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SURFACE WATER DRAINAGE DESIGN

HOWE BARRACKS PHASE 2

September 2019
34109/R006/AJB

SURFACE WATER DRAINAGE DESIGN
FOR
HOWE BARRACKS
PHASE 2

Report Status: Rev C Date of Issue September 2019		
	Name	Signature & Date
Author:	Andrew Bird	[redacted]
Checked & Approved:	Neil Kimmance	

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This report shall not be used for engineering or contractual purposes unless signed above by the author and the checker/approver, and unless the report status is "Final".

CONTENTS

1 INTRODUCTION

This report details the proposed surface water drainage design for the Phase 2 development to the Howe Barracks development and has been written to address planning conditions for that site.

2 SITE DESCRIPTION

The site is located at NGR TR 16583 58162 to the East of Canterbury City centre. It is a brownfield site which has previously been used as a military barracks.

The Phase 2 development is currently part brownfield site which covers a total area measuring 6 hectares. The proposal include for the construction of a distributor road bisecting the Phase 2 development, with the western side of the development overseeing Legacy Park and the eastern side of the development will oversee a wildlife buffer zone. There is also a proposed Phase 3 development to the northeast of the Phase 2 site.

3 EXISTING DRAINAGE

The sewer map for the locality shows surface and foul water sewers adjacent to the site in Littlebourne Road. It is believed that there is not capacity within the existing surface water sewer network to accept any additional flows. However, the existing development located within Howe barracks is estimated to contribute into the public surface water sewer with discharge rates estimated to be approximately 115 l/s for the 1 in 30 year storm return period (see existing contributing area plan, Appendix A) and 145 l/s for the 1 in 100 year storm return period.

The Howe Barracks developed site, inclusive of all three phases covers an area of 13.8 hectares with the additional land given over to park land and conservation areas; and currently has an estimated Greenfield run-off rate of 27.3 l/s.

The equivalent area based on Canterbury City Council's Brownfield run off rate, at a maximum of 4 l/s/ha, will produce a peak controlled discharge rate site wide of approximately 55 l/s which will be a betterment over the existing surface water sewer discharge. All existing and new surface water connections are subject to the agreement of Southern Water including a Section 104 approval and Section 106 approval. Phase 1 has been approved by Southern Water.

Proposals are for Phase 1 to discharge at a controlled 15 l/s and for the remaining Phase 2 and Phase 3 developments to discharge at a controlled combined rate of 40 l/s and that the surface water sewers connections will be adopted under a formal Section 106 agreement with Southern Water.

4 GEOLOGY & HYDROGEOLOGY

Following on from recent ground investigations, the prevailing ground conditions consist of a gravelly clay head deposits overlying fine sand with localised deposits of made ground.

Infiltration across the development has been found to be variable with results indicating that within the gravelly head deposits infiltration rates are medium to low but within the fine sand these are low to very low intrusive.
Infiltration site specific tests results carried out on the 3rd April 2019 have revealed soakage rates carried out in the top 1.2m in material described as gravely head deposits and results suggest shallow soakaways such as permeable paving are suitable SuDS option for Phase

2 where the permeable paving is sited out of deep made ground. The soakage test results are shown in Table 4.0 shown below.

Table 4.0 Soakage Tests Results (3rd April 2019)

Test No.	Results (m/hr)
STN1	0.0133
STN2	0.0115
STN3	0.1127
STN4	0.2754
STN5	0.4104
STN6	0.4104
STN7	0.4104
STN8	0.0414
STN9	0.4320

The locations and soakage tests results are shown in Appendix B Proposed Surface Water Plan showing Suds Strategy together with locations of the demolished building.

The site is set upon a minor aquifer and is located outside of an Environment Agency area defined Groundwater Source Protection Zone.

5 PROPOSED PHASE 2 DEVELOPMENT

The Phase 2 development consists of 200 dwellings with associated access roads and hardstanding areas.

The Phase 2 development is located in a brownfield site and where the existing buildings pre-demolition were located and have now been backfilled with type 1 material which is most probably unsuitable for infiltration. In these locations it is proposed to discharge surface water runoff generated by roof and impermeable private areas into the new surface water sewer located in the carriageway and or to a flood basin to the east of the development. Plan 5.0 shown below shows a summary and contained in Appendix B the proposed surface water plan showing SuDS strategy.

The new surface water sewers will be offered for adoption under a formal Section 104 agreement with Southern water and will discharge to an existing public surface water sewer in Littlebourne Road at a controlled rate of no greater than 40 l/s for all storms up to and including the 1 in 100 year storm with a 40% allowance for climate change.

Where driveways and parking courts are located in unaffected areas, it is proposed to discharge surface water runoff generated by roof and private areas to ground via a series of shallow soakaways into the gravely head deposits in a similar design to the Phase 1 development. The design and type of permeable pavement / soakaway will be based on the soakage test results in the whole of the site and are shown in Appendix B.

The summary of the three specific types of surface water discharge as discussed above are summerised in Table 5.0 below.

Table 5.0 Summary of Phase 2 Drainage

Type of Drainage	No.	Private Area m2	Road Area m2	Total Area m2	Permeable Area m2
Private Permeable Paving	135	13,090	2,331	15,810	7,140
Direct to surface water sewer outfall Littlebourne Rd	31	3,041	0	3,041	0
Direct to Basin	34	2,634	0	2,634	**
Total	200	18,765	2331	21,485	7,140

** Basin to be designed to take surface from Phase 2, Phase 3 and mix of sports pitches / NEAP located between Phase 1 and Phase 2

The main spine road bisecting the Phase 2 development site is proposed to be offered for adoption by Kent County Council Highways under Section 38 / Section 278 and the resulting surface water run-off will be discharged into the surface water sewers via deep trapped gullies. All on site carriageways will be similarly offered for adoption with Kent Highways County Council and surface water will be directed into the surface water sewers.

Legacy Park is an area of approximately 5.7 hectares made up of open woodland / grassland and is located to the west of Phase 2, south of Chaucer road and north of Querns Road. There are no plans to develop in this area and it can be confirmed no surface water drainage from any of the three residential development phases will discharge to Legacy Park.

6 PUBLIC SURFACE WATER SEWERS

Highway drainage and a proportion of the residential drainage is proposed to discharge into the Public Surface Water Sewer located within the adoptable highway and to then discharge into the existing Public Surface Water Sewer in Littlebourne Road. The discharge from Phase 2 will be limited by hydro brake to a maximum of 40 l/s for all storm events.

Windes calculations (see appendix B) indicate that there will be no detrimental flooding from the surface water sewers for the 1 in 100 year event plus 40% climate change. Calculations are based on FEH data for this area.

The surface water and foul drainage emanating from the Phase 2 development has been offered for adoption under the Section 104 agreement with Southern water.

7 CLIMATE CHANGE

Surface water run-off has be calculated from the 1 in 100 year (Q100) return period, 1 in 100 year (Q100) return period +20% allowance for climate change and 100 year (Q100) return period +40% allowance for climate change. Any flooding for the 1 in 100 year return period with +40% allowance for climate change has been be reviewed for potential flooding issues.

A 10% allowance for urban sprawl should also be factored into the calculations. The results of the worst case areas are included in the Drainage Surface Water private critical storm results. Please note no flooding was encountered for all storms up to Q100.

8 POTENTIAL ADVERSE IMPACTS ON GROUNDWATER

Water Quality

The proposed land use for this site is residential thus there will be no pollution generated beyond the usual highway runoff. This is likely to contain the following pollutants which will have varying effects on the receiving groundwater:

- sediments
- metals (zinc, copper, cadmium)
- hydrocarbons (oil and fuel) including polycyclic aromatic hydrocarbons (PAH)
- pesticides and herbicides (from landscaping maintenance)
- chlorides (from de-icing).

The level of pollution associated with any runoff event depends on a number of factors including the type of site, the length of time since the last rainfall event (runoff that occurs after long dry periods will tend to be more polluted), and the duration and intensity of the rainfall itself.

Surface water runoff has higher concentrations of pollutants at the start of a storm, known as the “first flush”, due to higher initial rainfall intensities, greater erosion potential and greater availability of solids and pollutants that have built up on urban surfaces during the preceding dry weather period. Consequently it is most important that the surface water from these storms is dealt with effectively.

9 MITIGATION STRATEGY

Water Quality

The SuDS Manual (CIRIA C697) recommends that the best solution for dealing with surface water runoff from a development is to mimic the natural catchment processes as closely as possible which is done by creating a “management train” of treatment processes. This concept is fundamental to designing a successful SuDS scheme – it uses drainage techniques in series to incrementally reduce pollution, flow rates and volumes.

Wherever possible, storm water should be managed as close to its source as possible rather than being conveyed to large systems at the bottom of drainage areas (end of pipe solutions). The techniques that are higher in the hierarchy are preferred to those further down so that prevention and control of water at source should always be considered before site or regional controls. However, where upstream control opportunities are restricted, a number of lower hierarchy options should be used in series. Water should be conveyed elsewhere only if it cannot be dealt with on site.

The SuDS Manual goes on to recommend the appropriate number of treatment processes for each area depending upon the end land use and the sensitivity of the receiving waters, ranging from low to high. Table 9.0 Treatment Train, summarised below, indicates that for a receiving environment such as this the following numbers of treatment processes will be required.

Table 9.0 Treatment Train

Receiving Water Sensitivity		MEDIUM
Runoff catchment		
Roofs Only		1
Residential Roads, Parking Areas,		2

The current surface water drainage scheme for the development comprises two stages for the adoptable highways and residential parking and one stages for the roof area as listed below in Table 9.1.

Table 9.1 Treatment Stages

Treatment Stage	Adoptable Roads	Residential Area Roads	Roofs
1	Trapped Gully	Trapped Gully	Permeable Paving
2	Catchpits	Permeable Paving	

The typical pollutants to be expected on this site as discussed earlier are likely to be the following:

- sediments
- metals (zinc, copper, cadmium)
- hydrocarbons (oil and fuel) including polycyclic aromatic hydrocarbons (PAH)
- pesticides and herbicides (from landscaping maintenance)
- chlorides (from de-icing).

These need differing methods to remove the pollutants from the surface water.

Improvements to surface water quality can be achieved by filtering the runoff using, for example, sand filters, gravels (e.g. permeable pavements, filter trenches), soils (e.g. bio retention), grasses and other surface vegetation (e.g. swales, detention basins) or aquatic vegetation (e.g. wetlands). The travel time or flow velocity through the system is specified to maximise treatment benefits.

Storing runoff volumes within detention basins contributes mainly to meeting the runoff rate criteria, but such systems also allow sedimentation to take place which contributes to water quality improvement.

Maintenance Requirements

It is essential that a regular maintenance programme is established and carried out to ensure the optimum performance of the SuDS elements. This will establish who owns each facility and who is responsible for its maintenance. It will also detail the required actions and the frequency with which they should be undertaken as shown in Table 9.2.

Table 9.2 Maintenance Responsibility

Device	Location	Responsibility
Permeable Surfaces	Located within the curtilage of owner occupied properties	Freeholder of the property
	Located within shared areas	Management company on behalf of the site owner.
Sediment sumps & hydrodynamic vortex separator	Located within public highway	Kent Highways and or Southern water

Permeable Pavements

Permeable pavements provide hardstanding areas and roads suitable for vehicular traffic whilst allowing rainwater to infiltrate through the surface and into the underlying layers. The water is temporarily stored in a specially designed sub-base before discharge to a soakaway system. At this site they will be surfaced using concrete blocks designed for permeable systems.

Before handing over these pavements to the site owner they 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.

Permeable surfaces need to be regularly cleaned of silt and other sediments so that their infiltration capacity is retained. CIRIA advise a minimum of three surface sweepings per year, as noted below, using a brush and suction cleaner, which can be a lorry-mounted device or a smaller precinct sweeper.

To prevent the loss of permeable areas form re-development or re-use, a covenant needs to be included in the sale to protect the integrity of the soakaways.

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 and any lost material should be replaced refer to Table 9.3

Please note the basin has not been included in this section as the final design and size of the basin will form part of the Phase 3 and the sports pitches, MUGA and NEAP package to follow.

Table 9.3 Maintenance Schedule

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

Catchpits and Hydrodynamic Vortex Separators

Catchpits should be inspected on an annual basis by lifting the cover of the inspection points to observe the condition of the base and the inlet points.

As with the soakaway chambers regular sweeping of all contributing hard surfaces will reduce the sediment load within the surface water discharge.

The Table 9.4 below summarises the recommended maintenance regime for catchpits on the site:-

Table 9.4 Maintenance Schedule

Maintenance Schedule	Required action	Frequency
Regular maintenance	Debris removal from catchment surface (where may cause risks to performance)	Monthly
	Remove sediment	Annually, or as required
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

10 FOUL WATER

Foul water is currently proposed to discharge via a public foul water sewer into Chaucer Road. A Section 106 agreement with Southern Water for this connection has been approved.

11 CONCLUSION

1) The surface water from the site is currently being discharged into the public surface water sewer located in Littlebourne Road at an estimated peak rate of 115 l/s based on a 1 in 30 year return period and via deep soakaways located elsewhere on site.

2) The existing deep soakaways are founded in the fine sands and although provide sufficient volumes for the current site may not meet the half drain time required for current standards.

3) Where existing development were to be located the surface water is to discharge into a Public surface water sewer.

4) Infiltration tests carried out across the site suggest that infiltration within the shallow gravely clayey head deposits should provide sufficient infiltration for the residential units and private drives

5) Surface water sewers are to be offered for adoption with Southern Water under a Section 104 agreement. Highway drainage is proposed to discharge into the onsite surface water sewers and into the existing surface water sewer in Littlebourne Road at a controlled rate of not more than 15 l/s and 40 l/s for the remaining phases. Attenuation and flow controls will limit peak surface water across the development to a maximum 55 l/s based on Canterbury City Council's Brownfield run off rate. The existing highway drainage from Chaucer Road which is to be modified to account for the realignment of the carriageway is to be updated to accommodate the 1 in 100 year storm plus climate change.

6) In agreement with Southern Water, and as a site wide drainage strategy it is proposed to discharge a total of 418 units into the existing public foul water from the development into Chaucer Road and to discharge 83 units from Phase 1 into Littlebourne Road. Having undertaken a Section 98 agreement with Southern Water for these works it has been concluded that no upgrade works are required.

7) The drainage design has been modelled for all storms including Q100, Q100 20% CC and Q100 40% CC. The results showed no flooding for Q100 and limited flooding for Q100 20% CC and Q100 40% CC, the limited flooding from these storms will discharge either into the highway and or into the basin. There is no detrimental risk of properties building being flooded for any of the storms modelled

APPENDIX A

Existing Site Plan
Existing Utility Plan
Existing Contributing Areas
ICP SuDS mean annual flood
Sewer Records
Proposed master Plan

LEGEND

SHEET LAYOUT

OMEGA GEOMATICS

Landlord Measured Building Surveyors

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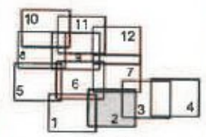
CANTERBURY, KENT, CT1

TITLE
TOPOGRAPHICAL SURVEY

JOB Ref.	13-0255	DATE	DEC 2013
SCALE	1:250 @ A0	DWG. No.	1 OF 12
SHEET SIZE	A0	DRAWING FILE	

LEGEND

SHEET LAYOUT



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OMEGA
GEOMATICS

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CANTERBURY, KENT, CT1

TITLE TOPOGRAPHICAL SURVEY

JOB Ref. 13-0255	DATE DEC 2013
SCALE 1:250 @ A0	DWG. No. 2 OF 12
SHEET SIZE A0	

LEGEND

SHEET LAYOUT

N

ΩMEGA
GEOMATICS

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TITLE
TOPOGRAPHICAL SURVEY

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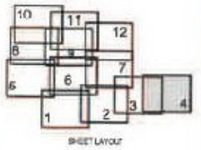

SHEET LAYOUT

N

OMEGA GEOMATICS

Land and Measured Building Surveyors

CLIENT
PETER BRETT ASSOCIATES

PROJECT
HOWE BARRACKS
CANTERBURY, KENT, CT1

TITLE
TOPOGRAPHICAL SURVEY

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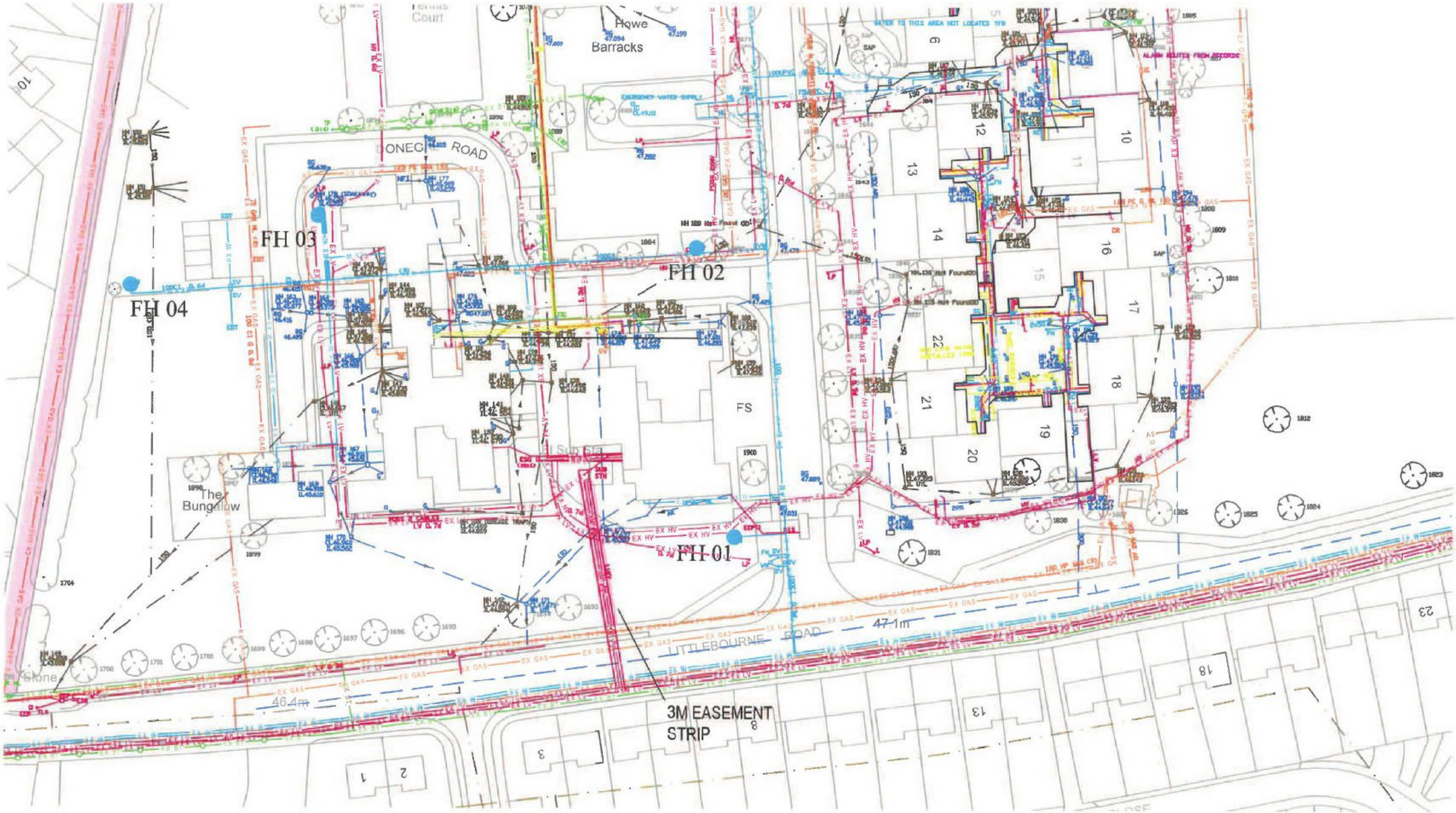
Howe Barracks
FH 03
FH 04
FH 02
FH 01
FS
The Bungalow
LITTLEBOURNE ROAD
47.1m
46.4m
3M EASEMENT STRIP

EXISTING AREA = 8302m²

DISCHARGE RATE BASED ON
50MM PER HOUR = 115L/s

KEY OF SYMBOLS

RISK OF COLLAPSE

OBTAIN CONSERVATION ACCESS TO ELEMENTS AT HIGH LEVEL

RISK OF FALLING

LIFTING HAZARD

CAUTION STEEP ROOF PITCH - ACCESS BY SUITABLY QUALIFIED PERSON/EQUIPMENT ONLY

Use figured dimensions only. Do not scale from drawing.
All levels and dimensions are to be checked on site.
This drawing is to be read in conjunction with all relevant documents

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NOTES.

1) GENERAL

A) ....
B) ....

CONSTRUCTION (DESIGN AND MANAGEMENT) REGULATIONS 2007

DESIGNERS HAZARD INFORMATION FOR CONSTRUCTION

1. SERVICES TO BE LOCATED
2. MANUAL LIFTING
3. HOT MATERIAL WORKING
4. CUTTING/DUST
5. CONCRETE, HANDLING, LIFTING, PLACEMENT
6. DEEP EXCAVATIONS, COLLAPSE/FALLING
7. SERVICE VOIDS/RISERS, FALLING

PRELIMINARY

Rev.	Date	Revision	By	Chk
-	16.12.16	PRELIMINARY	AJB	CET

Client

Project
HOWE BARRACKS
CANTERBURY

Title
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SCALE	1/500	DRAWN	AJB
DATE	DEC 16	CHECK	CET

A1

34109/C/SK 11/ -

Knapp Hicks & Partners Ltd		Page 1
Kingston House Long Barrow Road Orbital Park Ashford		Micro Drainage
Date 07/12/2016 14:21 File	Designed by andrewb Checked by	
Causeway	Source Control 2015.1	

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	19.000	Urban	0.000
SAAR (mm)	700	Region Number	Region 7

Results	l/s
QBAR Rural	83.5
QBAR Urban	83.5
Q100 years	266.3
Q1 year	70.9
Q30 years	189.2
Q100 years	266.3

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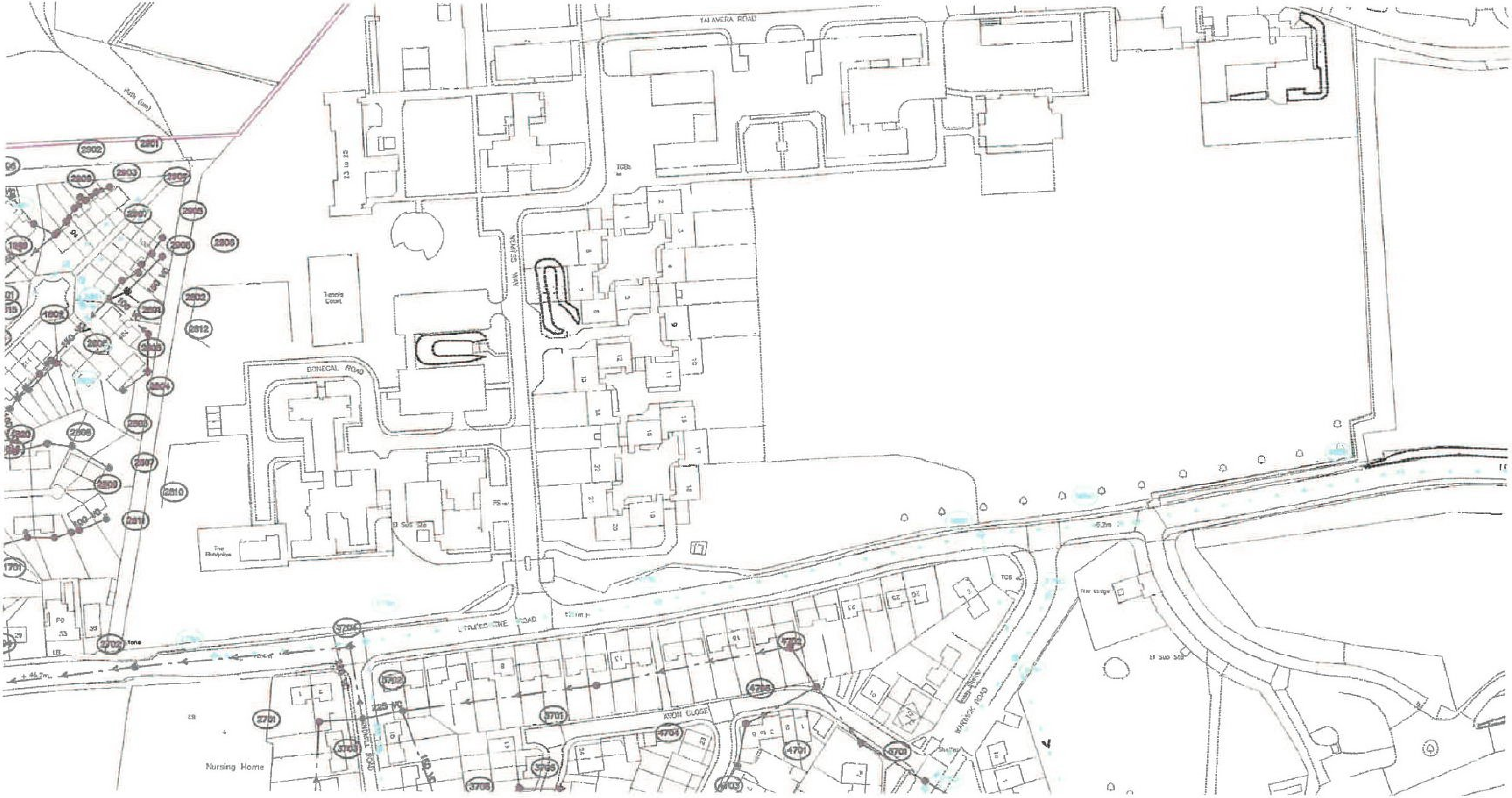


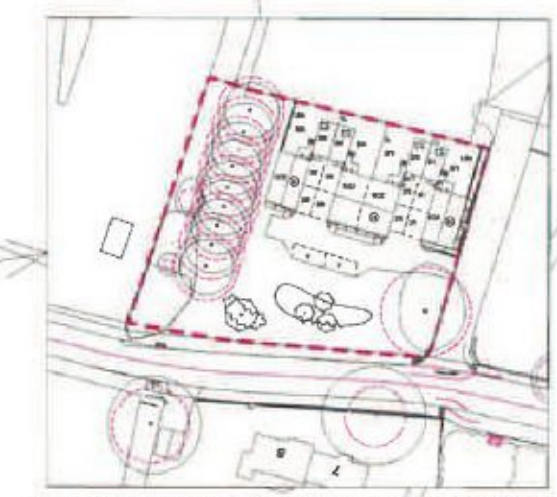
23 to 25
Tennis Court
WEMYSS WAY
DONEGAL ROAD
The Bungalow
El Sub Sta
Nursing Home
AVON CLOSE
WARWICK ROAD


Balaclava House
Alma House
PILGRIM CLOSE
SOMME CRESCENT
TUNIS COURT
ST JAGO AVENUE
CRIMEAN COURT
ALBUHERA SQUARE
ASSAYE DRIVE
DOURO CLOSE
BUSACO AVENUE
SEVASTOPOL PLACE
BARGOTO PLACE
VIMIERA COURT
TALAVERA ROAD
LITTLEBOURNE ROAD
STUDLEIGH ROAD
CIVIC CRESCENT
The Lodge
A2

APPENDIX B

Proposed Phase 2 Development
Construction Area Plan
Proposed Foul & Surface Water Layouts
Proposed Surface Water Plan showing Suds Strategy
SuDS Property Drainage Summary
Soakaway Tests 3rd April 2019
Drainage Surface Water Private Critical Storm Results
Proposed Surface Water Master Strategy

CDM 2015 Health & Safety Information



FULL BOUNDARY EXTENT OF PLOTS 368 TO 371

SEE LANDSCAPE PLAN FOR MORE DETAIL

Accommodation Schedule

Open Market Provision - 147 Dwellings

2 no. NB51	5-Bedroom House (8 Person)
2 no. NT42P	4-Bedroom House (6 Person)
1 no. NT42	4-Bedroom House (6 Person)
7 no. NT41	4-Bedroom House (5 Person)
1 no. NT40	4-Bedroom House (5 Person)
9 no. NA42P	4-Bedroom House (5 Person)
18 no. NA42	4-Bedroom House (5 Person)
6 no. NC30	3-Bedroom Town House (6 Person)
18 no. NB31	3-Bedroom Town House (5 Person)
8 no. NT32	3-Bedroom House (4 Person)
20 no. NA32	3-Bedroom House (4 Person)
4 no. NA21	2-Bedroom House (4 Person)
8 no. 2BCH	2-Bedroom Coach House (4 Person)
45 no. BLOCK B	2-Bedroom Flat (4 Person)

*Affordable Provision - 53 Dwellings

6 no. NA40A	4-Bedroom House (5 Person)
4 no. NC30A	3-Bedroom Town House (6 Person)
6 no. NB31A	3-Bedroom Town House (5 Person)
2 no. 2BW	2-Bedroom Wheelchair Unit (3 Person)
12 no. NA30A	3-Bedroom House (4 Person)
5 no. 2BCHA	2-Bedroom Coach House (4 Person)
3 no. NA20A	2-Bedroom House (3 Person)
2 no. BLOCK C	2-Bedroom Flat (3 Person) GF Wheelchair
4 no. BLOCK C	2-Bedroom Flat (4 Person)
3 no. BLOCK D	2-Bedroom Flat (3 Person) GF Wheelchair
6 no. BLOCK D	2-Bedroom Flat (4 Person)

KEY

Taylor Wimpey

HOWE BARRACKS, PHASE 2
CANTERBURY, KENT

DETAILED SITE LAYOUT

1:500 @ A0

Owner	Checked by	Date
cooperbaillie	CAD	26.10.18
Job No	Drawing No	Rev
06246-21135	SL01	-

Status
TENDER ISSUE

SITE BOUNDARY

PERMEABLE PAVING (CAR PARKING AREAS)

80mm concrete block paving (Brindle Colour), to architect specification, to SHW Clause 1101

50mm washed sand (well compacted, to SHW Clause 1102)

60mm AC32 dense base 100/150 to BS EN 13108-1 to be cored every metre to allow for infiltration

450mm 4/40 sub-base in accordance with Table D.5

Permeable membrane, Terram 1000 or similar

PERMEABLE PAVING (PRIVATE DRIVES)

80mm concrete block paving (Brindle Colour), to architect specification, to SHW Clause 1101

50mm washed sand (well compacted, to SHW Clause 1102

500mm 4/40 sub-base in accordance with Table D.5

Permeable membrane, Terram 1000 or similar

BLOCK PAVING (PRIVATE DRIVES) Non Permeable

80mm concrete block paving (Brindle Colour), to architect specification, to SHW Clause 1101

50mm washed sand (well compacted, to SHW Clause 1102

320mm Category A Type 1 sub-base

FLEXIBLE PRIVATE DRIVE (Permeable sub-base)

30mm AC10 close graded surf 100/150; over

60mm AC20 dense bin 40/60; over

500mm 4/40 sub-base in accordance with Table D.5

Permeable membrane, Terram 100 or similar

FLEXIBLE PRIVATE DRIVES - standard construction

30mm AC10 close graded surf 100/150; over

60mm AC20 dense bin 40/60; over

370mm Category A Type 1 sub-base

MACADAM FOOTWAY

20mm of AC6 dense surf 100/150 to BS EN 13108-1

60mm AC20 dense bin 100/150 to BS EN 13108-1

160mm Category A Type 1 sub-base

PRIVATE PATHS AND PATIOS

600 x 900 x 35mm PCC slabs, laid close jointed with fine sand.

50mm thk sharp sand as laying course.

150mm compacted clean hardcore free from roots, weeds or any other organic material

SHED BASES

100mm concrete, smooth finish laid 50mm above garden level

75mm compacted clean hardcore (free from roots, weeds and other organic material

REV	DATE	DRAWN	DESCRIPTION	CHECK	APPR.
-	19.10.18	CJH	INITIAL ISSUE	AJB	

PROJECT: HOWE BARRACKS PHASE 2

TITLE: PRIVATE CONSTRUCTION AREAS SHEET 1 OF 6 (KNAPP HICKS AND PARTNERS REF: 34109)

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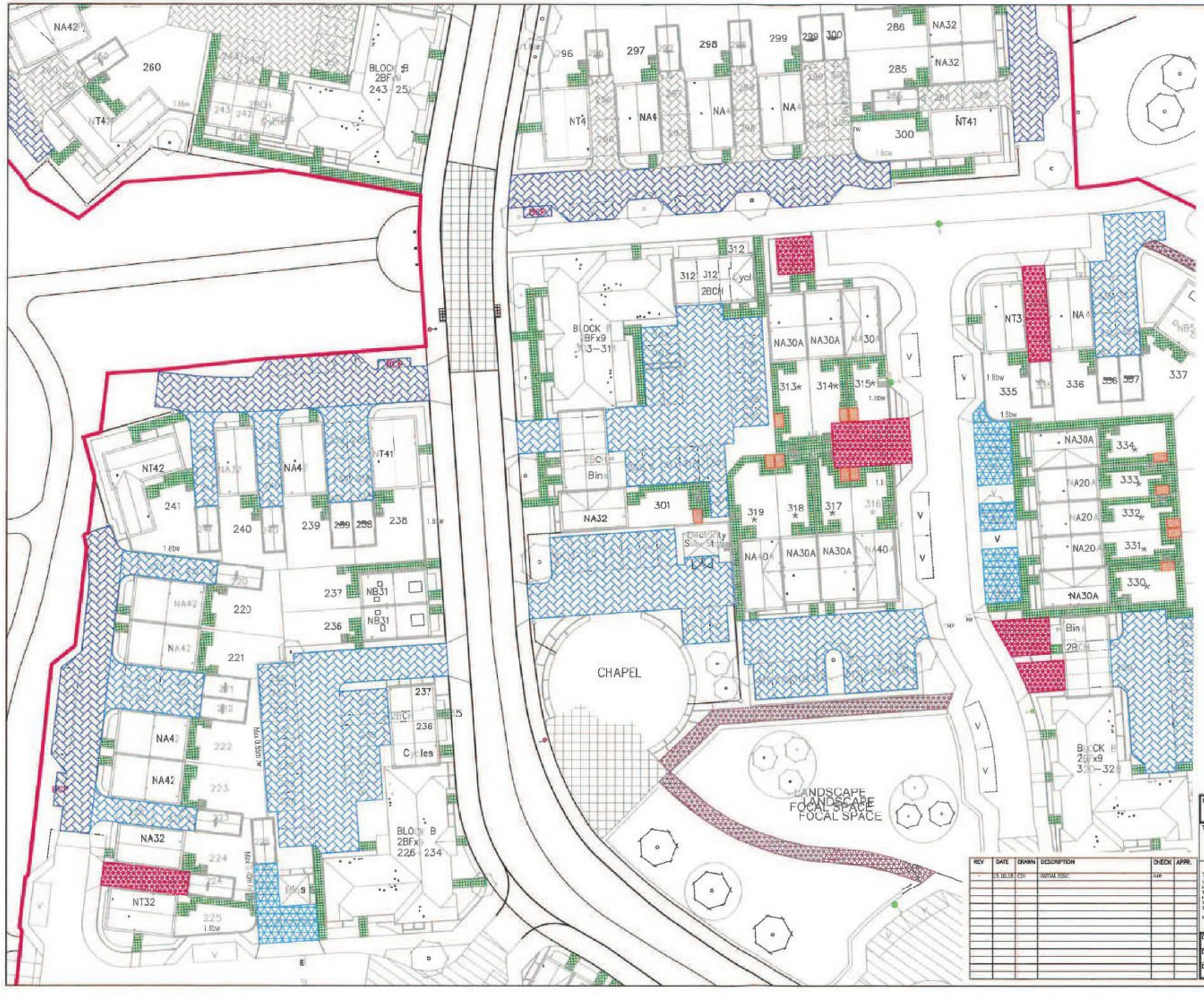
Taylor Wimpey

CHECKED BY		DATE	APPROVED BY	DATE
DRN BY CJH	SCALE 1:250	DRAWING NUMBER 21135-CIV-1406		REV -
DATE OCT 18				

ORIGINAL SHEET SIZE - A1 Landscape

DO NOT SCALE



PERMEABLE PAVING (CAR PARKING AREAS)

80mm concrete block paving (Brindle Colour), to architect specification, to SHW Clause 1101

50mm washed sand (well compacted, to SHW Clause 1102)

90mm AC32 dense base 100/150 to BS EN 13108-1 to be cored every metre to allow for infiltration

450mm 4/40 sub-base in accordance with Table D.5

Permeable membrane, Terram 1000 or similar

PERMEABLE PAVING (PRIVATE DRIVES)

80mm concrete block paving (Brindle Colour), to architect specification, to SHW Clause 1101

50mm washed sand (well compacted, to SHW Clause 1102

500mm 4/40 sub-base in accordance with Table D.5

Permeable membrane, Terram 1000 or similar

BLOCK PAVING (PRIVATE DRIVES) Non Permeable

80mm concrete block paving (Brindle Colour), to architect specification, to SHW Clause 1101

50mm washed sand (well compacted, to SHW Clause 1102

320mm Category A Type 1 sub-base

FLEXIBLE PRIVATE DRIVE (Permeable sub-base)

30mm AC10 close graded surf 100/150; over

60mm AC20 dense bin 40/60; over

500mm 4/40 sub-base in accordance with Table D.5

Permeable membrane, Terram 100 or similar

FLEXIBLE PRIVATE DRIVES - standard construction

50mm AC10 close graded surf 100/150; over

50mm AC20 dense bin 40/60; over

370mm Category A Type 1 sub-base

MACADAM FOOTWAY

20mm of AC6 dense surf 100/150 to BS EN 13108-1

60mm AC20 dense bin 100/150 to BS EN 13108-1

100mm Category A Type 1 sub-base

PRIVATE PATHS AND PATIOS

600 x 600 x 38mm PCC slabs, laid close jointed with fine sand.

50mm thk sharp sand as laying course.

150mm compacted clean hardcore free from roots, weeds or any other organic material

SHED BASES

100mm concrete, smooth finish laid 50mm above garden level

75mm compacted clean hardcore (free from roots, weeds and other organic material

REV	DATE	DRAWN	DESCRIPTION	CHECK	APPR.
-	23.10.18	CJH	INITIAL ISSUE	CJH	

PROJECT: HOWE BARRACKS PHASE 2

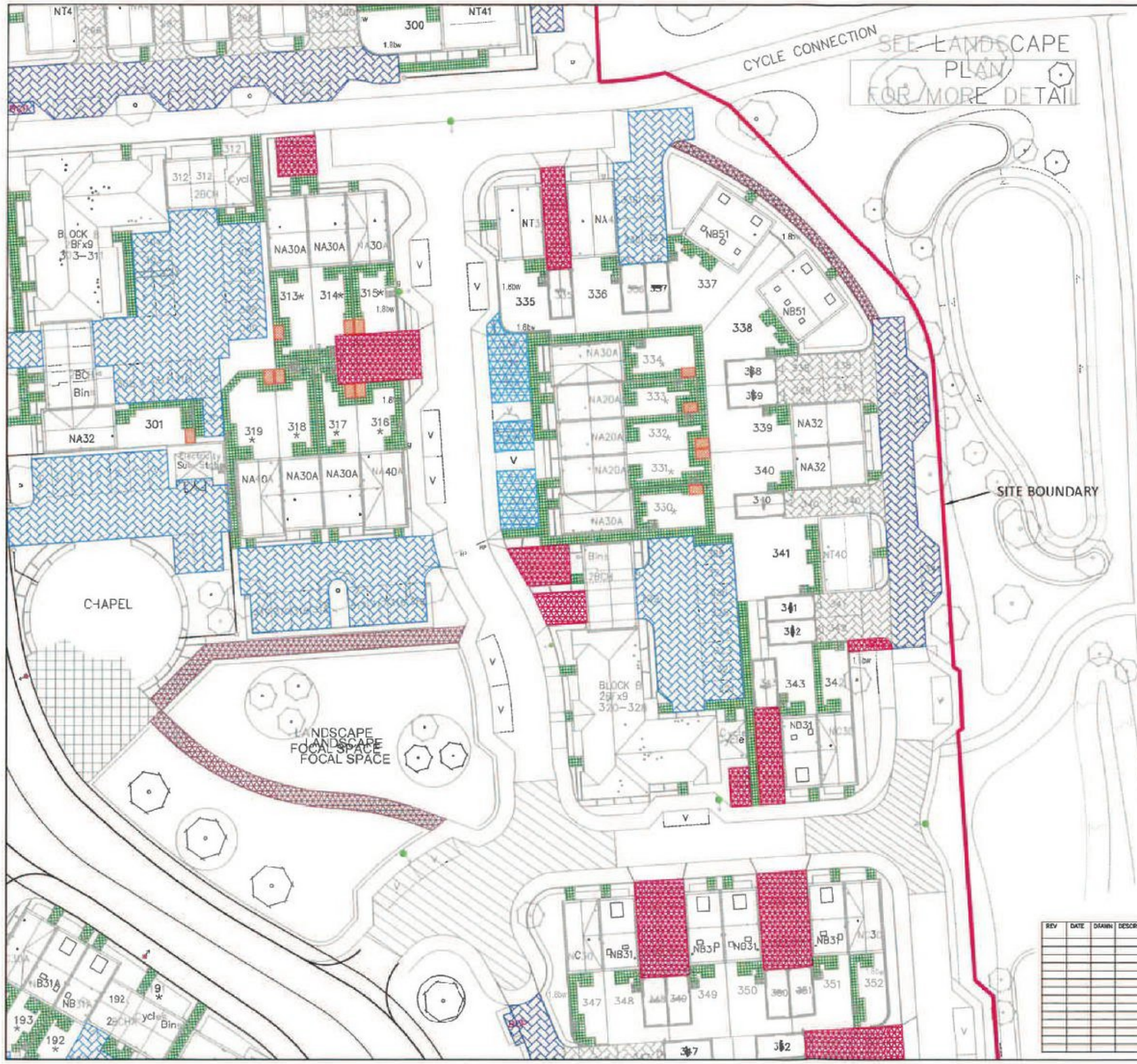
TITLE: PRIVATE CONSTRUCTION AREAS SHEET 2 OF 6 (KNAPP HICKS AND PARTNERS REF: 04139)

Taylor Wimpey South East

Taylor Wimpey

CHECKED BY		DATE	APPROVED BY	DATE
DWN BY CJH	SCALE 1:250	DRAWING NUMBER 21135–CIV–1407		REV –
DATE OCT 18				

DO NOT SCALE ORIGINAL SHEET SIZE - A1 Landscape



PERMEABLE PAVING (CAR PARKING AREAS)

80mm concrete block paving (Brindle Colour), to architect specification, to SHW Clause 1101

50mm washed sand (well compacted, to SHW Clause 1102)

90mm AC32 dense base 100/150 to BS EN 13108-1 to be cored every metre to allow for infiltration

450mm 4/40 sub-base in accordance with Table D.6
Permeable membrane, Terram 1000 or similar

PERMEABLE PAVING (PRIVATE DRIVES)

80mm concrete block paving (Brindle Colour), to architect specification, to SHW Clause 1101

50mm washed sand (well compacted, to SHW Clause 1102

160mm 4/40 sub-base in accordance with Table D.6

Permeable membrane, Terram 1000 or similar

BLOCK PAVING (PRIVATE DRIVES) Non Permeable

80mm concrete block paving (Brindle Colour), to architect specification, to SHW Clause 1101

50mm washed sand (well compacted, to SHW Clause 1102

320mm Category A Type 1 sub-base

FLEXIBLE PRIVATE DRIVE (Permeable sub-base)

30mm AC10 close graded surf 100/150; over

80mm AC20 dense bin 40/60; over

700mm 4/40 sub-base in accordance with Table D.6

Permeable membrane, Terram 100 or similar

FLEXIBLE PRIVATE DRIVES - standard construction

30mm AC10 close graded surf 100/150; over

80mm AC20 dense bin 40/60; over

270mm Category A Type 1 sub-base

MACADAM FOOTWAY

30mm of AC6 dense surf 100/150 to BS EN 13108-1

80mm AC20 dense bin 100/150 to BS EN 13108-1

200mm Category A Type 1 sub-base

PRIVATE PATHS AND PATIOS

600 x 600 x 38mm PCC slabs, laid close jointed with fine sand.

50mm thk sharp sand as laying course.

150mm compacted clean hardcore free from roots, weeds or any other organic material

SHED BASES

100mm concrete, smooth finish laid 50mm above garden level

75mm compacted clean hardcore (free from roots, weeds and other organic material

REV	DATE	DRAWN	DESCRIPTION	CHECK	APPR.

PROJECT: HOWE BARRACKS PHASE 2

TITLE: PRIVATE CONSTRUCTION AREAS SHEET 3 OF 6 (KNAPP HICKS AND PARTNERS REF: 04100)

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CHECKED BY		DATE	APPROVED BY	DATE
DRN BY CJH	SCALE 1:250	DRAWING NUMBER 21135–CIV–1408		REV –
DATE OCT 18				

DO NOT SCALE ORIGINAL SHEET SIZE - A1 Landscape

Howe Barracks, Canterbury, Phase 2
SuDS Property Drainage Discharge Summary

Area	Unit Numbers	No. of props	Private Area m2	Road Area m2	Total Area m2	Perme-able Area m2	Type of Drainage	Ratio	Depth of sub base m	Infiltration Rate m/hr	Nett Volume (m3)	Q100 00%	Q100 20%	Q100 40%	Results Summary	Additional Drainage Comment
274A	274,275	2	272	0	272	72	Private Permeable Paving	0.265	0.4	0.04140	8.64	okay	1.2m3	4.3m3	Flood water will discharge into highway 46.280	
276A	276,277,278	3	242	0	242	72	Private Permeable Paving	0.298	0.4	0.04140	8.64	okay	1.2m3	4.2m3	flood water will discharge into highway 46.680	
280A	279,280,281,282,283,284	6	558	0	558	195	Private Permeable Paving	0.349	0.4	0.04140	23.4	okay	okay	ok	private car park has capacity for exceedance	
270A	270,271,272,273	4	525	273	798	477	Private Permeable Paving	0.909	0.4	0.43200	57.24	okay	ok	ok	private road has capacity for exceedance	
262A	273,261,262	2	268	68	336	121	Private Permeable Paving	0.451	0.4	0.43200	14.52	okay	ok	ok	private road has capacity for exceedance	
	266,267,268,269									0.43200	14.4				Q100 40cc - Garden flooding @ 200m2 area = less than	
269A		3	284	0	284	0	Private Soakaway	0.000				okay	ok	1.8m3	20mm depth of water standing for less than 30 mins	Q100 40% 89 mins half drain down time
258A	256,257,258,259	5	289	261	550	346	Private Permeable Paving	1.197	0.4	0.43200	41.52	okay	ok	ok	private road has capacity for exceedance	
239A	238,239,240,241	4	408	217	625	386	Private Permeable Paving	0.946	0.4	0.11268	46.32	okay	okay	ok	private car park has capacity for exceedance	
222A	220,221,222,223	4	501	245	746	419	Private Permeable Paving	0.836	0.4	0.11268	50.28	okay	okay	ok	private car park has capacity for exceedance	
225A	225 + BINS	1	98	0	98	60	Private Permeable Paving	0.612	0.4	0.11268	7.2	okay	ok	ok	private road has capacity for exceedance	
235A	226-234,235,236,237	12	914	0	914	452	Private Permeable Paving		0.4	0.11268		okay	ok	ok	private road has capacity for exceedance	
213A	213,214	2	158	0	158	48	Private Permeable Paving	0.304	0.4	0.01150	5.76	0.5m3	2.1m3	4.8m3	flood water will discharge into road	Q100 40% 24 hours half drain down time
215A	215	1	149	0	149	48	Private Permeable Paving	0.322	0.4	0.01150	5.76	Trace	2.3m3	4.6m3	flood water will discharge into road	Q100 40% 24 hours half drain down time
217A	215,216'217'218'219	4	477	176	653	360	Private Permeable Paving	0.755	0.4	0.01332	43.2	okay	okay	okay	private road has capacity for exceedance	
202A	200,201,202,203,204,205									0.01332	46.32				Flood equates to nominal depth water standing for less	
		5	678	212	890	386	Private Permeable Paving	0.569	0.4			okay	ok	**0.8m3**	than 30 mins	Q100 40% 12 hours half drain down time.
	211,212									0.01332	7.2				Properties are on high point water will discharge to	
211A		2	153	0	153	60	Private Permeable Paving	0.392	0.4			Okay	ok	2m3	highway	Q100 40% 14 hours half drain down time
212A	212	1	89	0	89	41	Private Permeable Paving	0.461	0.4	0.01332	4.92	okay	ok	ok	private areas have capacity for exceedance	
	198,199,172-180,182,183,184									0.01332	72.96				Flood equates to 8mm depth water standing for less	
172A		13	1196	0	1196	608	Private Permeable Paving	0.508	0.4			okay	okay	2.2m3	than 30 mins	Q100 40% 11 hours half drain down time
	183,184,185-190, 191,192,193,194,195,196,197									0.01332	49.8				Flood equates to 20mm depth water standing for less	
184A		15	1091	0	1480	415	Private Permeable Paving	0.380	0.4			okay	0.0m3	4.3m3	than 60 mins.	
339A	338,339,340,341	4	440	389	829	498	Private Permeable Paving	0.601	0.4	0.41040	59.76	okay	ok	ok	private areas have capacity for exceedance	
337A	336,337,338	2	372	0	372	129	Private Permeable Paving	0.347	0.4	0.41040	15.48	okay	ok	ok	private areas have capacity for exceedance	
330A	330,331,332,333	4	221	123	344	123	Private Permeable Paving	0.557	0.4	0.41040	14.76	okay	ok	ok	private areas have capacity for exceedance	
345A	344,345,346	3	400	182	582	182	Private Permeable Paving	0.455	0.4	0.41040	21.84	okay	ok	ok	private areas have capacity for exceedance	
316A	316,317,318,319	2	516	0	516	290	Private Permeable Paving	0.562	0.4	0.41040	34.8	okay	ok	ok	private areas have capacity for exceedance	
316A	316,317,318,319	2	247	0	247	247	Private Permeable Paving		0.4	0.41040	29.64	okay	ok	ok	private areas have capacity for exceedance	
301A	314,315,313,312,303-311,301,302	15	1105	0	1105	402	Private Permeable Paving	0.364	0.4	0.41040	48.24	okay	ok	ok	private areas have capacity for exceedance	
291A	291,292,293,294,295,296,297,298,299	9	873	0	873	306	Private Permeable Paving	0.351	0.4	0.41040	36.72	okay	ok	ok	private areas have capacity for exceedance	
290A	290	1	138	0	138	80	Private Permeable Paving	0.580	0.4	0.41040	9.6	okay	ok	ok	private areas have capacity for exceedance	
285A	285,286,287,300	4	428	185	613	317	Private Permeable Paving	0.741	0.4	0.41040	38.04	okay	ok	ok	private areas have capacity for exceedance	
	Totals	135	13090	2331	15810	7140										

Area	Unit Numbers	No. of props	Private Area m2	Road Area m2	Total Area m2	Perme-able Area m2	Type of Drainage	Ratio	Depth of sub base m	Infiltration Rate m/hr	Nett Volume (m3)	Q100 00%	Q100 20%	Q100 40%	Results Summary	Additional Drainage Comment
263A	263,264	2	218	0	218	0	Direct to surface water sewer	0.000	n/a	n/a	n/a	okay	okay	okay	free drain to positive at 3l/s	
265A	264,265,266,267	3	424	0	424	0	Direct to surface water sewer	0.000	n/a	n/a	n/a	okay	okay	okay	free drain to positive at 5l/s	**Porous asphalt surfacing will limited Tc**
	259,260,242,243-251,252,253,254,255,256						Attenmuation Tank/to surface				76.8				limit discharge to 5 l/s flood 1.2m3 (5mm depth) for	
260A		17	1395	0	1395	0	water sewer	0.000	n/a	tanked		okay	okay	1.2m3	Q100 +40% drain time 120mins	12m x 8m x 0.8m Polypipe Polystorm Tank
224A	224,225	1	143	0	143	0	Direct to surface water sewer		n/a	n/a	n/a	okay	okay	okay	free drain to positive at 2l/s	
206A	206,207,208,209,210	4	475	0	475	0	Direct to surface water sewer	0.000	n/a	n/a	n/a	okay	okay	okay	free drain to positive at 5l/s	**Porous asphalt surfacing will limited Tc**
335A	335,336	2	148	0	148	0	Direct to surface water sewer	0.000	n/a	n/a	n/a	okay	okay	okay	free drain to positive at 2l/s	
288A	288,289	2	238	0	238	0	Direct to surface water sewer	0.000	n/a	n/a	n/a	okay	okay	okay	free drain to positive at 3l/s	
	Totals	31	3041	0	3041	0										

Area	Unit Numbers	No. of props	Private Area m2	Road Area m2	Total Area m2	Perme-able Area m2	Type of Drainage	Ratio	Depth of sub base m	Infiltration Rate m/hr	Nett Volume (m3)	Q100 00%	Q100 20%	Q100 40%	Results Summary	Additional Drainage Comment
358A	355,356,357,358,359-367	13	1061	0	1061	0	Direct to Basin	0.000	n/a	n/a	n/a				free drain to attenuation basin at 15l/s	Basin design to Follow Part of Phase 3
347A	347,348,349,350,351,352,353,354	8	794	0	794	0	Direct to Basin	0.000	n/a	n/a	n/a				free drain to attenuation basin at 11l/s	Basin design to Follow Part of Phase 3
320A	320-328,329,342,343,344	13	779	0	779	0	Direct to Basin	0.000	n/a	n/a	n/a				free drain to attenuation basin at 11l/s	Basin design to Follow Part of Phase 3
		34	2634	0	2634	0										