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Project				Job Ref.	
The Cormorant, Golant				J-19323	
Section				Sheet no./rev.	
SW Calculations & Drainage Strategy				1	
Calc. by	Date	Chk'd by	Date	App'd by	Date
MC	28-11-18				

SW CALCULATIONS & DRAINAGE STRATEGY

Revision D

Homes at The Cormorant, Golant

GENERAL

Calculations are required for the design of the surface water drainage system at the above location following comments from a recent planning application to construct a dwellings on the site.

The hierachy for a sustainable drainage strategy was followed and it was descided to use a soakaway for an appropriate means of surface water discposal from the proposed dwellings and associated impermeable areas as percolation rates were good.

After submission of the drainage proposals, the Local Authority have informed us that they no longer consider soakaways to be an appropriate means of SW drainage for the site and have asked for a attenuated design to be put forward. These calculations have now been revised to show a SW attenuation tank, flow control devise and an outfall into the combined sewer.

Further discussions with the Council's Drainage Engineer has concluded that, due to the difficulty in digging out rock for deep excavations on site, permeable paving may be considered for the external surfaced areas which will reduce the volume of attenuation required (and therefore size of excavation). Previous site investigations have shown that good permeability is achieved (1.42m/hr worst case) for the site and therefore permeable paving is a viable option.

It was agreed that all house roofs will drain via an engineered piped ssytem to a smaller attenuation tank with the outfall controlled via a Hydrobrake at the agreed rate of 4.83l/s.

A storm period of 1in100 years with a 30% allowance for global warming has been used in the attenuation tank design together with a SW regional growth factor of 2.93. This gives an overal storm design in excess of 1/100 years plus 40% as previously used in the soakaway design.

GREEN FIELD RUNOFF RATE

The ADAS data and runoff rate for the site are as follows:

ADAS APPENDIX 5 GREENFIELD RUNOFF CALCULATOR

Project:	**J-18600; Cormorant Hotel, Golant;**		
Area Description	Existing buildings and car parking	**Date:**	**14/05/2019**
Catchment Area	1790	m²	
Length of catchment between highest & lowest points	113.0	m	
First point elevation	32.00	m	
Second point elevation	4.00	m	
Average Annual Rainfall (AAR)	1047	mm	
Average slope	0.248	m/m	
Catchment Characteristic C	0.05		
Dominant vegetation type	Grass		
Permeability class (m/day): Very Slow (< 0.1)			
Soil Type Factor (St)	1		
Catchement Area (A)	0.18	ha	
Factor (F)	26.99		
Peak flood flow $Q_o = S_T \times A \times F$:	4.8	l/s	

IMPERMEABLE AREAS:

From the proposed architectural plans, the proposed impermeable areas are as follows:

- Roof area of all units = 977m2
- Area of permeable paving = 689m2
- Car Parking Areas = inc

Note: The above areas include a 10% allowance for 'Urban Creep'

ATTENUATION TANK DESIGN:

It can be seen from the site topography that a suitable tank can be located within the external area and car parking area as shown on the attached plan ref: J-18600-1000H. A total impermeable area of 977m2 has been used in the attenuation tank design. The car parking area is to be of a permeable surfacing as are the external paved areas.

As stated above, the tank is designed to a 1 in 100 year event with an additional 30% allowance for climate change with a further SW regional growth factor of 2.93 bringing the overall storm design greater than the 1/100 year + 40% design previously used for soakaways.

The attached layout plan (J-18600-1000) shows exceedance flow routes for the site. It can be seen that the site falls in a southern direction and would travel across the access drive to the existing highway during an extreme storm event. In this scenario, the majority of the surrounding environs will also travel in a similar fashion and towards the lower residential areas and towards the town centre.

It should be noted that an attenuation tank construction using infiltration crates with an HDPE liner has been used as, following excavations on site, rock is found at a minimal depth. It is therefore necessary to reduce the depth of the tank (by using crates) following concerns regarding the vibrations generated when excavating in hard rock.

Below are our calculations for a suitable attenuation tank based on the worst case impermeable area of 977m2 during a 1 in 100 year event with 30% for climate change and a 2.93 SW regional growth factor:

Table-1 Wallingford Procedure Depth of Rainfall Generator

Project: J-18600; Cormorant Hotel, Golant;

Date: 05/14/19

Location: England & Wales

M5-60: 18.05 mm

r: 0.29

Rainfall Depth in mm for Duration vs Return Period

Duration (Hours)	Return Period (years) 1	2	5	10	20	30	50	100	M5-D
0.1	4.75	5.42	6.47	7.39	8.44	9.13	10.07	11.50	6.33
0.25	7.49	8.66	10.50	12.14	14.05	15.29	17.03	19.70	10.26
0.5	9.96	11.60	14.18	16.51	19.22	21.01	23.50	27.36	13.84
1	12.86	15.04	18.50	21.64	25.31	27.73	31.12	36.40	18.05
2	16.41	19.21	23.66	27.70	32.43	35.57	39.95	46.77	23.08
4	20.99	24.46	29.92	34.85	40.60	44.39	49.67	57.86	29.21
6	24.26	28.13	34.22	39.69	46.02	50.19	55.98	64.92	33.43
10	29.08	33.52	40.46	46.64	53.77	58.44	64.90	74.82	39.56
24	39.74	45.26	53.76	61.23	69.74	75.26	82.83	94.35	52.66
48	51.04	57.47	67.22	75.69	85.23	91.35	99.70	112.26	65.98

Rainfall Intensities derived from above and adjusted to match CIRIA 156 page 51 (mm/hr)

Duration (Hours) 1.146	Return Period (years) 1	2	5	10	20	30	50	100
0.1	54.4	62.2	74.1	84.7	96.8	104.6	115.4	131.8
0.25	34.3	39.7	48.1	55.7	64.4	70.1	78.1	90.3
0.5	22.8	26.6	32.5	37.8	44.1	48.2	53.9	62.7
1	14.7	17.2	21.2	24.8	29.0	31.8	35.7	41.7
2	9.4	11.0	13.6	15.9	18.6	20.4	22.9	26.8
4	6.0	7.0	8.6	10.0	11.6	12.7	14.2	16.6
6	4.6	5.4	6.5	7.6	8.8	9.6	10.7	12.4
10	3.3	3.8	4.6	5.3	6.2	6.7	7.4	8.6
24	1.9	2.2	2.6	2.9	3.3	3.6	4.0	4.5
48	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.7

WALLINGFORD PROCEDURE FOR URBAN RAINFALL RUNOFF STORAGE TANK DESIGN

Project: J-18600; Cormorant Hotel, Golant - REVISED DESIGN;
Catchment: TOTAL ROOF AREA PLUS COURTYARDS

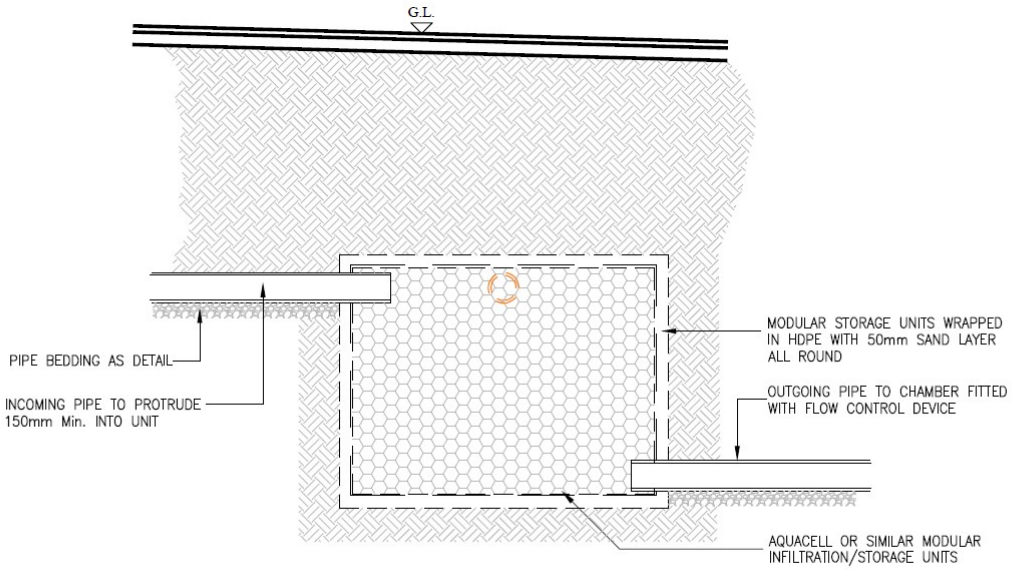
Date: 05/14/19

		100	years		User runoff rate (ltrs/sec)	4.83	☑ Set runoff value	
		977	m²		Outflow multiplier Factor:	1		
Global Warming Increase Factor		130%	2085 to 2115		SW Region Growth Factor:	2.93	☐ Set Growth Factor	
(1) Storm Duration (Hrs)	(2) M100-D mm	(3) Average Point Intensity (2) ÷ (1) (mm/Hr)	(4) ARF (Areal Reduction Factor)	(5) Average Areal Intensity (3) × (4) (mm/Hr)	(6) Accumulated volume at time D: 977m × (4) × (2) (ltrs)	(7) Q from Accumulated volume (6) ÷ (1) (ltrs/sec)	(8) Peak Runoff: 4.83 (ltrs/sec) × 1 (Outflow Factor) × 2.93 (Growth Factor)	(9) Storage Volume (6) - (8) (m³)
0.1	26.5	264.6	0.992	262.6	25,654	71	5,094	20.6
0.25	45.3	181.2	0.995	180.2	44,016	49	12,736	31.3
0.5	62.9	125.8	0.996	125.3	61,206	34	25,472	35.7
1	83.7	83.7	0.997	83.4	81,519	23	50,944	30.6
2	107.6	53.8	0.997	53.6	104,822	15	101,888	2.9
4	133.1	33.3	0.998	33.2	129,747	9	203,776	-74.0
6	149.3	24.9	0.998	24.8	145,614	7	305,664	-160.1
10	172.1	17.2	0.998	17.2	167,863	5	509,441	-341.6
24	217.0	9.0	0.999	9.0	211,769	2	1,222,658	-1,010.9
48	258.2	5.4	0.999	5.4	252,030	1	2,445,315	-2,193.3
							Storage volume required:	35.7m³

It can be seen from the above that an attenuation tank volume of 35.7m3 is required.

A 10m long x 4m wide x 0.9m deep attenuation tank formed using infiltration crates with an HDPE liner equates to a volume of 36m3 which is greater than the required attenuation volume of 35.7m3.
This exceeds the capacity required by a 1in100 year event plus 40% for climate change.

A typical drawing of an infiltration crate attenuation tank is shown below:



TYPICAL ATTENUATION TANK DETAIL
1:20

The specification of permeable resin bound paving (installed by a specialist contractor) is shown below:

EXCEEDENCE FLOWS:

The attached drainage layout shows the anticipated exceedance flow routes across the site. It is concluded that, due to the site topography, exceedance flows will travel in a southern direction away from the application site and across the proposed access drive.

As stated above, in an extreme event, it is likely that the surrounding areas will act in the same manner as the application site. The existing highway network falls toward the village centre at a considerable gradient. It can therefore be seen that flood waters will travel quickly away from this area and towards the river. Minimal flood depths to the existing access road are anticipated during extreme flood events (1 in 1000 year event) although the area of road adjacent to the river is known to flood.

It is recommended that the access drive will have kerbed sides to ensure that any exceedance flows will travel within the drive and not to the surrounding areas. There are no records of the site (former hotel) flooding during any storm event as expected of an area as elevated as this. Safe egress from the proposed dwellings is gained via the footpath link and existing access road at the top of the site.

FLOOD RISK:

The application site has been considered as lying adjacent to or within a Flood Zone 1 catchment area (taken from Environment Agency flood maps). Given the site location and topography it is highly unlikely that it will flood within a 1 in 100 year storm event or beyond.

The SuDS scheme identified above has been designed to 1 in 100 year storm event with an additional allowance of 40% for climate change. A further factor of safety of 3 has been applied to the design which makes the soakaway three times bigger than needed to cope with the designed storm event. An allowance of 10% has also been made for ‘urban creep’ which is good practice in urban environments.

Given this, and also the exceedance flow routes for the site, it can be seen that there is very little risk of the site flooding from fluvial or any other source. It can also be concluded that the proposed development will not increase the risk of flooding to the surrounding areas.

We therefore confirm that no further mitigation measures are required for the proposed development when considering the overall flood risk to the building occupants or surrounding environs.

SuDS MANAGEMENT & MAINTENANCE:

The SuDS system will be managed by the building occupiers and, if necessary, other approved operatives. The surface water drainage system requires minimal maintenance or management when compared to alternative pumped schemes.

A management plan will be drawn up prior to the construction phase and will incorporate the following:

- The location, type and size of the SuDS scheme including all RWP's, gullies. ACO drains, inspection chambers and the main SuDS attenuation tank.
- A maintenance schedule for the individual elements such as the de-sludging of any chambers, gullies and the main tank itself.
- Emergency contact information in case the system becomes surcharged or damaged in any way.
- Appropriate COSHH data and risk assessment for the individual elements where necessary.

The management of surface water flows during the construction phase is an important factor to consider. Temporary trench fill soakaways will be used at strategic locations downstream of the main construction activities. These temporary measures are required to ensure that no exceedance flows leave the site during the construction phase. All temporary soakaways will be maintained on a regular basis to ensure that they are fully functional at all times. The use of temporary soakaways will ensure that there is no risk of flooding to the surrounding environs during the construction phase.

A when wash may also be required during the initial excavation and cart away phase to ensure that no mud or other debris leaves the site and gets deposited on the surrounding road network. Should this happen then the contractor on site will ensure that an appropriate road sweeper (vactor) is used to clean the road areas without delay or risk to the road users.

FOUL WATER DRAINAGE:

SWW have been notified of the possible connection to the existing sewer network from the proposed dwellings and have no objections with this regard. SWW will be given full details of the connection location and type prior to construction commencing on site.

DRAINAGE LAYOUT:

REFER TO CDEC Ltd DRAINAGE LAYOUT DRAWING REF: J-18600-1000/H FOR DETAILS