Red & Yellow Specialist Extra Care

Melliss Avenue – Kew

SuDS Statement

October 2018

Contents

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1 Introduction

AKT II have been commissioned by Melliss Ave Devco Ltd to provide engineering design services for the proposed development at the Melliss Avenue site adjacent to the River Thames in the London Borough of Richmond upon Thames, South west London.

The scheme involves demolition of existing buildings and structures and redevelopment of the site to provide a Specialist Extra Care facility (C2 Use Class) for the elderly with existing health conditions. Comprising, 89 units, with extensive private and communal healthcare, therapy, leisure and social facilities set within a building of ground plus 3 to 5 storeys including set backs. Provision of car and cycle parking, associated landscaping and publicly accessible amenity spaces including a children's play area.

The purpose of this report is to provide information on the proposed storm water drainage strategy, to support the planning application.

2 Surface water drainage

2.1 Existing scheme

The available Thames Water record plans do not indicate any surface water sewers in the vicinity of the site. An extract of Thames Water sewer records is shown in Figure 2.1 for reference.

However, a CCTV drainage survey was undertaken in April 2018 which confirmed that there is a 450mm dia. surface water sewer under Melliss Avenue running to the South and under Saffron House. Following this, a pre-planning enquiry was sent to Thames Water Utilities and, it has been established that the storm water sewer is owned by Thames Water despite not being shown on their record plans. Refer to Appendix 3 for the Thames Water correspondence.

The private drainage on site comprises of a combined drainage network that collects storm water run-off and foul water waste serving the existing infrastructure associated with the decommissioned Thames Water Biothane Plant. There are number of buried pumping structures which discharge to the 2440mm dia. Kew Transfer tunnel along the North – West corner of the site, an existing Thames Water pumping station to the north and into an existing foul water sewer in Melliss Avenue. All existing drainage on site has been decommissioned and will be removed in the final scheme, with the exception of the existing Kew 2440mm dia. sewer which will be retained.

The total site area is approximately 6,970 m^2 of which approximately 2,900 m^2 is currently hardstanding. In accordance with the Modified Rational Method, the peak existing run-off from the site is calculated from the formula:

$Q = 3.61 \times C_v \times A \times i$

where C_v is the volumetric runoff coefficient, A is the catchment area in hectares and i is the peak rainfall intensity in mm/hr.

For the peak 1-in-1-year return period storm event this gives an existing discharge rate from the site of:

Q_1 = 3.61 × 0.75 × 0.290 × 31.4 = **24.7 litres/sec**

and for the peak 1-in-100-year return period storm event this gives an existing discharge rate from the site of:

Q_{100} = 3.61 × 0.75 × 0.290 × 99.7 = **78.3 litres/sec**

2.2 Proposed scheme

The proposed impermeable area is approximately 3,700 m^2. Again using the Modified Rational Method, the proposed (unattenuated) peak run-off from the site for the 1-in-1-year return period storm would be:

Q_1 = 3.61 × 0.75 × 0.370 × 31.4 = **31.5 litres/sec**

and for the peak 1-in-100-year return period storm event:

Q_{100} = 3.61 × 0.75 × 0.370 × 99.7 = **99.9 litres/sec**

The Environment Agency updated their guidance on climate change allowance in February 2016 to include an upper and lower allowance to be considered depending on the specific site characteristics. Figure 2.2 shows the revised figures based on various building life spans. Therefore, making an allowance for climate change of 40 % this would give an unattenuated design discharge of:

$Q_{1\,(+40\%)}$ = **44.1 litres/sec** and $Q_{100\,(+40\%)}$ = **139.9 litres/sec**

In accordance with the Environment Agency's guidelines, the Building Regulations and the Water Authority's advice, the preferred means of surface water drainage for any new development is into a suitable soakaway or infiltration drainage system. Sustainable Urban Drainage Systems (SuDS) can reduce the impact of urbanisation on watercourse flows, ensure the protection and enhancement of water quality and encourage recharging of groundwater in a manner which mimics nature.

In addition to this, the National Planning Policy Framework requires that surface water arising from a developed site should, as far as is practicable, be managed in a sustainable manner to mimic surface water flows arising from the site prior to the proposed development, whilst reducing flood risk to the site itself and elsewhere, taking climate change into account.

Figure 2.1 Thames Water Sewer Record

Therefore, as an absolute minimum, the proposed site discharge under the 1-in-100-year storm plus climate change should be no greater than the existing 1-in-100-year storm discharge (i.e. mitigate the impact of climate change and any increase in the area of hardstanding). In this case, this would mean that, rather than discharging 139.9 1 litres/sec, the maximum permissible discharge from the site would be **78.3 litres/sec**.

Further to the above, the London Plan's Policy 5.13 states that "Development proposals should aim to achieve greenfield run-off rates. The Environment Agency (EA) also suggests that Developers should aim to achieve greenfield run off from their site. In accordance with the method outlined in the Institute of Hydrology Report 124, the Greenfield runoff for the site is calculated from the formula:

$Q_{BAR} = 0.00108 \times AREA^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}$

where AREA is the site area in km^2 (pro rata of 50 ha if the site is less than 50 ha), SAAR is the Standard Average Annual Rainfall in mm and SOIL is the Soil Index both read from The Wallingford Procedure maps. This gives a greenfield runoff for the site of:

$Q_{BAR} = 0.00108 \times 0.50^{0.89} \times 600^{1.17} \times 0.30^{2.17}$ = **76.1 litres/sec (for 50 ha)**

Scaling this for the actual site area gives:

Q_{BAR} = (76.1 × 0.699) ÷ 50 = **1.06 litres/sec**

Using the Hydrological Growth Curve for south east England, the growth factor from Q_{BAR} to Q_{100} is 3.146 which gives a value for Q_{100} = **3.35 litres/sec.** However, Clause 17 of the DEFRA/EA publication 'Rainfall runoff management for developments' states that "A practicable minimum limit on the discharge rate from a flow attenuation device is often a compromise between attenuating to a satisfactorily low flow rate while keeping the risk of blockage to an acceptable level. This limit is set at 5 litres per second, using an appropriate vortex or other flow control device. Where sedimentation could be an issue, the minimum size of orifice for controlling flow from an attenuation device should normally be 150 mm laid at a gradient not flatter than 1 in 150, which meets the requirements of Sewers for Adoption 7th Edition".

As the project is a new build it is proposed to limit the surface water discharge rate from site to 5 litres/sec.

Potential approaches that can be taken to achieve the above reduction are discussed in the next section.

Range	Total potential change anticipated for 2010-2039	Total potential change anticipated for 2040-2059	Total potential change anticipated for 2060-2115
Upper end	10%	20%	40%
Central	5%	10%	20%

Figure 2.2 Peak rainfall intensity allowance

2.3 Disposal methods

SuDS management train

A useful concept used in the development of sustainable drainage systems is the SuDS management train (sometimes referred to as the treatment train). Just as in a natural catchment, drainage techniques can be used in series to change flow and quality characteristics of the runoff in stages. There are a variety of measures that can be implemented to achieve these goals:

Site management / Prevention

Site management procedures are used to limit or prevent runoff and pollution and include:

- Minimising the hardened areas within the site
- Frequent maintenance of impermeable surfaces
- Minimising the use of de-icing products

Source control

Source control techniques will be used where possible as they control runoff at source in smaller catchments. They can also provide effective pollution control and treatment, thereby improving the quality of the effluent discharged to the receiving waters.

Site control

Where source control techniques do not provide adequate protection to the receiving watercourses in terms of flood protection and pollution control, site control may be required.

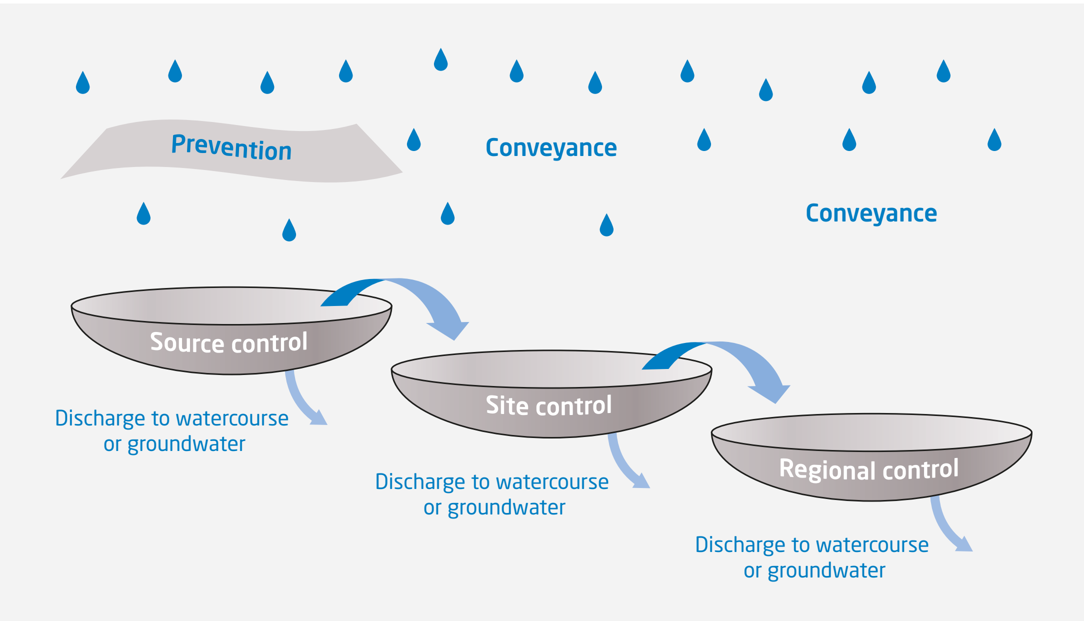

Figure 2.3 SuDS management train

Regional control

Where large areas of public space are available regional control can be incorporated to provide additional 'communal' storage and treatment to runoff from a number of sites. However, in this case, all storage and treatment will be implemented on site.

Drainage hierarchy

Based on the above and in line with the London Plan and the Sustainable Drainage Manual published by CIRIA, the following drainage hierarchy will therefore need to be considered when preparing the surface water disposal strategy:

1. Store water for later use
2. Use infiltration techniques such as porous surfaces in non-clay area
3. Attenuate rainwater in ponds or open water features for gradual release to a watercourse
4. Attenuate rainwater by storing in tanks or sealed water features for gradual release to a watercourse
5. Discharge rainwater direct to a watercourse
6. Discharge rainwater to a surface water drain
7. Discharge rainwater to a combined sewer

Assessment of SuDS techniques

Rainwater harvesting

This involves the capture of rainwater into a tank for re-use (usually non-potable) such as irrigation, toilet flushing or vehicle cleaning. Systems are now available which combine rain water harvesting with tanked attenuation. This means that water is stored during dry periods for re-use but released ahead of predicted storms in order to ensure that the full attenuation capacity remains available when it is needed.

As the project is a new build, it would be practical to install a rainwater harvesting system. However the actual roof area available would not generate sufficient water yield to satisfy a sufficient proportion of the demand to make it viable and therefore, it is not proposed to implement the rainwater harvesting.

Green / brown / blue roofs

These are used on flat or shallow pitched roofs to provide a durable roof covering which also provides thermal insulation, amenity space, biodiversity habitat as well as attenuation of rainwater. Depending on the design, these roofs can attenuate differing volumes of rainwater. The term 'blue roof' is reserved for those roofs designed to maximise water retention. This is a relatively recent area of increased focus and can involve effectively an attenuation tank at roof level which reduces (or avoids) the need for pumping of basement tanks.

Green / blue roofs are not proposed to be incorporated into the scheme as the majority of the roof area has been utilised to accommodate plant equipment.

Raingardens

Raingardens are planted areas (usually close to buildings but not immediately adjacent) that allow the diversion of a portion of rainwater from either downpipes or the surrounding paved surfaces. These techniques can be incorporated into the landscaping plans for a site and are most effective where the landscaping regime is designed with the aim of capturing as much rainfall as possible. They can either allow infiltration into the ground or have tanked systems for water retention, depending on the site and soil conditions. There are also a number of vertical raingardens attached to building walls with rainwater downpipes diverted through a stacked series of planters.

It may be possible to incorporate Raingardens into the scheme, but this is not envisaged to form part of the landscaping scheme.

Bio-retention

This refers to a chain of landscaped features, potentially including reed beds, filter drains, etc. designed to hold and treat surface water. They are often used where there is a high risk of low-level pollution, for example from road run-off. However, it does require areas of open space. The design of a bio-retention system can vary widely depending on site conditions and available space. At a small scale this could include flow through planters or tree pits.

It may be possible to implement Bio-retention system, but this is not envisaged to form part of the landscaping scheme.

Permeable surfacing

Permeable hard surfaces which work in much the same way as traditional impermeable surfaces apart from the ability to allow rainwater to pass through. Permeable blocks are traditionally used but there are now a range of permeable asphalt and resin bound gravel pavings being used increasingly commonly. Permeable surfaces can either allow infiltration into the ground or have tanked systems for water retention, depending on the site and soil conditions. They are suitable in even the most densely built-up development. However, they're not well suited to roads carrying heavy or fast motor traffic.

As there are areas of paving proposed as part of the scheme it is proposed to implement permeable paving. However, due to the history of the site, the potential contamination on the site and fact that the underlying soil has little porosity it will be a tanked system for water retention and conveyance only rather than disposal.

Swales

These are dry ditches used as landscape features to allow the storage, carriage and infiltration of rainwater and are often used as linear features alongside roads, footpaths or rail lines. They can also be integrated into the design of many open spaces.

It may be possible to incorporate Swales into the scheme, but this is not envisaged to form part of the landscaping scheme.

Detention basin / ponds

Landscape features designed to store and in some cases infiltrate rainwater. Detentions basins are usually dry, whereas a pond should retain water. These features need areas of open space but can often be combined with other sustainable drainage techniques.

As the site is heavily developed with limited external areas there is insufficient space to provide a basin or pond.

Discharge to tidal river / dock / canals

Discharging clean rainwater directly to tidal rivers, canals or docks isn't normally a sustainable drainage technique. Other more productive techniques should be used first. However, it is generally more sustainable than discharging to the combined or surface drainage systems. Residual surface water can be discharged to tidal / large waterbodies, in some cases with no limitation on volumes. Some storage may be required to allow for outfalls becoming tide locked. Care is needed to prevent scour in the receiving waterbody and potentially to prevent pollution. Consent from the Environment Agency, the asset owner and where applicable the Canal and River Trust is required.

A new connection point to the River Thames has been considered. However, this has been discounted as there is a storm water sewer in Melliss Avenue which is believed to already discharge to the River Thames to the South of the site.

Storage tanks / geocellular storage

Storage tanks are single GRP units usually located (but not necessarily) below ground level which attenuate rainwater for later slow release back into the drainage system but do not provide the wider benefits of green infrastructure sustainable drainage. Where tanks are designed for large storm events, care is needed to ensure that they still perform a useful sustainable drainage function for low order storms.

Geocellular storage tanks are similar to storage tanks except that the volume is made up from multiple units rather than a single tank meaning they can be more flexible in terms of shape to suit constrained sites.

It is believed that this is the most feasible disposal option is to connect to the existing storm water sewer under Melliss Avenue which ultimately discharges to the River Thames. The approximate tank volume required under the 1-in-100-year (plus 40 % climate change) storm event to limit the discharge to the Greenfield rate of 5 litres/sec (based on DEFRA guidance) is **230 m³**.

The attenuation tank will be located at a high enough level to allow a new sewer connection to be made to the public sewer by gravity.

Ground investigations confirmed that the site is overlain by gravelly clay followed by a made ground comprising of clayey gravelly sand and sandy gravelly clay which would offer little porosity. There is a layer of Kempton Park Gravel beneath the clay strata, however the high groundwater table would not allow soakaways to function. In addition, there may be a risk associated with contamination as the result of the former use of the site and therefore, soakaways have been discounted taking into account the ground conditions. Refer to Appendix 2 for the site investigation extract.

It is proposed that the run-off from the paths and the children's play area at the back of the development will discharge onto the surrounding soft landscaping.

Oversized piping

Using larger than necessary pipework creates more room to store rainwater. Potentially more sustainable than storage tanks / geocellular storage if the pipes drain by gravity and do not require pumping. However, lacks the wider benefits of the green infrastructure based techniques.

Due to the restricted nature of the site the pipework would become impractically large to provide the volume of storage required to achieve the required run-off rate.

Design for exceedance

This involves designing areas within a site such that they will flood and hold water during rare storm events (typically a frequency of once in ten years or longer).

As the attenuation tank has been sized to accommodate the 1-in-100-year plus climate change event there is no need to design for exceedance

Element	Management stage	Water quantity	Water quality	Amenity & biodiversity	Proposed in scheme
Rainwater harvesting	Prevention	✓	✗	✗	✗
Green / brown / blue roof	Source control	✓	✓	✓	✗
Raingardens	Source control	✓	✓	✓	✗ / ✓
Bio-retention	Source control	✓	✓	✓	✗ / ✓
Permeable surfacing	Source control	✓	✓	✗	✗
Swales	Source control	✓	✓	✓	✗ / ✓
Detention basin / ponds	Source control	✓	✓	✓	✗
Discharge to tidal river / dock / canals	Site control	✓	✗	✗	✗ / ✓
Storage tanks / Geocellular storage	Site control	✓	✗	✗	✓
Oversized piping	Site control	✓	✗	✗	✗
Design for exceedance	Site control	✓	✗	✗	✗

Figure 2.4 Summary of proposed SuDS devices

Summary of the proposed SuDS strategy

It is proposed to provide a below ground attenuation tank and tanked permeable pavements to the car parking areas for run-off treatment.

The outfall from the site will connect to the existing 450mm dia. sewer under Melliss Avenue by a new connection. This strategy has been confirmed by Thames Water in a response to a pre-planning enquiry.

A schematic SuDS layout is contained in Appendix 1 for reference.

Thames Water response to pre-planning enquiry is contained in Appendix 3.

3 Flood risk assessment requirements

The Environment Agency's Indicative Floodplain Map (see Figure 3.1) shows that the site lies in Zone 3a. – an area with a high probability of flooding from rivers and sea without the local flood defences. A Flood Risk Assessment has been undertaken by AKT II and concluded that the site will not increase the flood risk to other properties. Refer to AKT II FRA report dated October 2018.

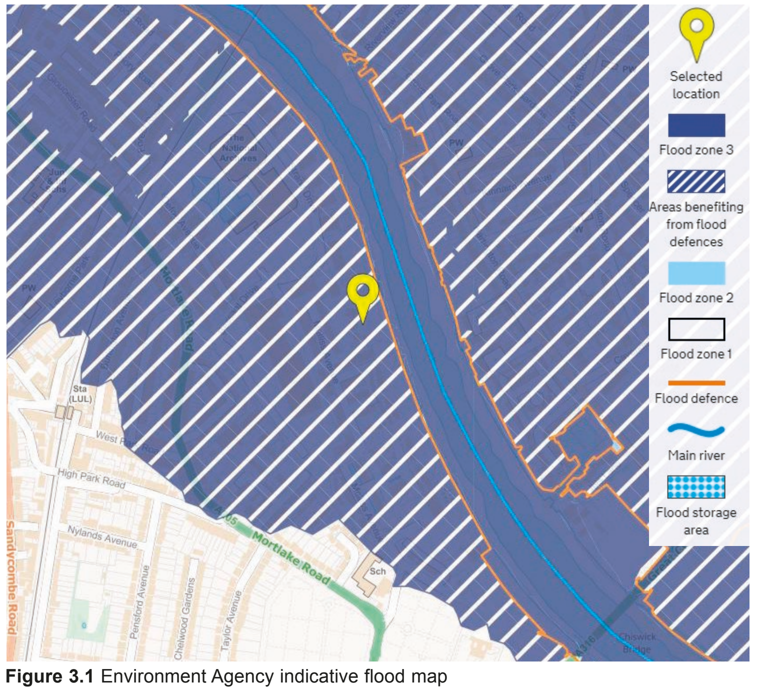

Figure 3.1 Environment Agency indicative flood map

4 BREEAM

Pol 03: Flood and surface water management

Prerequisite

1. An appropriate consultant is appointed to carry out and demonstrate the development's compliance with all criteria.

Up to two credits – Flood resilience

Two credits – Low flood risk

2. A site specific flood risk assessment (FRA) confirms the development is in a flood zone that is defined as having a low annual probability of flooding. The FRA takes all current and future sources of flooding into consideration.

One credit – Medium or high flood risk

3. A site specific FRA confirms the development is in a flood zone that is defined as having a medium or high annual probability of flooding and is not in a functional floodplain. The FRA must take all current and future sources of flooding into consideration.
4. To increase the resilience and resistance of the development to flooding, one of the following must be achieved:
   - **a.** The ground level of the building and access to both the building and the site, are designed (or zoned) so they are at least 600 mm above the design flood level of the site's flood zone; **OR**
   - **b.** The final design of the building and the wider site reflects the recommendations made by an appropriate consultant in accordance with the hierarchy approach outlined in Section 5 of BS 8533 : 2017.

Two credits – Surface water run-off

Prerequisite for surface water run-off credits

5. Surface water run-off design solutions must be bespoke, i. e. they must take account of the specific site requirements and natural or man-made environment of and surrounding the site. The priority levels detailed in the Methodology must be followed, with justification given by the appropriate consultant where water is allowed to leave the site.

One credit – Surface Water Run-Off – Rate

6. Drainage measures are specified so that the peak rate of run-off from the site to the watercourses (natural or municipal) shows a 30 % improvement for the developed site compared with the pre-developed site. This should comply at the 1-year and 100-year return period events.
7. Relevant maintenance agreements for the ownership, long term operation and maintenance of all specified Sustainable Drainage Systems (SuDS) are in place.
8. Calculations include an allowance for climate change. This should be made in accordance with current best practice planning guidance.

One Credit – Surface Water Run-Off – Volume

9. Flooding of property will not occur in the event of local drainage system failure (caused either by extreme rainfall or a lack of maintenance); **AND EITHER**
10. Drainage design measures are specified so that the post-development run-off volume, over the development lifetime, is no greater than it would have been prior to the assessed site's development. This must be for the 100-year 6-hour event, including an allowance for climate change.
11. Any additional predicted volume of run-off for this event is prevented from leaving the site by using infiltration or other SuDS techniques.

OR (only where Criteria 10 & 11 cannot be achieved)

12. Justification from the appropriate consultant indicating why the above criteria cannot be achieved, i. e. where infiltration or other SuDS techniques are not technically viable options.
13. Drainage design measures are specified so that the post-development peak rate of run-off is reduced to the limiting discharge. The limiting discharge is defined as the highest flow rate from the following options:
    a. The pre-development one-year peak flow rate **OR**
    b. The mean annual flow rate Q_{BAR} **OR**
    c. 2 litres / sec / ha

    For the one-year peak flow rate, the one year return period event criterion applies.
14. Relevant maintenance agreements for the ownership, long-term operation and maintenance of all specified SuDS are in place.
15. For either option, above calculations must include an allowance for climate change; this should be made in accordance with current best practice planning guidance.

One credit – Minimising watercourse pollution

One credit

16. There is no discharge from the developed site for rainfall up to 5 mm (confirmed by the appropriate consultant).
17. Areas with a low risk source of watercourse pollution, an appropriate level of pollution prevention treatment is provided, using appropriate SuDS techniques.
18. Areas with a high risk of contamination or spillage of substances, such as petrol and oil, have separators (or an equivalent system) installed in surface water drainage systems.
19. Chemical or liquid gas storage areas have a means of containment fitted to the site drainage system (i. e. shutoff valves). This is to prevent the escape of chemicals to natural watercourses in the event of a spillage or bunding failure.
20. All water pollution prevention systems have been designed and installed in accordance with the recommendations of documents such as the SuDS Manual and other relevant industry best practice. They must be bespoke solutions taking account of the specific site requirements and natural or man-made environment of and surrounding the site.
21. A comprehensive and up-to-date drainage plan of the site will be made available for the building or site occupiers.
22. Relevant maintenance agreements for the ownership, long term operation and maintenance of all specified SuDS must be in place.
23. All external storage and delivery areas designed and detailed in accordance with the current best practice planning guidance.

Assessment of available credits

Prerequisite

Criterion	AKT II assessment	
1.	AKT II are appropriate consultants with the relevant qualifications and experience to design SuDS and flood prevention measures and completing peak rate of run-off calculations.	✓

Flood resilience

Criterion	AKT II assessment	
2.	The site is located in Flood Zone 3A.	✓
3.	A site specific floor risk assessment has been carried out which confirms that the development is at low risk from all flooding sources.	✓
4a.	The proposed floor levels to the building have been set 600 mm above the local surface water flooding levels recorded in the Environment Agency surface water flood maps.	✓
4b.	The design of the building and the wider site is in accordance with the flood risk assessment and the hierarchical approach outlined in the relevant standards.	✓

Based on this we believe that potentially one credit out of a possible two can be awarded under these criteria.

Surface water run-off

Run-off criteria	AKT II assessment	
5.	The drainage strategy has been prepared in line with the London Plan drainage hierarchy and the priority levels detailed in the BREEAM Methodology.	✓
6.	The proposed peak run-off rate has been reduced to greenfield rate.	✓
7.	The ownership, operation and maintenance requirements for each SuDS device will be written into the O & M Manual for the site.	✓
8.	An allowance of 40 % has been made for climate change in all calculations in line with the Environment Agency's guidance.	✓
9.	The site-specific FRA carried out by AKT II confirms that the site is at low risk of flooding from local drainage system failure.	✓
10.	The post development hard standing areas are larger than pre development, therefore this cannot be achieved..	✗
11.	As confirmed in Section 2.3 infiltration is not a viable option. Therefore, it is not possible to prevent the additional run-off from leaving the site.	✗
12.	As confirmed in Section 2.3 infiltration is not a viable option.	✓
13.	Pre-development 1-year peak flow rate = 24.7 litres / sec Mean annual flow rate Q_{bar} = 1.06 litres / sec 2 litres / sec / ha = 1.4 litres / sec It is proposed to reduce the proposed peak discharge rate to the greenfield run-off rate.	✓
14.	The ownership, operation and maintenance requirements for each SuDS device will be written into the O & M Manual for the site.	✓
15.	An allowance of 40 % has been made for climate change.	✓

Based on this we believe that potentially two credits out of a possible two can be awarded under these criteria.

Minimising watercourse pollution

Pollution criteria	AKT II assessment	
16.	As confirmed in Section 1.3, no infiltration is possible and there is insufficient green roof coverage therefore this criterion cannot be achieved.	✗
17.	SuDS devices will be specified where possible within the limitations of the development.	✓
18.	Run-off from the car park will be treated by a sub-base of permeable pavments.	✓
19.	There are no chemical / liquid gas storage areas proposed as part of the scheme.	N / A
20.	All water pollution prevention and SuDS devices will be designed in accordance with the SuDS Manual.	✓
21.	An up-to-date drainage plan will be made available to the site occupiers upon completion.	✓
22.	The ownership, operation and maintenance requirements for each SuDS device will be written into the O & M Manual for the site.	✓
23.	Delivery areas will be connected to a petrol separator.	✓

Based on this we believe that no credit out of a possible one can be awarded under these criteria.

Overall, we believe that potentially three credits out of a possible five can be awarded under the Pol03 criteria outlined above.

5 Maintenance and operation

Before cleaning, final testing and immediately before handover the Contractor will:

- Lift covers to manholes, inspection chambers and access points. Remove mortar droppings, debris and loose wrappings.
- Thoroughly flush pipelines with water to remove silt and check for blockages. Rod pipelines between access points if there is any indication that they may be obstructed.
- Carry out a CCTV of the pipework to ensure that it is free of silt and blockages.

The End User shall then follow the "Waste Management, The Duty of Care – A Code of Practice (Revised 1996)" and shall ensure that their waste does not escape from their control and is transferred only to a registered waste carrier to be sent for recycling or disposal at a suitably licensed facility.

All waste arising from the maintenance of the drains and sewers shall be handled, stored and disposed of correctly to avoid pollution. Waste may be designated as hazardous / special waste and, as such, the End User shall ensure that they comply with the Hazardous Waste (England and Wales) Regulations 2005.

Reference shall be made to CIRIA publication C753 - The SuDS Manual by the Contractor and the End User. A suitable maintenance schedule must be developed, maintained, followed and updated as required to reflect observed performance. The following items are highlighted for guidance.

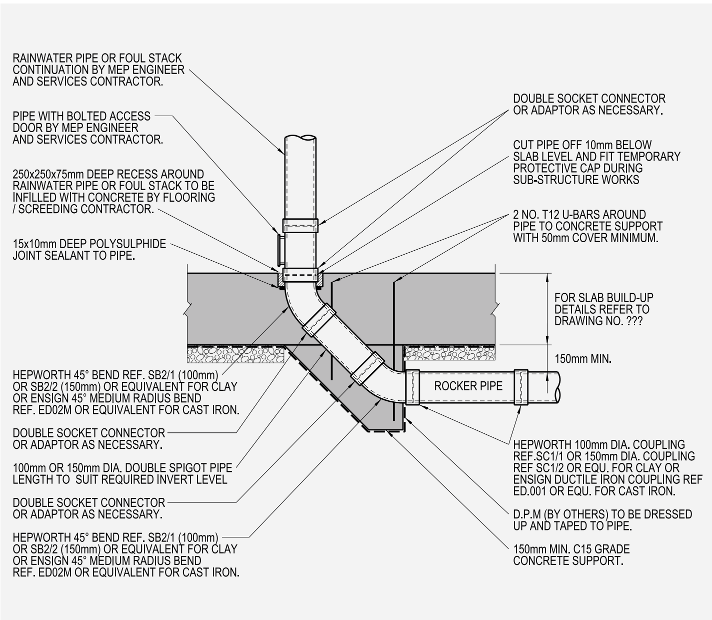

Figure 5.1 Rodding/jetting access detail

5.1 General drainage

The below ground drainage network will be designed in accordance with the requirements of the Building Regulations whilst acknowledging the need to limit the number of inspection chambers within "front of house" areas. To this end, all main runs will have rodding eyes, manholes or inspection chambers at the head of the run and at all changes of direction to provide access to rod or jet the main pipework.

Where possible, connections from stacks or gullies will be made directly to these manholes or inspection chambers to allow the connection to be rodded or jetted from the downstream end. Where this is not possible, each stack will be detailed to have an access hatch provided just above floor level (see Figure 5.1) to allow the connection to be rodded or jetted from the upstream end. Similarly, the gullies will have a rodding access provided within their body allowing the pipework to be rodded or jetted from the gully downstream.

Gullies and channels will be specified with silt buckets and silt trap manholes have been provided upstream of all tanks and infiltration structures to prevent the ingress of silts into the drainage network and impairing the performance of the system.

Maintenance schedule	Required action	Recorded frequency
Regular maintenance	Inspect and identify areas that are not operating correctly. If required, take remedial action.	Monthly for the first three months then six-monthly
	Remove sediment from pre-treatment structures (e.g. gullies, channels, silt traps).	Six-monthly or as required
Occasional maintenance	Debris removal from catchment surface where this may cause risks to performance.	Monthly
Remedial actions	Repair/rehabilitation of inlets, outlets, overflows and vents.	As required
Monitoring	Inspect all manholes, inspection chambers, inlets, outlets, overflows and vents to ensure they are in good condition and operating as designed.	Annually and after large storms

6 Drainage design standards

The following guides and current British Standards will be used for the design of the drainage elements on this project:

- BS EN 752:2017 Drain and Sewer Systems Outside Buildings. Sewer System Management
- BS EN 12056 Gravity Drainage Systems Inside Buildings: Part 2
- Building Regulations 2010 Part H1 – Foul Water Drainage (2015 Edition)
- Building Regulations 2010 Part H2 – Wastewater Treatment Systems and Cesspools (2015 Edition)
- Building Regulations 2010 Part H3 – Rainwater Drainage (2015 Edition)
- Building Regulations 2010 Part H4 – Building Over Sewers (2015 Edition)
- Building Regulations 2010 Part H5 – Separate Systems of Drainage (2015 Edition)
- Building Regulations 2010 Part H6 – Solid Waste Storage (2015 Edition)
- Environment Agency “Control of Runoff from New Developments Interim Regional Guidance”
- National Planning Policy Framework
- Planning Practice Guidance

7 Materials

	Item	Material	British standard
a)	Drainage pipe work	Vitrified clayware	BS EN 295–1
		Cast iron	BS EN 877
		Concrete	BS 5911–1 and BS EN 1916
		uPVC	BS EN 1401–1
b)	Precast inspection chambers	Precast concrete	BS 5911 Part 200
c)	Drainage gullies and gratings	Vitrified clayware	BS EN 295–1
		Ductile iron	BS EN 124 D 400
d)	Drainage channels and gratings	Polymer concrete	
		Ductile iron	BS EN 124 D 400
e)	Access covers	Grey iron	BS EN 124
		Galvanised steel	Facta Class A, B & D
f)	Cellular units	Polypropylene	
g)	Geotextiles		

Appendix 1

Schematic SuDS Layout