamp

Street Lamp

Street Lamp

TRASHBOX /SILTBOX
ON OUTLET
CL: 2.855
IL: 1.955
HYDRO FIRST DEFENSE
OR SIMILAR VORTEX
SEPARATOR

HYDROBRAKE OR
SIMILAR LIMITING
FLOWS TO 0.9l/s
CL: 2.809
IL: 1.828

GEOCELLULAR TANK,
PERMAVOID OR SIMILAR SUITABLY RATED FOR
PROVIDED COVER AND ANTICIPATED LOADS,
TO PROVIDE 71.6m³ STORAGE.
AREA: 170m²
THICKNESS: 0.450m
IL: 1.750
MIN COVER DEPTH: 0.400m

TRASHBOX /SILTBOX
ON OUTLET
IL: 1.820
HYDRO FIRST
DEFENSE OR
SIMILAR VORTEX
SEPARATOR

TRASHBOX /SILTBOX
ON OUTLET
IL: 1.882

HYDROBRAKE OR
SIMILAR LIMITING
FLOWS TO 0.9l/s
CL: 2.711
IL: 1.760

HYDRO FIRST
DEFENSE OR
SIMILAR VORTEX
SEPARATOR

HYDROBRAKE OR
SIMILAR LIMITING
FLOWS TO 0.9l/s
CL: 2.757
IL: 1.860

PLOT D

GEOCELLULAR TANK,
PERMAVOID OR SIMILAR SUITABLY RATED FOR
PROVIDED COVER AND ANTICIPATED LOADS,
TO PROVIDE 66.2m³ STORAGE.
AREA: 155m²
THICKNESS: 0.450m
IL: 1.878
MIN COVER DEPTH: 0.500m

PLOT B

GEOCELLULAR TANK,
PERMAVOID OR SIMILAR SUITABLY RATED FOR
PROVIDED COVER AND ANTICIPATED LOADS,
TO PROVIDE 55.6m³ STORAGE.
AREA: 145m²
THICKNESS: 0.450m
IL: 1.785
MIN COVER DEPTH: 0.493m

PLOT A

GEOCELLULAR TANK,
PERMAVOID OR SIMILAR SUITABLY RATED FOR
PROVIDED COVER AND ANTICIPATED LOADS,
TO PROVIDE 115.5m³ STORAGE.
AREA: 270m²
THICKNESS: 0.450m
IL: 1.890
MIN COVER DEPTH: 0.415m

DESIGN PHILOSOPHY
PEAK RUNOFF FROM SITE: EQUIVALENT TO Qbar, 2.6l/s
UNDERGROUND ATTENUATION STORAGE PROPOSED TO ATTENUATE ALL
RUNOFF FROM 1in30 YEAR STORM UNDERGROUND
RUNOFF FROM 1in100 YEAR STORM (PLUS CLIMATE CHANGE ALLOWANCE)
PROPOSED TO BE ATTENUATED WITHIN A FLOODABLE AREA ABOVE GROUND
SHOWN IN 3809-DR02.
PROPOSED LEVELS DESIGNED TO ALLOW GRAVITATIONAL DISCHARGE WHILE
PROVIDING FEASIBLE COVER FOR ATTENUATION TANKS AND PIPES.
PROPOSED MINIMUM COVER FOR TANKS 0.4m IN COMPLIANCE WITH
POLYPIPE RECOMMENDATIONS FOR ANTICIPATED LOAD CATEGORY. IF
ALTERNATIVE SYSTEM TO BE USED, LEVELS NEED TO BE REVISED.
PIPE COVERS SMALLER THAN 0.9m TO BE CONCRETE ENCASED.

- GENERAL
a. THIS DRAWING IS NOT TO BE SCALED, WORK TO FIGURED DIMENSIONS
ONLY, CONFIRMED ON SITE.
b. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT
ARCHITECTURAL DRAWINGS, DETAILED SPECIFICATIONS WHERE
APPLICABLE AND ALL ASSOCIATED DRAWINGS IN THIS SERIES.
c. ANY DISCREPANCY ON THIS DRAWING IS TO BE REPORTED IMMEDIATELY
TO THE PARTNERSHIP FOR CLARIFICATION.
d. THE CONTRACTOR IS RESPONSIBLE FOR ALL TEMPORARY WORKS AND FOR
THE STABILITY OF THE WORKS IN PROGRESS.
- CONSTRUCTION NOTE
a. THE MAIN CONTRACTOR IS RESPONSIBLE FOR THE DESIGN OF ALL
TEMPORARY WORKS, AND IS ALSO RESPONSIBLE FOR THE SAFE
MAINTENANCE AND STABILITY OF EXISTING BUILDINGS AT ALL TIMES.
b. THE MAIN CONTRACTOR IS RESPONSIBLE FOR ALL OCCURRENCES OF
GROUND WATER DURING THE CONSTRUCTION PERIOD.
c. ANY INFORMATION GIVEN REGARDING EXISTING UNDERGROUND SERVICES
IS GIVEN IN GOOD FAITH AFTER CONSULTATION WITH THE RELEVANT
AUTHORITY, HOWEVER ACCURACY IS NOT CERTAIN. THE MAIN
CONTRACTOR IS RESPONSIBLE FOR CHECKING ALL INFORMATION ON SITE
PRIOR TO WORK COMMENCING AND TAKING DUE CARE AND ATTENTION
WHILST UNDERTAKING THE WORKS.
d. THE CONTRACTOR MUST COMPLY WITH ALL CURRENT LEGISLATION
RELATING TO HEALTH & SAFETY.
e. ALL PRODUCTS SPECIFIED SHALL BE INSTALLED IN STRICT ACCORDANCE
WITH THE MANUFACTURERS RECOMMENDATIONS AND INSTRUCTIONS.
IF THERE ARE DISCREPANCIES BETWEEN THAT INFORMATION AND THE
DETAILS ON ANY AMBIENTAL DRAWINGS, THE MANUFACTURERS
INSTRUCTIONS MUST BE USED.
- BELOW GROUND DRAINAGE
j. PIPEWORK TO BE UPVC-U PIPES TO BS 4660 : 2000 AND INSPECTION
CHAMBERS TO BS 7158 : 2001.
k. ALL ADAPTABLE DRAINAGE TO BE CONSTRUCTED IN ACCORDANCE WITH
"SEWERS FOR ADOPTION" 7TH EDITION AND THE RELEVANT COUNCIL
DESIGN GUIDE.
l. ALL PRIVATE SURFACE WATER SEWERS TO BE LAID AT 1 IN 100 UNLESS
OTHERWISE STATED ON THE DRAWING.
m. ALL PRIVATE FOUL WATER SEWERS TO BE LAID AT 1 IN 40 AT THE HEAD OF
PIPE RUNS AND 1 IN 80 ELSEWHERE UNLESS OTHERWISE STATED.
n. ALL PRIVATE FOUL SEWER PIPES TO BE 150MM DIAMETER UNLESS
OTHERWISE STATED ON THE DRAWING. ALL PRIVATE SURFACE WATER
SEWER PIPES TO BE 100MM DIAMETER FROM DOWNPIPES AND 150MM
DIAMETER ELSEWHERE UNLESS OTHERWISE STATED ON THE DRAWING.
o. ALLOW FOR RODDING ACCESS ABOVE GROUND WHERE RAINWATER
DOWNPIPES DO NOT HAVE A DIRECT CONNECTION TO AN INSPECTION
CHAMBER. EXISTING SEWER PIPE TO BE RE-USED TO BE SURVEYED AND
LEVELLED PRIOR TO COMMENCEMENT OF THE DRAINAGE WORKS AND
REFURBISHED IF NECESSARY.
p. CONNECTIONS TO AN ADOPTED SEWER ONLY TO BE MADE FOLLOWING
APPROVAL FROM THE RELEVANT ADOPTING AUTHORITY.
q. ALL DRAINS, SEWER PIPES AND MANHOLES TO BE CLEANED AND TESTED
FOR WATER TIGHTNESS ON COMPLETION OF CONSTRUCTION.
- MANHOLE COVERS AND FRAMES
r. MANHOLE COVERS TO BE CLASS D400 IN HIGHWAYS, CLASS B125 IN
FOOTWAYS AND VERGES, CLASS A15 IN NON-TRAFFICKED AREAS.
s. MANHOLE COVER AND FRAME TO BE BEDDED AND SURROUNDED IN 1:3
MORTAR.

REV	DATE	CKD	APPD	BY	DESCRIPTION
PRELIMINARY DRAWING FOR INFORMATION ONLY. NOT FOR CONSTRUCTION.					
Client CLIENT					
Project LAND BETWEEN COMMA OIL AND TREATMENT WORKS GRAVESEND, DA13					
Drawing DRAINAGE STRATEGY SURFACE WATER DRAINAGE LAYOUT					
Drawn by: BB Date: 18/06/2018					
Drawing No: 3809 - DR01					
Revision -					
Drawing Scale: 1:200 @ A1 0 2m 4m 6m 8m 10m					

LEGEND	
	SURFACE WATER DRAIN SLOT/CHANNEL DRAIN
	TYPE 2 MANHOLE
	OVERLAND FLOW ROUTE
	EXCEEDANCE EVENT FLOW ROUTE
	ATTENUATION SYSTEM
	FIRST DEFENSE OR SIMILAR VORTEX SEPARATOR
	HYDRO UP-FLOW OR SIMILAR HIGH PERFORMANCE FILTER

Appendix 5 – Communication with Hydro

Gravesham Borough Council

[REDACTED]

From: [REDACTED]

[REDACTED] tion mitigation devices

Attachments: The Hydro StormTrain Series Brochure Rev F0117.pdf

[REDACTED].uk>

Hi Stavros

There are two options for your treatment needs. The Downstream Defender would be the minimum that you would require for the high pollution level, or the Up-Flo filter is a higher specification device that uses a media to filter the flow. The Downstream Defender uses Hydro dynamic separation so there is no filtration taking place. Please see the attached brochure to help with your selection process.

We offer them in a range of sizes to suit the flow rate you need to treat, and this is the further information that we require for quotation purposes. You have an attenuation system so this can help in reducing the size and cost of the unit as it can be used to treat the consent to discharge flow rate, and not the actual run off flow rate which can be a lot higher. The attenuation system will then act as a buffer so you are not treating the peak storm event flow rate, just the lower flow rate of your consent.

To protect the geocellular attenuation tank for silting up you may want to install a First Defense or Downstream Defender upstream of the storage as a primary treatment device that will also soften the blow to the Up-Flo filter by removing the larger particles first.

I hope this helps, please get back to me if there is anything else.

Best regards,

Mark Bowditch, BEng(hons)
Technical Proposals Engineer
Hydro International – Stormwater Solutions
Direct Dial: +44 (0)1275 337965

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[REDACTED]

Hello everyone,

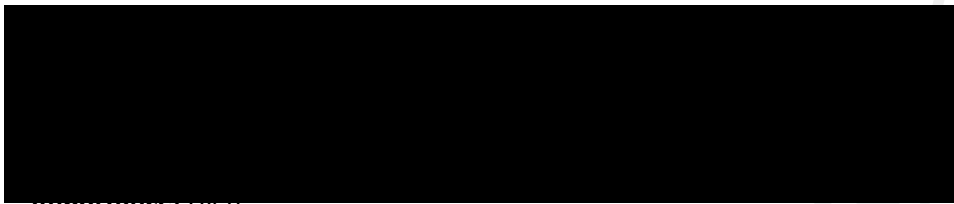
Please can someone respond to Stavros?

With best regards,
Fiona

Fiona Britton
Proposals Engineer
Direct Dial: +44 (0)1275 337916
Skype: fbritton.hydro

Hydro International Stormwater Solutions

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Importance: High

Hi

What treatment train design would you recommend for the following pollution hazard indices below. The drainage strategy uses channel drains to intercept runoff and geocellular crates for attenuation. The runoff is ultimately discharged into a watercourse.

POLLUTION HAZARD INDICES FOR DIFFERENT LAND USE CLASSIFICATIONS				
LAND USE	Pollution Hazard Level	Total suspended Solids (TSS)	Metals	Hydrocarbons
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2	0.05
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and	High	0.8	0.8	0.9

fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways				
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We are currently working on a site that would require extensive treatment. Any help on this issue would be greatly appreciated.

Please let us know if additional information is required.

We are looking forward to your reply at your earliest convenience.

Kind regards,

Stavros

Stavros Drakopoulos, MEng (Hons) | Graduate Flood Risk and Drainage Consultant



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