BPS

drainage strategy & flood risk assessment

for a residential development including parking and access

project: 58 Maidstone Road

client: Mr & Mrs Bell

date: Jan 21

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Appendix

1. BPS calculations
2. Southern Water Sewer Records
3. Environment Agency Product 4 ref. KSL 196669 AC including: -
   - Covering Letter dated 09/12/2020
   - Defended Tidal Flood Event
   - Undefended Tidal Flood Event
   - Risk of Flooding from Surface Water
   - Node Point Plan
   - Node Point Flood Water Level

References

i. Studio Bloom Architecture + Design Drawings nod. 19-133_0022 (latest revision).
ii. Geological Survey of Great Britain Solid Online Viewer (grid ref. E 566843 N 145052).
iii. CIRIA Report C753 The SuDS Manual-V5
iv. Planning Practice Guidance – Flood Risk & Coastal Change
v. EA Guidance – Flood Risk Assessments: climate change allowances (April 2016)
vi. Kent County Council Preliminary flood risk assessment maps
vii. Southern Waters Drainage and Wastewater Management Plans (DWMPs)
viii. Southern Waters Infrastructure Improvement Charges (2020-21)

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1. Notes

1.1. General

This 'Report' is prepared for the sole use of the person, firm, or company to whom it is addressed (together with that of any other person, firm, or company whose interest was disclosed to and accepted by us prior to its preparation) and no responsibility is accepted by us to any other party whatsoever for the whole or part of its contents.

2. Introduction

2.1. We have been instructed by Mr & Mrs Bell to carry out a flood risk assessment & drainage strategy, to appraise a development upon the land of 58–60 Maidstone Road, Paddock Wood, Kent.

2.2. The assessment has been undertaken in compliance with the Planning Practice Guidance and has followed the SuDS design process, from early consideration of the strategic objectives for the development of this nature.

2.3. We confirm that BPS are an 'appropriately qualified professional', being a company with extensive knowledge and experience in using SuDS based solutions and hydraulic calculations.

2.4. The information used for the preparation of the assessment is attached within the Appendices.

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3. Existing Site

Description

3.1. This is a developed site, which contains a large detached two storey building with commercial units on the ground floor and residential above. To the east of the building is a parking area.

3.2. The area surrounding the site is predominantly an urban settlement.

Location

The site is located at 58–60 Maidstone Road, Paddock Wood, Kent, TN12 6AF (national grid reference E 566843 N 145052 and adjacent to the highway of B2160, Maidstone Road. photograph below: -

Size

3.3. The site area is approximately 845.0m^2 (0.0845ha). Estimated 100% is impermeable.

Levels

From a topographical survey of the site and OS data available, it should be noted that the site is reasonably level and flat.

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Drainage

3.4. Existing surface water drainage serving the site, is believed to discharge under gravity into the public sewer upstream of MH8055.

3.5. Existing foul water drainage serving the site, is believed to discharge under gravity into the public sewer upstream of MH8001.

3.6. There are existing public sewers running through the site (refer to Foul MHs 7009-8001 and surface water MHs 8055-8054) on Southern Water sewer record map.

Geology

3.7. From Geological Survey of Great Britain Solid Online Viewer, it can be seen that the underlying substrata here should be of Wealden Group. This generally comprises interbedded sandstones, siltstones, mudstones ("shales"), limestones and clay ironstones of predominantly non-marine facies and is likely to offer moderate/slow infiltration for surface water.

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4. Flood Data Assessment

Environment Agency Product 4

4.1. This is included within Appendix 3 and provides localised flood maps and detailed information for modelled flood water depths for various events, both defended and undefended.

Tidal and River Flooding Incidences

4.2. The flood maps show that this site lie(s) within the outline of the 1% Annual exceedance Probability (AEP) (1 in 100 year), chance of flooding from rivers and a 0.1% AEP (1 in 1000 years of flooding from the sea in any given year.

4.3. There are no formal flood defences owned or maintained by the Environment Agency in the area of this site.

4.4. For a 1% (1 in 100) event, the maximum predicted depth of flood water is 640mm (16.89-16.94m AOD) at the central access road.

4.5. For a 0.1% (1 in 1000) event, the maximum predicted depth of flood water is 820mm (17.12m AOD) for the 1% (1 in 1000) event, at the central access road.

4.6. Environment Agency flood history data records show there has been no flood events recorded at the site.

Highway Flooding Incidences

4.7. With reference to Kent County Council's Strategic Flood Risk Assessment – Recorded past flood events map, it is noted that the development neighbourhood does not have a history of recorded flood events.

Sewerage Flooding Incidences

4.8. With reference to Kent County Council Council's Strategic Flood Risk Assessment - Sewer flood incidents map, it is noted that the it is noted that the development neighbourhood does not have a history of record flood events.

Ground Water Flooding Incidences

4.9. With reference to Kent County Council Council's Strategic Flood Risk Assessment – Ground water risk Areas map, it is noted that the development neighbourhood is not at risk of groundwater flooding.

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5. Flood Probability and Flood Risk Vulnerability

Probability

5.1. Refer to 4.2 – 4.6. above.

Vulnerability

5.2. The Planning Practice Guidance: Flood Risk and Coastal Changes defines the type and nature of different development classifications based on their flood risk vulnerability.

5.3. The flood risk vulnerability classifications are set out as follows:

Flood Risk Vulnerability Classifications	Zone 1	Zone 2	Zone 3a	Zone 3b
Essential Infrastructure - Essential transport & utility infrastructure, including electricity generating power stations, water treatment works and wind turbines	√	√	e	e
Highly Vulnerable – Emergency services, basement dwellings, caravans, mobile homes, and park homes intended for permanent residential use. Installations requiring hazardous substances consent.	√	e	×	×
More Vulnerable - Hospitals, residential care homes. Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs, and hotels. Non–residential uses for health services, nurseries, and educational establishments.	√	√	e	×
Less vulnerable - shops; financial, professional and other services; restaurants; offices; general industry, storage and distribution; agriculture; waste & water treatment works	√	√	e	×
Water-compatible development - Flood control infrastructure, water and sewage transmission infrastructure and pumping stations; Docks, marinas, wharves and Ship building; Water-based recreation	√	√	√	√

Key:

√	Development is appropriate
×	Development should not be permitted
e	Exception Test Retired
	Denotes the classification of this development

5.4. Using the principles outlined above development would be classed as 'more vulnerable', under the NPPF guidance, this development should be required to implement the exception test.

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The Sequential Test

5.5. Local Planning Authorities (LPA) are encouraged to take a risk-based approach to proposals for development in areas at risk of flooding through the application of the Sequential Test. The sequential approach is followed to steer a new development to areas with the lowest probability of flooding and away from high-risk areas.

5.6. The existing site already has permission for commercial and residential use. Therefore, in this case the sequential test assessment has not been undertaken in support of this FRA.

5.7. However, the work undertaken as part of this flood risk assessment can help provide additional evidence to demonstrate that the development will not increase flood risk at the site or elsewhere, enabling an informed judgment to be made.

The Exception Test

5.8. As defined in the NPPF for the exception test to be passed:

- It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared; and
- A site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

(a) Demonstrating the development provides wider sustainability benefits to the community that outweigh flood risk is outside the scope of this report, and predominantly an issue for the planners, who previously deemed there to be benefits allowing commercial and residential assets to be built on the site.

(b) The key objective of this report to establish the risks associated with flooding and help demonstrate how these dangers can be suitably managed to fulfil part 'b' of the exception test.

Flood Risk Mitigation

5.9. It would be recommended to ensure that all habitable accommodation be above the design flood level for a 1% (1 in 100) event (16.89-16.94m AOD), Therefore the minimum recommended finished floor level should be 17.00m AOD, approximately 700mm above existing ground level.

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5.10. It should be noted that the risk of flooding for an event up to 0.1% (1 in 1000 year) , the maximum predicted flood water level (17.05- 17.13m AOD) or 130mm above the proposed the ground floor level (17.00 AOD). This is considered to be of acceptable risk and practical in consideration of the surrounding area as a whole, and the scale of the development, providing the following additional measures are also put into place: -

- Flood resilient measures should be included within the construction. These include but are not limited to masonry walls; raising electrical sockets, fitting tiled floors, applying damp resistant wall finishes, barriers on ground floor doors, windows and access points, non-return valves on foul connections, water to be permitted to enter under buildings, to prevent ground floor walls suffering structurally due to lateral water pressures and allow reasonably unhindered flow.

- A definitive site-specific Flood Emergency Evacuation Plan is to be agreed with the Local Authority, this document is to be provided during introduction to ensure that owners and occupiers of the property are aware that the development is at risk of flooding. Ensuring the occupiers are aware of the appropriate course of action to be taken in a flood event.

- Advice will be sort from the emergency services when producing an evacuation plan for the development as part of the Flood Emergency Evacuation Plan.

- That all future owners and occupiers be made aware of the potential flood threat, and to include signing up to the Flood Warning Service, forming part of any tenancy agreement. This would be a similar situation for all residents in this area and local flood warnings are likely to be broadcast widely, allowing evacuation to take place in a safe manner ahead of the time of danger.

- Reference is to be made to the Department for communities and local Government publication 'Preparing for Floods' and Environment Agency Flood line Publication 'Damage Limitation' when considering flood proofing measures.

- All flood proofing measures are to be agreed with local Building Control department prior to construction.

Flood Risk Rating

5.11. If all the additional measures above are also put into place, the overall flood risk for the proposed development would not increase.

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6. SuDS Assessment

Sustainable Drainage Systems (SuDS)

6.1. The SuDS Hierarchy is set out as follows:

SuDs Drainage Hierarchy	Suitability	Comment
Store rainwater for later use	✗	Not suitable for surface water attenuation. It can reduce the water demand, but it can provide no attenuation benefits if it is full prior to a storm event.
Infiltration techniques, such as porous surfaces and soakaways	✗	Due to the geology at the site and space available infiltration is considered unsuitable.
Attenuate rainwater in ponds or open water features for gradual release	✗	There is not adequate green space on the site to exclusively consider ponds for surface water attenuation.
Attenuate rainwater by storing in tanks or sealed water features for gradual release	√	System 'C' porous structures and Geocellular storage systems to provide underground attenuation.
Discharge rainwater direct to a watercourse	✗	Watercourse's were not found with the vicinity of the site
Discharge rainwater to a surface water sewer/drain	√	Public surface water sewer has been located on site
Discharge rainwater to the combined sewer.	–	
Discharge rainwater to the foul sewer.	–	

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6.2. SuDS treatment train (sometimes called the management train) sets out the order in which SuDS features should be delivered to best mimic natural drainage processes, and so is an important concept for SuDS designers to follow. The treatment train is illustrated in the figure below:

1. **Prevention:** Good housekeeping and site design to reduce and manage runoff and pollution (e.g., land use planning, reduction of paved surfaces

2. **Source control:** Runoff managed as close as possible to prevent migration of pollution (e.g., using green roofs, rainwater harvesting, permeable paving, filter strips).

3. **Site control:** Runoff managed in a network across a site using a series of SuDS features in sequence. By providing several SuDS in a series, treatment is enhanced. By slowing down water, sediment will settle out, and bypassing water through a variety of features, different treatment mechanisms will be used (e.g., vegetation or gravel filtration).

4. **Regional control:** Downstream management of runoff for a whole site/catchment (e.g., retention ponds, wetlands).

6.3. In accordance with SuDS Management Train approach, the use of various interconnected SuDS features that surface water flows through have been considered for the development. Each feature reduces pollution, flow rates, the volume of water and improves water quality.

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6.4. SuDS Component Suitability:

Suitability of SuDS Components

SuDS Component	Description	Suitability
Green Roofs	An area of roof that is partially or completely covered with vegetation. Controls runoff close to source. Provides storage and filters out pollutants. Also, can provide visual benefits and ecological value.	✗
Soakaways	An excavation or trench filled with filter material. Can be a perforated storage structure backfield with granular material. Allows water to soak away into the ground. Stores run off, filters out pollutants and recharges groundwater. The suitability and infiltration rate depends on the permeability of the surrounding soils.	✗
Rainwater Harvesting	System to collect water from impermeable surfaces for use in-potable water situations. Reduces the amount of portable water use.	✗
Permeable Pavements	Surfaces allowing water to soak into the ground or a gravel-filled sub-base. Porous surface replaces traditional hard (impermeable) surfaces. Provides attenuation and can treat runoff and remove pollutants. Can be used in permeable and impermeable ground conditions. Can incorporate an outflow or overflow device to limit flows.	√
Goecellular Systems	Modular plastic systems that can be used to create below ground store and allow the infiltration of water. Incorporates an outflow or overflow device to limit flows.	√
Channels and Rills	Open landscaped channels which can be vegetated, used to convey water form one SuDS component to another. Provides storage and filters out pollutants. Also, can provide visual benefits and ecological value.	✗
Bioretention Systems	Depressions backfilled with sand/soil mixture and planted with vegetation. Water enters through a vegetated surface and then trickles via a filter layer entering a perforated pipe at the bottom before discharging downstream. Stores water and releases it gradually, some water improvement provided by a filter layer.	✗
Infiltration trench	Stone filled tranches that allow water to soak into the ground, and close to where it lands as possible. Controls the amount of runoff and provides storage. Needs permeable ground conditions.	✗
Filter Strips	A vegetated area of gently sloping ground designed to designed to drain water evenly off impermeable areas and filter out pollutants, sediment and other materials before runoff entering another SuDS component or Watercourse.	✗
Filter Drains	Gravel filled trenches. Stores water and releases it gradually, filtering out pollutants. Can be used in permeable or impermeable conditions. Incorporates an outflow or overflow device to limit flows.	✗
Swales	Shallow vegetated swales that can run parallel to hard standings allowing runoff to trickle down the side slopes and into a base. Water is transported in a controlled manner to other SuDS components or a watercourse downstream. Treats and attenuate runoff. Can be used in permeable or impermeable ground conditions.	✗
Detention Basin	Shallow vegetated depressions to control the amount and rate of runoff and some water improvement. Stores water during large storms and releases it gradually.	✗
Retention Pond and Wetlands	Artificial depressions with an open water area and emergent aquatic vegetation around the edge. Stores water and releases it slowly allowing sediment to settle in the pond in a stilling/settlement area at the inlet, while the vegetation provides biological treatment.	✗
Proprietary Treatment Systems	Manufactured products that remove specific pollutants from the water runoff.	✗

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6.5. Therefore several SuDS components are deemed appropriate to be use the following management train:

1. **Permeable Pavement System 'C' No Infiltration**: The main SuDS component to treat the initial surface water runoff.

2. **Geocellular System - No Infiltration:** Providing impermeable storage tanks to safely accommodate storm flows without flooding to allow a restricted storm water flow to discharge off site into the watercourse.

6.6. Pollution typically found in surface water runoff can be harmful to watercourses, groundwater and coastal waters, therefore adequate treatment must be provided to remove pollutants.

6.7. CIRIA 753 SuDS Manual (ref. [iv]) has set out the quality management requirements for discharges receiving surface water and groundwater. Pollution hazards and SuDS mitigation components have been indexed please refer to Tables 1 & 2 below.

6.8. The approach is to deliver adequate treatment. The selected SuDS components should have a total pollution mitigation index (for each contaminant type) that equals or exceeds the pollution hazard index (for each contaminant type):

Total SuDS Mitigation Index (Table 1) ≥ Pollution Hazard Index Table 2)

(for each contaminant type) (for each contaminant type)

Table 1 - Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total Suspended Solids (TSS)	Metals	Hydro-carbons
Residential roofs individual property driveways, residential car parks, low traffic roads (eg cul de sacs, home zones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Very low	0.2	0.2	0.05
	Low	0.5	0.4	0.05

Summary of pollution hazard indices taken from Table 26.2 - CIRIA 753 SuDS Manual

Table 2 - Indicative SuDS mitigation indices for discharges to surface waters

Type of SuDS component	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Geocellular Tank	-	-	-
Permeable pavement	0.7	0.6	0.7

Summary of Indicative SuDS mitigation indices taken from Table 26.3 - CIRIA 753 SuDS Manual

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The mitigation indices of the proposed SuDS components summarized above equal to the pollution hazard index, therefore for it is considered sufficient pollution treatment has been provided in accordance with CIRIA 753 SuDS Manual.

a. Additional measures have also been integrated to offer further pollutant reductions:

- Sump filter chambers are provided to each plot to capture roof runoff and retain silt, preventing ingress into main sewer network.

7. Additional Considerations

Climate Change

7.1. With reference to 2016 EA guidance (ref. [vi]), the design of the surface water drainage system will need to accommodate an allowance for climate change effects of 40%.

Off-site Impacts

7.2. Providing the proposed surface water and foul water strategies are followed, there will be no off-site impacts as a result of this development.

Residual Risks

7.3. Providing the proposed surface water and foul water strategies are followed, in our opinion there would be no residual risks of flooding.

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8. Development Proposals

Description

8.1. The proposed development relates to a planning application for the erection of 9 dwellings together with access, parking and open space. In order to evaluate surface water run-off and foul drainage rates that this flood risk and drainage assessment is based upon the information shown on the submitted drawings include the following: -

- 4No. 1 bed flats
- 2No. 2 bed flats
- 3No. 2 bed houses
- Private and visitor off road parking
- A access road link

Details of the site layout are indicated upon the Drawing/s included within ref. [i].

Levels

8.2. It is intended to generally follow the lie of the existing land for the development

Drainage Strategy

8.3. Surface water strategy:

b. The drainage should demonstrate the surface water run-off generated up to and including 100 year, including climate change critical storm, will not exceed the run-off from the existing developed site following the corresponding rainfall event.

c. The post-development peak rate of discharge and volume of run-off would be no greater than existing.

d. With reference to 2016 EA guidance, the design of the surface water drainage system will need to accommodate an allowance increase of 40% for climate change (CC)

e. The existing site impermeable area is 845m^2

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f. The existing storm run-off rates discharging into the public sewer have been calculated and are summarised as follows (refer to calculations included within the Appendix 1): -

Existing storm peak run-off rates

Event	**(l/s)**
1 in 1 year	11.0
1 in 2 year	14.1
1 in 30 year	26.0
1 in 100 year	33.1

These all exclude any allowance for climate change, as an added factor of safety.

g. Due to the flood risk on site, infiltration has been discounted as a suitable means of dealing with surface water discharge in this instance.

h. The proposal is therefore to design a cascade of SUDS features under the impermeable areas to temporarily attenuate storm flows, including critical 1 in 100 year + 40% event on-site to discharge a restricted flow into the public sewer network.

i. The proposed impermeable area is 700m^2

j. The estimated post-development peak rate of discharge and volume of run-off is to be no greater than the existing 1 in 1-year critical storm event : -

Post-development peak run-off rates

Event	**Design discharge (l/s)**
1 in 1 year	10.0
1 in 2 year	10.0
1 in 30 year	10.0
1 in 100 year + 40% CC	10.0

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k. Attenuation to be provided via cellular storage units and permeable paving sub-base:-

15.0m³ = Approximate underground storage provided to safely accommodated storm flows without flooding on or off-site including a 100 year + 40% climate change storm return period.

l. Calculations have been produced for the above design discharge rates and none flood on site. Calculations included within Appendix 1.

The existing public sewer running through the site are to remain

8.4. Foul water strategy:

m. It is preferable that all new foul drainage should discharge to an existing public sewer, subject to a capacity check, and there is potential to do so on this site, reusing the existing connection into the public combined sewer.

n. non-return valves are to be provided on all foul connections before discharging into the public sewer.

Design for Exceedance

8.5. All storm events up to and including 100 year plus 40% CC are safely accommodated without flooding on or off site.

8.6. Exceedance of this event is to be considered carefully on site, flood paths, should be contained by kerb lines and other hard landscaping structures, and funnelled towards the SuDS features. The risk of adversely affecting the new properties is considered to be negligible.

On site Construction

8.7. Both foul and surface water drainage systems shall be constructed strictly in accordance with current Building Regulations.

8.8. The Contractor shall provide evidence, including photographs, to show that the drainage systems have been constructed as such. Records shall be incorporated within the Health & Safety File.

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Maintenance and management

8.9. Both surface and foul water on site networks are not to adopted or be transferable into public ownership.

8.10. A schedule of ongoing maintenance will be required, and the implementation of such would be the responsibility of a Management Company. We have formulated the following table to be used in developing the schedule, to identify key areas. Recommendations and more detailed operations will need to be added via drainage product/equipment suppliers and specialists as and when these are chosen and implemented during construction.

Maintenance Schedule for Main Drainage

Activity	Indicative Frequency	Typical Tasks
Routine/regular maintenance	Monthly	• Litter picking. • Removal of any vegetation growth to permeable paving. • Verge grass cutting (seasonal).
	Every six months	• Highway sweeping. • Inspect, road gullies and channels for damage or blockages. • Inspect flow control chambers and orifice plates for damage and blockages.
Occasional maintenance	Annually	• Suction sweep permeable paving. • Inspect and clean out silt traps. • CCTV inspection of cellular storage units. • Jet wash surface water drainage, including cellular storage units. • Inspect foul chambers and jet wash foul drainage system. • Inspection and maintenance of flow control units. • Vegetation management throughout all drainage components
Remedial Maintenance	As required	• Road re-surfacing. • Reinstatement of damaged highway edgings/kerbs. • Inlet and outlet repairs. • Erosion repairs. • Clean up and reinstatement following pollution and/or flooding.

8.11. Ultimately this information should be incorporated within the Health & Safety File and Site Maintenance Manual.

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8.12. Summary & Conclusion

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8.13. Surface water drainage scheme has been considered using SuDS principles to preserve natural water movement in accordance with SuDS Treatment Train and CIRIA 753 SuDS Manual (ref. [iv]) to deliver the necessary pollution treatment for safe mitigation of storm water.

8.14. Surface water run-off generated post-development for all storms including 100 years + 40% climate change critical storm will be less than existing developed site. The risk of flooding on and off the site will reduce post-development and means of both surface water and foul drainage disposal are achievable.

8.15. This FRA has assessed the overall flood risk for the proposed development and demonstrates providing the proposed measures are put into place the risk of flooding will not be increased on-site or elsewhere.

8.16. Consequently, it has been shown that the development can pass the second element of the Exception Test and therefore meet the requirements of the NPPF.

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