

# **SUDS / DRAINAGE Strategy for Planning**

**Includes FRA for completeness**

**Outline Planning for  
nursing home / assisted  
living scheme with  
maximised porous &  
permeable areas and SUDS**

**AT**

**High Field, Yapton  
Road, Barnham, West  
Sussex, PO22 0AZ**

**November 2019**

**Ark Environmental Consultancy Ltd**



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*If this report has been released electronically, the appendices referred to herein can be found in the annexed zip folder/s as .pdf or .dwg files. If this report has been released in hard copy the appendices will be bound into the back of this report. Plans may be annexed separately as A1 or A0 copies where a bound-in A3 copy is not appropriate.*

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## 1.0 Scope

This report contains the details of an FRA and SUDS & Drainage Strategy for Conditions Discharge carried out by Ark Environmental Consulting Limited ("ARK Ltd") for High Field, Yapton Road, Barnham, West Sussex, PO22 0AZ, henceforth referred to as "the site" in this report.

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## 2.0 Introduction

The information source used to undertake this FRA & SUDS / Drainage Strategy has been collected from the following sources:

- British Geological Survey Website;
- EA Website;
- Arun District Council (ADC) Strategic Flood Risk Assessment (2018);
- ADC Council Website
- West Sussex County Council as the Lead Local Flood Authority (LLFA) Surface Water Management Plan (SWMP)
- LLFA SUDS Guidance and Policies
- Internet mapping and searches

## 3.0 Existing Site Status and Environmental Setting

### 3.0 Site Location and Status

The planning application boundary is c. 1.18 hectares and is an open field with perimeter shrubbery / hedgerows. The site is wholly in EA FZ1 (low risk for fluvial / tidal). The site is in EA NO risk for surface water flooding.

The existing layout is also provided in Appendix A.

### 3.1 Geology

Based on BGS mapping, surrounding borehole records and the council SFRA, the site is underlain by:

Bedrock: London Clay

Superficial deposits: River Terrace Deposits (undifferentiated) - Sand, Silt And Clay

The site is also surrounded on all sides by a large expanse of the London Clay.

- These are not water bearing strata.
- These strata do not support any subterranean watercourses in this area based on available data

### BGS Borehole Logs

As with all areas of London Clay, there is the potential for the upper areas to have isolated lenses / pockets of silty deposits and perched water.

This is not an underground waterbody. These lenses if encountered during construction will be dewatered and managed as appropriate.

### Strata and Flood Risk:

There will be no groundwater body displaced and hence there will be no increased risk of flooding from the scheme from groundwater to surrounding areas.

### Strata and Drainage / SUDS

These strata suggest that infiltration is not likely feasible and hence will not be relied upon, but if found to be suitable at the site, it will be the preferred discharge method.

NOTE: the site is just north of the border of Lambeth Group strata and south of this is the southern area of the Lewes Nodular Chalk Formation stratum.

It is possible that at the site there are some areas of chalk, but this is not necessary to determine at this stage given the evidence that the site is above strata that are not suitable for infiltration.

## **3.2 Existing Drainage**

Public sewer records have not been sourced from Southern Water, however, the site is a vacant field and there are no sewers recorded on the site.

A specific drainage survey of the surrounding area has not been carried out, there are Southern manholes in the road and connections to neighbouring properties to the public sewer network.

There is no evidence of any existing SUDS. The site currently discharges 100% unattenuated by a combination of natural on site interception from vegetation and soil infiltration and via existing informal drainage ditches.

The scheme will formally attenuate storm surface water on site using the highest form of SUDS hence there are no reasons for Southern Water to object on the grounds of this drainage strategy.

An assessment of the Greenfield equivalent discharge for the site has been carried out. This has confirmed an average discharge rate (QBAR) of a nominal 1.95 l/s. A copy of the calculation output is included in Appendix C.

### 3.3 Summary of Flood Risks Posed to and From Site and Scheme

| <b>Flood Sources</b>           | <b>Site Status</b>                                                                                                                                                                                                                    | <b>Comment on flood risk posed to / from the development</b>                                                                                                                         |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fluvial / Tidal                | Site is in wholly FZ1                                                                                                                                                                                                                 | Nursing home use is appropriate in FZ1                                                                                                                                               |
| Groundwater                    | SFRA indicates site is not in an area of groundwater flooding / incidents.                                                                                                                                                            | There will be no groundwater body displaced<br>The proposed development will not increase the risk of groundwater flooding.<br>Low Risk                                              |
| Artificial Sources             | Site is not within EA Reservoir Flood Warning area<br>No other artificial sources with likely flood flowpaths that could reach the site                                                                                               | Low Risk                                                                                                                                                                             |
| Surface Water / Sewer Flooding | Site is not located in a Critical Drainage Area<br>Condition, depth and location of surrounding infrastructure uncertain<br>EA 2019 surface water flood mapping indicates the whole site is in EA NO hazard for all EA risk scenarios | SUDS incorporated appropriately<br>Development will not increase the peak flow or volume of discharge from the site.<br>No additional specific design responses required<br>Low Risk |
| Climate Change                 | Included in the flood modelling extents<br>40% used in the SUDS storage calculations                                                                                                                                                  | Development will manage the peak flow and volume of discharge from the site<br>Low risk posed to and from the development                                                            |

## 4.0 Assessment of Proposed Development

### 4.1 Proposed Development

The proposed development (Appendix B) comprises:

- Erect nursing home / assisted living scheme with maximized porous and permeable areas
  - Maximisation of SUDS storage areas
- Restricted discharge using on site highest forms of SUDS:
  - Surface storage attenuation basins
  - Planted “rain gardens” and swales incorporated into landscaping
  - Permeable paving with geocellular storage
- **Reduces flood risk overall and meets ADC and WSCC SUDS requirements**
  - New SUDS to meet 2019 requirements

### 4.2 Foul Drainage

Based on likely number of units / dwellings, the maximum peak foul discharge generated remains a nominal amount and is unlikely to give rise to any capacity concerns within the public sewer network. Subject to the approval of the water company, it is proposed to make a connection to discharge the foul to the public foul sewer, subject to condition and level.

Subject to confirmation of the public sewer invert level and the proposed finished development levels, it is expected that the existing gravity connection will be retained and suitable.

### 4.3 Surface Water Drainage

In accordance with NWDC, NPPF, PPG and LLFA policy requirements, sustainable drainage systems (SUDS) should be incorporated wherever possible to reduce positive surface water run-off and flood risk to other areas.

Intrusive ground investigation works have not been carried out on site at this stage, however, the likely strata as per the British Geological Survey (BGS) mapping suggests the strata would potentially be not suitable for the use of infiltration SUDS techniques; groundwater levels and percolation testing in accordance with BRE365 will be undertaken as part of detailed designs to confirm the potential for infiltration.

Infiltration is not required for the SUDS strategy.

As a precaution for the discharge connection, so as not to rely on an unknown and to demonstrate a worse case of SUDS storage on site with restricted discharge, it is recommended that SUDS techniques are restricted to the use of surface storage, permeable paving and additional storage with restricted discharge to attenuation basin and drainage ditch / public sewer.

There is no watercourse for the scheme to connect to.

If detailed investigations suggest infiltration is feasible, then this will be the detailed designs discharge method subject to approval with the EA and LLFA as appropriate.

It is proposed to provide an attenuation based surface water strategy to serve run-off from the proposed roof area, with a residual positive discharge rate being restricted to a minimal 1 l/s to oversize the storage to also account for discharge point to the informal drainage ditch.

#### 4.4 SUDS Storage Calculations

Calculations have been prepared based on the Micro Drainage software package to assess the size of structure require, based on the following design criteria.

This is an outline planning application.

Assumptions made:

Scheme will likely result in 40% of the site becoming impermeable;

Urban creep factor: add a further 10%

To further compensate and oversize: add a further 30%

**Hence assume an 80% impermeable site as an overestimate in order to oversize the SUDS storage.**

- Contributing impermeable area – 9,800m<sup>2</sup>
- Design event - 100 year
- Climate change allowance - 40%
- Max. residual Discharge rate - 3 l/s (via modern vortex control / hydrobrake)
  - This is the safest minimum discharge rate for a site of this size (greater than a 1ha); any smaller and the size of the aperture itself could be easily blocked and thus become an inherent flood risk
- The calculation output is included within Appendix C.
  - 895.0m<sup>3</sup> of storage required based on the parameters above

#### SUDS Specifications: SUDS Hierarchy Compliant

| Formal SUDS Type                                                               | Source Control | Dimensions                                                                         | Storage Volume       |
|--------------------------------------------------------------------------------|----------------|------------------------------------------------------------------------------------|----------------------|
| Attenuation Basin                                                              | Yes            | 2 number:<br>25.0m by 6.0m by 0.6m<br>= 105m <sup>3</sup> x 2: 180.0m <sup>3</sup> | 210.00m <sup>3</sup> |
| Selected landscape areas to be surface storage planted "rain gardens" SUDS     | YES            | Total of c. 90m <sup>2</sup><br>Depths to be c. 0.65m                              | 58.5m <sup>3</sup>   |
| Larger landscaped areas to be contoured as planted surface storage swales SUDS | YES            | Total of c. 350m <sup>2</sup><br>Depths to be shallow at 0.3m depths               | 105.0m <sup>3</sup>  |

|                                                                                          |                                                      |                                                                                                                |                                                                       |
|------------------------------------------------------------------------------------------|------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| Permeable Paving Car Park Spaces with underground storage                                | YES<br>Permeable paving / car park takes roof runoff | 44 car park spaces<br>Each 4.9m by 2.5m = 539.0m <sup>2</sup><br>Use 0.8m depth = 431.2m <sup>3</sup>          | 431.2m <sup>3</sup>                                                   |
| Turning Area adjacent to the 5 car park spaces in north of site also to have geocellular | YES<br>Permeable paving / car park takes roof runoff | This area is 122.50m <sup>2</sup> .<br>Use 0.8m depth = 98.0m <sup>3</sup>                                     | 98.0m <sup>3</sup>                                                    |
| Permeable surfaces for all other areas of access / paths etc                             | YES                                                  | n/a                                                                                                            | n/a                                                                   |
| Sedum Roofs<br>Specification not confirmed at this stage.                                | YES                                                  | n/a<br>Not required at this stage to contribute to storage; exact specification / depth of strata not required | n/a                                                                   |
| c. 60% of site retained as porous landscaping                                            | YES                                                  | n/a                                                                                                            | n/a                                                                   |
|                                                                                          |                                                      | Total                                                                                                          | 902.70m <sup>3</sup><br>Greater than the 895.0m <sup>3</sup> required |

[Note: car park spaces are also used in order to unequivocally quantify the SUDS areas as they are assumed as a standard 4.9m by 2.5m = 12.25m<sup>2</sup> and can be readily seen and scaled on a drawing.

**The SUDS layout plan included within Appendix D shows locations for the SUDS structures.**

It is proposed to connect the now restricted discharge from the attenuation basin, the rain gardens, swales and permeable paving + geocellular storage directly to the adjacent drainage ditch / public sewer.

With respect to other SUDS techniques, the proposed buildings will have part sedum roofs; but these are not required to contribute to the storage volumes at this stage. Whilst internal rainwater harvesting is not proposed, it is recommended that rainwater pipes are fitted with water butts wherever feasible. Whilst the use of water butts won't reduce the design criteria of the receiving surface storage and below ground drainage system, their use will reduce the time of entry and provide a supply of water for irrigation.

It will be necessary for the surface water drainage system to comply with the Environment Agency's pollution prevention guidance. Roof run-off is classified as uncontaminated and, in accordance with

EA pollution prevention guidance, will not require any treatment. Any surface water run-off draining through permeable paving will receive an adequate level of filtration through the associate substrate.

#### **4.5 Maintenance**

With respect to maintenance, the proposed SUDS techniques should be maintained in accordance with the appropriate regimes set out within the SUDS manual and will be the responsibility of the owner / management company. A SUDS maintenance schedule is included within Appendix E.

### **5.0 Summary**

The site is in an area of low flood risk posed from all sources.

The scheme also reduces flood risk overall.

It is proposed to connect the foul drainage from the new development to the public sewer in Yapton Road. Any amendments to the existing discharge arrangements or new connection will be subject to the approval of Southern Water, via a Section 106 Connection Application under the Water Industry Act 1991 at the design stage.

It is proposed to provide an attenuation-based surface water drainage system to serve run-off from the new development roof area. It is proposed to provide a combination of a pond, swale and permeable paving (source control) with shallow cellular block attenuation structure with a restricted 3 l/s residual discharge to the public sewer / drainage ditch, subject to the approval of Southern Water.

It is proposed to construct the new external hard standing areas from permeable paving. It should be noted that the proposed surface water strategy will reduce positive run-off from the site in the post development scenario and therefore reduce flood risk to other areas.

The proposed drainage strategy is subject to the approval of the Local Planning Authority, Lead Local Flood Authority, Environment Agency and Southern Water.

Based on the likely flooding risk, it is considered that the proposed development can be constructed and operated safely in flood risk terms, without increasing flood risk elsewhere, in fact reducing flood risk overall and is therefore appropriate development in accordance with the NPPF/PPG.

## **APPENDICES**

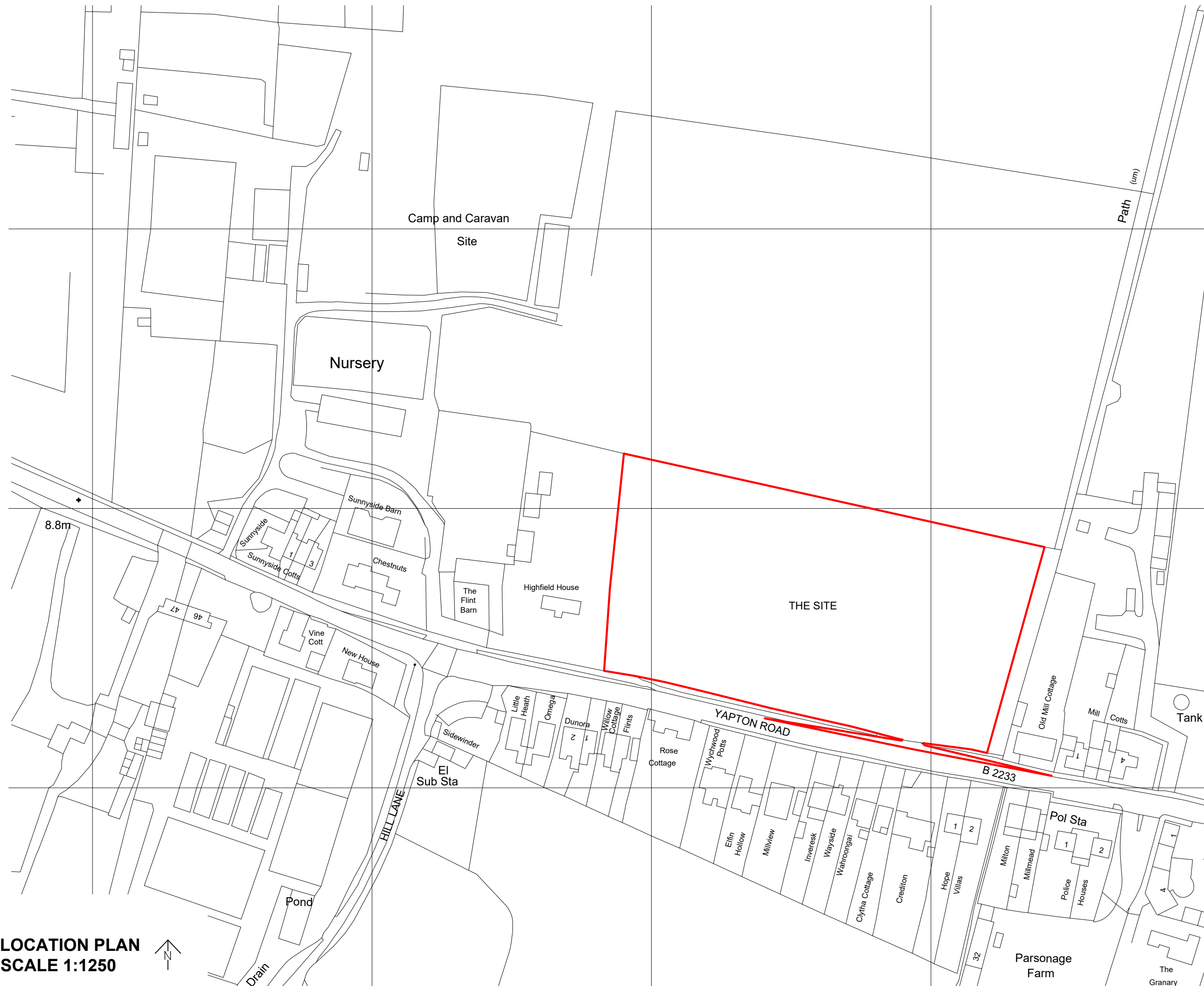
## APPENDIX A



SCALE DRAWINGS FOR PLANNING PURPOSES ONLY

ALL DIMENSIONS TO BE CHECKED ON SITE PRIOR TO COMMENCEMENT AND ANY DISCREPANCY REPORTED TO RCCA

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CONTRACT  
LAND AT YAPTON ROAD  
ARUN DISTRICT  
PO22 0BG

CLIENT  
ORCHESTRA LAND  
DRAWING  
LOCATION PLAN

DRAWN  
IE  
SCALE  
1:1250 A3  
DATE  
NOV 2019  
JOB / DRWG No  
1693 / LP1



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ARUN DISTRICT COUNCIL BN7 2B19/OUT

LOCATION PLAN  
SCALE 1:1250



## **APPENDIX B**

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GOLPLA OR SIMILAR  
PERMEABLE PAVING WITH GEOCELLULAR OR  
GRANULAR STORAGE SUDS

SURFACE STORAGE PLANTED "RAIN GARDENS" SUDS

PLANTED SURFACE STORAGE SWALES SUDS

EXISTING PUBLIC  
FOOTPATH

FOOTPATH LINK WITH GATE  
AT BOUNDARY

EXISTING PUBLIC FOOTPATH

NOTE:  
ALL LIGHTING TO BE LOW-LEVEL LIGHTING

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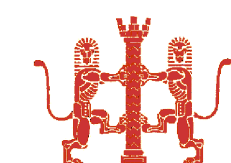
CONTRACT  
LAND AT YAPTON  
ROAD  
ARUN DISTRICT  
PO22 0BG

CLIENT  
ORCHESTRA LAND  
DRAWING  
SITE PLAN

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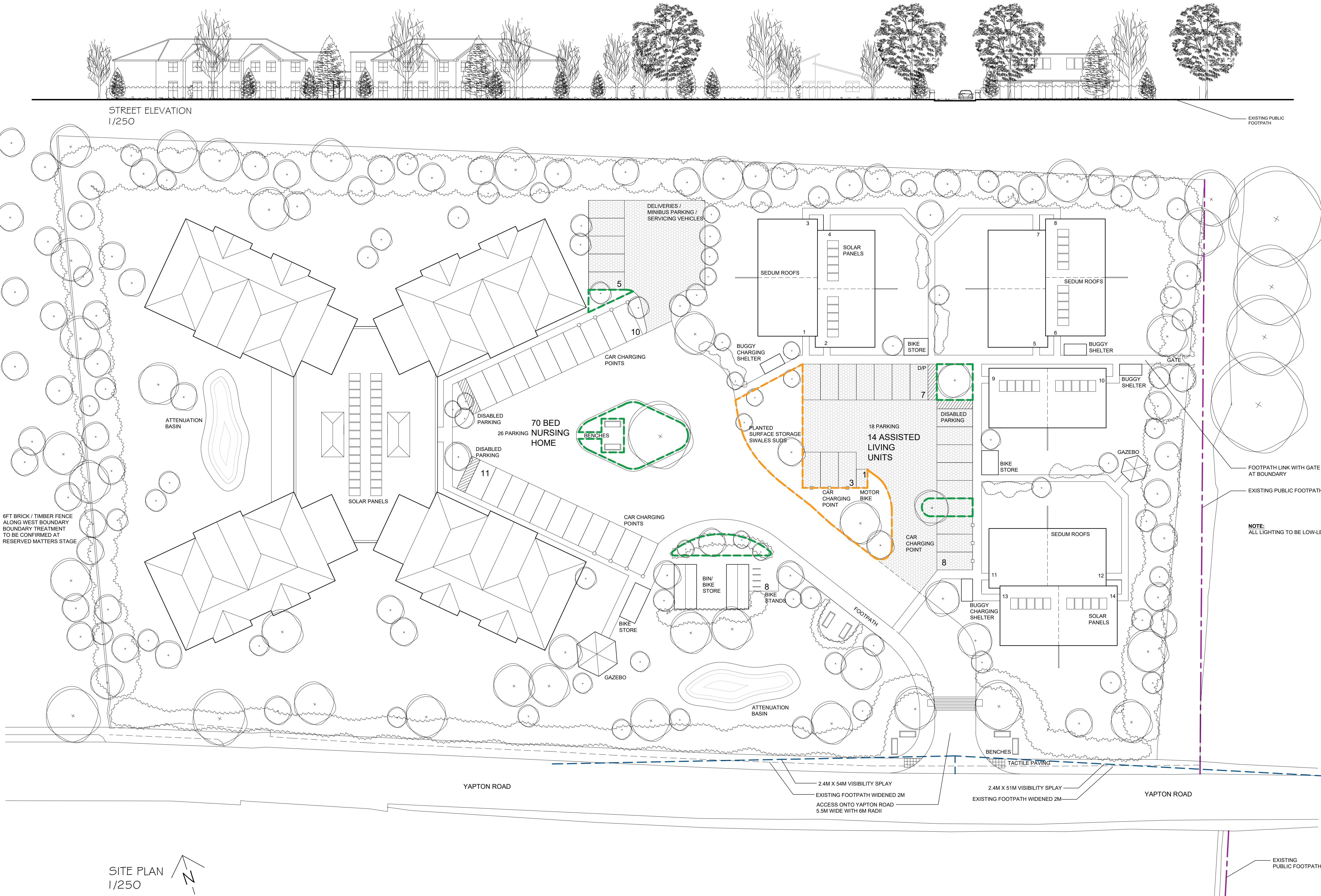
DATE  
JULY 2019  
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BUILDING  
FOR LIFE  
AWARD  
WINNER



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STREET ELEVATION  
1/250



SITE PLAN  
1/250



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GOLPLA OR SIMILAR PERMEABLE PAVING WITH GEOCELLULAR OR GRANULAR STORAGE SUDS

SURFACE STORAGE PLANTED "RAIN GARDENS" SUDS

PLANTED SURFACE STORAGE SWALES SUDS

EXISTING PUBLIC FOOTPATH

FOOTPATH LINK WITH GATE AT BOUNDARY

EXISTING PUBLIC FOOTPATH

NOTE: ALL LIGHTING TO BE LOW-LEVEL LIGHTING

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LAND AT YAPTON ROAD  
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CLIENT ORCHESTRA LAND  
DRAWING  
SITE PLAN

DRAWN IE  
SCALE 1:250 A1  
DATE JULY 2019  
JOB / DRWG No 1693 / SP1

BUILDING FOR LIFE  
AWARD  
WINNER



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STREET ELEVATION  
1/250

6FT BRICK / TIMBER FENCE  
ALONG WEST BOUNDARY  
BOUNDARY TREATMENT  
TO BE CONFIRMED AT  
RESERVED MATTERS STAGE

SITE PLAN  
1/250



YAPTON ROAD

YAPTON ROAD

2.4M X 54M VISIBILITY SPLAY  
EXISTING FOOTPATH WIDENED 2M  
ACCESS ONTO YAPTON ROAD  
5.5M WIDE WITH 6M RADIUS

2.4M X 51M VISIBILITY SPLAY  
EXISTING FOOTPATH WIDENED 2M

TACTILE PAVING

EXISTING PUBLIC FOOTPATH

ATTENUATION BASIN

ATTENUATION BASIN

70 BED NURSING HOME

14 ASSISTED LIVING UNITS

DELIVERIES / MINIBUS PARKING / SERVING VEHICLES

SEDUM ROOFS

SEDUM ROOFS

SEDUM ROOFS

SEDUM ROOFS

SEDUM ROOFS

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## APPENDIX C

Calculated by:

Site name:

Site location:

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

## Site Details

Latitude:

Longitude:

Reference:

Date:

## Runoff estimation approach

## Site characteristics

Total site area (ha):

## Methodology

$Q_{BAR}$  estimation method:

SPR estimation method:

## Soil characteristics

|              | Default | Edited |
|--------------|---------|--------|
| SOIL type:   | 2       | 2      |
| HOST class:  | N/A     | N/A    |
| SPR/SPRHOST: | 0.3     | 0.3    |

## Hydrological characteristics

|                                | Default | Edited |
|--------------------------------|---------|--------|
| SAAR (mm):                     | 756     | 756    |
| Hydrological region:           | 7       | 7      |
| Growth curve factor 1 year:    | 0.85    | 0.85   |
| Growth curve factor 30 years:  | 2.3     | 2.3    |
| Growth curve factor 100 years: | 3.19    | 3.19   |
| Growth curve factor 200 years: | 3.74    | 3.74   |

## Notes

### (1) Is $Q_{BAR} < 2.0$ l/s/ha?

When  $Q_{BAR}$  is  $< 2.0$  l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

### (2) Are flow rates $< 5.0$ l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

### (3) Is $SPR/SPRHOST \leq 0.3$ ?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

## Greenfield runoff rates

|                       | Default | Edited |
|-----------------------|---------|--------|
| $Q_{BAR}$ (l/s):      | 2.35    | 2.35   |
| 1 in 1 year (l/s):    | 2       | 2      |
| 1 in 30 years (l/s):  | 5.41    | 5.41   |
| 1 in 100 year (l/s):  | 7.51    | 7.51   |
| 1 in 200 years (l/s): | 8.8     | 8.8    |

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at [www.uksuds.com](http://www.uksuds.com). The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at [www.uksuds.com/terms-and-conditions.htm](http://www.uksuds.com/terms-and-conditions.htm). The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.



# Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:

Site name:

Site location:

## Site Details

Latitude:

Longitude:

Reference:

Date:

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

## Site characteristics

|                                                        |                                   |
|--------------------------------------------------------|-----------------------------------|
| Total site area (ha):                                  | <input type="text" value="1.18"/> |
| Significant public open space (ha):                    | <input type="text" value="0"/>    |
| Area positively drained (ha):                          | <input type="text" value="1.18"/> |
| Impermeable area (ha):                                 | <input type="text" value="0.94"/> |
| Percentage of drained area that is impermeable (%):    | <input type="text" value="80"/>   |
| Impervious area drained via infiltration (ha):         | <input type="text" value="0"/>    |
| Return period for infiltration system design (year):   | <input type="text" value="10"/>   |
| Impervious area drained to rainwater harvesting (ha):  | <input type="text" value="0"/>    |
| Return period for rainwater harvesting system (year):  | <input type="text" value="10"/>   |
| Compliance factor for rainwater harvesting system (%): | <input type="text" value="66"/>   |
| Net site area for storage volume design (ha):          | <input type="text" value="1.18"/> |
| Net impermeable area for storage volume design (ha):   | <input type="text" value="0.96"/> |
| Pervious area contribution to runoff (%):              | <input type="text" value="30"/>   |

\* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of  $Q_{BAR}$  and other flow rates will have been reduced accordingly.

## Design criteria

Climate change allowance factor:

Urban creep allowance factor:

Volume control approach:

Interception rainfall depth (mm):

Minimum flow rate (l/s):

## Methodology

esti:

$Q_{BAR}$  estimation method:

SPR estimation method:

## Soil characteristics

|            | Default                          | Edited                           |
|------------|----------------------------------|----------------------------------|
| SOIL type: | <input type="text" value="2"/>   | <input type="text" value="2"/>   |
| SPR:       | <input type="text" value="0.3"/> | <input type="text" value="0.3"/> |

## Hydrological characteristics

|                                      | Default                           | Edited                             |
|--------------------------------------|-----------------------------------|------------------------------------|
| Rainfall 100 yrs 6 hrs:              | <input type="text" value="--"/>   | <input type="text" value="63"/>    |
| Rainfall 100 yrs 12 hrs:             | <input type="text" value="--"/>   | <input type="text" value="90.86"/> |
| FEH / FSR conversion factor:         | <input type="text" value="1.18"/> | <input type="text" value="1.18"/>  |
| SAAR (mm):                           | <input type="text" value="756"/>  | <input type="text" value="756"/>   |
| M5-60 Rainfall Depth (mm):           | <input type="text" value="20"/>   | <input type="text" value="20"/>    |
| 'r' Ratio M5-60/M5-2 day:            | <input type="text" value="0.4"/>  | <input type="text" value="0.4"/>   |
| Hydrological region:                 | <input type="text" value="7"/>    | <input type="text" value="7"/>     |
| Growth curve factor 1 year:          | <input type="text" value="0.85"/> | <input type="text" value="0.85"/>  |
| Growth curve factor 10 year:         | <input type="text" value="1.62"/> | <input type="text" value="1.62"/>  |
| Growth curve factor 30 year:         | <input type="text" value="2.3"/>  | <input type="text" value="2.3"/>   |
| Growth curve factor 100 years:       | <input type="text" value="3.19"/> | <input type="text" value="3.19"/>  |
| $Q_{BAR}$ for total site area (l/s): | <input type="text" value="2.35"/> | <input type="text" value="2.35"/>  |
| $Q_{BAR}$ for net site area (l/s):   | <input type="text" value="2.35"/> | <input type="text" value="2.35"/>  |

## Site discharge rates

|                      | Default                          | Edited                           |
|----------------------|----------------------------------|----------------------------------|
| 1 in 1 year (l/s):   | <input type="text" value="3"/>   | <input type="text" value="3"/>   |
| 1 in 30 years (l/s): | <input type="text" value="5.4"/> | <input type="text" value="5.4"/> |
| 1 in 100 year (l/s): | <input type="text" value="7.5"/> | <input type="text" value="7.5"/> |

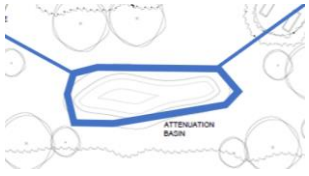
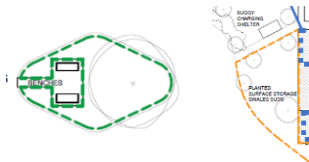
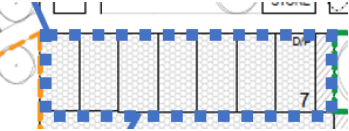
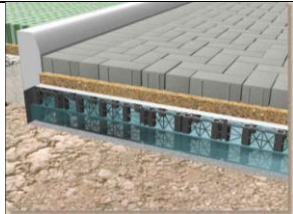
## Estimated storage volumes

|                                       | Default                          | Edited                           |
|---------------------------------------|----------------------------------|----------------------------------|
| Attenuation storage 1/100 years (m³): | <input type="text" value="812"/> | <input type="text" value="812"/> |
| Long term storage 1/100 years (m³):   | <input type="text" value="83"/>  | <input type="text" value="83"/>  |
| Total storage 1/100 years (m³):       | <input type="text" value="895"/> | <input type="text" value="895"/> |

This report was produced using the storage estimation tool developed by HRWallingford and available at [www.uksuds.com](http://www.uksuds.com). The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at <http://uksuds.com/terms-and-conditions.htm>. The outputs from this tool have been used to estimate storage volume requirements. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

## **APPENDIX D**

# YAPTON: Drainage Layout with Oversized SUDS Storage and Restricted Discharge

| Key                                                                                 | SUDS Element                                                                                                                                                    | Example Spec / Layout<br>As per Sustainable Drainage Developer Guide; Local Sustainable Drainage Design Guide |                                                                                     |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|    | <div data-bbox="685 411 1137 533"> <p>Attenuation Basin</p> <p>Refer to FRA&amp;SUDS report for dimensions</p> </div>                                           |                            |  |
|    | <div data-bbox="685 651 1137 845"> <p>Rain garden / planted swale planting areas</p> <p>Refer to FRA&amp;SUDS report</p> </div>                                 |                            |  |
|   | <div data-bbox="685 954 1034 1075"> <p>Maximised porous and permeable areas</p> </div>                                                                          | <p>See SUDS Site Layout Plan</p> <p>See Appendix B for detailed site layout</p>                               |                                                                                     |
|  | <div data-bbox="685 1193 1115 1375"> <p>Geocellular storage under car parking areas / access area</p> <p>Refer to FRA&amp;SUDS report for dimensions</p> </div> |                          |                                                                                     |

## Yapton SUDS Layout

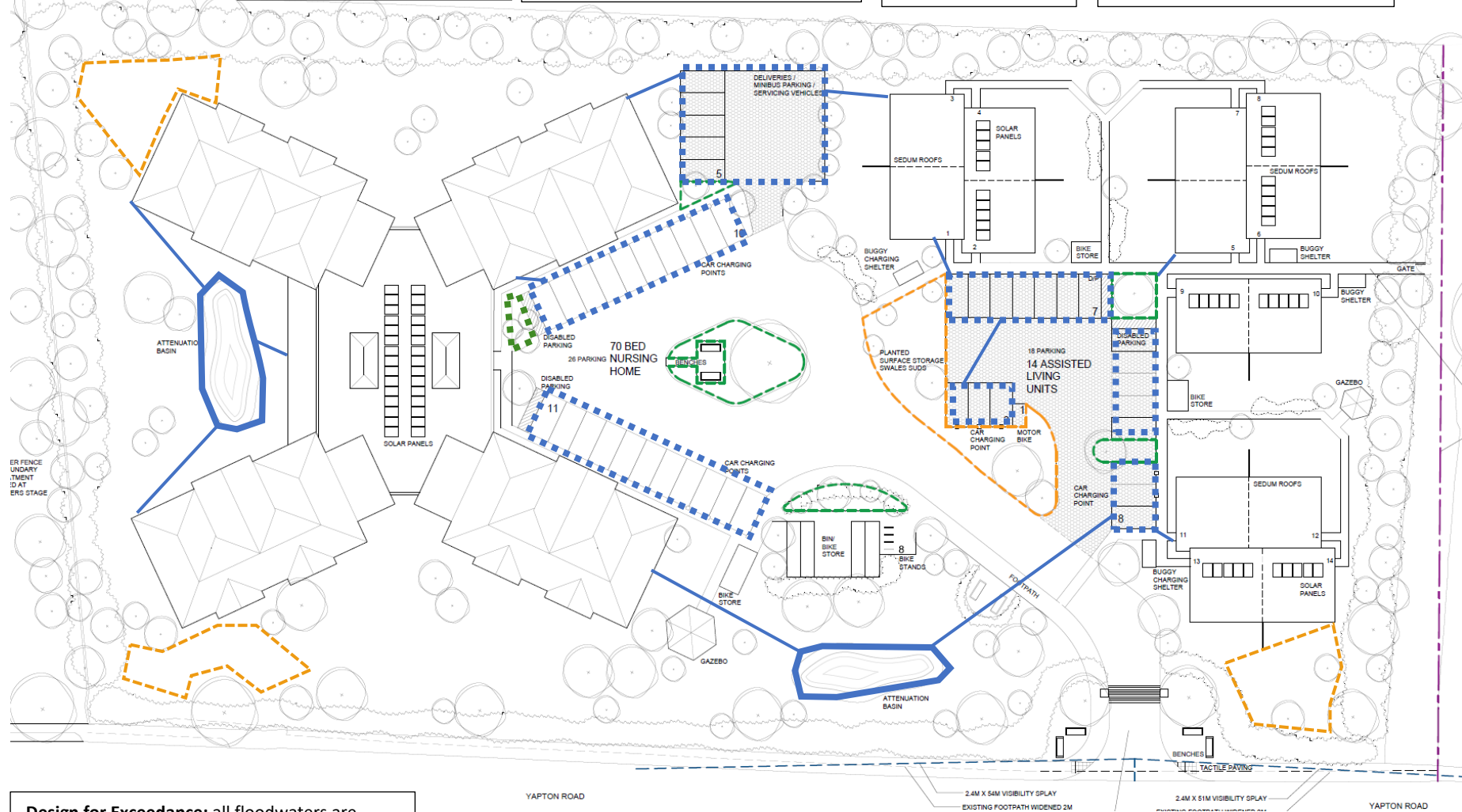
**Dashed Green Outline**  
Rain Garden Planters:  
integrated storage.

**Dashed Blue Outline**  
Geocellular storage under  
permeable parking areas.

**Orange Outline:**  
Larger landscaped area contoured as  
planted surface storage swales SUDS

**Solid Blue Outline**  
Attenuation Basins

**Blue Lines**  
Indicative main pipe connections:  
not required at planning stage as  
this is part of detailed design



**Design for Exceedance:** all floodwaters are stored to the 1in100year; large areas of retained porous green / permeable access areas can ensure first 5mm is retained on site

Refer to report for dimensions

## **APPENDIX E**

### **SUDS Maintenance Schedule**

| <b>Installation</b>                                                         | <b>Maintenance Required</b>                                                                                                                                                                   | <b>Frequency</b>                                                                                                                                      | <b>Responsibility</b>                                                     |
|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Attenuation Basin Swale<br><br>Rain Garden / planted swale areas            | Attenuation basin maintenance regime to be coordinated with the ecology consultant as appropriate<br><br>Swales and planted rain garden<br><br>Inspection / Grass cutting / weeding / jetting | De-silting to be part of maintenance plan<br><br>Part of general grass cutting regime (likely 6 times a year)                                         | Estate/Building Management Company                                        |
| Cellular Attenuation                                                        | Inspection, sediment removal and jetting                                                                                                                                                      | Annually or as per supplier's recommendations                                                                                                         | Supplier (via a maintenance/service package) or Estate Management Company |
| Hydrobrake / Vortex Flow Control                                            | Inspection, cleaning and testing                                                                                                                                                              | Annually or as per supplier's recommendations                                                                                                         | Supplier (via a maintenance/service package) or Estate Management Company |
| Permeable Paving (incl. associated distribution pipework and sump chambers) | Inspection, debris removal and jetting                                                                                                                                                        | Typically, inspection is recommended annually or after a severe or significant storm event, with any jetting/cleaning being carried out as necessary. | Estate/Building Management Company                                        |