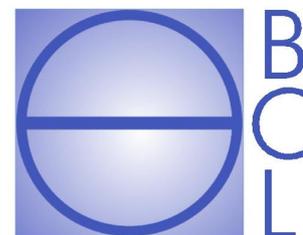


TECHNICAL NOTE  
Flood Risk Assessment



Proposal to Construct Bandstand:  
Kimberley Park, Falmouth, Cornwall

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Commercial Road  
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July 2014  
BCL/hil/KPK/001.doc/14

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## 1 OVERVIEW

- 1.1 BCL Consultant Hydrogeologists Limited has been instructed by Marraum Limited to carry out a Flood Risk Assessment (FRA) to support a Planning Application seeking consent to construct a bandstand at Kimberley Park, Falmouth (the Site).
- 1.2 The Application Area is centred upon National Grid Reference (NGR) <sup>1</sup>80175(E) <sup>0</sup>32720(N).
- 1.3 The Proposed Development involves the construction of a bandstand in Kimberley Park. The footprint of the bandstand overlaps an area that was previously occupied by a paddling pool, which has been infilled and covered by lawn.
- 1.4 Current land use within Kimberley Park includes: formal bedding areas, ornamental trees, paved walkways, lawns and pond. The Park covers some 2.6 hectares.
- 1.5 The proposed bandstand (with associated paved surfaces and access ramp) will occupy an area of close to 100 m<sup>2</sup>. Of this, 31 m<sup>2</sup> will comprise pervious pavement.
- 1.6 At the same time, an existing tarmac pathway (47 m<sup>2</sup>) will be removed during the course of the development and this 47 m<sup>2</sup> area will be returned to lawn.
- 1.7 Thus, the bandstand will only introduce 53 m<sup>2</sup> of new hardstanding in the Park.
- 1.8 In order to compensate for additional runoff arising from the new hardstanding, the drainage scheme for the development proposal incorporates a shallow swale, in which storm runoff will be detained prior to being discharged at the Greenfield rate into the existing drainage system leading to the pond at the centre of the Park.
- 1.9 The full extent of the development is illustrated upon *Drawing P3.7* appended to this report.
- 1.10 The FRA has been prepared to accompany the planning application (PA14/05187) seeking consent for the Proposed Development.
- 1.11 This document details the findings of the FRA.

## 2 INFORMATION CONSULTED IN THE PREPARATION OF THIS FRA

### 2.1 Policy and data sources consulted in the course of this assessment have included:

- i) “National Planning Policy Framework” (NPPF: Department for Communities and Local Government [DCLG], March 2012).
- ii) “Planning Practice Guidance for Flood Risk and Coastal Change”, DCLG, updated 6<sup>th</sup> March 2014 (referred to herein as PPG).
- iii) Defra & Environment Agency (EA), Flood and Coastal Defence R&D Programme: “Preliminary rainfall runoff management for developments” (Technical Report W5-074/A/TR/1, Revision E).
- iv) HR Wallingford Drainage Tools Catalogue: UK Sustainable Drainage Guidance and Tools, including “Greenfield Runoff Estimation” and “Stormwater Storage Analysis”.
- v) EA Flooding Maps (published online): fluvial/tidal, reservoir and surface water.
- vi) Rainfall data: Meteorological Office and Flood Estimation Handbook (FEH), with accompanying CD-ROM.
- vii) Published mapping data obtained from the Ordnance Survey (1:25,000 scale).
- viii) Detailed topographic survey data and development plans (*Drawing P3.7*), provided by Marraum.
- ix) Homecheck Report (Reference 56838675\_1\_1).

### **3 TERMS OF REFERENCE / METHODOLOGY**

3.1 The assessment has been conducted in accordance with guidance given in Diagram 1 of “Planning Practice Guidance for Flood Risk and Coastal Change”. In this instance, the assessment has therefore involved:

- i. An appraisal of the availability and adequacy of existing information.
- ii. Quantitative appraisal of the potential flood risk to the development.
- iii. Quantitative appraisal of the potential impact of the Development Site on flood risk elsewhere.
- iv. Qualitative demonstration of the effectiveness of any proposed mitigation measures.

## 4 APPRAISAL OF THE FLOOD RISK POSED TO THE SITE

### 4.1 Fluvial and Tidal Flooding

- 4.1.1 For background information on flood risk in the local area, reference has been made to the EA Modelled Flood Plain Map: 1:100 year (fluvial), 1:200 year (tidal flood) & 1:1,000 year (extreme flood). The same mapping is presented in Sections 2a and 2b of the appended Homecheck Report (Reference 56838675\_1\_1), which was commissioned by Marraum.
- 4.1.2 The Application Area lies within Flood Zone 1 (“Low Probability”) *i.e.* less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).
- 4.1.3 The Proposed Development falls into the category “Buildings used for assembly and leisure”. According to Table 2 of PPG, an extract from which is presented below, the Flood Risk Vulnerability Classification for the Proposed Development is defined as “Less Vulnerable”.

#### **Less Vulnerable**

- Police, ambulance and fire stations which are **not** required to be operational during flooding.
- Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the ‘More Vulnerable’ class; and assembly and leisure.
- Land and buildings used for agriculture and forestry.
- Waste treatment (except landfill\* and hazardous waste facilities).
- Minerals working and processing (except for sand and gravel working).
- Water treatment works which do not need to remain operational during times of flood.
- Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.

- 4.1.4 Table 3 of PPG (reproduced below) indicates that the Proposed Development, being classed as “Less Vulnerable”, can be undertaken within any Flood Risk Zone (except 3b).

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	x	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	x	x	x	✓*

**Key:**

✓ Development is appropriate

x Development should not be permitted.

4.1.5 There is therefore no requirement to apply the “exemption test” in this instance. The methodology followed in the derivation of this conclusion is consistent with that presented in Diagram 2 of PPG (Application of the Sequential Test).

## 4.2 Flooding from Surface Water

4.2.1 Section 2c of the Homecheck Report (Reference 56838675\_1\_1) includes a map illustrating the risk posed by surface water flooding at Kimberley Park.

4.2.2 The bandstand will be largely isolated from runoff from adjacent land due to (i) its floor level being raised 500 mm above surrounding ground and accessed by ramp (ii) the fall of the ground (as indicated by the spot levels on the topographic survey) means that the existing pavements act as preferential pathways for surface water runoff.

4.2.3 The area formerly occupied by the paddling pool is characterised by poor drainage, with the accompanying risk of surface water flooding. The drainage scheme for the development proposal incorporates a shallow swale (Section 5 of this report). There is a marginal overlap between the outline of the former paddling pool and the downstream end of the proposed swale. This will help to improve the current drainage situation in this area.

- 4.2.4 There is considered to be negligible potential for significant flooding of the bandstand from rainfall runoff from neighbouring properties / land.
- 4.2.5 The risk posed by flooding from surface water is deemed manageable. Given that the development is classed as “less vulnerable” in terms of fluvial flooding and *can* be undertaken within any Flood Risk Zone (except 3b), the same would apply when considering the risk posed by surface water flooding.

## **5 APPRAISAL OF THE FLOOD RISK POSED ELSEWHERE WITHIN THE CATCHMENT BY THE PROPOSED DEVELOPMENT**

### **5.1 Controlling Runoff**

- 5.1.1 Rainfall data for the design storm has been taken from the Flood Estimation Handbook (FEH) and accompanying CD-ROM.
- 5.1.2 The pre-development runoff rate has been compared with that for the proposed bandstand.
- 5.1.3 Current land use within the bulk of Kimberley Park (2.6 hectares) will be unchanged.
- 5.1.4 The proposed bandstand (with associated paved surfaces and access ramp) will occupy an area of close to 100 m<sup>2</sup>. Of this, 31 m<sup>2</sup> will comprise pervious pavement.
- 5.1.5 At the same time, an existing tarmac pathway (47 m<sup>2</sup>) will be removed during the course of the development and this 47 m<sup>2</sup> area will be returned to lawn.
- 5.1.6 Thus, the bandstand will only introduce 53 m<sup>2</sup> of new hardstanding in the Park.
- 5.1.7 The rainfall runoff rates have been calculated using the HR Wallingford Drainage Tools Catalogue: UK Sustainable Drainage Guidance and Tools, including “Greenfield Runoff Estimation” and “Stormwater Storage Analysis”. These tools incorporate the assessment procedure described in: “Preliminary rainfall runoff management for developments” (Technical Report W5-074A/TR/1, Revision E), which was prepared as part of the Flood and Coastal Defence R&D Programme undertaken by Defra and the EA.
- 5.1.8 The aim of the procedure is to calculate the rainfall runoff generated on Site during design storm events (e.g. 1 in 100-yr).
- 5.1.9 Full calculations are appended to the report; the findings are summarised below.
- 5.1.10 The current (Greenfield) runoff rate in the Application Area is calculated to be 5 l/s/ha (100-yr event).

- 5.1.11 In order to compensate for additional runoff arising from the new hardstanding, the drainage scheme for the development proposal incorporates a shallow swale (*Drawing P3.7*), in which storm runoff will be detained prior to being discharged at the Greenfield rate into the existing drainage system leading to the pond at the centre of the Park.
- 5.1.12 As detailed in the appended calculations, when applying the IH124 Method, the storage requirement in the swale equates to less than 4.5 m<sup>3</sup> to cope with the 100-yr storm. This reduces to 3.2 m<sup>3</sup> when using the FEH method. Taking a precautionary approach, the higher figure (4.5 m<sup>3</sup>) should be adopted when sizing the swale.
- 5.1.13 Thus, the new swale should be constructed to have dimensions as indicated upon *Drawing P3.7* i.e. a length of 15 m, a width of 1 m and a storage depth of 30 cm.
- 5.1.14 It is noteworthy that the swale will be a dry feature except during adverse weather. It will be kept empty in readiness for the storm event.

## **5.2 Floodplain Storage**

- 5.2.1 The Application Area lies outside the floodplain.
- 5.2.2 Therefore, there will be no development-related reduction in floodplain storage.

## **6 RESIDUAL RISK**

- 6.1 If the rainfall is of sufficient intensity and duration such that it exceeds the capacity of the system (*e.g.* the 200-year event), any excess runoff will overflow on to the neighbouring lawns.
- 6.2 Amenity open space is classed as “water-compatible” in terms of fluvial flooding and this classification might be extended to cover for any risk associated with water overflowing from the swale.
- 6.3 However, it is important that there is adequate passive flood warning in place, with signs highlighting the residual risk of flooding in the vicinity of the swale and clearly signed evacuation routes if necessary.

## 7 SUMMARY AND CONCLUSIONS

- 7.1 The Application Area lies within Flood Risk Zone (FRZ) 1.
- 7.2 The various elements of the Proposed Development are classified as Appropriate Activities for FRZ1. This conclusion remains valid when accounting for the assumed effects of climate change.
- 7.3 The risk posed by flooding from surface water is deemed manageable. Given that the development is classed as “less vulnerable” in terms of fluvial flooding and *can* be undertaken within any Flood Risk Zone (except 3b), the same would apply when considering the risk posed by surface water flooding.
- 7.4 The drainage proposals for the bandstand have been measured against the existing performance of the Site. The proposed swale has more than sufficient capacity to compensate for additional runoff from new hardstanding during the 100-year storm event.
- 7.5 In this way, assessment has been made of the flood risk that may be posed elsewhere within the catchment by implementation of the Proposed Development. The proposals are considered acceptable in this regard.

Henry Lister  
**Senior Hydrogeologist**  
**BCL Consultant Hydrogeologists Limited**  
July 2014

Site name: Kimberley Park  
Site location: Falmouth

Site coordinates  
Latitude: 50.15368° N  
Longitude: 5.07862° W  
Reference: gbumk6jy7ed6 / 0.01  
Date: 24 Jul 2014

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the CIRIA SUDS Manual (2007). It is not to be used for detailed design of drainage systems. It is recommended that every drainage scheme uses hydraulic modelling software to finalise volume requirements and design details before drawings are produced.

## Site characteristics

Total site area	2.58	ha
Significant public open space	2.57	ha
Area positively drained	0.01	ha
Impermeable area	0.01	ha
Percentage of drained area that is impermeable	50	%
Impervious area drained via infiltration	0	ha
Return period for infiltration system design	100	year
Impervious area drained to rainwater harvesting systems	0	ha
Return period for rainwater harvesting system design	100	year
Compliance factor for rainwater harvesting system design	66	%
Net site area for storage volume design	0.01	ha

## Methodology

Greenfield runoff method	IH124
Volume control approach	Use Long Term Storage
Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type
SOIL type	2
HOST class	N/A
SPR	0.30

## Hydrological characteristics

	Default	Edited	
SAAR	1048	1048	mm
M5-60 Rainfall Depth	17	17	mm
'r' Ratio M5-60/M5-2 day	0.3	0.3	
FEH/FSR conversion factor	0.83	0.83	
Hydrological region	8	8	
Growth curve factor: 1 year	0.78	0.78	
Growth curve factor: 10 year	1.49	1.49	
Growth curve factor: 30 year	1.95	1.95	
Growth curve factor: 100 year	2.43	2.43	

## Design criteria

Climate change allowance factor	1.3	
Urban creep allowance factor	1.1	
Interception rainfall depth	5	mm

## Greenfield runoff rates

	Default	Edited	
Qbar	0.03	0.03	l/s
1 in 1 year	5.00	5.00	l/s
1 in 30 years	5.00	5.00	l/s
1 in 100 years	5.00	5.00	l/s

Please note that a minimum flow of 5 l/s applies to any site

## Estimated storage volumes

	Default	Edited	
Interception storage	0.20	0.20	m <sup>3</sup>
Attenuation storage	3.63	3.63	m <sup>3</sup>
Long term storage	0.61	0.61	m <sup>3</sup>
Treatment storage	0.60	0.60	m <sup>3</sup>
Total storage	4.44	4.44	m <sup>3</sup>

Site name: Kimberley Park  
Site location: Falmouth

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Latitude: 50.15368° N  
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## Site characteristics

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Impermeable area	0.01	ha
Percentage of drained area that is impermeable	50	%
Impervious area drained via infiltration	0	ha
Return period for infiltration system design	100	year
Impervious area drained to rainwater harvesting systems	0	ha
Return period for rainwater harvesting system design	100	year
Compliance factor for rainwater harvesting system design	66	%
Net site area for storage volume design	0.01	ha

## Methodology

Greenfield runoff method	FEH
Volume control approach	Use Long Term Storage
Qmed estimation method	Calculate from BFI and SAAR
BFI and SPR estimation method	Specify BFI and SPR manually
HOST class	N/A
BFI / BFIHOST	0.58
SPR / SPRHOST	0.32
Qmed	0.055 l/s
Qbar / Qmed Conversion Factor	1.075

## Hydrological characteristics

	Default	Edited	
SAAR	1048	1048	mm
M5-60 Rainfall Depth	17	17	mm
'r' Ratio M5-60/M5-2 day	0.3	0.3	
FEH/FSR conversion factor	0.83	0.83	
Hydrological region	8	8	
Growth curve factor: 1 year	0.78	0.78	
Growth curve factor: 10 year	1.49	1.49	
Growth curve factor: 30 year	1.95	1.95	
Growth curve factor: 100 year	2.43	2.43	

## Design criteria

Climate change allowance factor	1.3
Urban creep allowance factor	1.1
Interception rainfall depth	5 mm

## Greenfield runoff rates

	Default	Edited	
Qbar	0.06	0.06	l/s
1 in 1 year	5.00	5.00	l/s
1 in 30 years	5.00	5.00	l/s
1 in 100 years	5.00	5.00	l/s

Please note that a minimum flow of 5 l/s applies to any site

## Estimated storage volumes

	Default	Edited	
Interception storage	0.20	0.20	m <sup>3</sup>
Attenuation storage	2.54	2.54	m <sup>3</sup>
Long term storage	0.47	0.47	m <sup>3</sup>
Treatment storage	0.60	0.60	m <sup>3</sup>
Total storage	3.21	3.21	m <sup>3</sup>