

DRAINAGE MAINTENANCE AND MANAGEMENT PLAN

**Parcel 8, Finchwood
Park**

**Prepared for
Barratt Homes**

by

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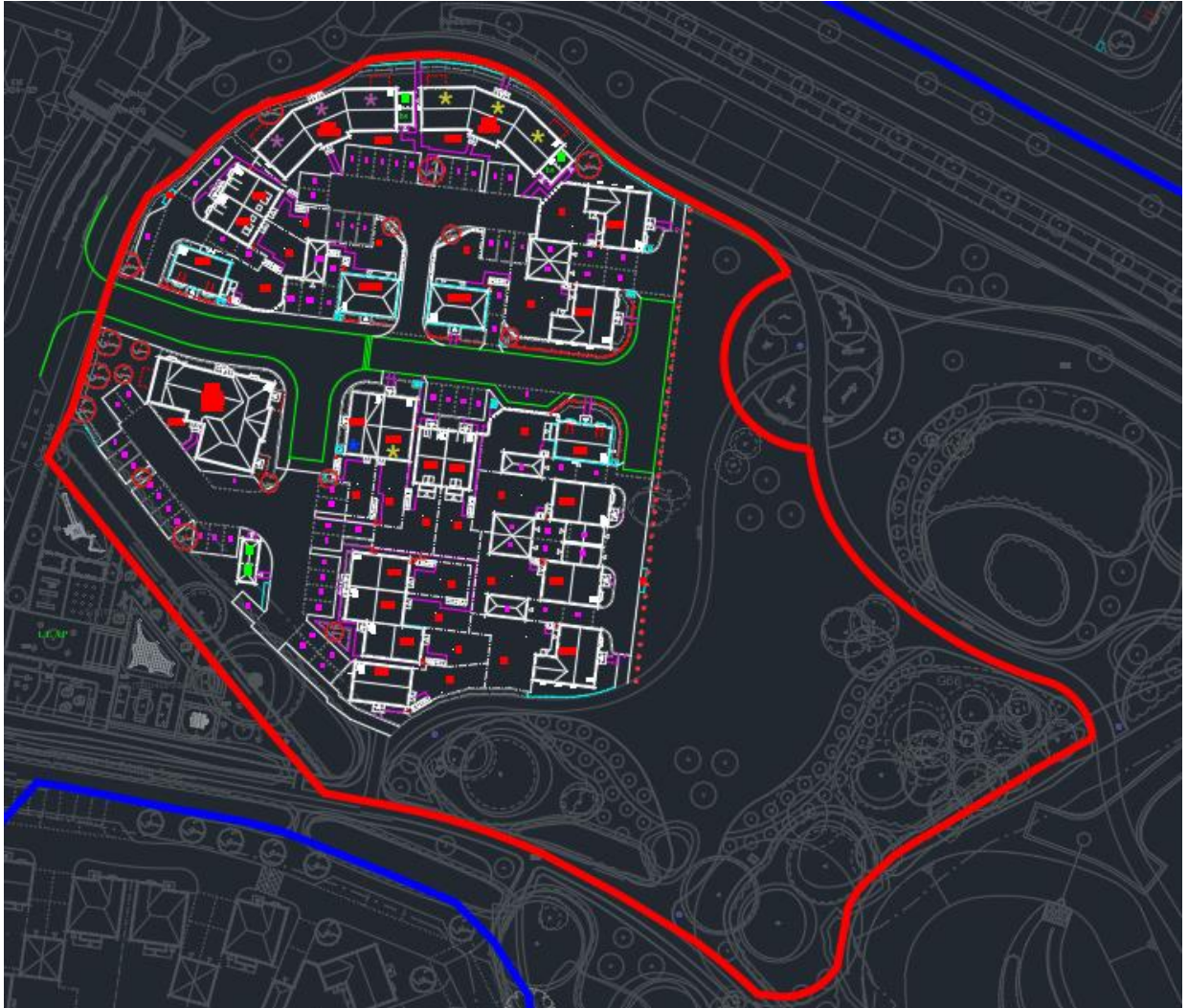
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INTRODUCTION

This drainage maintenance plan explains how the entire surface and foul water systems shall be maintained and managed after completion for the lifetime of the development.



Site Layout



The responsibilities of each relevant party are described below:

Party Responsible	Feature Requiring Maintenance	Drainage Type
Adopting Water Authority	Pipes Manholes Attenuation Storage Tanks Hydrobrake Chambers	Adoptable Drainage System
Local Highway Authority	Pipes Manholes Road Gullies	Highway Drainage System
Private Landowner	Pipes Manholes RWP's SVP's	Private Drainage System (within plot curtilage)
Private Management Company	Pipes Manholes Permeable Pavements	Private Drainage System (communal areas)



SURFACE WATER MAINTENANCE PLAN

The surface water system consists of a number of different components, this includes trapped gullies, pipes, manholes, orifice control chambers, SuDS pervious/porous pavements & cellular storage. In order for the surface water drainage system to operate as originally designed, it is necessary to ensure that it is adequately maintained throughout its lifetime.

A handover pack must be made available for private property buyers to include advice on maintaining drains across their property. This will include advice similar to below but on a smaller scale.

The following give details on each components inspection and maintenance requirements. The SUDS features/structures will be covered under a separate section of this maintenance plan.

ROAD & YARD GULLIES

Trapped gullies are to be inspected as required if there is thought to be a blockage, or annually. Any accumulated sediment or blockage is to be removed and gullies hosed down if required. Maintenance responsibility for road gullies are proposed to be with the adopting highway authority. Yard gullies are proposed to be with the private dwelling owner or Private Management Company.

PIPES

Pipes are to be inspected as required if there is thought to be a blockage. Any blockages within a pipe are to be removed by rodding or high pressure water jetting to clear the debris. Maintenance responsibility for pipes within private areas are proposed to be with a Private Management Company or Private Landowner, and pipes within the adoptable carriageway with the Adopting Water Authority. Any pipes in adoptable areas which do not account for private drainage are to be with the Local Highway Authority.

MANHOLES

All manholes are to be inspected annually and accumulated sediment or blockage is to be removed and manholes hosed down if required. Maintenance responsibility for manholes in private areas is proposed to be with a Private Management Company or Private Landowner, and manholes within the adoptable highway with the Adopting Water Authority. Any manholes in adoptable areas which do not account for private drainage are to be with the Local Highway Authority.

HYDROBRAKE CONTROL CHAMBER

The Hydro-brake vortex flow control has no moving parts and no power requirements and provides reliable, low-maintenance, engineered flood management as part of green infrastructure developments. Maintenance should include periodic desilting of the Hydrobrake sump as well as checking the emergency drain down mechanism. The sump should be emptied/checked as follows (but with an annual inspection and additional cleansing if required): On completion of drainage works, Year 1, Year 3, and then every 5 years. As the hydrobrake chamber forms part of the adoptable drainage network, the maintenance regime will be undertaken as part of the Adopting Water Authority maintenance schedule.



FOUL WATER MAINTENANCE PLAN

The foul water system consists of a network of pipes that connect to an existing foul sewer to the south of the Site. In order for the foul water drainage system to operate as originally designed, it is necessary to ensure that it is adequately maintained throughout its lifetime. The following give details on each components inspection and maintenance requirements.

PIPES

Pipes are to be inspected as required if there is thought to be a blockage. Any blockages within a pipe are to be removed by rodding or high pressure water jetting to clear the debris. Maintenance responsibility for pipes within private areas are proposed to be with a Private Management Company or Private Landowner, and pipes within the adoptable carriageway with the Adopting Water Authority.

MANHOLES

All manholes are to be inspected annually and accumulated sediment or blockage is to be removed and manholes hosed down if required. Maintenance responsibility for manholes within private areas are proposed to be with a Private Management Company or Private Landowner, and pipes within the adoptable carriageway with the Adopting Water Authority.



SUDS MAINTENANCE PLAN

The introduction to this maintenance plan describes general requirements for various components can be properly risk assessed in accordance with Health and Safety requirements.

LEVEL OF OPERATION AND MAINTENANCE

There are many factors which will influence the type and intensity of maintenance required for SUDS at the site, including:

- type of SUDS scheme
- land-use associated with contributing catchment
- level of construction ongoing within the contributing catchment
- planting types
- habitat types that have been created
- amenity requirements of the area.

OPERATION AND MAINTENANCE ACTIVITY CATEGORIES

There are three categories of maintenance activities:

1 Regular maintenance (including inspections and monitoring).

2 Occasional maintenance.

3 Remedial maintenance.

Regular maintenance consists of basic tasks done on a frequent and predictable schedule, including vegetation management, litter and debris removal, and inspections.

Occasional maintenance comprises tasks that are likely to be required periodically, but on a much less frequent and predictable basis than the routine tasks (sediment removal is an example). Table 1 summarises the likely maintenance activities required for each SUDS component and guidance on specific maintenance activities is given in the following sections.

Remedial maintenance comprises intermittent tasks that may be required to rectify faults associated with the system, although the likelihood of faults can be minimised by good design. Where remedial work is found to be necessary, it is likely to be due to site-specific characteristics or unforeseen events, and as such timings are difficult to predict. Remedial maintenance items can comprise items such as:

- inlet/outlet repairs
- erosion repairs
- reinstatement or realignment of edgings, barriers, rip-rap or other erosion control
- infiltration surface rehabilitation
- replacement of blocked filter fabrics
- construction stage sediment removal (although this activity should have been undertaken before the maintenance contract)
- system rehabilitation immediately following a pollution event.



Table 1 SUDS components operation and maintenance activities:

O&M Activity	SUDS Component						
	Detention basin	Infiltration basin	Soakaway	Infiltration trench	Filter trench	Pervious paving	Pre-treatment systems
Regular maintenance							
Inspection	■	■	■	■	■	■	■
Litter/debris removal	■	■	□	■	■	■	■
Grass cutting	■	■	□	■	■	□	□
Weed/invasive plant control	□	□		□	□	□	□
Shrub management	□	□				□	□
Occasional maintenance							
Sediment management (*)	■	■	■	■	■	■	■
Vegetation/plant replacement	□	□					□
Vacuum sweeping and brushing						■	
Remedial maintenance							
Structural rehabilitation	□	□	□	□	□	□	□
Infiltration surface reconditioning		□	□	□	□	□	

■ Will be required

□ May be required

* Sediment should be collected and managed in pre-treatment systems, upstream of the main device



REGULAR MAINTENANCE ACTIVITIES

Inspections and reporting

Regular SUDS scheme inspections are required to:

- help determine optimum future maintenance activities
- confirm hydraulic, water quality, amenity and ecological performance allow identification of potential system failures, e.g. blockage, poor infiltration, poor water quality etc.

Inspections can generally be required at monthly site visits (e.g. for grass cutting) for little additional cost, and should, therefore, be subsumed into regular maintenance requirements. During the first year of operation, inspections should ideally be carried out after every significant storm event to ensure proper functioning, but in practice this may be difficult or impractical to arrange.

Typical routine inspection questions that will indicate when occasional or remedial maintenance activities are required, and/or when water quality requires investigation include the following checklist:

- are inlets or outlets blocked?
- does any part of the system appear to be leaking (especially ponds and wetlands)?
- is the vegetation healthy?
- is there evidence of poor water quality (e.g. algae, oils, milky froth, odour, unusual colourings)?
- is there evidence of sediment build-up?
- is there evidence of ponding above an infiltration surface?
- is there any evidence of structural damage that requires repair?
- are there areas of erosion or channelling over vegetated surfaces?

Litter/debris removal

This is an integral part of SUDS maintenance and reduces the risks of inlet and outlet blockages, retains amenity value and minimises pollution risks. High litter removal frequencies may be required at high profile commercial/retail parks where aesthetics are a major driver.

Grass cutting

It is recommended that grass cutting be minimised around SUDS facilities, apart from swales and filter strips and structural embankments where a height of 100–150 mm is recommended to prevent the plants falling over, or “lodging”, when water flows across the surface. In general, allowing grass to grow tends to enhance water quality performance. Short grass around a wet system such as pond or wetland provides an ideal habitat for nuisance species such as geese; allowing the grass to grow is an effective means of discouraging them. Grass around wet pond or wetland systems should not be cut to the edge of the permanent water. Grass cutting is an activity undertaken primarily to enhance the perceived aesthetics of the facility. The frequency of cutting will tend to depend on surrounding land uses, and public requirements. Therefore, grass cutting should be done as infrequently as possible, recognising the aesthetic concerns of local residents. However, grass around inlet and outlet infrastructure should be strimmed closely to reduce risks to system performance. If a manicured, parkland effect is required, then cutting will need to be undertaken more regularly than for meadow type grass areas, which aim to maximise habitat and biodiversity potential.

Weed/invasive plant control

Weeds are generally defined as vegetation types that are unwanted in a particular area.



For SUDS, weeds are often alien or invasive species, which do not enhance the technical performance or aesthetic value of the system, or non-native species and the spread of which is undesirable. In some places, weeding has to be done by hand to prevent the destruction of surrounding vegetation (hand weeding should generally be required only during the first year, i.e. during plant establishment). However, over grassed surfaces, mowing can be an effective management measure. The use of herbicides and pesticides should be prohibited since they cause water quality deterioration. The use of fertilisers should also be limited or prohibited to minimise nutrient loadings which are damaging to water bodies.

Shrub management

Shrubs tend to be densely planted and are likely to require weeding at the base, especially during the first year to ensure that they get enough water. Shrubs should be selected so they can grow to their maximum natural height without pruning.

Management of green waste

Appropriate methods should be implemented to dispose of green waste, including:

The development of wildlife piles

These provide refuges, hibernation shelter, food and egg laying sites for a large number of animals. When rotted down at the end of 3–5 years they provide compost that can be used as fertiliser for planting areas outside of the SUDS system.

In general:

- wildlife piles should be located in sunny or semi-shaded areas away from direct access by people
- their bases should be constructed using substantial prunings or other branch material laid in a criss-cross pattern
- seasonal shrub and other woody prunings should be added through the winter
- non-woody and grass cuttings should be added through the summer
- wildlife piles should comprise tidy piles up to 1.2 m high
- New wildlife piles should be constructed each year and old wildlife piles should be used as compost to plant beds after 3–5 years wildlife piles should be located above normal flood level of watercourses and be protected by hedges or similar features.

On- or off-site composting

A compost facility allows all green waste, particularly grass cuttings and prunings to be recycled and provide compost for mulching ornamental plant beds. The following process should be followed for composting:

- shred all arisings from site
- combine all arisings in active compost bin with grass cuttings not exceeding 70%
- turn and mix active compost when bin is >50% full, at weekly intervals for at least four weeks
- turn and mix full bin every 28 days until used
- combine adjacent compost bins/bays when contents are settled to 50% volume reduction
- Use compost after 3–4 months.

Disposal to landfill

As a last resort, green waste can be disposed of to some approved tips or landfill sites, although it is only accepted at certain locations.



IRREGULAR MAINTENANCE ACTIVITIES

Sediment removal

To ensure long-term effectiveness, the sediment that accumulates in SUDS should be removed periodically. The required frequency of sediment removal is dependent on many factors including:

- design of upstream drainage system
- type of system
- design storage volume
- Characteristics of upstream catchment area (e.g. land use, level of imperviousness, upstream construction activities, erosion control management and effectiveness of upstream pre-treatment).

Sediment accumulation will typically be rapid for the entire construction period (including time required for the building, turfing and landscaping of all upstream development plots). Once a catchment is completely developed and all vegetation is well-established, sediment mobility and accumulation is likely to drop significantly.

Vegetation/plant replacement

Some replacement of plants may be required in the first 12 months after installation, especially after storm events. Dead or damaged plants should be removed and replaced to restore the prescribed number of living plants per hectare. Inspection programmes should identify areas of filtration, or infiltration surfaces where vegetation growth is poor and likely to cause a reduced level of system performance. Such areas can then be rehabilitated and plant growth repaired.

REMEDIAL MAINTENANCE

Structure rehabilitation/repair

There will come a time with most SUDS techniques when a major overhaul of the system is required to remove clogged filters, geotextiles, gravel etc. This will typically be between 10 and 25 years, depending on the technique and factors such as the type of catchment and sediment load. The SUDS design should allow for vehicle access to undertake this work and consider the need for the overhaul without causing major disruption. For example the use of geotextiles close to the surface in pervious surfaces traps the majority of sediment in a relatively easily accessible location. Reconstruction of the surface layer and bedding layer is all that is required, rather than reconstruction of the whole pavement depth.

Major overhaul is most likely to be required on techniques that rely on filtration through soils or aggregates, such as sand filters and infiltration devices. Other SUDS techniques are unlikely to need major overhaul if routine maintenance is undertaken as required (for example ponds and wetlands). Rehabilitation activities for each SUDS component are described in the individual component chapters. The requirements should be identified in the owner's manual.



Infiltration surface rehabilitation

In the event that grassed surface permeability has reduced, there are a number of landscape techniques that can be used to open the surface to encourage infiltration.

Such activities are not commonplace and are likely to be required only in circumstances where silt has not been effectively managed upstream.

1. Scarifying to remove “thatch”. Thatch is a tightly intermingled organic layer of dead and living shoots, stems and roots, developing between the zone of green vegetation and the soil surface. Scarifying with tractor-drawn or self-propelled equipment to a depth of at least 50 mm breaks up silt deposits, removes dead grass and other organic matter and relieves compaction of the soil surface.
2. Spiking or tining the soil, using aerating equipment to encourage water percolation. This is particularly effective if followed by top dressing with a medium to fine sand, and is best undertaken when the soil is moist. Spiking or tining with tractor drawn or self-propelled equipment penetrates and perforates soil layers to a depth of at least 100 mm (at 100 mm centres) and allows the entry of air, water, nutrients and top dressing materials.
3. As a last resort, it may be necessary to remove and replace the grass and topsoil by:
 - removing accumulated silt and (subject to a toxicity test) applying to land or dispose of to landfill
 - removing damaged turf which should be composted
 - cultivating remaining topsoil to required levels
 - Re-turfing (using turf of a quality and appearance to match existing) or reseeded (to BS 7370: Part 3, Clause 12.6 (BSI, 1991) using seed to match existing turf) area to required levels. It may be necessary to supply and fix fully biodegradable coir blanket to protect seeded soil. Turf and seeded areas should be top dressed with fine sieved topsoil to BS 3882 (BSI, 1994) to achieve final design levels. Watering will be required to promote successful germination and/or establishment.



PERVIOUS PAVEMENTS

OPERATION AND MAINTENANCE REQUIREMENTS

Regular inspection and maintenance is important for the effective operation of pervious pavements. Maintenance responsibility for a pervious pavement and its surrounding area is proposed to be either the private dwelling owner or a private management company.

The design of pervious sub-base construction should include monitoring points where the water level in the system can be observed or measured. This can either be via an inspection well or inspection cover/chamber prior to the entry/outfall of the system.

The useful life and effective operation of an infiltration component is related to the frequency of maintenance and the risk of sediment being introduced into the system. A silt trap chamber should be incorporated into the design prior to discharge into the pervious sub-base, to restrict grit/silt from entering into the system.

Before handing over the facility to the client, it should be inspected for clogging, litter, weeds and water ponding and all failures should be rectified. After handover, the facility should be inspected regularly, preferably during and after heavy rainfall to check effective operation and to identify any areas of ponding.

Pervious surfaces need to be regularly cleaned of silt and other sediments to preserve their infiltration capability. Experience in the UK is limited, but advice issued with permeable precast concrete paving has suggested a minimum of three surface sweepings per year. Manufacturers' recommendations should always be followed.

A brush and suction cleaner, which can be a lorry-mounted device or a smaller precinct sweeper, should be used and the sweeping regime should be as follows:

1. End of winter (April) – to collect winter debris.
2. Mid-summer (July/August) – to collect dust, flower and grass-type deposits.
3. After autumn leaf fall (November).

Care should be taken in adjusting vacuuming equipment to avoid removal of jointing material. Any lost material should be replaced.

The likely design life (or period before pavement rehabilitation is required) has yet to be established for the UK. However, it should be no different from standard paving assuming that an effective maintenance regime is in place to minimise risks of infiltration clogging.

If reconstruction is necessary, the following procedure should be followed:

1. Lift surface layer and laying course.
2. Remove any geotextile filter layer.
3. Inspect sub-base and remove, wash and replace if required.
4. Renew any geotextile layer.
5. Renew laying course, jointing material and concrete block paving.

The reconstruction of failed areas of concrete block pavement should be less costly and disruptive than the rehabilitation of continuous concrete or asphalt porous surfaces due to the reduced area that is likely to be affected. Materials removed from the voids or the layers below the surface may contain heavy metals and hydrocarbons and may need to be disposed of as controlled waste. Sediment testing should be carried out before disposal to confirm its classification and appropriate disposal methods.

Maintenance plans and schedules should be prepared during the design phase. Specific maintenance needs of the pervious pavement should be monitored and maintenance schedules adjusted to suit requirements.



Pervious pavement operation and maintenance requirements

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Brushing and vacuuming	Three times/year at the end of winter, mid-summer, after autumn leaf fall, or as required on site-specific observations of clogging or manufacturers' recommendations.
Occasional Maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds	
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving	As required (if infiltration performance is reduced as a result of significant clogging).
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users.	
	Rehabilitation of surface and upper sub-structure.	
Monitoring	Initial Inspection.	3 monthly, 48 hours after a large storm
	Inspect for evidence of poor operation and/or weed growth. If required take remedial action.	
	Inspect silt accumulation rates and establish appropriate brushing frequencies.	Annually
	Monitor inspection chambers.	

Many of the specific maintenance activities for pervious pavements can be undertaken as part of a general site cleaning contract (many car parks or roads are swept to remove litter, and for visual reasons to keep them tidy) and, therefore, if litter management is required at site, this should have marginal cost implications.



ATTENUATION STORAGE OR INFILTRATION TANKS

OPERATION AND MAINTENANCE REQUIREMENTS

The useful life and effective operation of a storage system is related to the frequency of maintenance and the risk of sediment being introduced into the system.

Regular inspection and maintenance is important to ensure the effective long-term operation of below ground storage systems.

The design of soakaways should include monitoring points where the water level in the system can be observed or measured. This can either be via an inspection well or inspection cover (where the attenuation storage space is a void).

The table below provides guidance on the type of operational and maintenance requirements that may be appropriate for storage systems. The list of actions is not exhaustive and some actions may not be required.

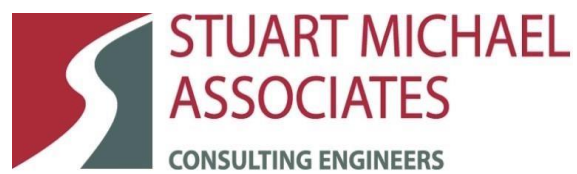
Operation and maintenance requirements for attenuation/filtration storage systems

Maintenance schedule	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 from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary	Annually
	Remove sediment from pre-treatment structures and/or internals forebays	Annually (or as required)
Remedial actions	Repair/ rehabilitate inlets, outlets, overflows and vents	As required
Monitoring	Inspect/ check all inlets, outlets, vents and overflows to ensure that 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



Maintenance will usually be carried out manually, although a suction tanker can be used for sediment/debris removal for large systems. If maintenance is not undertaken for long periods, deposits can become hard-packed and require considerable effort to remove.

Replacement of the geocellular units will be necessary if the system becomes blocked with silt. Effective monitoring will give information on changes in infiltration rate and provide a warning of potential failure in the long term.



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