Our Ref: J-2823
05 January 2023

Stuart Keogh
c/o Purelight Architecture & Landscape
Prow Park
Treloggan
Newquay
TR7 2SX

RE: Proposed Statue at Killacourt Field, Newquay TR7 1DT – Drainage Statement

Introduction

Stuart Keogh is proposing to erect a permanent sculpture depicting a surfer on a wave at Killacourt Field, Newquay. In line with the Newquay Neighbourhood Plan (NNP), further consideration is required for the disposal of surface water from the development. Engineering and Development Solutions have been commissioned to provide a drainage statement for the development.

This report comprises the drainage statement for the proposed statue, in line with the National Planning Policy Framework (NPPF), Planning Practice Guidance (PPG), NNP, and Drainage Guidance for Cornwall (DGfC).

Drainage Policy

The site is not within a Critical Drainage Area and is less than 1 hectare in area, therefore any surface water drainage for the site should comply with the relevant guidance laid out in Drainage Guidance for Cornwall (DGfC). The DGfC document is currently under review, though until an updated version is published, advice appropriate to the proposed development is reproduced below for ease of reference:

"*Outside Critical Drainage Areas*

Small Development Sites, less than 1 hectare.

- *Following the Building Regulations Drainage hierarchy, surface water should:-*

i. *Drain to a soakaway or infiltration system designed in accordance with the SUDS Manual - CIRIA C697, using a minimum of a 30-year return period storm.*

Where infiltration is not possible:-

ii. *A sustainable drainage system shall be provided ensuring flow attenuation, no adverse impact on water quality and where possible habitat creation.*

- *The total discharge from the site should aim to mimic greenfield rates. These shall be no more than the theoretical greenfield run-off rates from each of the corresponding 1, 10, 30 and 100 year storms. When these values are less than 5 litres/second, a rate of 5 litres/second can be used. Attenuation may not be necessary if the discharge is directly to coastal waters. In these cases the impact on the receiving environment in terms of habitat, erosion and water quality should be assessed.*
- *The design must take into account the appropriate allowance for increased rainfall from climate change. This should be based on the lifetime of the development, the guidance in Annex B of PPS25 and the PPS25 Practice Guide.*"

The site should also adhere to more recent guidance (2019) in the NNP, as summarised below:

"Policy: G2 - Development Principles

i. *Sustainable Drainage Systems (SuDS) must be considered for all development and developers must consult with the Local Planning Authority on the requirement for SuDS. Where development is phased, SuDS must be integrated into the overall design and demonstrate how water will travel at each phase of development; its size and location within or near to the proposed development; responsibility for its ongoing maintenance. If it is agreed with the Local Planning Authority that SuDS is not required, the developer must qualify what type of drainage system will be installed that remains in conformity to the NNP and provide evidence of its effectiveness in preventing flood risk including to surrounding areas*.

Policy: CC3 - Drainage Management

a. *Applications for development within 30 metres of the Exclusion Zone (i.e. the CEV Zone) as identified on map CC a,b,c & d will be required to provide a Drainage Impact Assessment showing how foul water and surface water will be managed.*
b. *Proposals must demonstrate how the development will provide for the drainage of surface water directly into existing sewers, without exceeding their capacity.*
c. *The use of drainpipes which would discharge water onto any cliff or cliff face will not be supported.*
d. *The use of soakaways and permeable surfaces in the Exclusion Zone or within 5 metres of it will not be supported.*
e. *The use of water collection tanks within or immediately adjacent to the Exclusion Zone will not be supported*."

Existing Drainage Infrastructure

The site is served by an existing surface water drainage system installed as part of the regeneration of Killacourt, which discharges into the public combined sewer at a controlled rate. Runoff originating from hardstanding and buildings at Killacourt is routed towards a flow control device limiting the flow to 3 l/s before entering the public sewer, as indicated in **Figure 1** below. If upstream flow exceeds 3 l/s, water backs up into a storage tank sized to contain the 1 in 100-year storm event including climate change allowance.

Ground Conditions

According to BGS mapping, the underlying bedrock geology is the Bovisand Formation – Mudstone, siltstone and sandstone. Soilscapes map viewer indicates that the site is situated on freely draining loamy soils over rock. The site is not located within a Groundwater Source Protection Zone (SPZ). The site appears to be within 30m of the Coastal Erosion Vulnerability (CEV) Zone.

Trial pits excavated on site in May 2020 for percolation testing failed to drain sufficiently in line with BRE 365.

The site is situated not far from the eroding cliff edge, so introducing infiltration systems into the ground may impact coastal stability. It is therefore considered that the use of infiltration for surface water disposal is not suitable for this site.

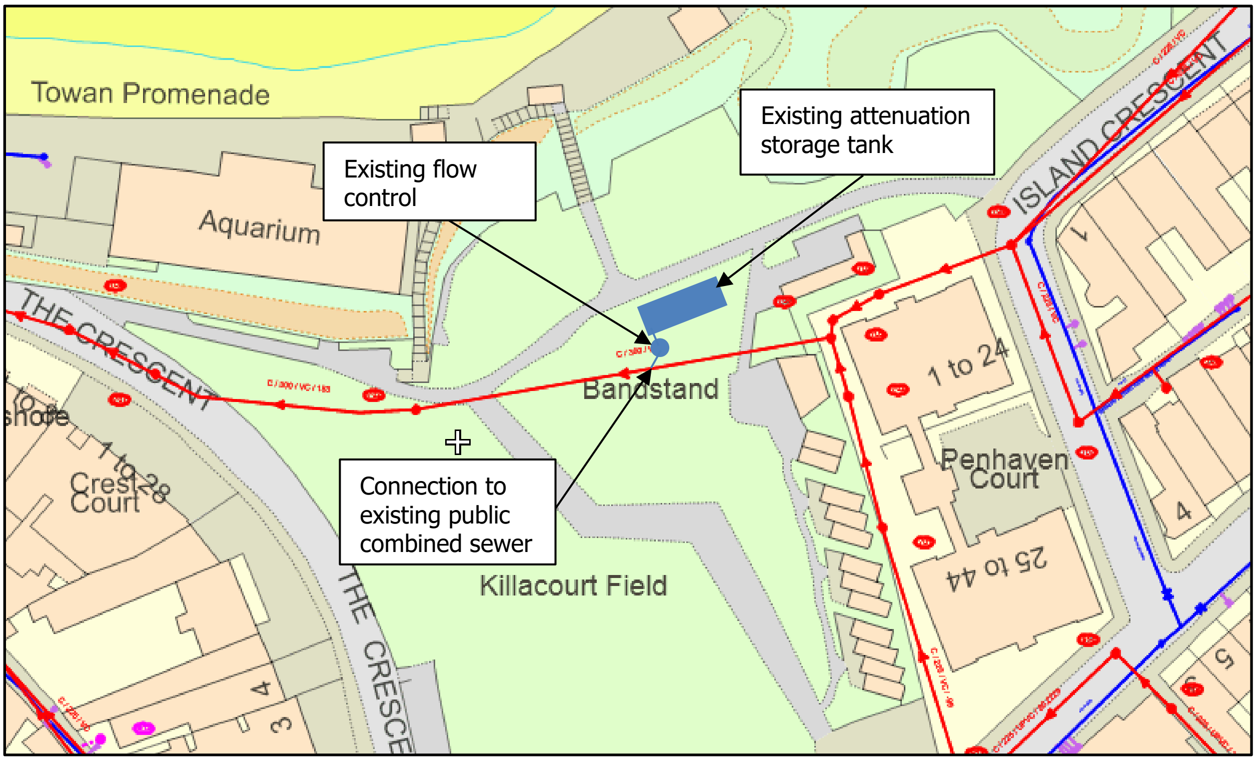

Figure 1 – Indicative Existing Drainage Arrangements

Drainage Design – Surface Water

In line with sustainable drainage hierarchy, it is preferable to use infiltration-based surface water drainage systems within the curtilage of site to deal with runoff as close to source as possible. However, it is determined that a soakaway drainage system compliant with BRE 365 is not suitable for this site.

As infiltration drainage has been ruled out as a viable option to deal with surface water from development on this site, it is proposed to connect into the existing surface water attenuation system which restricts the surface water discharge from the wider Killacourt Field. This is to ensure no increase in runoff rates and overland flows downstream of the site and consequently flood risk to downstream properties or interests will not increase.

It is anticipated that runoff may originate from the proposed statue base, which has a surface area of 9m^2. It is proposed that surface water originating from the base will drain towards the existing flow control device limiting the flow to 3.0 l/s, which discharges into the public combined sewer.

If the upstream flow exceeds 3.0 l/s, the system will back up into a storage tank sized to contain the 1 in 100-year rainfall event including climate change allowance. Calculations suggest that an additional flow volume of 0.4m^3 would be created by the statue base and that the existing storage tank volume of 24m^3 has suitable spare capacity to incorporate flows from the proposed statue base.

Figure 2 below shows the indicative layout of the proposed surface water drainage system on the site; calculations are included in **Annex A** of this report.

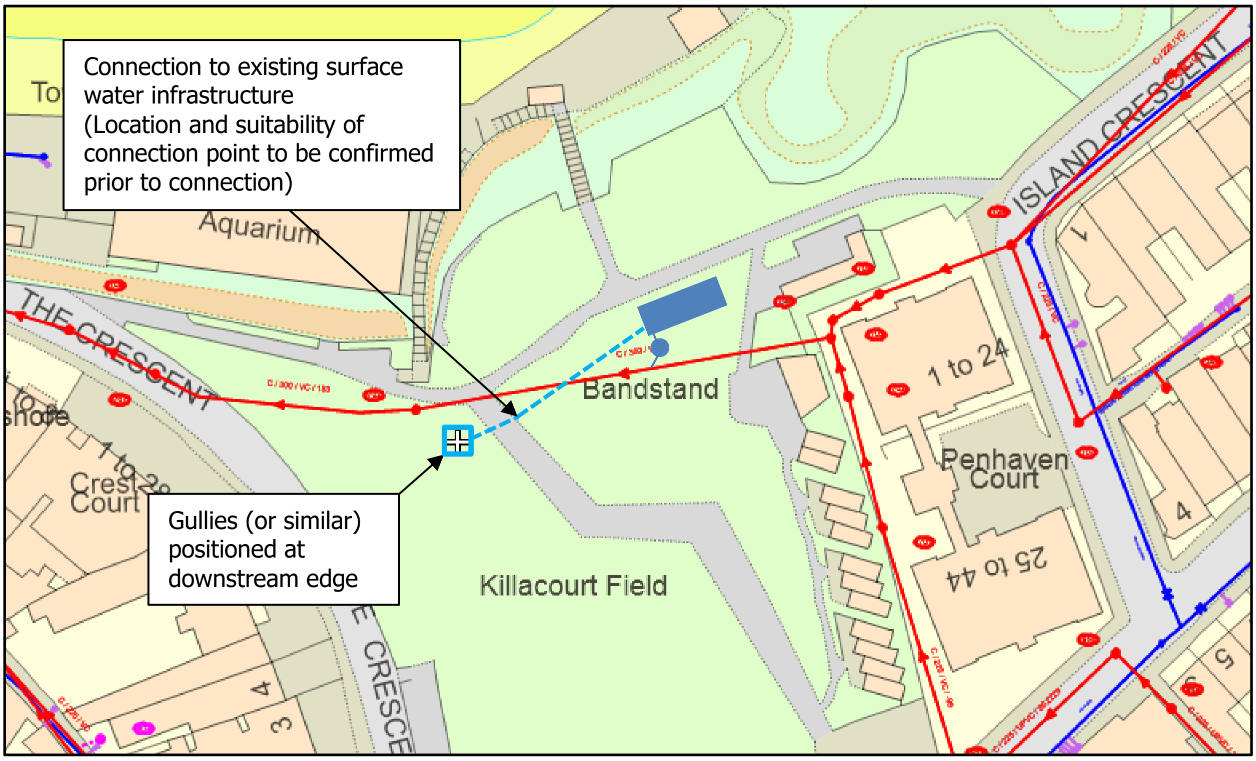

Figure 2 – Proposed Statue Drainage Arrangements

<u>Management & Maintenance</u>

The surface water drainage system will remain in private ownership. Management and maintenance responsibility for the Killacourt Field drainage system lies with Newquay Town Council.

Maintenance activities will broadly comprise regular maintenance, monitoring, and remedial work where necessary, as per the guidance in the CIRIA SuDS Manual C753 as summarised in **Table 2** below.

ATTENUATION TANK		
Maintenance Activity	**Required Action**	**Typical Frequency**
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris form the catchment surface (where it may cause risks to performance)	Monthly
	Remove sediment from pre-treatment structures and/or internal forebays	Annually, or as required
Remedial actions	Repair/rehabilitate inlets, outlet, overflows, and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents, and overflows to ensure they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

Table 1 – Typical Operation and Maintenance Requirements for SuDS

Exceedance Events

In the unlikely event of a storm more than the 1 in 100-year return period rainfall event (including climate change allowance), or if the proposed drainage system were to become blocked, water may surcharge from the system. In this case it is considered that the overflowing water would run in a northerly direction towards the adjacent grass area, as per the pre-development scenario.

Due to the storage provided in the proposed attenuation system, and design standard used (1 in 100-year storm with an additional allowance for the effects of climate change), any exceedance flows would be lower than would flow off the site in the pre-development scenario for a similar storm event.

Conclusions

The site is not suitable for the use of infiltration drainage to deal with surface water at the site. As such it is proposed to connect into the existing Killacourt Field attenuation-based drainage system and this has been designed to the 100-year standard with allowance for climate change, in line with drainage design standards required by Cornwall Council LLFA.

The existing surface water system serving Killacourt Field has capacity to accept flows from the proposed statue base and discharges into the public combined sewer at a controlled rate of 3 l/s.

The indicative proposed drainage layout is shown in **Figure 2** above; calculations are included in **Annex A**.

Provided the recommendations outlined in this report are adopted in the development proposal then there is the capacity to manage the surface water runoff from the development in line with best practice. The proposed drainage infrastructure has been designed in accordance with guidance outlined in NPPF, Drainage Guidance for Cornwall and Newquay Neighbourhood Plan and therefore the development is entirely appropriate on this site from a surface water drainage perspective.

Enc. Annex A Calculations

ANNEX A - CALCULATIONS

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 70 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	20.062	0.322	0.0	3.0	0.0	3.0	11.7	O K
30 min Summer	20.174	0.434	0.0	3.0	0.0	3.0	15.8	O K
60 min Summer	20.258	0.518	0.0	3.0	0.0	3.0	18.9	O K
120 min Summer	20.291	0.551	0.0	3.0	0.0	3.0	20.1	O K
180 min Summer	20.283	0.543	0.0	3.0	0.0	3.0	19.8	O K
240 min Summer	20.261	0.521	0.0	3.0	0.0	3.0	19.0	O K
360 min Summer	20.201	0.461	0.0	3.0	0.0	3.0	16.8	O K
480 min Summer	20.130	0.390	0.0	3.0	0.0	3.0	14.2	O K
600 min Summer	20.067	0.327	0.0	3.0	0.0	3.0	11.9	O K
720 min Summer	20.014	0.274	0.0	3.0	0.0	3.0	10.0	O K
960 min Summer	19.932	0.192	0.0	3.0	0.0	3.0	7.0	O K
1440 min Summer	19.852	0.112	0.0	2.8	0.0	2.8	4.1	O K
2160 min Summer	19.824	0.084	0.0	2.3	0.0	2.3	3.0	O K
2880 min Summer	19.810	0.070	0.0	1.8	0.0	1.8	2.6	O K
4320 min Summer	19.797	0.057	0.0	1.3	0.0	1.3	2.1	O K
5760 min Summer	19.790	0.050	0.0	1.1	0.0	1.1	1.8	O K
7200 min Summer	19.786	0.046	0.0	0.9	0.0	0.9	1.7	O K
8640 min Summer	19.782	0.042	0.0	0.8	0.0	0.8	1.5	O K
10080 min Summer	19.779	0.039	0.0	0.7	0.0	0.7	1.4	O K
15 min Winter	20.107	0.367	0.0	3.0	0.0	3.0	13.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	104.373	0.0	14.5	0.0	22
30 min Summer	72.185	0.0	20.0	0.0	35
60 min Summer	47.821	0.0	26.5	0.0	60
120 min Summer	30.679	0.0	34.0	0.0	94
180 min Summer	23.321	0.0	38.8	0.0	128
240 min Summer	19.055	0.0	42.3	0.0	164
360 min Summer	14.198	0.0	47.3	0.0	232
480 min Summer	11.527	0.0	51.2	0.0	296
600 min Summer	9.797	0.0	54.4	0.0	356
720 min Summer	8.572	0.0	57.1	0.0	414
960 min Summer	6.935	0.0	61.6	0.0	528
1440 min Summer	5.133	0.0	68.3	0.0	746
2160 min Summer	3.788	0.0	75.7	0.0	1104
2880 min Summer	3.049	0.0	81.2	0.0	1468
4320 min Summer	2.239	0.0	89.5	0.0	2204
5760 min Summer	1.796	0.0	95.7	0.0	2888
7200 min Summer	1.516	0.0	101.0	0.0	3664
8640 min Summer	1.320	0.0	105.5	0.0	4384
10080 min Summer	1.174	0.0	109.5	0.0	5120
15 min Winter	104.373	0.0	16.2	0.0	23

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	20.237	0.497	0.0	3.0	0.0	3.0	18.1	O K
60 min Winter	20.335	0.595	0.0	3.0	0.0	3.0	21.7	O K
120 min Winter	20.369	0.629	0.0	3.0	0.0	3.0	22.9	O K
180 min Winter	20.351	0.611	0.0	3.0	0.0	3.0	22.3	O K
240 min Winter	20.315	0.575	0.0	3.0	0.0	3.0	21.0	O K
360 min Winter	20.220	0.480	0.0	3.0	0.0	3.0	17.5	O K
480 min Winter	20.103	0.363	0.0	3.0	0.0	3.0	13.2	O K
600 min Winter	20.008	0.268	0.0	3.0	0.0	3.0	9.8	O K
720 min Winter	19.936	0.196	0.0	3.0	0.0	3.0	7.2	O K
960 min Winter	19.856	0.116	0.0	2.9	0.0	2.9	4.2	O K
1440 min Winter	19.823	0.083	0.0	2.2	0.0	2.2	3.0	O K
2160 min Winter	19.805	0.065	0.0	1.6	0.0	1.6	2.4	O K
2880 min Winter	19.797	0.057	0.0	1.3	0.0	1.3	2.1	O K
4320 min Winter	19.787	0.047	0.0	1.0	0.0	1.0	1.7	O K
5760 min Winter	19.782	0.042	0.0	0.8	0.0	0.8	1.5	O K
7200 min Winter	19.778	0.038	0.0	0.7	0.0	0.7	1.4	O K
8640 min Winter	19.775	0.035	0.0	0.6	0.0	0.6	1.3	O K
10080 min Winter	19.773	0.033	0.0	0.5	0.0	0.5	1.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
30 min Winter	72.185	0.0	22.4	0.0	35
60 min Winter	47.821	0.0	29.7	0.0	60
120 min Winter	30.679	0.0	38.1	0.0	100
180 min Winter	23.321	0.0	43.5	0.0	138
240 min Winter	19.055	0.0	47.4	0.0	176
360 min Winter	14.198	0.0	52.9	0.0	252
480 min Winter	11.527	0.0	57.3	0.0	314
600 min Winter	9.797	0.0	60.9	0.0	372
720 min Winter	8.572	0.0	63.9	0.0	424
960 min Winter	6.935	0.0	69.0	0.0	520
1440 min Winter	5.133	0.0	76.5	0.0	742
2160 min Winter	3.788	0.0	84.8	0.0	1108
2880 min Winter	3.049	0.0	90.9	0.0	1468
4320 min Winter	2.239	0.0	100.2	0.0	2188
5760 min Winter	1.796	0.0	107.2	0.0	2936
7200 min Winter	1.516	0.0	113.1	0.0	3536
8640 min Winter	1.320	0.0	118.1	0.0	4368
10080 min Winter	1.174	0.0	122.6	0.0	5144

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	17.000	Shortest Storm (mins)	15
Ratio R	0.300	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.074

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	4	0.025	4	8	0.025	8	12	0.024

Model Details

Storage is Online Cover Level (m) 21.000

Cellular Storage Structure

Invert Level (m) 19.740 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	38.4	38.4	0.661	0.0	57.4
0.660	38.4	57.4			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0087-3000-0660-3000
Design Head (m)	0.660
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	87
Invert Level (m)	19.740
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.660	3.0
Flush-Flo™	0.196	3.0
Kick-Flo®	0.441	2.5
Mean Flow over Head Range	-	2.6

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	2.7	1.200	3.9	3.000	6.1	7.000	9.0
0.200	3.0	1.400	4.2	3.500	6.5	7.500	9.3
0.300	2.9	1.600	4.5	4.000	6.9	8.000	9.7
0.400	2.7	1.800	4.8	4.500	7.3	8.500	10.0
0.500	2.6	2.000	5.0	5.000	7.7	9.000	10.2
0.600	2.9	2.200	5.2	5.500	8.1	9.500	10.5
0.800	3.3	2.400	5.5	6.000	8.4		
1.000	3.6	2.600	5.7	6.500	8.7		

Pipe Overflow Control

Diameter (m)	0.150	Entry Loss Coefficient	0.500
Slope (1:X)	100.0	Coefficient of Contraction	0.600
Length (m)	10.000	Upstream Invert Level (m)	20.400
Roughness k (mm)	0.600		

Event: 120 min Winter