[redacted]
BAYA Group

VIA EMAIL

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14th March 2024

Dear [redacted]

RESPONSE TO ESSEX COUNTY COUNCIL'S COMMENTS ON THE PROPOSED DRAINAGE STRATEGY FOR THE PROPOSED DEVELOPMENT AT LAND WEST OF CLATTERBURY LANE, CLAVERING, ESSEX CB11 4QS

This letter has been prepared in response to comments from Essex County Council LLFA to support the removal of the holding objection to planning application UTT/23/3113/PINS following on from the submission of an FRA prepared by EAS dated December 2023.

The comments from the LLFA (included in **Appendix A**) are summarised in italics below with the required additional information/response shown in blue below:

"The LLFA require the discharge rate to be restricted to the 1 in 1-year greenfield runoff rate, and not the 1:2 year runoff rate as proposed for the alternative drainage strategy. Please note the LLFA do not accept the QBAR rate. This should be accompanied with the greenfield runoff rate estimation, as Appendix J currently appears blank."

Greenfield runoff rates were estimated using the ReFH2 method on the Causeway Flow software. The results of which are included in **Appendix B**. The proposed impermeable area of the site is 0.5816ha, the following greenfield runoff rates for a range of storm events have been scaled accordingly:

1 in 1 year – 3.9 l/s/ha – 2.3 l/s

1 in 2 year – 4.8 l/s/ha – 2.8 l/s

1 in 30 year – 12.8 l/s/ha – 7.4 l/s

1 in 100 year – 16.4 l/s/ha – 9.5 l/s

The proposed attenuation drainage strategy has been updated to restrict the maximum discharge rate from the site to match the 1 in 1 year rate of 2.3 l/s. This has resulted in the size of the proposed attenuation basin increasing slightly from 350m^2 to 367m^2. The base area of the basin has also increased to 134.8m^2 however, the total depth of 1.2m including a 300mm freeboard has remained the same, with a permanently wet area with a depth of 600mm also still provided. The rest of the attenuation based drainage strategy has remained unchanged.

The Causeway Flow Calculations for the updated attenuation strategy have been included in **Appendix C** with the updated drainage plan included in **Appendix D**.

"Please provide preliminary ground investigation information, such as historic borehole logs, BGS data etc to support an infiltration scheme."

As described within the submitted Flood Risk Assessment the British Geological Survey (BGS)online mapping shows the site is located within an area underlain by a bedrock of Lewes Nodular Chalk Formation with subsidiary calcareous mudstone and flint. While the superficial deposits on site consist of the Lowestoft Formation – a chalky till with outwash sands, gravels, silts, and clays.

The nearest borehole records to the site are from borehole TL43SE10, located approximately 600m to the south of the site. The borehole records show gravel and loam up to a depth of 8.2m followed by 2.1m of brown clay and gravel. The borehole records confirm the geology indicated by the BGS mapping which further supports that an infiltration based drainage strategy could be viable however, this will need to be confirmed following site specific infiltration tests.

However, as detailed within the submitted FRA, at this stage both an infiltration-based and attenuation-based strategy have been provided. Therefore, if testing undertaken at a Reserved Matters stage finds that infiltration is not viable at the site, the proposed attenuation strategy will be implemented as a suitable alternative.

"More information is required regarding the volume of onsite storage provided to mitigate against the offsite flows and whether the storage features have sufficient capacity to store any offsite flows."

Due to surface water flood risk to the north of the development site it could be argued that offsite surface water flows could potentially enter the site. However, upon reviewing the detailed surface water flood risk data generated using QGIS included within the submitted FRA it can be seen that for both the 1 in 30yr and 1 in 100yr events the vast majority of flood depth to the immediate north of the site is shown to be below 150mm. Therefore, it is very likely that the majority if not all surface water flooding to the north of the site will be contained within the road before being directed west due to the gradient of the road, away from the site. Even during the 1 in 1000yr exceedance level event areas of flood depth to the north are shown to be less than 150mm however, during this event there are also areas shown to have a depth of up to 300mm with some small areas shown up to 600mm.

The surface water flood risk mapping has been included in **Appendix E** for reference.

At this stage it cannot be determined exactly how much offsite surface water runoff will enter the site without undertaking surface water modelling. As described within the submitted FRA undertaking surface water runoff at this early stage of the development is unreasonable particularly as the majority of runoff from the surface water flood risk to the north will likely be directed west away from the site.

Nonetheless, a 300mm freeboard has been provided within the proposed basin as part of both the attenuation and infiltration based drainage strategies. This freeboard provides a total storage volume of 99.7m^3 which would be available to store any offsite flows that do enter the site.

In the event the freeboard does not provide adequate attenuation for offsite flows, the flows would simply continue to the southwest as it does in the existing scenario. Given the land to the southwest consist of agricultural and grassland this would not increase flood risk to a vulnerable land use and is therefore considered acceptable.

"Please clarify how the runoff from the roofs will be treated. For example, if rainwater down pipes will be connected into the permeable paving etc.."

Rainwater downpipes will be used to collect surface water from the roof areas with sewers used to discharge the runoff from the downpipes to the sub-base of the permeable paving via diffuser units. Silt traps and raingarden planters may also be used within this part of the system however, this will be considered in more detail at a later stage of the development.

I trust the above provides sufficient additional information to satisfy the comments received with regards to the proposed drainage strategy. Should you require any further information please do not hesitate to contact me.

Yours sincerely,

[redacted]

Michael Caraglia

Engineer

Enc. Appendix A – Comments Relating to the Objection of Planning Application UTT/23/3113/PINS

Appendix B – Greenfield Runoff Rate Calculations

Appendix C – Attenuation Strategy Causeway Flow Calculations

Appendix D – Attenuation Strategy Drainage Plan

Appendix E – Surface Water Flood Risk Mapping

Appendix A – Comments Relating to the Objection of Planning Application UTT/23/3113/PINS

Essex County Council
Development and Flood Risk
Waste & Environment
C426 County Hall
Chelmsford
Essex CM1 1QH

Essex County Council

Date: 7th February 2024
Our Ref: SUDS-007316
Your Ref: S62A/2023/0030

Leanne Palmer
The Planning Inspectorate

Dear Ms Palmer,

Consultation Response – S62A/2023/0030 - Land to the west of Clatterbury Lane, Clavering, Essex

Thank you for your email received on 16th January 2024 which provides this Council with the opportunity to assess and advise on the proposed surface water drainage strategy for the above mentioned planning application.

As the Lead Local Flood Authority (LLFA) this Council provides advice on SuDS schemes for major developments. We have been statutory consultee on surface water since the 15th April 2015.

In providing advice this Council looks to ensure sustainable drainage proposals comply with the required standards as set out in the following documents:

- Non-statutory technical standards for sustainable drainage systems
- Essex County Council's (ECC's) adopted Sustainable Drainage Systems Design Guide
- The CIRIA SuDS Manual (C753)
- BS8582 Code of practice for surface water management for development sites.

Lead Local Flood Authority position

Having reviewed the Flood Risk Assessment and the associated documents which accompanied the planning application, we wish to issue a **holding objection** to the granting of planning permission based on the following:

- The LLFA require the discharge rate to be restricted to the 1 in 1-year greenfield runoff rate, and not the 1:2 year runoff rate as proposed for the alternative drainage strategy. Please note the LLFA do not accept the QBAR rate.
  This should be accompanied with the greenfield runoff rate estimation, as Appendix J currently appears blank.
- Please provide preliminary ground investigation information, such as historic borehole logs, BGS data etc to support an infiltration scheme.
- More information is required regarding the volume of onsite storage provided to mitigate against the offsite flows and whether the storage features have sufficient capacity to store any offsite flows.

- Please clarify how the runoff from the roofs will be treated. For example, if rainwater down pipes will be connected into the permeable paving etc.

We also have the following advisory comments:

- We strongly recommend looking at the Essex Green Infrastructure Strategy to ensure that the proposals are implementing multifunctional green/blue features effectively. The link can be found below. https://www.essex.gov.uk/protecting-environment
- Please note that the Environment Agency updated the peak rainfall climate change allowances on the 10 May 2022. planning application with outline approval are not required to adjust an already approved climate change allowance, however, wherever possible, in cases that do not have a finalised drainage strategy please endeavour to use the updated climate change figures Flood risk assessments: climate change allowances - GOV.UK (www.gov.uk)
- For the alternative drainage strategy as the receiving watercourse is a Main River, the Environment Agency should be consulted.
- We recommend that rainwater harvesting is incorporated into the drainage design, including a water butt fitted to each dwelling.
- FFL's of 300mm above the existing ground level will be required.
- At detailed design surface water flood modelling must be provided, and a MADD Factor of 0 must be used within the detailed calculations.

Any questions raised within this response should be directed to the applicant and the response should be provided to the LLFA for further consideration. If you are minded to approve the application contrary to this advice, we request that you contact us to allow further discussion and/or representations from us.

Summary of Flood Risk Responsibilities for your Council

We have not considered the following issues as part of this planning application as they are not within our direct remit; nevertheless these are all very important considerations for managing flood risk for this development, and determining the safety and acceptability of the proposal. Prior to deciding this application you should give due consideration to the issue(s) below. It may be that you need to consult relevant experts outside your planning team.

- Sequential Test in relation to fluvial flood risk;
- Safety of people (including the provision and adequacy of an emergency plan, temporary refuge and rescue or evacuation arrangements);
- Safety of the building;
- Flood recovery measures (including flood proofing and other building level resistance and resilience measures);
- Sustainability of the development.

In all circumstances where warning and emergency response is fundamental to managing flood risk, we advise local planning authorities to formally consider the emergency planning and rescue implications of new development in making their decisions.

Please see Appendix 1 at the end of this letter with more information on the flood risk responsibilities for your council.

INFORMATIVES:

- Essex County Council has a duty to maintain a register and record of assets which have a significant impact on the risk of flooding. In order to capture proposed SuDS which may form part of the future register, a copy of the SuDS assets in a GIS layer should be sent to suds@essex.gov.uk.
- Any drainage features proposed for adoption by Essex County Council should be consulted on with the relevant Highways Development Management Office.
- Changes to existing water courses may require separate consent under the Land Drainage Act before works take place. More information about consenting can be found in the attached standing advice note.
- It is the applicant's responsibility to check that they are complying with common law if the drainage scheme proposes to discharge into an off-site ditch/pipe. The applicant should seek consent where appropriate from other downstream riparian landowners.
- The Ministerial Statement made on 18th December 2014 (ref. HCWS161) states that the final decision regarding the viability and reasonableness of maintenance requirements lies with the LPA. It is not within the scope of the LLFA to comment on the overall viability of a scheme as the decision is based on a range of issues which are outside of this authority's area of expertise.
- We will advise on the acceptability of surface water and the information submitted on all planning applications submitted after the 15th of April 2015 based on the key documents listed within this letter. This includes applications which have been previously submitted as part of an earlier stage of the planning process and granted planning permission based on historic requirements. The Local Planning Authority should use the information submitted within this response in conjunction with any other relevant information submitted as part of this application or as part of preceding applications to make a balanced decision based on the available information.

Yours sincerely,

Gemma Parson, Development and Flood Risk Officer
Team: Green Infrastructure and Sustainable Drainage
Service: Climate Action and Mitigation
Essex County Council

Internet: www.essex.gov.uk
[redacted]

Appendix 1 - Flood Risk responsibilities for your Council

The following paragraphs provide guidance to assist you in determining matters which are your responsibility to consider.

- Safety of People (including the provision and adequacy of an emergency plan, temporary refuge and rescue or evacuation arrangements)

  You need to be satisfied that the proposed procedures will ensure the safety of future occupants of the development. In all circumstances where warning and emergency response is fundamental to managing flood risk, we advise LPAs formally consider the emergency planning and rescue implications of new development in making their decisions.
  We do not normally comment on or approve the adequacy of flood emergency response procedures accompanying development proposals as we do not carry out these roles during a flood.

- Flood recovery measures (including flood proofing and other building level resistance and resilience measures)

  We recommend that consideration is given to the use of flood proofing measures to reduce the impact of flooding when it occurs. Both flood resilience and resistance measures can be used for flood proofing.

  Flood resilient buildings are designed to reduce the consequences of flooding and speed up recovery from the effects of flooding; flood resistant construction can help prevent or minimise the amount of water entering a building. The National Planning Policy Framework confirms that resilient construction is favoured as it can be achieved more consistently and is less likely to encourage occupants to remain in buildings that could be at risk of rapid inundation.

  Flood proofing measures include barriers on ground floor doors, windows and access points and bringing in electrical services into the building at a high level so that plugs are located above possible flood levels. Consultation with your building control department is recommended when determining if flood proofing measures are effective.

  Further information can be found in the Department for Communities and Local Government publications 'Preparing for Floods' and 'Improving the flood performance of new buildings'.

- Sustainability of the development

  The purpose of the planning system is to contribute to the achievement of sustainable development. The NPPF recognises the key role that the planning system plays in helping to mitigate and adapt to the impacts of climate change, taking full account of flood risk and coastal change; this includes minimising vulnerability and providing resilience to these impacts. In making your decision on this planning application we advise you consider the sustainability of the development over its lifetime.

Appendix B – Greenfield Runoff Rate Calculations

Simulation Settings

Rainfall Methodology	FEH-22	Drain Down Time (mins)	240	30 year (l/s)	12.8
Summer CV	1.000	Additional Storage (m³/ha)	20.0	100 year (l/s)	16.4
Winter CV	1.000	Check Discharge Rate(s)	✓	Check Discharge Volume	x
Analysis Speed	Normal	1 year (l/s)	3.9		
Skip Steady State	x	2 year (l/s)	4.8		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
30	40	0	0
100	0	0	0
100	40	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Betterment (%)	0
Greenfield Method	ReFH2	Q 1 year (l/s)	3.9
Region	England, Wales, NI	Q 2 year (l/s)	4.8
Include Baseflow	x	Q 30 year (l/s)	12.8
Positively Drained Area (ha)	1.000	Q 100 year (l/s)	16.4

Appendix C – Attenuation Strategy Causeway Flow Calculations

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	50.0		

Nodes

	Name	Area (ha)	T of E (mins)	Cover Level (m)	Node Type	Manhole Type	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
✓	SW1	0.007	5.00	97.500	Manhole	Adoptable	1500	108.825	59.661	2.996
✓	SW2	0.007	5.00	96.800	Manhole	Adoptable	1500	97.074	59.702	2.398
✓	SW3	0.007	5.00	96.640	Manhole	Adoptable	1500	86.554	59.748	2.357
✓	SW4	0.029	5.00	96.513	Manhole	Adoptable	1500	86.821	48.567	2.358
✓	SW5	0.006	5.00	96.385	Manhole	Adoptable	1800	96.356	38.893	2.418
✓	PP ATTENUATION	0.068	5.00	96.385	Junction			87.287	27.264	0.600
✓	SW6	0.039	5.00	96.385	Manhole	Adoptable	1800	87.252	38.831	2.508
✓	SW7	0.024	5.00	95.400	Manhole	Adoptable	1800	72.219	39.049	1.642
✓	STORAGE TANK	0.018	5.00	95.000	Junction			63.228	39.757	1.284
✓	PP CONVEY2	0.050	5.00	94.800	Junction			66.878	24.848	0.600
✓	SW9	0.045	5.00	94.800	Manhole	Adoptable	1350	52.950	31.925	1.143
✓	SW10	0.013	5.00	96.700	Manhole	Adoptable	1500	74.062	65.685	1.853
✓	SW11	0.013	5.00	96.100	Manhole	Adoptable	1500	64.565	69.331	1.423
✓	PP CONVEY1	0.043	1.00	95.500	Junction			39.995	72.561	0.550
✓	SW12	0.013	5.00	95.400	Manhole	Adoptable	1500	55.773	59.789	0.835
✓	CONVEY SWALE	0.018	5.00	95.150	Junction			48.225	48.267	0.700
✓	ATTENUATION BASIN			94.800	Junction			38.450	32.035	1.200
✓	1			94.700	Manhole	Adoptable	1200	19.714	29.453	1.200

Links (Input)

US Node	DS Node	Length (m)	ks (mm) / n	Velocity Equation	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of (mi
SW1	SW2	20.400	0.600	Colebrook-White	94.504	94.402	0.102	200.0	300	Circular	5.
SW2	SW3	23.700	0.600	Colebrook-White	94.402	94.283	0.119	199.2	300	Circular	5.
SW3	SW4	25.000	0.600	Colebrook-White	94.283	94.155	0.128	195.3	300	Circular	6.
SW4	SW6	25.500	0.600	Colebrook-White	94.155	94.027	0.128	199.2	300	Circular	6.
SW5	SW6	27.000	0.600	Colebrook-White	93.967	93.877	0.090	300.0	450	Circular	5.
PP ATTENUATION	SW6	6.000	0.600	Colebrook-White	95.785	95.377	0.408	14.7	100	Circular	5.
SW6	SW7	35.800	0.600	Colebrook-White	93.877	93.758	0.119	300.8	450	Circular	6.
SW7	STORAGE TANK	12.700	0.600	Colebrook-White	93.758	93.716	0.042	302.4	450	Circular	7.
STORAGE TANK	SW9	17.700	0.600	Colebrook-White	93.716	93.657	0.059	300.0	450	Circular	7.
PP CONVEY2	SW9	4.000	0.600	Colebrook-White	94.200	93.957	0.243	16.5	150	Circular	5.
SW9	ATTENUATION BASIN	11.000	0.600	Colebrook-White	93.657	93.620	0.037	297.3	450	Circular	7.
SW10	SW11	34.000	0.600	Colebrook-White	94.847	94.677	0.170	200.0	300	Circular	5.
SW11	SW12	22.400	0.600	Colebrook-White	94.677	94.565	0.112	200.0	300	Circular	5.
PP CONVEY1	SW12	20.300	0.600	Colebrook-White	94.950	94.640	0.310	65.5	100	Circular	1.
SW12	CONVEY SWALE	13.774	0.600	Colebrook-White	94.565	94.450	0.115	119.8	300	Circular	6.
CONVEY SWALE	ATTENUATION BASIN	10.000	0.600	Colebrook-White	94.450	93.620	0.830	12.0	100	Circular	6.
ATTENUATION BASIN	1	10.000	0.600	Colebrook-White	93.600	93.500	0.100	100.0	150	Circular	7.

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	20.0
Summer CV	1.000	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	1440	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
30	40	0	0
100	0	0	0
100	40	0	0

Node PP ATTENUATION Online Orifice Control

Flap Valve	x	Replaces Downstream Link	✓	Diameter (m)	0.025
Downstream Link	3.000	Invert Level (m)	95.605	Discharge Coefficient	0.600

Node ATTENUATION BASIN Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Downstream Link	1.008	Sump Available	✓
Replaces Downstream Link	✓	Product Number	CTL-SHE-0074-2300-0900-2300
Invert Level (m)	93.600	Min Outlet Diameter (m)	0.100
Design Depth (m)	0.900	Min Node Diameter (mm)	1200
Design Flow (l/s)	2.3		

Node STORAGE TANK Online Orifice Control

Flap Valve	x	Replaces Downstream Link	✓	Diameter (m)	0.038
Downstream Link	1.006	Invert Level (m)	93.716	Discharge Coefficient	0.600

Node PP CONVEY2 Online Orifice Control

Flap Valve	x	Replaces Downstream Link	✓	Diameter (m)	0.130
Downstream Link	4.000	Invert Level (m)	94.200	Discharge Coefficient	0.600

Node PP ATTENUATION Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	95.935	Slope (1:X)	300.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	
Safety Factor	2.0	Width (m)	8.562	Inf Depth (m)	
Porosity	0.30	Length (m)	79.311		

Node PP CONVEY2 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	94.200	Slope (1:X)	40.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	25	Depth (m)	
Safety Factor	2.0	Width (m)	5.480	Inf Depth (m)	
Porosity	0.30	Length (m)	62.000		

Node PP CONVEY1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	94.950	Slope (1:X)	40.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	27	Depth (m)	
Safety Factor	2.0	Width (m)	5.640	Inf Depth (m)	
Porosity	0.30	Length (m)	55.000		

Node STORAGE TANK Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	93.716
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	173.6	0.0	0.800	173.6	0.0	0.801	0.0	0.0

Node CONVEY SWALE Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	94.450
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	26

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	5.6	0.0	0.700	85.6	0.0

Node PP ATTENUATION Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	95.785	Slope (1:X)	300.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.150
Safety Factor	2.0	Width (m)	6.179	Inf Depth (m)	
Porosity	0.95	Length (m)	74.906		

Node ATTENUATION BASIN Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	93.600
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	134.8	0.0	1.200	367.0	0.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.91%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW1	11	94.529	0.025	1.1	0.0448	0.0000	OK
15 minute summer	SW2	11	94.436	0.034	2.2	0.0619	0.0000	OK
15 minute summer	SW3	12	94.323	0.040	3.2	0.0733	0.0000	OK
15 minute summer	SW4	11	94.218	0.063	7.6	0.1268	0.0000	OK
15 minute summer	SW5	11	93.989	0.022	1.0	0.0583	0.0000	OK
360 minute winter	PP ATTENUATION	344	96.006	0.221	5.0	29.0708	0.0000	SURCHARGED
15 minute summer	SW6	11	93.963	0.086	14.9	0.2443	0.0000	OK
720 minute summer	SW7	720	93.945	0.187	3.8	0.5308	0.0000	OK
720 minute summer	STORAGE TANK	720	93.945	0.229	4.1	37.8487	0.0000	OK
15 minute summer	PP CONVEY2	12	94.331	0.131	10.4	1.0644	0.0000	OK
360 minute summer	SW9	280	93.874	0.217	7.2	0.4822	0.0000	OK
15 minute summer	SW10	11	94.880	0.033	2.1	0.0631	0.0000	OK
15 minute summer	SW11	11	94.722	0.045	4.1	0.0887	0.0000	OK
15 minute summer	PP CONVEY1	9	95.053	0.103	12.3	0.5769	0.0000	SURCHARGED
15 minute summer	SW12	10	94.640	0.075	13.6	0.1559	0.0000	OK
15 minute summer	CONVEY SWALE	11	94.524	0.074	16.2	0.7630	0.0000	OK
360 minute summer	ATTENUATION BASIN	280	93.874	0.274	11.7	44.2526	0.0000	SURCHARGED
15 minute summer	1	1	93.500	0.000	2.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW1	1.000	SW2	1.1	0.315	0.014	0.0723	
15 minute summer	SW2	1.001	SW3	2.1	0.431	0.027	0.1174	
15 minute summer	SW3	1.002	SW4	3.1	0.388	0.039	0.2036	
15 minute summer	SW4	1.003	SW6	7.3	0.697	0.093	0.2678	
15 minute summer	SW5	2.000	SW6	0.9	0.084	0.005	0.3218	
360 minute winter	PP ATTENUATION	Orifice	SW6	0.8				
15 minute summer	SW6	1.004	SW7	14.5	0.662	0.078	0.7851	
720 minute summer	SW7	1.005	STORAGE TANK	3.6	0.588	0.020	0.9105	
720 minute summer	STORAGE TANK	Orifice	SW9	1.3				
15 minute summer	PP CONVEY2	Orifice	SW9	9.0				
360 minute summer	SW9	1.007	ATTENUATION BASIN	6.9	0.366	0.037	0.9245	
15 minute summer	SW10	5.000	SW11	2.0	0.380	0.026	0.1852	
15 minute summer	SW11	5.001	SW12	4.0	0.438	0.051	0.2249	
15 minute summer	PP CONVEY1	6.000	SW12	7.8	1.070	1.048	0.1535	
15 minute summer	SW12	5.002	CONVEY SWALE	13.3	1.038	0.131	0.1835	
15 minute summer	CONVEY SWALE	5.003	ATTENUATION BASIN	15.6	2.522	0.888	0.0619	
360 minute summer	ATTENUATION BASIN	Hydro-Brake®	1	2.3				141.2

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.91%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW1	10	94.545	0.041	3.2	0.0739	0.0000	OK
15 minute summer	SW2	11	94.459	0.057	6.3	0.1038	0.0000	OK
15 minute summer	SW3	11	94.352	0.069	9.4	0.1258	0.0000	OK
15 minute summer	SW4	11	94.267	0.112	22.0	0.2264	0.0000	OK
960 minute summer	SW5	990	94.208	0.241	0.2	0.6257	0.0000	OK
360 minute winter	PP ATTENUATION	360	96.131	0.346	10.5	75.1799	0.0000	FLOOD RISK
960 minute summer	SW6	990	94.208	0.331	4.7	0.9459	0.0000	OK
960 minute summer	SW7	990	94.208	0.450	5.3	1.2772	0.0000	SURCHARGED
960 minute summer	STORAGE TANK	990	94.208	0.492	5.6	81.3133	0.0000	SURCHARGED
30 minute summer	PP CONVEY2	21	94.524	0.324	27.4	4.7034	0.0000	FLOOD RISK
480 minute winter	SW9	472	94.161	0.504	7.8	1.1181	0.0000	SURCHARGED
15 minute summer	SW10	10	94.902	0.055	6.0	0.1047	0.0000	OK
15 minute summer	SW11	11	94.754	0.077	11.8	0.1506	0.0000	OK
15 minute summer	PP CONVEY1	11	95.255	0.305	34.4	3.8001	0.0000	FLOOD RISK
15 minute summer	SW12	15	94.695	0.130	26.7	0.2704	0.0000	OK
15 minute summer	CONVEY SWALE	14	94.691	0.241	35.5	4.8024	0.0000	SURCHARGED
480 minute winter	ATTENUATION BASIN	472	94.161	0.561	13.0	106.0398	0.0000	SURCHARGED
15 minute summer	1	1	93.500	0.000	2.3	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW1	1.000	SW2	3.1	0.426	0.040	0.1524	
15 minute summer	SW2	1.001	SW3	6.3	0.590	0.080	0.2540	
15 minute summer	SW3	1.002	SW4	9.3	0.521	0.118	0.4536	
15 minute summer	SW4	1.003	SW6	22.0	0.941	0.280	0.5956	
960 minute summer	SW5	2.000	SW6	0.2	0.051	0.001	2.8560	
360 minute winter	PP ATTENUATION	Orifice	SW6	0.9				
960 minute summer	SW6	1.004	SW7	4.3	0.310	0.023	5.0727	
960 minute summer	SW7	1.005	STORAGE TANK	4.9	0.602	0.027	2.0115	
960 minute summer	STORAGE TANK	Orifice	SW9	1.5				
30 minute summer	PP CONVEY2	Orifice	SW9	18.0				
480 minute winter	SW9	1.007	ATTENUATION BASIN	7.6	0.407	0.041	1.7429	
15 minute summer	SW10	5.000	SW11	5.8	0.514	0.074	0.3927	
15 minute summer	SW11	5.001	SW12	11.6	0.635	0.148	0.4211	
15 minute summer	PP CONVEY1	6.000	SW12	9.4	1.205	1.260	0.1565	
15 minute summer	SW12	5.002	CONVEY SWALE	27.6	1.070	0.272	0.6157	
15 minute summer	CONVEY SWALE	5.003	ATTENUATION BASIN	18.3	2.457	1.041	0.0782	
480 minute winter	ATTENUATION BASIN	Hydro-Brake®	1	2.3				240.2

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 99.91%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW1	10	94.552	0.048	4.5	0.0870	0.0000	OK
15 minute summer	SW2	11	94.470	0.068	8.9	0.1234	0.0000	OK
960 minute summer	SW3	1050	94.425	0.142	1.2	0.2598	0.0000	OK
960 minute summer	SW4	1050	94.425	0.270	2.9	0.5438	0.0000	OK
960 minute summer	SW5	1050	94.425	0.458	0.4	1.1881	0.0000	SURCHARGED
480 minute winter	PP ATTENUATION	480	96.213	0.428	11.8	112.1418	0.0000	FLOOD RISK
960 minute summer	SW6	1050	94.425	0.548	6.0	1.5652	0.0000	SURCHARGED
960 minute summer	SW7	1050	94.425	0.667	6.6	1.8923	0.0000	SURCHARGED
960 minute summer	STORAGE TANK	1035	94.425	0.709	7.3	117.1266	0.0000	SURCHARGED
30 minute summer	PP CONVEY2	22	94.641	0.441	38.3	8.0883	0.0000	FLOOD RISK
720 minute winter	SW9	705	94.351	0.694	7.6	1.5404	0.0000	SURCHARGED
15 minute summer	SW10	10	94.912	0.065	8.4	0.1239	0.0000	OK
15 minute summer	SW11	15	94.776	0.099	16.6	0.1922	0.0000	OK
15 minute summer	PP CONVEY1	11	95.351	0.401	47.8	6.3025	0.0000	FLOOD RISK
30 minute summer	SW12	24	94.774	0.209	32.1	0.4341	0.0000	OK
30 minute summer	CONVEY SWALE	24	94.773	0.323	41.2	7.9272	0.0000	SURCHARGED
720 minute winter	ATTENUATION BASIN	705	94.351	0.751	12.5	155.8596	0.0000	SURCHARGED
15 minute summer	1	1	93.500	0.000	2.3	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW1	1.000	SW2	4.4	0.466	0.056	0.1947	
15 minute summer	SW2	1.001	SW3	8.8	0.647	0.113	0.3244	
960 minute summer	SW3	1.002	SW4	1.2	0.303	0.015	1.2463	
960 minute summer	SW4	1.003	SW6	2.9	0.532	0.037	1.7498	
960 minute summer	SW5	2.000	SW6	0.3	0.050	0.002	4.2780	
480 minute winter	PP ATTENUATION	Orifice	SW6	1.0				
960 minute summer	SW6	1.004	SW7	5.2	0.333	0.028	5.6723	
960 minute summer	SW7	1.005	STORAGE TANK	6.0	0.642	0.033	2.0122	
960 minute summer	STORAGE TANK	Orifice	SW9	1.3				
30 minute summer	PP CONVEY2	Orifice	SW9	21.6				
720 minute winter	SW9	1.007	ATTENUATION BASIN	7.1	0.399	0.038	1.7429	
15 minute summer	SW10	5.000	SW11	8.2	0.565	0.105	0.5000	
15 minute summer	SW11	5.001	SW12	16.4	0.692	0.209	0.7900	
15 minute summer	PP CONVEY1	6.000	SW12	10.2	1.308	1.367	0.1588	
30 minute summer	SW12	5.002	CONVEY SWALE	31.0	1.033	0.305	0.8455	
30 minute summer	CONVEY SWALE	5.003	ATTENUATION BASIN	18.5	2.524	1.050	0.0782	
720 minute winter	ATTENUATION BASIN	Hydro-Brake®	1	2.3				249.6

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.91%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW1	10	94.550	0.046	4.1	0.0831	0.0000	OK
15 minute summer	SW2	11	94.466	0.064	8.1	0.1173	0.0000	OK
15 minute summer	SW3	11	94.361	0.078	11.9	0.1423	0.0000	OK
960 minute summer	SW4	1035	94.331	0.176	2.3	0.3548	0.0000	OK
960 minute summer	SW5	1035	94.331	0.364	0.3	0.9448	0.0000	OK
480 minute winter	PP ATTENUATION	472	96.178	0.393	10.3	95.7555	0.0000	FLOOD RISK
960 minute summer	SW6	1035	94.331	0.454	5.2	1.2972	0.0000	SURCHARGED
960 minute summer	SW7	1050	94.331	0.573	6.0	1.6262	0.0000	SURCHARGED
960 minute summer	STORAGE TANK	1050	94.331	0.615	6.5	101.6316	0.0000	SURCHARGED
30 minute summer	PP CONVEY2	22	94.605	0.405	34.9	6.9635	0.0000	FLOOD RISK
480 minute winter	SW9	472	94.271	0.614	9.4	1.3614	0.0000	SURCHARGED
15 minute summer	SW10	10	94.908	0.061	7.5	0.1172	0.0000	OK
15 minute summer	SW11	11	94.764	0.087	14.8	0.1693	0.0000	OK
15 minute summer	PP CONVEY1	11	95.320	0.370	43.3	5.4163	0.0000	FLOOD RISK
30 minute summer	SW12	24	94.748	0.183	29.7	0.3803	0.0000	OK
30 minute summer	CONVEY SWALE	23	94.748	0.298	39.0	6.9068	0.0000	SURCHARGED
480 minute winter	ATTENUATION BASIN	472	94.271	0.671	15.6	133.8900	0.0000	SURCHARGED
15 minute summer	1	1	93.500	0.000	2.3	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW1	1.000	SW2	4.0	0.455	0.051	0.1813	
15 minute summer	SW2	1.001	SW3	8.0	0.631	0.102	0.3025	
15 minute summer	SW3	1.002	SW4	11.9	0.555	0.151	0.5433	
960 minute summer	SW4	1.003	SW6	2.3	0.497	0.029	1.4464	
960 minute summer	SW5	2.000	SW6	0.3	0.050	0.002	3.9942	
480 minute winter	PP ATTENUATION	Orifice	SW6	1.0				
960 minute summer	SW6	1.004	SW7	4.8	0.323	0.026	5.6718	
960 minute summer	SW7	1.005	STORAGE TANK	5.6	0.641	0.030	2.0122	
960 minute summer	STORAGE TANK	Orifice	SW9	1.4				
30 minute summer	PP CONVEY2	Orifice	SW9	20.6				
480 minute winter	SW9	1.007	ATTENUATION BASIN	8.8	0.428	0.047	1.7429	
15 minute summer	SW10	5.000	SW11	7.3	0.548	0.094	0.4622	
15 minute summer	SW11	5.001	SW12	14.6	0.680	0.187	0.6325	
15 minute summer	PP CONVEY1	6.000	SW12	10.0	1.275	1.333	0.1588	
30 minute summer	SW12	5.002	CONVEY SWALE	29.7	1.033	0.293	0.7942	
30 minute summer	CONVEY SWALE	5.003	ATTENUATION BASIN	18.2	2.504	1.034	0.0782	
480 minute winter	ATTENUATION BASIN	Hydro-Brake®	1	2.3				228.7

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.91%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	SW1	930	94.825	0.321	0.3	0.5816	0.0000	SURCHARGED
960 minute winter	SW2	930	94.825	0.423	0.6	0.7720	0.0000	SURCHARGED
960 minute winter	SW3	930	94.825	0.542	0.9	0.9895	0.0000	SURCHARGED
960 minute winter	SW4	930	94.824	0.669	2.2	1.3467	0.0000	SURCHARGED
960 minute winter	SW5	915	94.823	0.856	0.7	2.2212	0.0000	SURCHARGED
480 minute winter	PP ATTENUATION	480	96.275	0.490	14.4	141.7617	0.0000	FLOOD RISK
960 minute winter	SW6	930	94.825	0.948	4.9	2.7061	0.0000	SURCHARGED
960 minute winter	SW7	930	94.824	1.066	5.3	3.0236	0.0000	SURCHARGED
960 minute winter	STORAGE TANK	915	94.824	1.108	6.2	132.3287	0.0000	FLOOD RISK
30 minute summer	PP CONVEY2	24	94.746	0.546	48.7	11.9100	0.0000	FLOOD RISK
960 minute winter	SW9	960	94.499	0.842	7.3	1.8694	0.0000	SURCHARGED
15 minute summer	SW10	10	94.920	0.073	10.6	0.1394	0.0000	OK
30 minute summer	SW11	26	94.843	0.166	18.8	0.3236	0.0000	OK
30 minute summer	PP CONVEY1	22	95.444	0.494	40.1	9.2993	0.0000	FLOOD RISK
30 minute summer	SW12	26	94.842	0.277	38.7	0.5766	0.0000	OK
30 minute summer	CONVEY SWALE	25	94.840	0.390	48.1	11.0604	0.0000	SURCHARGED
960 minute winter	ATTENUATION BASIN	960	94.499	0.899	12.0	199.4857	0.0000	SURCHARGED
15 minute summer	1	1	93.500	0.000	2.3	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
960 minute winter	SW1	1.000	SW2	0.3	0.206	0.004	1.4366	
960 minute winter	SW2	1.001	SW3	0.6	0.289	0.008	1.6689	
960 minute winter	SW3	1.002	SW4	0.9	0.276	0.011	1.7605	
960 minute winter	SW4	1.003	SW6	2.2	0.490	0.028	1.7957	
960 minute winter	SW5	2.000	SW6	-0.6	0.049	-0.003	4.2780	
480 minute winter	PP ATTENUATION	Orifice	SW6	1.1				
960 minute winter	SW6	1.004	SW7	4.2	0.347	0.023	5.6723	
960 minute winter	SW7	1.005	STORAGE TANK	5.0	0.598	0.027	2.0122	
960 minute winter	STORAGE TANK	Orifice	SW9	1.7				
30 minute summer	PP CONVEY2	Orifice	SW9	24.5				
960 minute winter	SW9	1.007	ATTENUATION BASIN	6.8	0.393	0.037	1.7429	
15 minute summer	SW10	5.000	SW11	10.4	0.595	0.133	0.7028	
30 minute summer	SW11	5.001	SW12	18.7	0.704	0.238	1.2097	
30 minute summer	PP CONVEY1	6.000	SW12	10.7	1.369	1.431	0.1588	
30 minute summer	SW12	5.002	CONVEY SWALE	35.1	1.024	0.346	0.9535	
30 minute summer	CONVEY SWALE	5.003	ATTENUATION BASIN	18.3	2.529	1.043	0.0782	
960 minute winter	ATTENUATION BASIN	Hydro-Brake®	1	2.3				294.8

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Appendix D – Attenuation Strategy Drainage Plan

KEY

- SITE BOUNDARY (TOTAL SITE AREA 1.26ha)
- PROPOSED RESIDENTIAL BUILDING (INCLUDED IN 10% URBAN CREEP)
- PROPOSED GARAGE OR FLAT BUILDING (NOT INCLUDED IN 10% URBAN CREEP)
- CONVEYANCE PERMEABLE PAVING (PP CONVEY1) WITH MIN. 500mm SUB-BASE
- CONVEYANCE PERMEABLE PAVING (PP CONVEY2) WITH MIN. 550mm SUB-BASE
- ATTENUATION PERMEABLE PAVING (PP ATTENUATION) WITH MIN. 450mm SUB-BASE
- SUB-BASE REPLACEMENT TANK (PP ATTENUATION) WITH 150mm DEPTH
- IMPERMEABLE HARDSTANDINGS (PATHS/DRIVEWAYS)
- PROPOSED GEO-CELLULAR STORAGE TANK (0.8m X 6.0m X 31.6m)
- ATTENUATION BASIN (DEPTH: 1.2m; TOP OF POND: 367.0m²; BASE OF POND: 134.8m²)
- PERMANENT WATER WITHIN ATTENUATION BASIN (600mm DEPTH)
- CONVEYANCE SWALE (DEPTH: 0.7m; SURFACE AREA: 85.0m²)
- SURFACE WATER PIPE NETWORK
- SURFACE WATER MANHOLE
- PERMAVOID DIFFUSER UNIT
- VARYING SIZE ORIFICE PLATE WITH SUITABLE FILTER TO RESTRICT RUNOFF
- HYDRO-BRAKE TO RESTRICT SURFACE WATER RUNOFF TO MAXIMUM OF 2.3 L/S
- FLOW ARROW
- EXCEEDANCE FLOW ARROW

DRAWING STATUS: OUTLINE APPLICATION

EAS

CLIENT: BAYA GROUP LTD.

PROJECT: CLAVERING, ESSEX, CB11 4QS
LAND TO THE WEST OF CLATTERBURY LANE

TITLE: SuDS ATTENUATION STRATEGY

SCALE @ A1	DRAWN-CHECKED	DATE
1:250	MC	14/02/2024
PROJECT No	DRAWING No	
4641/2023	SK05 – A	

Appendix E – Surface Water Flood Risk Mapping

1 IN 30 YEAR STORM FLOOD DEPTH LEVELS

- 0 – 150mm
- 150 – 300mm
- 300 – 600mm
- 600 – 900mm
- 900 – 1200mm
- > 1200mm

OUTLINE APPLICATION

EAS

BAYA GROUP LTD.

LAND TO THE WEST OF CLATTERBURY LANE
CLAVERING, ESSEX, CB11 4QS

DEFRA
3.3% AEP SURFACE WATER FLOOD DEPTHS
OVERLAID ON PROPOSED DEVELOPMENT PLANS

1:250m	MS	22/11/2023
4641/2023	SK01	

1 IN 100 YEAR STORM FLOOD DEPTH LEVELS

- 0 – 150mm
- 150 – 300mm
- 300 – 600mm
- 600 – 900mm
- 900 – 1200mm
- > 1200mm

OUTLINE APPLICATION

EAS

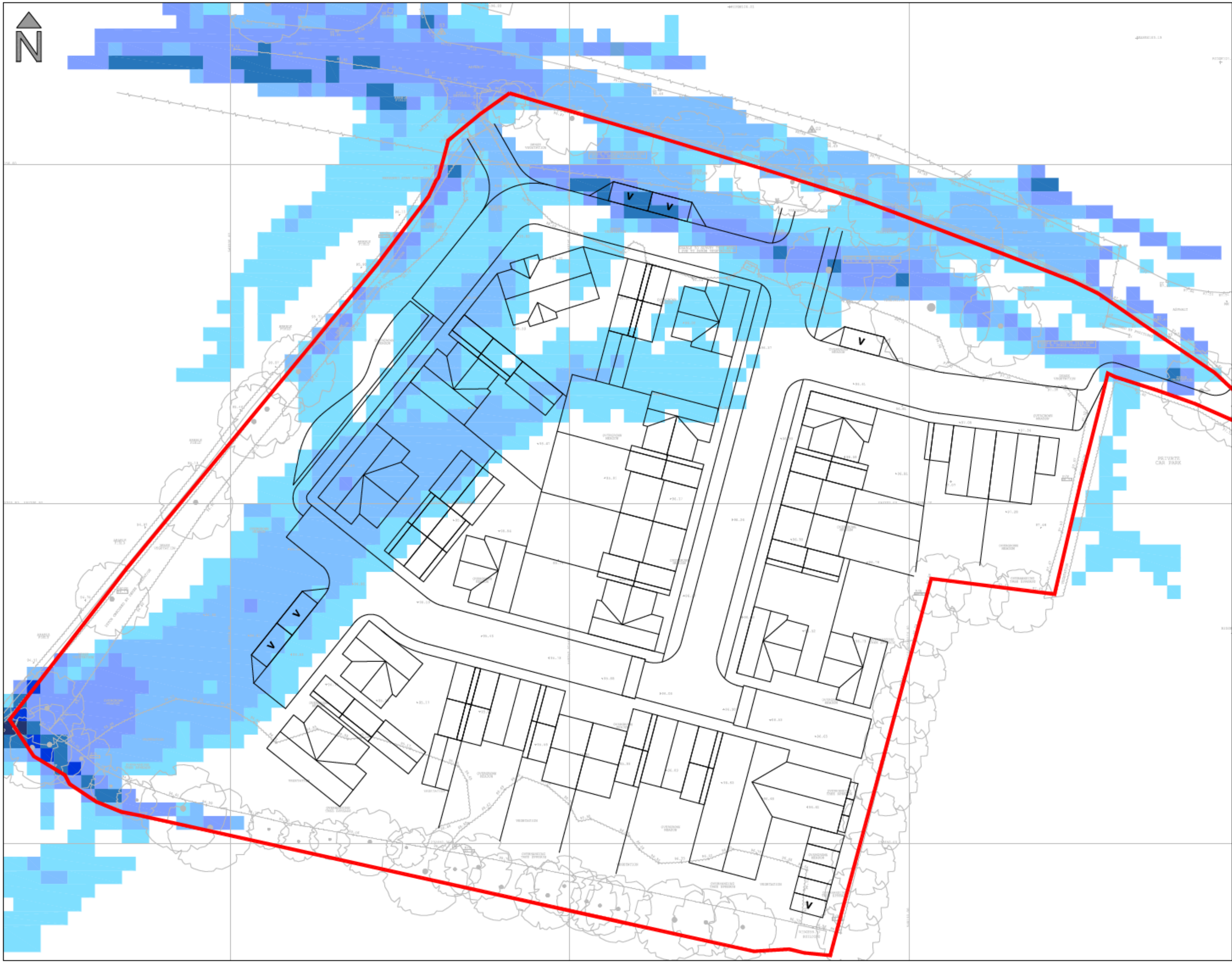
BAYA GROUP LTD.

LAND TO THE WEST OF CLATTERBURY LANE
CLAVERING, ESSEX, CB11 4QS

DEFRA
1.0% AEP SURFACE WATER FLOOD DEPTHS
OVERLAID ON PROPOSED DEVELOPMENT PLANS

1:250m | MS | 22/11/2023

4641/2023 | SK02



1 IN 1000 YEAR STORM (EXCEEDANCE EVENT) FLOOD DEPTH LEVELS

- 0 – 150mm
- 150 – 300mm
- 300 – 600mm
- 600 – 900mm
- 900 – 1200mm
- > 1200mm

REV	DATE	BY	DESCRIPTION	CHK	APD
-	-	-	-	-	-

DRAWING STATUS: OUTLINE APPLICATION

EAS

1st Floor Millers House, Roydon Road, Stanstead Abbotts, Hertfordshire, SG12 8HN
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CLIENT: BAYA GROUP LTD.

ARCHITECT:

PROJECT: LAND TO THE WEST OF CLATTERBURY LANE CLAVERING, ESSEX, CB11 4QS

TITLE: DEFRA (EXCEEDANCE EVENT) 0.1% AEP SURFACE WATER FLOOD DEPTHS OVERLAID ON PROPOSED DEVELOPMENT PLANS

SCALE @ A1:	DESIGN-DRAWN:	DATE:
1:250m	MS	22/11/2023

PROJECT No:	DRAWING No:
4641/2023	SK02