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26 May 2023
JD/203905

For the attention of William Myers/Chris Bower

Dear William/Chris,

Peartree Lane, Welwyn Garden City.
LLFA comments

Thank you for your comments dated 6 April 2023 relating to the information to support the discharge of Condition 5 (Drainage Scheme), 29 (Drainage Strategy), and 33 (Final Design of Drainage Scheme) of the Outline Application (6/2019/2714/OUTLINE).

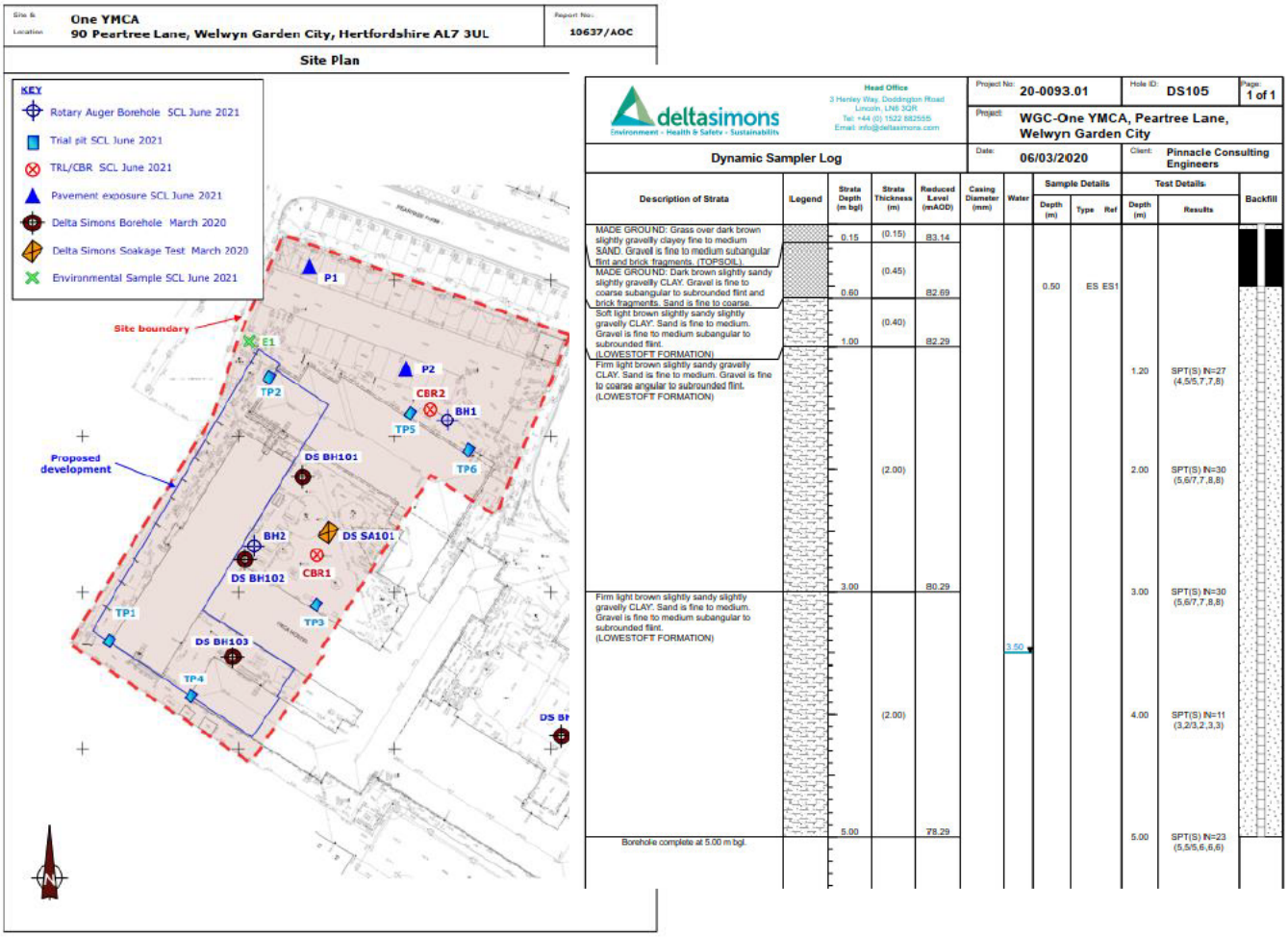
We note your comments and supply the further information requested.

Conditions 5 and 33

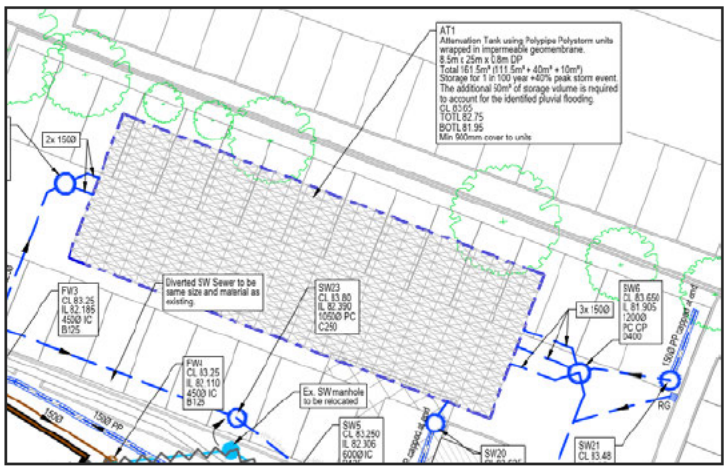
LLFA Point 4 of condition 5 and 33

The base of the proposed tank is located 1.7m below finished ground level at 81.95m AOD. In the location of the car park the levels are higher than the general site.

Based on section 7.4 of the SI report by Soil Consultants, the ground water level is at depth, however perched ground water was noted in earlier readings. The shallowest perched water was noted in DS105 (for the initial reading only) at around 1.5m below ground level (GL 83.3mAOD), with lower depths recorded in subsequent visits. Ground water depth was 3.5m BGL and on this basis the tank will not be in hydraulic connectivity with groundwater.



Extract of SI report showing location of DS105 and log.



Extract of drainage plan showing levels adopted for tank

With regard to floatation the tank is considered to be above groundwater levels and therefore not at risk of floatation. This is still true if the absolute minimum perched water level is taken.
If the minimum perched water depth is taken will be at around 81.8m AOD.

The cover level to the tank as indicated on the drawing as 83.65m AOD represents the minimum level over the tank. On this basis the minimum cover of 900mm is achieved.

LLFA Point 5 of condition 5 and 33

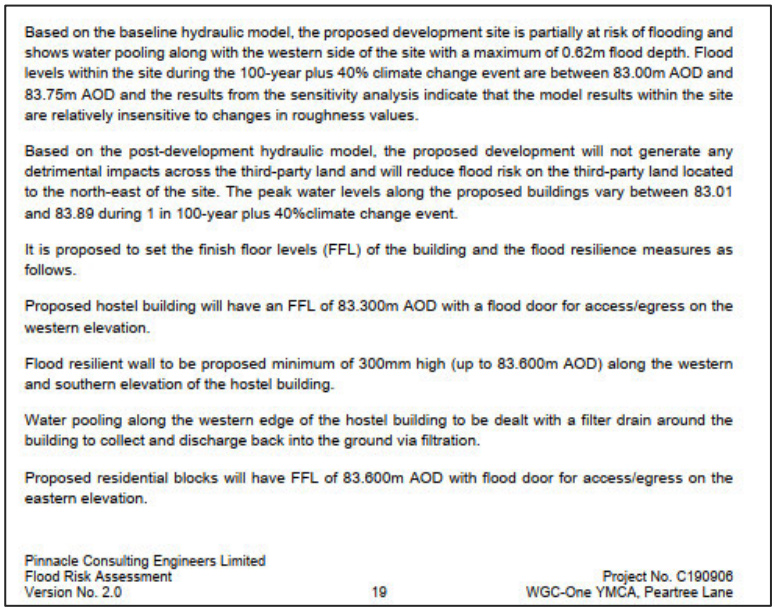
The 50m^3 additional allowance provides mitigation for the anticipated predicted surface water flood volume identified in AKS Ward report (Section 7.0 Conclusion) and JBA report (refer to figures 4.2 to 4.7). It is understood that the volume represents the areas of pooling water shown in the JBA report and the volume is derived based on the areas and depths indicated. This additional volume is over and above the volume required for rainfall events on the site and is therefore considered to be a conservative allowance for the attention requirements.

> The total storage provided is **161.5m^3** which account for surface water runoff from the site (111.5m^3) and also allowing for the predicted flood waters storage of 50m^3.

Extract of AKS Ward Report, page 12.

LLFA Point 8 of condition 5 and 33

Proposed site and FFL levels for the building show a minimum floor level of 83.400mAOD. The AKS Ward report summarises the findings of the Pinnacle report. The Pinnacle report gives a minimum floor level of 83.300mAOD for the hostel building. The Pinnacle report discusses the issues with setting the floor levels and mitigation measures proposed. See extract below.



Based on the baseline hydraulic model, the proposed development site is partially at risk of flooding and shows water pooling along with the western side of the site with a maximum of 0.62m flood depth. Flood levels within the site during the 100-year plus 40% climate change event are between 83.00m AOD and 83.75m AOD and the results from the sensitivity analysis indicate that the model results within the site are relatively insensitive to changes in roughness values.

Based on the post-development hydraulic model, the proposed development will not generate any detrimental impacts across the third-party land and will reduce flood risk on the third-party land located to the north-east of the site. The peak water levels along the proposed buildings vary between 83.01 and 83.89 during 1 in 100-year plus 40%climate change event.

It is proposed to set the finish floor levels (FFL) of the building and the flood resilience measures as follows.

Proposed hostel building will have an FFL of 83.300m AOD with a flood door for access/egress on the western elevation.

Flood resilient wall to be proposed minimum of 300mm high (up to 83.600m AOD) along the western and southern elevation of the hostel building.

Water pooling along the western edge of the hostel building to be dealt with a filter drain around the building to collect and discharge back into the ground via filtration.

Proposed residential blocks will have FFL of 83.600m AOD with flood door for access/egress on the eastern elevation.

Extract of Pinnacle Report, page 19

It is acknowledged that the AKS Ward report recommends that the final finished floor levels will be built a minimum 300mm above the critical 1:100 year plus 40% climate change storm event

elevation, however AKS Ward's Drainage Drawings enclosed in Appendix C of their report show a Finished Floor Level of 83.40m AOD. The finished floor level may be only 150-200mm above ground levels in some areas, however other flood mitigation measures are proposed as specified in the extract above. AKS Ward have adopted the information in the Pinnacle report which suggests that floor levels are set at a minimum of 83.300mAOD and flood resilient construction is provided to 300mm to the Western and Southern elevations.

To conclude, SWH's proposed FFL of 83.40m AOD is in line with the Pinnacle FRA report recommendations and matches those shown on the AKS Ward drainage layout drawings and is therefore it is considered to be acceptable.

Please note the arrows on drawing 203905-SWH-ZZ-XX-DR-C-5501 represent the fall of the access road and parking area. Levels are to OS Datum. We have added a note to the key to clarify this in Appendix B.

Condition 29

LLFA Point 3 of condition 29

There will be no increase in surface water runoff volume leaving the site given there will be a decrease in impermeable area a result of the proposals. The existing pre-development impermeable area is 5083m^2 whereas the proposed impermeable area is 3433m^2.

The predevelopment run off rate is 54.93 l/s. The calculation for the existing uncontrolled run off is based on BS EN 752-4:1998 Clause 11.3.2. This was provided in Appendix B of our letter 13 March 2023, extract below. The post development run off rate is 2.5 l/s for storms up to 1:100+40%. This is the allowable run off dictated by the hyrobrake flow control.

Project Title: **PEARTREE LANE, WELWYN GARDEN CITY**
Ref: **EXISTING SW RUNOFF**

Return Period: 1

Peak flow rate Q = ψiA

ψ = run-off coefficient from table below. 1

i = 0.016 l/s/m² (Obtained from Figures ND.1, ND.2, ND.3 or ND.4 dependent on Return Period required**)

A = 3433 m² (Total impermeable area)

Q = 54.93 l/s

NOTE: A Q of 54.93l/s equates to an average rainfall depth of approximately 2.4mm over the duration of the storm.

** Interpolated rainfall intensity values 'i' should be used for Return Periods other than 1, 5, 50 and 100 years.

Nature of connected area	Run-off coefficient, ψ	Comments
Impermeable areas and steeply sloping roofs (1)	0,9 to 1,0	Depending on depression storage.
Large flat roofs	0,5	Over 10000m² (>1ha)
Small flat roofs	1,0	Less than 100 m²
Permeable areas	0,0 - 0,3	Depending on ground slope and cover
(1) Impermeable areas may be increased by 30% for large vertical surfaces.		

Predevelopment run off calculation (Assuming uncontrolled discharge)

LLFA Point 4 of condition 29

We have provided updated design hydraulic calculations using the FEH method with a MADD factor of 0, see calculations enclosed Appendix A. The calculations cover the 1 in 1yr, 1 in 30yr, and 1 in 100yr+40%CC storm events. The 1 in 100 year +40%CC storm event calculations show no flooding of the site.

I trust this provides the further information you require. Please call if you have any queries.

Yours Sincerely

Jason Daniels BEng(Hons) CEng MICE MIStructE
Technical Director
Scott White and Hookins Ltd

Appendix A

Assessment of design using FEH values.

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for 203905-Site3D-Model.sws

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 524400 212600 TL 24400 12600
Data Type	Catchment
Maximum Rainfall (mm/hr)	0
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	1.000
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.500
Maximum Backdrop Height (m)	2.000
Min Design Depth for Optimisation (m)	0.000
Min Vel for Auto Design only (m/s)	0.10
Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Network Design Table for 203905-Site3D-Model.sws

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
S1.000	55.895	0.294	190.1	0.073	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	12.057	0.092	131.1	0.017	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	14.008	0.093	150.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	18.129	0.045	402.9	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	17.705	0.115	154.0	0.081	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	6.086	0.288	21.1	0.068	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.005	10.467	0.105	99.7	0.000	0.00	0.0	0.600	o	225	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)
S1.000	0.00	5.99	82.600	0.073	0.0	0.0	0.0	0.94	37.6	0.0
S1.001	0.00	6.16	82.306	0.090	0.0	0.0	0.0	1.14	45.3	0.0
S1.002	0.00	6.38	82.214	0.090	0.0	0.0	0.0	1.06	42.3	0.0
S1.003	0.00	6.85	81.950	0.090	0.0	0.0	0.0	0.65	25.7	0.0
S1.004	0.00	7.13	81.905	0.171	0.0	0.0	0.0	1.05	41.8	0.0
S2.000	0.00	5.04	82.153	0.068	0.0	0.0	0.0	2.86	113.7	0.0
S1.005	0.00	7.26	81.790	0.239	0.0	0.0	0.0	1.31	52.1	0.0

Area Summary for 203905-Site3D-Model.sws

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.073	0.073	0.073
1.001	-	-	100	0.017	0.017	0.017
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.081	0.081	0.081
2.000	-	-	100	0.068	0.068	0.068
1.005	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.239	0.239	0.239

Free Flowing Outfall Details for 203905-Site3D-Model.sws

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.005	Sout	83.080	81.685	0.000	0	0

Simulation Criteria for 203905-Site3D-Model.sws

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coeffiecient	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	3
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 524400 212600 TL 24400 12600
Data Type	Catchment
Summer Storms	Yes
Winter Storms	No
Cv (Summer)	1.000
Cv (Winter)	0.840
Storm Duration (mins)	30

Online Controls for 203905-Site3D-Model.sws

Hydro-Brake® Optimum Manhole: S12, DS/PN: S1.005, Volume (m³): 2.3

Unit Reference	MD-SHE-0072-2500-1200-2500
Design Head (m)	1.200
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	72
Invert Level (m)	81.790
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	2.5
Flush-Flo™	0.318	2.3
Kick-Flo®	0.644	1.9
Mean Flow over Head Range	-	2.1

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	1.9	1.200	2.5	3.000	3.8	7.000	5.7
0.200	2.2	1.400	2.7	3.500	4.1	7.500	5.9
0.300	2.3	1.600	2.8	4.000	4.4	8.000	6.0
0.400	2.3	1.800	3.0	4.500	4.6	8.500	6.2
0.500	2.2	2.000	3.2	5.000	4.8	9.000	6.4
0.600	2.0	2.200	3.3	5.500	5.1	9.500	6.5
0.800	2.1	2.400	3.4	6.000	5.3		
1.000	2.3	2.600	3.6	6.500	5.5		

Storage Structures for 203905-Site3D-Model.sws

Infiltration Blanket Manhole: S5, DS/PN: S1.000

Infiltration Coefficient Base (m/hr)	0.00000	Diameter/Width (m)	1.5
Safety Factor	2.0	Length (m)	40.0
Porosity	0.30	Cap Volume Depth (m)	0.150
Invert Level (m)	83.030		

Tank or Pond Manhole: Stank, DS/PN: S1.003

Invert Level (m) 82.092

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	212.5	0.800	212.5	0.801	0.0

Infiltration Blanket Manhole: S13, DS/PN: S2.000

Infiltration Coefficient Base (m/hr)	0.00000	Diameter/Width (m)	13.6
Safety Factor	2.0	Length (m)	13.6
Porosity	0.30	Cap Volume Depth (m)	0.150
Invert Level (m)	82.880		

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 203905-Site3D-Model.sws

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	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	3
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	1999
Site Location	GB 524400 212600 TL 24400 12600
C (1km)	-0.028
D1 (1km)	0.293
D2 (1km)	0.320
D3 (1km)	0.277
E (1km)	0.321
F (1km)	2.481
Cv (Summer)	1.000
Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1
Climate Change (%)	0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S5	15 Summer	1	+0%					82.695
S1.001	S6	15 Summer	1	+0%					82.404
S1.002	S8	15 Summer	1	+0%					82.314
S1.003	Stank	60 Winter	1	+0%	1/60 Summer				82.178
S1.004	S10	15 Summer	1	+0%	1/15 Summer				82.240
S2.000	S13	15 Summer	1	+0%					82.281
S1.005	S12	15 Winter	1	+0%	1/15 Summer				82.271

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 203905-Site3D-Model.sws

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S5	-0.130	0.000	0.35		5	12.7	OK	
S1.001	S6	-0.127	0.000	0.39			15.1	OK	
S1.002	S8	-0.125	0.000	0.41			15.0	OK	
S1.003	Stank	0.003	0.000	0.17			4.2	SURCHARGED*	
S1.004	S10	0.110	0.000	0.10			3.7	SURCHARGED	
S2.000	S13	-0.097	0.000	0.17		5	13.1	OK	
S1.005	S12	0.256	0.000	0.05			2.3	SURCHARGED	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for 203905-Site3D-Model.sws

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 524400 212600 TL 24400 12600
Data Type	Catchment
Maximum Rainfall (mm/hr)	0
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	1.000
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.500
Maximum Backdrop Height (m)	2.000
Min Design Depth for Optimisation (m)	0.000
Min Vel for Auto Design only (m/s)	0.10
Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Network Design Table for 203905-Site3D-Model.sws

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
S1.000	55.895	0.294	190.1	0.073	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	12.057	0.092	131.1	0.017	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	14.008	0.093	150.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	18.129	0.045	402.9	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	17.705	0.115	154.0	0.081	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	6.086	0.288	21.1	0.068	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.005	10.467	0.105	99.7	0.000	0.00	0.0	0.600	o	225	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)
S1.000	0.00	5.99	82.600	0.073	0.0	0.0	0.0	0.94	37.6	0.0
S1.001	0.00	6.16	82.306	0.090	0.0	0.0	0.0	1.14	45.3	0.0
S1.002	0.00	6.38	82.214	0.090	0.0	0.0	0.0	1.06	42.3	0.0
S1.003	0.00	6.85	81.950	0.090	0.0	0.0	0.0	0.65	25.7	0.0
S1.004	0.00	7.13	81.905	0.171	0.0	0.0	0.0	1.05	41.8	0.0
S2.000	0.00	5.04	82.153	0.068	0.0	0.0	0.0	2.86	113.7	0.0
S1.005	0.00	7.26	81.790	0.239	0.0	0.0	0.0	1.31	52.1	0.0

Area Summary for 203905-Site3D-Model.sws

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.073	0.073	0.073
1.001	-	-	100	0.017	0.017	0.017
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.081	0.081	0.081
2.000	-	-	100	0.068	0.068	0.068
1.005	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.239	0.239	0.239

Free Flowing Outfall Details for 203905-Site3D-Model.sws

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.005	Sout	83.080	81.685	0.000	0	0

Simulation Criteria for 203905-Site3D-Model.sws

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coeffiecient	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	3
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 524400 212600 TL 24400 12600
Data Type	Catchment
Summer Storms	Yes
Winter Storms	No
Cv (Summer)	1.000
Cv (Winter)	0.840
Storm Duration (mins)	30

Online Controls for 203905-Site3D-Model.sws

Hydro-Brake® Optimum Manhole: S12, DS/PN: S1.005, Volume (m³): 2.3

Unit Reference	MD-SHE-0072-2500-1200-2500
Design Head (m)	1.200
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	72
Invert Level (m)	81.790
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	2.5
Flush-Flo™	0.318	2.3
Kick-Flo®	0.644	1.9
Mean Flow over Head Range	-	2.1

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	1.9	1.200	2.5	3.000	3.8	7.000	5.7
0.200	2.2	1.400	2.7	3.500	4.1	7.500	5.9
0.300	2.3	1.600	2.8	4.000	4.4	8.000	6.0
0.400	2.3	1.800	3.0	4.500	4.6	8.500	6.2
0.500	2.2	2.000	3.2	5.000	4.8	9.000	6.4
0.600	2.0	2.200	3.3	5.500	5.1	9.500	6.5
0.800	2.1	2.400	3.4	6.000	5.3		
1.000	2.3	2.600	3.6	6.500	5.5		

Storage Structures for 203905-Site3D-Model.sws

Infiltration Blanket Manhole: S5, DS/PN: S1.000

Infiltration Coefficient Base (m/hr)	0.00000	Diameter/Width (m)	1.5
Safety Factor	2.0	Length (m)	40.0
Porosity	0.30	Cap Volume Depth (m)	0.150
Invert Level (m)	83.030		

Tank or Pond Manhole: Stank, DS/PN: S1.003

Invert Level (m) 82.092

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	212.5	0.800	212.5	0.801	0.0

Infiltration Blanket Manhole: S13, DS/PN: S2.000

Infiltration Coefficient Base (m/hr)	0.00000	Diameter/Width (m)	13.6
Safety Factor	2.0	Length (m)	13.6
Porosity	0.30	Cap Volume Depth (m)	0.150
Invert Level (m)	82.880		

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 203905-Site3D-Model.sws

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	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	3
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 524400 212600 TL 24400 12600
Data Type	Catchment
Cv (Summer)	1.000
Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	30
Climate Change (%)	0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S5	15 Summer	30	+0%					82.775
S1.001	S6	15 Summer	30	+0%					82.518
S1.002	S8	240 Winter	30	+0%	30/120 Summer				82.473
S1.003	Stank	240 Winter	30	+0%	30/15 Summer				82.472
S1.004	S10	15 Summer	30	+0%	30/15 Summer				82.548
S2.000	S13	15 Summer	30	+0%	30/15 Summer				82.733
S1.005	S12	15 Summer	30	+0%	30/15 Summer				82.658

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S5	-0.050	0.000	0.91		5	32.9	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 203905-Site3D-Model.sws

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.001	S6	-0.013	0.000	0.98			38.1	OK	
S1.002	S8	0.034	0.000	0.20			7.5	SURCHARGED	
S1.003	Stank	0.297	0.000	0.15			3.7	SURCHARGED*	
S1.004	S10	0.418	0.000	0.11			4.0	SURCHARGED	
S2.000	S13	0.355	0.000	0.43		4	32.6	SURCHARGED	
S1.005	S12	0.643	0.000	0.05			2.3	SURCHARGED	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for 203905-Site3D-Model.sws

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 524400 212600 TL 24400 12600
Data Type	Catchment
Maximum Rainfall (mm/hr)	0
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	1.000
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.500
Maximum Backdrop Height (m)	2.000
Min Design Depth for Optimisation (m)	0.000
Min Vel for Auto Design only (m/s)	0.10
Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Network Design Table for 203905-Site3D-Model.sws

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
S1.000	55.895	0.294	190.1	0.073	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	12.057	0.092	131.1	0.017	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	14.008	0.093	150.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	18.129	0.045	402.9	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	17.705	0.115	154.0	0.081	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	6.086	0.288	21.1	0.068	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.005	10.467	0.105	99.7	0.000	0.00	0.0	0.600	o	225	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)
S1.000	0.00	5.99	82.600	0.073	0.0	0.0	0.0	0.94	37.6	0.0
S1.001	0.00	6.16	82.306	0.090	0.0	0.0	0.0	1.14	45.3	0.0
S1.002	0.00	6.38	82.214	0.090	0.0	0.0	0.0	1.06	42.3	0.0
S1.003	0.00	6.85	81.950	0.090	0.0	0.0	0.0	0.65	25.7	0.0
S1.004	0.00	7.13	81.905	0.171	0.0	0.0	0.0	1.05	41.8	0.0
S2.000	0.00	5.04	82.153	0.068	0.0	0.0	0.0	2.86	113.7	0.0
S1.005	0.00	7.26	81.790	0.239	0.0	0.0	0.0	1.31	52.1	0.0

Area Summary for 203905-Site3D-Model.sws

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.073	0.073	0.073
1.001	-	-	100	0.017	0.017	0.017
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.081	0.081	0.081
2.000	-	-	100	0.068	0.068	0.068
1.005	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.239	0.239	0.239

Free Flowing Outfall Details for 203905-Site3D-Model.sws

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.005	Sout	83.080	81.685	0.000	0	0

Simulation Criteria for 203905-Site3D-Model.sws

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coeffiecient	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	3
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 524400 212600 TL 24400 12600
Data Type	Catchment
Summer Storms	Yes
Winter Storms	No
Cv (Summer)	1.000
Cv (Winter)	0.840
Storm Duration (mins)	30

Online Controls for 203905-Site3D-Model.sws

Hydro-Brake® Optimum Manhole: S12, DS/PN: S1.005, Volume (m³): 2.3

Unit Reference	MD-SHE-0072-2500-1200-2500
Design Head (m)	1.200
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	72
Invert Level (m)	81.790
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	2.5
Flush-Flo™	0.318	2.3
Kick-Flo®	0.644	1.9
Mean Flow over Head Range	-	2.1

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	1.9	1.200	2.5	3.000	3.8	7.000	5.7
0.200	2.2	1.400	2.7	3.500	4.1	7.500	5.9
0.300	2.3	1.600	2.8	4.000	4.4	8.000	6.0
0.400	2.3	1.800	3.0	4.500	4.6	8.500	6.2
0.500	2.2	2.000	3.2	5.000	4.8	9.000	6.4
0.600	2.0	2.200	3.3	5.500	5.1	9.500	6.5
0.800	2.1	2.400	3.4	6.000	5.3		
1.000	2.3	2.600	3.6	6.500	5.5		

Storage Structures for 203905-Site3D-Model.sws

Infiltration Blanket Manhole: S5, DS/PN: S1.000

Infiltration Coefficient Base (m/hr)	0.00000	Diameter/Width (m)	1.5
Safety Factor	2.0	Length (m)	40.0
Porosity	0.30	Cap Volume Depth (m)	0.150
Invert Level (m)	83.030		

Tank or Pond Manhole: Stank, DS/PN: S1.003

Invert Level (m) 82.092

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	212.5	0.800	212.5	0.801	0.0

Infiltration Blanket Manhole: S13, DS/PN: S2.000

Infiltration Coefficient Base (m/hr)	0.00000	Diameter/Width (m)	13.6
Safety Factor	2.0	Length (m)	13.6
Porosity	0.30	Cap Volume Depth (m)	0.150
Invert Level (m)	82.880		

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 203905-Site3D-Model.sws

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	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	3
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 524400 212600 TL 24400 12600
Data Type	Catchment
Cv (Summer)	1.000
Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	100
Climate Change (%)	40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S5	15 Summer	100	+40%	100/15 Summer				83.246
S1.001	S6	360 Winter	100	+40%	100/15 Summer				82.917
S1.002	S8	360 Winter	100	+40%	100/15 Summer				82.914
S1.003	Stank	360 Winter	100	+40%	100/15 Summer				82.893
S1.004	S10	360 Winter	100	+40%	100/15 Summer				83.033
S2.000	S13	15 Summer	100	+40%	100/15 Summer				83.005
S1.005	S12	360 Winter	100	+40%	100/15 Summer				82.967

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S5	0.421	0.000	1.27		3	46.0	FLOOD RISK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 203905-Site3D-Model.sws

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.001	S6	0.386	0.000	0.25			9.5	SURCHARGED	
S1.002	S8	0.475	0.000	0.26			9.4	SURCHARGED	
S1.003	Stank	0.718	0.000	0.18			4.4	SURCHARGED*	
S1.004	S10	0.903	0.000	0.13			5.0	SURCHARGED	
S2.000	S13	0.627	0.000	0.63		4	47.9	FLOOD RISK	
S1.005	S12	0.952	0.000	0.06			2.4	FLOOD RISK	

Appendix B

Updated proposed site and building levels

Notes

For notes refer to drawing 203905-SWH-ZZ-XX-DR-C-5700

All levels to OS datum in metres.

Key

- Proposed contours
- 83.446m + Proposed finished levels
- 83.920m + Existing levels to remain
- Direction of fall
- 0.5m high gabion retaining wall
- 0.9m high gabion retaining wall
- 1.3m high gabion retaining wall
- 1.3m high retaining wall - Prefered construction to be confirmed by Architect/Client/Contractor

HAZARDS LEADING TO UNUSUAL OR SIGNIFICANT RISKS DURING THE CONSTRUCTION PROCESS ARE IDENTIFIED ON THIS DRAWING AS:

NOTE: THE LIST BELOW IDENTIFIES CERTAIN RISKS WHICH ARE DEEMED TO BE UNUSUAL, ABNORMAL OR UNEXPECTED TO A COMPETENT CONTRACTOR CARRYING OUT WORK OF THIS NATURE BUT DOES NOT COVER ALL POSSIBLE SITUATIONS WHICH MAY BE ENCOUNTERED DURING THE CONSTRUCTION PROCESS. IT IS THEREFORE THE MAIN CONTRACTOR'S RESPONSIBILITY TO IDENTIFY ANY FURTHER RISKS/HAZARDS AND TAKE APPROPRIATE ACTION.

RISKS/HAZARDS SPECIFIC TO THIS DRAWING:

PRELIMINARY - NOT FOR CONSTRUCTION

Rev.	Amendment	Dm.	Chkd.	Appd.	Date
P02	PRELIMINARY	CW	NC	JD	26.05.23
P01	PRELIMINARY	CW	NC	JD	05.12.22

Project

PEARTREE LANE
WELWYN GARDEN CITY

Drawing

FINISHED LEVELS LAYOUT

Client

Kori Construction

Scott White and Hookins
Structural Engineering | Civil Engineering | Sustainability and BREEAM | CDM Consultancy

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Scale at A1 - 1:200

203905-SWH-ZZ-XX-DR-C-5501-P02

Project | Originator | Zone | Level | Type | Role | Number | Rev.

CP004-01_FM_ST_008_D

DO NOT SCALE FROM THIS DRAWING