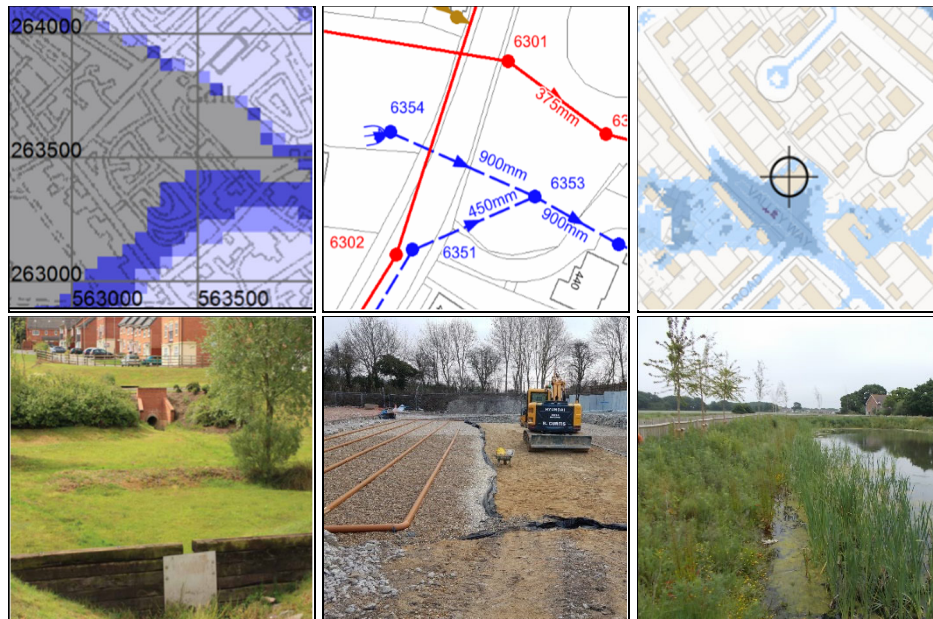




Flood Risk Assessment and Drainage Strategy

**Hayling Golf Club, Ferry Road
Hayling Island, Hants**

Reference: 24057

Issue: **Date:**

1

24/6/2024

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1. Introduction

- 1.1 Instructions were received from Pegasus Group to undertake a Flood Risk Assessment (FRA) and set out a Drainage Strategy (DS) for replacement of a pair of temporary portable toilets with a small permanent toilet structure at Hayling Golf Club, Ferry Road, Hayling Island, Hants.
- 1.2 This assessment has been undertaken by A P Traves BSc CEng MStructE MCIHT.
- 1.3 The client's attention is drawn to the conditions and limitations contained in Appendix D.

2. Development Description & Location

- 2.1 The site comprises a proposed 2 stall 5.4m² GIA course toilet building towards the far (western) end of the golf course remote from the club house facilities to Hayling Golf Club, Ferry Road, Hayling Island, Hants at grid ref approx. 469375 099500. The site location indicated on the annotated aerial photograph in Appendix A.
- 2.2 It is proposed to remove the two existing temporary portable toilets and replace these with a permanent 2 stall 5.4m² GIA course toilet building. The proposed building plan B4-100-P2 is contained in Appendix A of this report.

3. Local Development Documents & Strategic Flood Risk Assessment

- 3.1 The current, at the time of writing, Strategic Flood Risk Assessment (SFRA) for Havant BC has been reviewed and this indicates the following: *(The SFRA is due to be replaced later in 2024 but has not yet been published so no reference can be made to this) the HBC website directs on to the PfSH 2024 SFRA website which advises that the Havant BC components are awaiting publication. The following is therefore derived from the available current material predating this emerging and unavailable information.*
- 3.2 SFRA mapping indicates the toilet location lies in FZ3 tidal flood extents.
- 3.3 SFRA indicates the site is in immediate proximity to the Solent and Langstone Harbour and remote from significant river channels.
- 3.4 SFRA mapping indicates the toilet location is at very low risk of surface water flooding (<0.1% AEP).
- 3.5 The SFRA mapping does not indicate any record of sewer flooding at the site.
- 3.6 The SFRA mapping does not indicate the toilet location to be at risk of reservoir flooding.
- 3.7 The HCC Lavant Catchment Management Plan does not identify any recorded historical flooding events at the toilet location.
- 3.8 The HCC Lavant Test Catchment Management Plan does not identify the toilet location to lie within a priority group.
- 3.9 Hampshire CC Groundwater Management Plan (GWMP) does not identify groundwater issues at this location.
- 3.10 Flood mapping data has been reviewed from the Environment Agency (EA) website. (refer to Appendix B). This indicates the following:
- 3.11 The EA mapping indicates the toilet location lies in FZ3 tidal flood extents.
- 3.12 The EA mapping indicates the toilet location is at very low risk of surface water flooding (<0.1%AEP)

- 3.13 The EA mapping indicates the site is not in an area of reservoir flood risk.

4. Catchment Flood Management & Shoreline Management Plans

- 4.1 The site is located adjacent the tidal waters of Langstone Harbour and falls within policy unit 5AH106 of the North Solent Shoreline Management Plan (SMP).
- 4.2 The SMP identifies the area to comprise The harbour margin from Langstone harbour entrance around the Kench and along the shore north of the Sinah Warren Holiday development is subject to flooding and erosion. An extensive tidal floodplain covers the western frontage of Hayling Island's open coast. It is not intensively developed with relatively small numbers of residential properties or commercial assets and facilities within the tidal floodplain. The existing defences are owned and maintained by private individuals to protect private gardens and a holiday development, while other lengths have a natural transition to the foreshore, but these may prove to be inadequate in the future under conditions of higher sea level and greater wave energy. Inter-tidal, vegetated shingle and sand dune habitats of International, European and national nature conservation importance supports nearby and adjacent SPA/Ramsar sites. Heritage assets within the tidal flood plain include Conservation Areas, Scheduled Ancient Monument, monuments and maritime features. The agreed policy action is Hold the Line for all 3 Epochs.
- 4.3 The South East Hampshire Catchment Flood Management Plan summary – December 2009 (CFMP) indicates the site falls within sub-area 1 Portsmouth and Langstone Harbours Test. The CFMP states that policy 5 is the preferred policy approach:
- “Areas of moderate to high flood risk where we can generally take further action to reduce flood risk.”*
- 4.4 Overall the CFMP does not present any issues that would prohibit the development of this site with respect to flood issues provided the surface water drainage is based on SuDS principles.

5. Catchment Data

- 5.1 A review of BGS geological mapping for the area indicates site geology to generically comprise wind blown sand dune superficial surface deposits over Sand of the Portsmouth Sand Member.
- 5.2 Surface water drainage must accord with a receptor hierarchy in which Tier 1 (infiltration) must be considered first.
- 5.3 It was evident at the site walkover reconnaissance that the site geology comprises free draining sand. The existing portaloo roofs comprise only a few square metres and runoff to the immediate ground and infiltrate the sand geology. The proposed toilet building has a GIA of 5.4m² with a gross roof area of less than 10m². It was readily evident the roof runoff can be directed away from the building to naturally infiltrate the adjacent sand geology.
- 5.4 The site geology is considered sufficiently permeable to facilitate a Tier 1 (infiltration) discharge strategy. The existing portaloo drains by infiltration to the ground. The proposed replacement will drain by infiltration to the ground.

6. Sewage Authority Data

- 6.1 The toilet location is remote from the public sewer.

7. Site Particulars

- 7.1 The site comprises a few square metres of ancillary sand dune landscape to a golf course on which two portalos are proposed to be located.
- 7.2 The surrounding land use is in outdoor sports and recreational use as a golf course.

8. Source-Pathway-Receptor Assessments

- 8.1 The toilet location is in a low coastal elevation and is susceptible to extreme tidal flooding (FZ3 >0.5%AEP) but the golf course is located above normal tidal level.
- 8.2 The site is remote from rivers
- 8.3 The site is indicated to be at very low risk of surface water flooding (<0.1%AEP).
- 8.4 The EA mapping indicates the site is not in an area of reservoir flood risk.
- 8.5 Hampshire CC Groundwater Management Plan (GWMP) does not identify groundwater issues at the site.
- 8.6 The critical flood source is tidal flooding from the Langstone Harbour to the North/ the Solent to the South and West.
- 8.7 The flood receptors of the development would be:
- Essential facilities to outdoor sports and recreation
- 8.8 The proposed development and existing site classifications to NPPF Annex 3 are as follows:
- | | |
|--|------------------------------|
| • Existing outdoor sports and recreation | Water compatible development |
| • Proposed outdoor sports and recreation | Water compatible development |

9. Flood Probability

- 9.1 The EA flood zones shown on the outputs and included in Appendix B represents current best estimates of zone 2 and zone 3 flooding. It does not take account of potential climate change impacts. The flood zone definitions to Table 1 (NPPG Reference ID: 7-078-20220825) are as follows:

Zone 1	Low probability of flooding (<0.1% AEP)
Zone 2	Medium probability of tidal flooding (0.1-0.5% AEP) Medium probability of fluvial flooding (0.1-1% AEP)
Zone 3a	High probability of tidal flooding (>0.5% AEP) High probability of fluvial flooding (>1% AEP)
Zone 3b	Functional floodplain (>3.3% AEP probability of flooding)

The flood map does not differentiate between zones 3a and 3b.
Zone 3b is only considered appropriate for water-compatible development.
Zone 3a is additionally considered appropriate for less vulnerable uses.

- 9.2 The site is located within Flood Zone 3 (FZ2) extreme tidal high risk 0.5%AEP but the risk of flooding from other sources is low. (see 8.3)

10. Climate Change

- 10.1 The new climate change allowances for flood risk assessment GOV.UK 27 May 2022 update have been used. For a 75 year non-residential lifespan climate change values for the site are:
- Sea level rise: Table 1, South east, higher central 2024-2099

2024-2035	11 @ 0.0057m	+0.063m
2036-2065	30 @ 0.0087m	+0.261m
2066-2095	30 @ 0.0116m	+0.348m
2096-2099	4 @ 0.0131m	<u>+0.052m</u>
		+0.724

- 10.2 Surface water drainage strategy is discussed in Chapter 11. The volumes and flows for this strategy have been derived in accordance with CIRIA C753 and include for climate change effects.

11. Detailed Development Proposals & Surface Water Strategy

- 11.1 The portaloo roofs discharge runoff to the ground. The proposed replacement toilet building has a proposed roof area of 8m². The proposed toilet building roof will discharge surface water runoff to the ground. The geology comprises wind blown sand dune over Portsmouth Sand bedrock. The natural soils are suitable for infiltration. Given the small size of the toilet roof surface water drainage may be as basic as a perimeter area of gravel surfacing.
- 11.2 The roof runoff is low and very low pollution hazard levels (C753 Table 26.2) and does not require groundwater risk screening.
- 11.3 Simple index approach calculations are contained in Appendix C. These demonstrate that the proposed SUDS will provide the required level of mitigation index.
- 11.4 The surface water drainage system will be designed to accommodate a 1 in 100 year +45% climate change and +10% urban creep rainfall event. With respect to the Non-statutory Technical Standards for Sustainable Drainage Systems (NTS SuDS) the design accords with requirements S3, S5 and S7-9. Design and construction details will accord with Building Regulations and Sewers for Adoption, as appropriate, so according with S10-11 and S13-14. The design does not include pumping so S12 is not applicable.
- 11.5 In summary source control will be provided by:
- Drainage blanket or similar nominal infiltration media as outlined in paragraph 11.1.
- 11.6 The existing exceedance flow path on the site is south to north. The existing exceedance pathways are maintained by the proposed development.
- 11.7 The surface water strategy mimics the existing run-off regime. There will therefore be no adverse impact on flood flow rates outside the site.
- 11.8 A schedule of O&M maintenance requirements for the SuDS infrastructure is also contained in Appendix C. The maintenance of drainage will be undertaken by the owners.

12. Sequential & Exceptions Tests

- 12.1 The application is for replacement of an essential facilities to outdoor sports and leisure which is water compatible development. The development is minor non-residential leisure of less than 250m² and is classified as minor development for flood risk assessment purposes and is not subject to the Sequential or Exceptions Test as directed in NPPF 174.
- 12.2 The Exceptions Test is not required.

13. Flood Risk Management Measures

- 13.1 The source pathway receptor assessment is contained in Chapter 8.

- 13.2 Paragraph 8.6 identifies extreme tidal flooding from Langstone Harbour to the north is the governing flood source.
- 13.3 The proposed replacement toilet building is a non habitable outbuilding of utilitarian use. The Building fabric should be of resilient construction and detailing and reference should be made to the advice contained in DCLG 'Improving the Flood Performance of New Buildings – Flood Resilient Construction'. For example:
- Concrete floor construction
 - Resilient floor surface and finishes to the lower part of the walls
 - Utility outlets should not be located at low level

14. Off Site Impacts

- 14.1 The surface water strategy mimics the existing run-off regime. There will therefore be no adverse impact on flood risk.

15. Residual Risks

- 15.1 The proposed development provides for flood events up to 1:100 year 2024_{AD} + CC. The residual flood risk is therefore events in excess of 1:100 year 2024_{AD} + CC.

Appendix A



Site location



Existing portalooos

Brief Specification: System 2000

Flat mono-falled roof
Single layer blanket system
Vented end soffit
Floor designed to a 2.5kN/sq. m
Fixed plasterboard ceiling @ 2235mm affl
Insulation:
Roof: 60mm Mineral Wool
Walls: 60mm Mineral Wool
Floor: Foil
Steel Skids c/w Strop Pockets

External Plastisol Finish

Plastisol Walls: TBC
Plastisol Corners: TBC
Painted Plinth: TBC
Steel Fascia: TBC
Jacklegs: -
External Door: TBC
Door Frame: TBC
PVC Downpipes: White

Finishes are indicative. It is the client's responsibility to ensure these are correct

External Door: ED02

Kirncroft 910 Steel Single Doorset
Lift-To-Lock & Euro Cylinder Deadlock
Leaf Width 826mm
Structural Opening 915 x 2070mm

Plumbing

Ceramic Pan c/w Dual Flush Cistern
460mm WHB c/w Single Mixer Tap
Spray Pattern Taps
Plastic Pipework

Key

IB:
trh:
m:
h&c:
WO:
MCW:

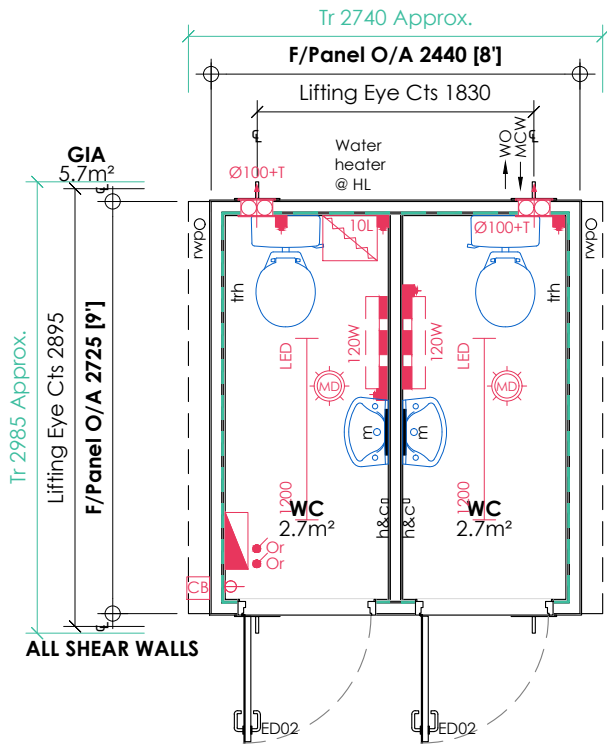
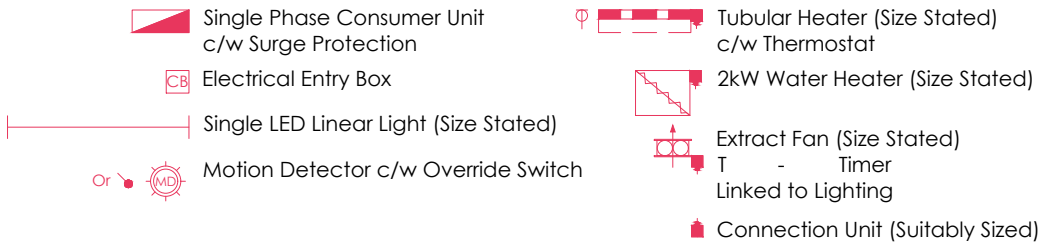
Indicator Bolt
Toilet Roll Holder
Mirror
Hat & Coat Hook
Waste Outlet
Mains Cold Water Inlet

Internal Finish

Wall Finish: Vinyl Faced Plasterboard - White
Ceiling Finish: Vinyl Faced Plasterboard - White
Floor Finish: Polysafe 4090 'Nordic Grey'
Plastic Door & Window Linings: Grey
PVC Skirting: PVC Sit-On - Black
Top Lath: 2 Part - Grey
'H' Sections: To Suit Board Finish
Internal Corners: Angle - White

Tolerance: ±2mm
Framing: 70mm
Internal Framing: 70mm
Prod. No.: -
Fleet No.: -
Stickers: Yes
Lifting Eyes: 17-01A

Electrical Key



00 General Arrangement
1:50

P02	Product code added	ST	01.02.24
P01	First issue	As Titled	As Titled
rev	description	by/chk	date



client

project
Toilet Cabins

title
1 + 1 WC WC1X1

date	design lead	checked
03.01.24	ST	-
project ref		Scale @ A2
2325086		As Shown

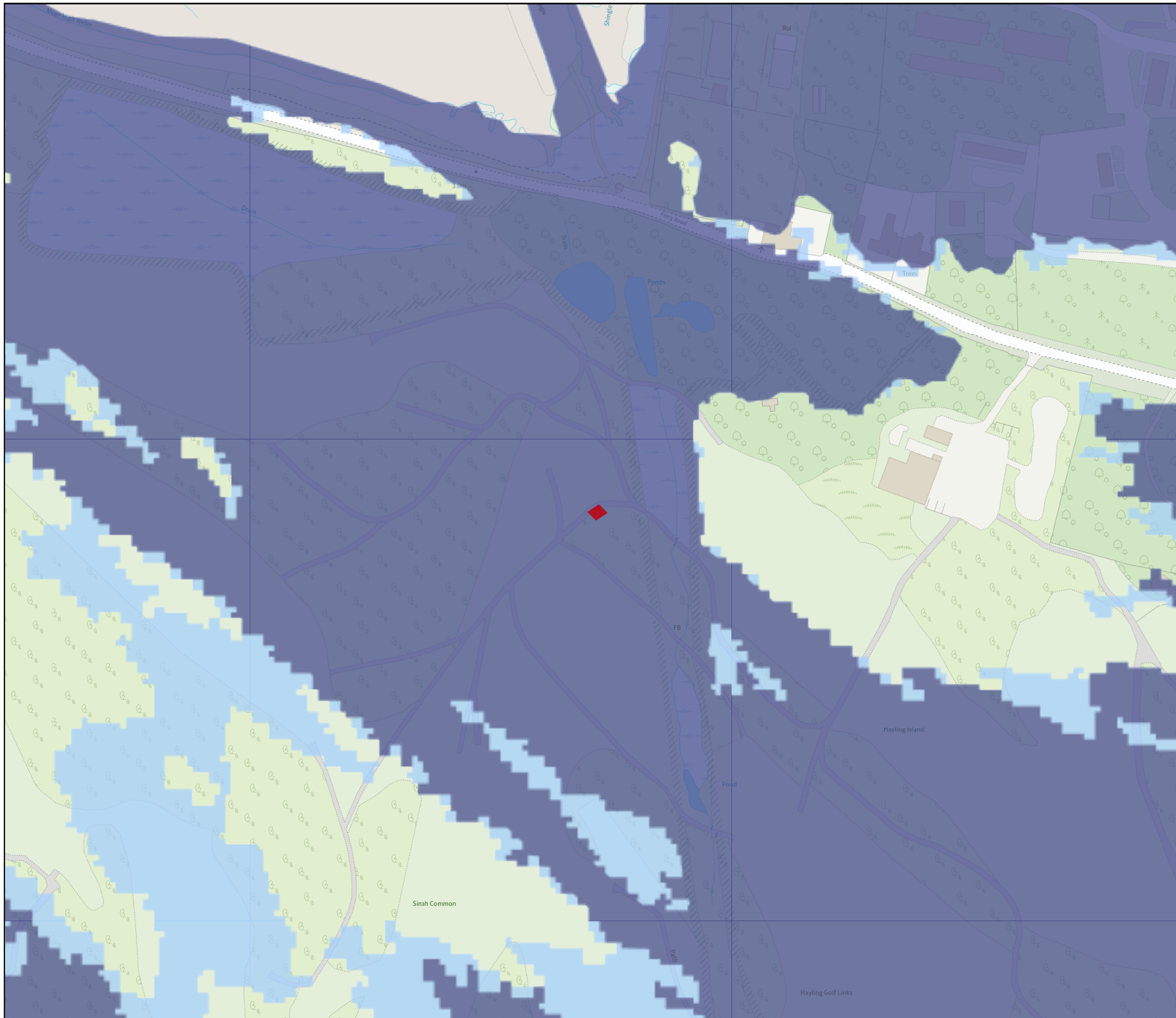
PRELIMINARY



dwg ref
B4-100

rev
P02

Appendix B



Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
469376/99498

Scale
1:2500

Created
24 Jun 2024 11:23

-  Selected area
-  Flood zone 3
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Water storage area

0 20 40 60m



Surface water

- ☒ Extent
- ☒ High risk
More than 3.3% chance each year
- ☒ Medium risk
Between 1% and 3.3% chance each year
- ☒ Low risk
Between 0.1% and 1% chance each year

Surface water flood risk



Reservoirs

- ☒ Extent
- ☒ When river levels are normal
- ☒ When there is also flooding from rivers

Map details

- ☒ Show flooding

Reservoir flood risk

Appendix C

Date: 24/06/2024

Site Ref

Hayling Island Golf Club

SuDS Water Quality Management CIRIA C753 Ch26

Simple Index Approach

Catchment

toilet cabin roof

Is discharge to: SPZ1? ☐ N Drinking Water Protection Area ?

☐ N

Is site in close proximity to an area with sensitive environmental designation?

☐ N

if so how close?

m

Is an additional treatment component required due to sensitivity?

☐ Y

Land Use

roofs-non-residential

Hazard

low

TSS index	Metals index	HydroCar index
0.3	0.2	0.05

Treatments

To surface water discharge ☐ N

Component

- 1 N/A
- 2 N/A
- 3 N/A

mitigation index

X1 N/A

Enhanced mitigation index

Residual pollution index

TSS MIndex	Metals MIndex	HydroCa MIndex	factor
0	0	0	1.00
0	0	0	0.50
0	0	0	0.50
0	0	0	
0	0	0	1.00
0	0	0	
0.3	0.2	0.05	

Land Use

roofs-non-residential

Hazard

low

TSS index	Metals index	HydroCar index	residual
0.3	0.2	0.05	

Treatments

To groundwater discharge ☐ Y

Infiltration surface

- 1 Soil only
- 2 N/A

Final residual pollution index

TSS MIndex	Metals MIndex	HydroCa MIndex	factor
0.4	0.3	0.3	1.00
0	0	0	0.50
0	0	0	

Is a groundwater risk screening required?

☐ N

Notes:

SUDS operation and maintenance - general

There are three categories on maintenance activities:

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). The table below summarises the likely maintenance activities required for each SUDS component and 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. 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.

O&M activity	SUDS component												
	Pond	Wetland	Detention basin	Infiltration basin	Soakaway	Infiltration trench	Filter trench	Modular storage	Pervious pavements	Swale/bioretention/greenroofs	Filter strip	Sand filter	Pre-treatment systems
Regular maintenance													
Inspection	■	■	■	■	■	■	■	■	■	■	■	■	■
Litter/debris removal	■	■	■	■	□	■	■	□	■	■	■	■	■
Grass cutting	■	■	■	■	□	■	■	□	□	■	■	□	□
Wee/invasive plant control	□	□	□	□		□	□		□	□	□	□	□
Shrub management	□	□	□	□					□	□	□		□
Shoreline vegetation management	■	■	□										□
Aquatic vegetation management	■	■	□										□
Occasional maintenance													
Sediment management *	■	■	■	■	■	■	■	■	■	■	■	■	■
Vegetation/plant replacement	□	□	□	□						□	□		□
Vacuum sweeping and brushing									■				
Remedial maintenance													
Structure rehabilitation/repair	□	□	□	□	□	□	□	□	□	□	□	□	□
Infiltration surface reconditioning				□	□	□	□		□	□	□	□	

■ will be required

□ may be required

* sediment to be collected upstream of the main device

GENERAL MAINTENANCE

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 trimmed 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, ie 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.

Aquatic/shoreline vegetation management

Aquatic plant aftercare in the first 1–3 years may be required to ensure establishment of planted vegetation and control nuisance weeds/invasive plants. Once established, the build-up of dead vegetation from previous seasons should be removed at convenient intervals to reduce organic silt accumulation (eg every three years and at the end of landscape contract periods).

Emergent vegetation may need to be harvested every 5–10 years to maintain flood attenuation volumes, optimise water quality treatment potential and ensure fresh growth, although this is often not required. Care should be taken to avoid nesting birds during the breeding season and to avoid great crested newt and water vole habitats. The typical window for this activity is towards the end of the growing season (September and October). As vegetation matures, plant height may also become a safety issue in residential areas.

Where emergent vegetation is managed, up to 25 per cent can be removed by cutting at 100 mm above soil level using shearing action machinery. Up to 25 per cent of submerged vegetation can be cut and raked out at any one time, using approved rakes, grabs or other techniques, depending on whether clay or waterproof membranes are present. Aquatic vegetation arisings should be stacked close to the water's edge for 48 hours to de-water and allow wildlife to return to the SUDS feature. They should then be removed to wildlife piles, compost heaps or off site before decomposition, rotting or damage to existing vegetation can occur.

Algae removal may be undertaken for aesthetic purposes during the first 3–5 years of a pond/wetland's life. The growth of algae, which is considered by some to be visually intrusive, is encouraged by nutrients introduced into the water body. This situation should settle down once upstream construction activities are complete.

Management of green waste

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

- The development of wildlife piles
- On- or off-site composting
- Disposal to landfill

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. 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 on the following tables.

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.

Soakaway operation and maintenance

Maintenance schedule	Required action	Frequency
Regular maintenance	Remove sediment and debris from pre-treatment devices and floor of inspection tube or chamber.	Annually
	Cleaning of gutters and any filters on downpipes.	Annually
	Trimming any roots that may be causing blockages	Annually (or as required)
Occasional maintenance	-	-
Remedial actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs.	As required
	Replacement of clogged geotextile	As required
Monitoring	Inspect silt traps and note rate of sediment accumulation.	Monthly in the first year and then annually.
	Check soakaway to ensure emptying is occurring.	Annually

Maintenance will usually be carried out manually, although a suction tanker can be used for sediment/debris removal for large systems or in public environments.

Bioretention areas operation and maintenance

Maintenance schedule	Required action	Frequency
Regular maintenance	Litter and debris removal.	Monthly (or more frequently for aesthetic reasons).
	Mulching – remove and replace.	Annually
	Pruning and trimming of trees – recycle back into mulch.	2 years
	Spiking, scarifying and thatch removal.	3 years 9when mulching)
Occasional maintenance	Watering of plants.	As required
	Weeding.	As required (probably annually)
Remedial actions	Removal of damaged or silt covered vegetation to a depth 50 mm below original design level.	As required
	Treatment of diseased trees.	As required
	Treatment and restoration of eroded areas.	As required
	Re-turfing.	As required
	Reinstatement of design levels, restoration or improvement of infiltration and silt removal.	As required
Monitoring	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly/after large storms.
	Inspect infiltration surfaces for ponding. Record dewatering time of the facility to determine if maintenance is necessary.	Monthly or when required
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Half yearly
	Test planting soil for pH – if adjustment is necessary, amalgamate with appropriate substances.	Annually

Adequate access must be provided for all bioretention areas for inspection and maintenance, including the appropriate equipment and vehicles.

When found necessary, infiltration in the facility should be restored or improved by removing silt or damaged vegetation and reinstating design levels. Damaged or siltcovered vegetation should be removed to a depth 50 mm below original design level and cultivated to a fine tilth. Infiltration rates can also be affected by the build-up of “thatch”. Any re-turfing that is required should be done using turf of a quality and appearance to match the existing sward.

Maintenance will usually be carried out manually, although a suction tanker can be used for sediment/debris removal for large systems or in public environments

Modular systems operation and maintenance

Maintenance schedule	Required action	Frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then six monthly
	Debris removal from catchment surface (where may cause risks to performance)	Monthly
	Where rainfall infiltrates into blocks from above, check surface of filter for blockage by silt, algae or other matter. Remove and replace surface infiltration medium as necessary.	Monthly (and after large storms)
	Remove sediment from pre-treatment structures	Annually, or as required
Occasional maintenance	-	-
Remedial actions	Repair/rehabilitation of inlets, outlet , 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 and after large storms

Appendix D

CONDITIONS AND LIMITATIONS OF FLOOD RISK ASSESSMENT & DRAINAGE STRATEGIES

October 2020

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