



**PERSIMMON HOMES THAMES VALLEY
LAND NORTH OF TODDINGTON LANE,
LITTLEHAMPTON**

**DRAINAGE STRATEGY, WEST OF
WETLANDS
(DISCHARGE OF CONDITIONS REPORT.
CONDITIONS 10, 11, 12 & 13)**

MARCH 2018

the journey is the reward

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**Persimmon Homes Thames Valley
Land North of Toddington Lane, Littlehampton
Drainage Strategy, West of Wetlands
(Discharge of Conditions Report. Conditions 10, 11, 12 & 13)**

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1 Introduction

- 1.1 Mayer Brown Ltd has been commissioned by Persimmon Homes Thames Valley (PHTV) to compile this Surface and Foul Water Drainage Strategy to assist with the discharge 4 of planning conditions for their outlined approved development (**Arun DC reference LU/47/11/**) for up to 1,260 residential dwellings, B1 employment use, Class A facilities, a 100 bed hotel, 60 bed care home, primary school, plus many other facilities and improvements to the local infrastructure.

Outline Planning Consent

- 1.2 Outline Planning Consent was granted in 2011, under Arun District Council planning reference LU/47/11, which includes four conditions that relate to drainage. These are covered in more detailed within the report but a high level description is as follows:

- Condition 10 – Surface Water Drainage Strategy
- Condition 11 – Existing Watercourses and Culverts
- Condition 12 – Discharge Consents
- Condition 13 – Foul Water Drainage

Purpose of this Drainage Report

- 1.3 This drainage report does not cover the entire area that received outline planning approval. It includes the development area of approximately 19.0 hectares to the west of the wetlands as identified Appendix B, titled “Land Uses and Drainage Areas Covered”.
- 1.4 There are a total of 18 land parcels and associated road infrastructure identified within this catchment at varying states of progress. The report describes the design philosophy behind the main surface and foul water sewers within the road network that will eventually drain the development parcels within this area. It also specifies the proposed connection points and peak allowable surface water discharge from each of the land parcels.
- 1.5 A parcel specific surface and foul water drainage strategy will still be required to accompany the reserved matters (RM) applications from the individual land parcels.

- 1.6 This report is to be used to accompany the RM planning applications for each of the individual parcels in order to demonstrate that the receiving drainage network has been adequately designed and considered.
- 1.7 This report should discharge outline planning Conditions 11 & 12 without the reliance of an accompanying RM strategy because these are remote from the individual land parcels and are considered to be strategic conditions.

Previous Consultancy Work

- 1.8 Greencore obtained outlined planning consent for the scheme in 2011, using White Young Green as their drainage consultants, and subsequently sold the site to PHTV.
- 1.9 Glanville Consulting Engineers were employed by PHTV to develop the surface and foul water strategy further. Glanville are no longer working on the project but produced useful information to depict the pre-development scenario, which is contained in a number of Appendices within this report.
- 1.10 Mayer Brown were employed by PHTV as their drainage consultants for the project in September 2017 and where possible will utilise the information produced by previous Consultants.

2 Condition 10 - Surface Water Drainage

Condition 10: *No development shall begin until a fully detailed surface water drainage scheme for that phase of the development, based on sustainable drainage principles and designed in accordance with the SUDS strategy for the whole development, has been submitted to and approved in writing by the Local Planning Authority. It should be demonstrated how each detailed scheme will contribute to delivering, and link into, the surface water drainage strategy for the site as a whole.*

- *The SUDS shall be designed to attenuate the 1 in 100 year storm event (plus climate change allowance of 30% in accordance with DEFRA's National Standards for Sustainable Drainage Systems).*
- *No infiltration of surface water drainage shall occur within ground affected by contamination unless suitable remediation is undertaken.*
- *Each detailed scheme should include a timetable for its implementation; and provide a management and maintenance plan in the form of a site specific Maintenance Manual for the SUDS system for the lifetime of the development. This shall include the arrangements for adoption by any public authority or statutory undertaker or details of the financial management of the scheme throughout its lifetime.*

Elements of the scheme serving any particular phase shall subsequently be implemented in accordance with the approved details (unless otherwise agreed with the Local Planning Authority) prior to the occupation of any dwellings in that phase and no building in that phase of the development shall be occupied until the surface water drainage scheme has been fully implemented in accordance with the approved details.

Reason: To ensure that the proposed development is satisfactorily drained to prevent the increased risk of flooding, and improve and protect water quality, habitat and amenity, and ensure future maintenance of these in accordance with national guidance and policies GEN7, GEN9 of the Arun District Local Plan.

Pre-Demolition Site

- 2.1 The pre-demolition site was heavily developed comprising large glasshouses with associated outbuildings and areas of hardstanding. Refer to the site location plan in Appendix A that shows the extent of the glasshouses covering the site to the east and west of the wetlands.
- 2.2 A plan illustrating the existing surface water regime, produced by Glanville in 2014, is contained in Appendix K.
- The former Toddington Nurseries: The western part of the site comprising is understood to have discharged to a combination of soakaways and outfall to the existing ditch system north of the site.
 - Central West Former Holland Nursery: Discharged to an irrigation pond before discharging to Toddington ditch. It is understood that there was no restriction of flows from the system.

Infiltration

- 2.3 Intrusive ground investigations and soakage testing undertaken by Merebrook have confirmed that infiltration methods for the disposal of surface water runoff are unlikely to be practical across the majority of the site as the underlying material is generally found to comprise of Clay.
- 2.4 Review of these investigative reports appears to indicate only two areas where infiltration drainage were feasible (subject to further testing):
- Towards the western part of the site at depths of around 1.0m into the localised sand deposits; Parcels B3, B5, B1, Care Home, Enterprise Zone
 - Towards the western part of the site at depths of around 2.0m into localised Sand deposits; notably Parcels A1, A2, Youth Facility, B6, Waste Recycling Centre, and Commercial Areas.
- 2.5 Other than the locations noted above infiltration methods for the disposal of surface water runoff are unlikely to be feasible due to either the presence of Clay material or high groundwater levels.
- 2.6 Modelled Flood Levels in the Black Ditch are within a metre of ground level in many locations which could restrict depths available to effectively locate SuDS features.

Sustainable Drainage (SuDS) and Drainage Hierarchy

- 2.7 Sustainable Urban Drainage Systems (SuDS) are a range of techniques that aim to mimic the way rainfall drains in natural systems and so reduces the hydraulic and hydrological impact on the local area and downstream catchments. There are a number of options available to impose surface water restrictions on proposed development plots such as oversized sewers, below ground storage tanks, attenuation ponds and basins, swales, permeable paving, or infiltration systems.
- 2.8 To determine the most sustainable method of surface water disposal the hierarchy from approved document part H was used, see below:
- **An adequate soakaway or some other adequate infiltration system** apart from a few locations across the site infiltration methods for the disposal of surface water runoff are not feasible due to either the presence of Clay material or high groundwater.
 - **A Watercourse** – The Black Ditch is located to the north of the site within the boundary of the consented scheme. There are ordinary watercourse tributaries that run across the wetlands and connect to the Black Ditch
 - **A Sewer** – There are no public surface water sewers in the immediate vicinity. The only drains available were those that drained the pre-demolition glasshouses and discharged into the black ditch.

Proposed Surface Water Strategy

- 2.9 Based upon the above hierarchy a high level description of the surface water strategy is that the entire 19 hectare catchment as identified in Appendix B will drain at a restricted rate of run-off into the Black Ditch via a single outfall located at the northern boundary of development parcel C2.
- 2.10 As explained in the introduction this report describes the drainage strategy for the development parcels and associated road network for the consented scheme to the west of the wetlands. (The remaining area to the east of the wetlands is currently under development).

Proposed and Pre-Demolition Discharge Rates

Pre-Demolition Discharge

- 2.11 As described in paragraph 1.9 Glanville Consulting Engineers (GCE) produced useful information to depict the pre-demolition scenario. In order to understand and quantify the existing drainage and associated discharge rates

PHTV commissioned MK Surveys to carry out a drainage survey of the pre-demolition drainage network. The resulting survey is contained in Appendix K of this report (a total of 12 AO drawings covering the whole site).

- 2.12 GCE subsequently reviewed the drainage survey and ascertained there was a total of 10 outfalls, ranging in diameter from 150mm up to 375mm, with run-off eventually ending up in the Black Ditch via the series of smaller upstream ditches.
- 2.13 GCE produced basic micro drainage models in order to quantify the discharge rate from each outfall. They also produced a plan summarising the discharge rates from the individual parcels. Refer to Appendix K of this report.
- 2.14 The resulting total pre-demolition discharge rate from the West of Wetlands is as follows:
- Outfalls 01, 02, 03 (**Not** including outfalls 04 to 09 or the overland flow)
 - Combined impermeable area = 8.33 hectares
 - Peak Pre-demolition 1 in 1 year discharge = **390 Litres / second**
- (The above figure does not account for the run-off from the demolished buildings and unrecorded drainage, as shown on the GCE plan. These areas are hatched on the GCE plan and are referred to as overland flow)
- 2.15 The overall development area of the west of wetlands catchment is 19.0 hectares, which equates to a pre-demolition peak **1 in 1 year** discharge rate of **20 litres / second / hectare**.
- 2.16 It is worth noting that the calculated pre-demolition discharge rate of 20 litres / second / hectare is for the 1 in 1 year return period and, although not calculated, would be significantly larger for the higher 1 in 30 year and 1 in 100 year return periods.

Proposed Discharge Rate

- 2.17 The Arun DC SFRA identifies the site as brownfield and states that development is unlikely to significantly increase run-off but should seek to reduce rates where possible. Therefore, the proposal is to specify a reduced rate of run-off when compared to the pre-demolition run-off described above.
- 2.18 A proposed peak discharge rate has been calculated using Greenfield runoff methods provided in IoH124 using a Soil Type of 5 to make allowance for the possible effect of the previous extensive impermeable area. The resulting 1 in 1 year brownfield rate has been calculated at approximately 15 litres

/second / hectare. A copy of the relevant calculation is contained in Appendix K.

- 2.19 The peak rate of surface water discharge for up to the **1 in 100 year return period + 30% climate change** will be restricted to **15 litres / second / hectare**. This proposed peak rate of surface water discharge will provide significant betterment when compared to the pre-demolition undeveloped scenario.

Calculations and Results

- 2.20 A Micro Drainage model has been created of the drainage network covering the overall catchment area of 19.0 hectares. The pipes have been sized to convey the surface water run-off from each area, and the proposed peak allowable discharge has been specified from each future development plot. The overall network schematic and details are contained in Appendix H.
- 2.21 Outfall B, the final outfall from the overall catchment, will discharge through a headwall into the existing ditch that is also located in a flood plain. There will be a flap valve on the final headwall to ensure floodwater within the floodplain will not back up into the drainage network. However, in this scenario the drainage network can't push open the flap valve until the water level within the site goes above the flood level in the wetlands.
- 2.22 There is a risk that a fully surcharged outfall could coincide with the on-site critical 1in100yr+CC storm so the Micro Drainage model has been simulated with a fully surcharged outfall.
- 2.23 The EA supplied 1in100yr+20%CC modelled flood level within the floodplain ranges from 1.72m AOD to 1.83m AOD. A flood level in the wetlands of 1.8m AOD by the outfall will result in the outfall (@ 1.0m AOD) being surcharged by approximately 0.8m.
- 2.24 There is also permeable sub-base designed beneath some of the Phase 2 roads, which has been incorporated into the Micro Drainage model.
- 2.25 The final peak allowable discharge of **285 litres / second** (19 hectares x 15 litres / second / hectares) has been modelled for the worst case 1 in 100 year storm event + 30% climate change. The simulation results are contained in Appendix I & J.

- 2.26 The discharge rates will be considerably lower for lower intensity storm events as shown below (discharge rates below are for a surcharged outfall. When the outfall is unsurcharged the full 285 litres / sec discharge is achieved):
- Critical 1 in 100 year storm (+30% CC): 265 litres / second
 - Critical 1 in 30 year Storm: 207 litres / second
 - Critical 1 in 1 year Storm: 167 litres / second
- 2.27 The proposed discharge rates represent a significant reduction when compared to the pre-demolition 1 in 1 year discharge rate of 390 litres / second, as follows:
- Critical 1 in 100 year storm (+30% CC): 32% Reduction
 - Critical 1 in 30 year Storm: 47% Reduction
 - Critical 1 in 1 year Storm: 58% Reduction
- 2.28 Most of the surface water attenuation will be located within the future car park area in a 1500 cubic metre proprietary storage tank and permeable paving sub-base. There will also be attenuation in the 900mm diameter pipe running from the car park to the outfall.
- 2.29 A maximum allowable discharge will be imposed on the majority of development parcels and, as such, each parcel will need to contain surface water storage within its respective reserved matters (RM) application boundary. These have been modelled indicatively within the micro drainage network but their design will need to be undertaken to accompany each RM Application.

Existing & Future Development Parcels

- 2.30 The discharge from each parcel into the main drainage network will be restricted to the following peak rate of run-off:
- Non-Resi Land (0.91Ha) 5 litres / second
 - Non-Resi Land (0.81Ha) 5 litres / second
 - Non-Resi Land (0.32Ha) 5 litres / second
 - Non-Resi Land (Hotel) 5 litres / second
 - Care Home: 5 litres / second
 - Parking Square: 5 litres / second
 - A1 Parcel (Existing): 34.5 litres / Second
 - A2 Parcel: 5 litres / second
 - B1 Parcel: 5 litres / second

- B2 Parcel: Free Discharge – See Appendix L & S
- B3 & B5 Parcel (Existing): 120 litres / second
- B6 Parcel: 5 litres / second
- Block B Parcel: 5 litres / second
- Block A Parcel: 5 litres / second

Free discharge areas below – See paragraph 2.27 to 2.29

- B4 Parcel (Phase2): Free Discharge – See Appendix L & S
- C1 Parcel: Free Discharge – See Appendix L & S
- C2 Parcel: Free Discharge – See Appendix L & S
- C4 Parcel: Free Discharge – See Appendix L & S
- Roads Serving Above Free Discharge into Network

Total Peak Discharge: **285 litres / Second**

(1in100yr return period, including climate change)

Free Discharge from Parcels

- 2.31 The surface water network serving the above parcels (C1, C2, C4, B4 Partial, Roads) are interconnected and overlap with each other, and the roads passing through these parcels also drain the upstream and surrounding parcels
- 2.32 There are also no flow controls (ie hydro-brakes) on the surface water sewers within Phase 2 parcels or roads. A total of 23 individual locations / sub-catchments have been identified within Phase 2. The free discharge varies for different return periods and their associated storm durations varying for short durations high intensity storms to longer durations low intensity rainfall events. The critical discharge rates have been identified in
- 2.33 Although there is a free discharge from these sub-catchments the downstream network has been designed to cater for this and the final outfall / discharge rate will not exceed 285 litres / second for the peak 1in100yr return period, including climate change. (The peak discharge rate will be considerably less for lower returns periods as set out above in paragraph 2.27.)
- 2.34 The type of attenuation tanks in the future development plots are to be determined at the time of the RM application. The volumes of tanks identified in Appendix L is approximate only and will need to be designed accurately by the Consultants undertaking the detailed design. Catch pit chambers are to

be specified immediately upstream to the tanks in order to limit the volume of debris / silt entering the tanks.

Modelled Overflow into Future Parcel B4

- 2.35 There is a requirement to add an overflow in the drainage network at the south west corner of the catchment (by SW01). The drainage is exceptionally shallow in this location so there is no scope to add surface water attenuation under the road or adjacent parking areas.
- 2.36 Approximately 226m³ of surface water run-off will overflow into the proposed surface water drainage network that will eventually serve the future development parcel B4. This will only occur for the critical duration storm (120mins) for the 1in100yr return period + climate change.
- 2.37 Therefore, the plan is to increase the size of the future attenuation tank in the adjacent B4 parcel so it will store the 226m³ and release it into the wetlands via a future outfall at the agreed rate of 15 liters / second / hectare.

Surface Water Treatment

- 2.38 Table 26.2 of the SuDS Manual identifies the pollution hazard level associated with the land uses within the Proposed Development as being 'Low'. On a scale from 0-1 a 'Low' pollution hazard level relates to the following pollution hazard indices (See table 26.2 of the SuDS Manual) This is applicable to runoff from residential roofs, driveways, paths, residential parking areas and low traffic roads:
- Total Suspended Solids = 0.5
 - Metals = 0.4
 - Hydrocarbons = 0.4
- 2.39 Table 26.3 of the SuDS Manual sets out the indicative mitigation indices provided by different SuDS features for discharges to surface water.

Permeable Paving

- 2.40 Communal parking and private driveways will be constructed using permeable paving allowing the rainwater falling onto permeable paved areas to be treated by the microorganisms as it passes through drainage medium, see Figure 4.1 below.

- 2.41 Permeable paving provides sufficient pollution mitigation for runoff from low hazard land uses and provides mitigation indices of 0.7, 0.6 and 0.7, which are in excess of the requirement set out in paragraph 2.25.

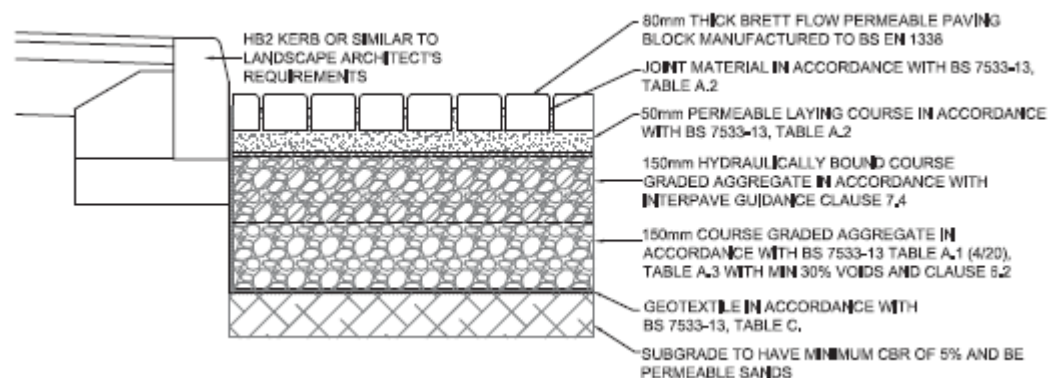


Figure 2.1: Typical Permeable Block Paving Construction

Permeable Sub-base Road

- 2.42 A number of the private roads within C2 Parcel, B2 Parcel and B4 Parcel draining into the drainage network will drain via permeable sub-base located under the road surface. The specific construction is contained in Appendix M.
- 2.43 It is considered that the permeable sub-base provides sufficient pollution mitigation for runoff from low hazard land uses and provides mitigation indices of 0.7, 0.6 and 0.7, which are in excess of the requirement set out in paragraph 2.25

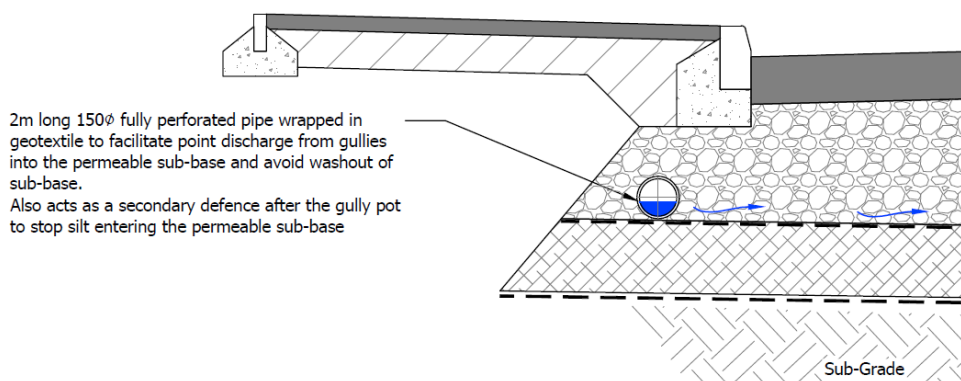


Figure 2.2: Permeable Sub-base Road (refer to Appendix M)

- 2.44 The private roads within C1 Parcel will drain via a filter trench running adjacent the carriageways. The specific construction is contained in Appendix M.
- 2.45 It is considered that the granular material sub-base will provide sufficient pollution mitigation for runoff from low hazard land uses and provides

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2.46 Full size precast concrete gully pots draining the asphalt roads that will act as the first line of defence to trap silt and sediments in the drainage network.

2.47 The drainage network is designed to cope with flooding up to the **1in100yr+30%CC** flood event and this water will be contained on site within the developed areas (not the wetlands)

2.49 Discussions have been had with WSCC to ascertain what would happen if the wetland are flooded and the outfall becomes surcharged. The 1in100yr+CC flood level in the wetlands is 3.23m AOD by the outfall that would result in the outfall (@ 1.0m AOD) being surcharged by approximately 2.23m.

2.50 The chances of the critical 1in100yr+CC flood level in the wetlands (which is tidal) coinciding with the peak 1in100yr+CC storm event on the site are

infinitesimally small. However, a fully surcharged outfall was simulated and results in a flood volume of 1750m³ escaping from the drainage network.

- 2.51 It was agreed with WSCC that it is not reasonable keep this flood water on site and the resulting flood water will flow safely through the road network and eventually into the wetlands, as shown in Appendix H.

Adoption and Maintenance

- 2.52 The proposed surface water drainage system will be constructed in accordance with Sewers for Adoption 7th edition (SFA7); however it will remain in private ownership and will be maintained by a Management Company organised by the Developer.
- 2.53 Some of the main roads, footpaths and shared areas will be adopted by Mid Sussex District Council under a Section 38 agreement. The remaining private roads and communal parking areas will be maintained by a Management Company, organised by the Developer.
- 2.54 Taking this approach will ensure shared drainage and infrastructure items are properly maintained. This should enable tight control over the operation and maintenance of the drainage / SuDS systems on site.

Attenuation Tank Maintenance

- 2.55 The primary purpose of the attenuation tanks is to attenuate surface water run-off during extreme rainfall events.
- 2.56 Regular inspection and maintenance is required to ensure the effective long-term operation of the below ground storage tanks, see table 2.1 below for details:

Maintenance Schedule	Required Action	Recommended Frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually
	Debris removal from catchment surface (where may cause risk to performance).	Monthly.
	Remove sediment from pre-treatment structures.	Annually, or as required.
Remedial Actions	Repair/rehabilitation of inlets, outlets, overflows and vents.	As required.
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed.	Annually and after large storms.

	Survey inside of tank for sediment build-up and remove if necessary.	Annually until evidence this is too regular, every 5 years thereafter.
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Table 2.1: Attenuation Tank Maintenance Requirements

Pervious Pavement Maintenance

- 2.57 Pervious pavements are pavements that allow for pedestrian and/or vehicular traffic while allowing rainwater to infiltrate through the surface and into underlying structural foundation layers.
- 2.58 Regular inspection and maintenance is important for the effective operation of pervious pavements as designed, these are described below in table 2.2:

Maintenance Schedule	Required Action	Recommended Frequency
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface).	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment.
Occasional Maintenance	Stabilise and mow contributing and adjacent areas.	As required.
	Removal of weeds or management using glyphosphate applied directly into weeds by an applicator rather than spraying.	As required – once per year on less frequently used pavements.
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving.	As required.
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost joining material.	As required.
	Rehabilitation of surface and upper substructure by remedial sweeping.	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging).
Monitoring	Initial inspection.	Monthly for three months after installation.
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action.	Three-monthly, 48h after large storms in first six months.
	Inspect silt accumulation rates and establish appropriate brushing frequencies.	Annually.
	Monitor inspections chambers.	Annually.

Table 2.2: Pervious Pavement Maintenance Requirements

Drainage Network Design Criteria

- 2.59 The positive drainage will be designed in accordance with Sewers for Adoption, and BS EN 752 – Drain and sewer systems outside buildings and the Building Regulations - part H (2002).
- 2.60 The surface water network design and rate of surface water runoff would be based on the Modified Rational method and designed in accordance with the Wallingford Procedure. In order to carry out the design of the networks, a number of Global Variables are used. These Global Variables / parameters are related to the location of the site in the UK and have been obtained from the Flood Estimation Handbook (FEH).
- 2.61 The positive surface water system would be designed such that:
- The pipes remain unsurcharged during the 1 in 2 year design storm;
 - The system should not flood during the worst case 1 in 30 year storm with a free outfall;
 - The surface water run-off from the proposed development would be safely contained on site for up to and including the worst case 1 in 100 year storm event, plus an additional 30% for climate change;
 - The pipe velocities are such that self-cleansing is achieved at lesser more moderate storm intensities :
 - o Pipe roughness (k_s) = 0.6
 - o Minimum pipe velocity at full flow = 1.0 m/s
 - o Cv Value of 0.84 (as agreed with WCSS, see Appendix F)
 - o Percentage Impermeable areas
 - Buildings = 100%
 - Carriageways and footpaths = 100%
 - Private and Communal Parking = 100%

Micro Drainage Software

- 2.62 The proposed and existing networks have been designed and analysed using the Micro drainage software package that is recognised as one of the industry standard design suites. There are two separate programmes used within the package to firstly generate and then analyse the completed model. These are 'System 1' and 'Simulation'.

- System 1: The surface water computer model has been generated in “System 1” in using proposed data, such as the cover levels, invert levels and catchment areas. This is used to size the pipes in the proposed network based on the global variable outlined above
- Simulation: Once the proposed drainage system has been generated it was analysed using ‘Simulation’. This is a full hydrograph method for the determination of flood risk and system failure under extreme conditions. It can be used to analyse system overloads, storage, reverse flow characteristics, surcharging and backwater effects. It can also analyse against a wide variety of critical variables.

Return Periods & Critical Duration Storms

- 2.63 To determine the hydraulic requirements for an element of a drainage system, one must first consider the consequences of that capacity being exceeded and then identify an acceptable frequency for this to occur. This acceptable frequency is termed the return period, the period of time during which the stated rainfall can be expected to be exceeded on average only once, that particular element is then designed to accommodate a storm / flood with this return period.
- 2.64 Once the design return period is established the most critical storm duration for each of the elements is determined. These range in duration from 15 to 1440 minutes. For example;
- A 1 in 30 year, 30 minute duration storm for the northern catchment has an average intensity of 56.762mm/hr. This intensity of storm would be used to size the pipes and other drainage elements for conveyance purposes.
 - A 480 minute duration storm has an average intensity of only 8mm/hr (figures obtained from simulated results). However, the 480 minute storm lasts 16 times longer, therefore generating a much greater volume of water and would be used to size the attenuation tanks.

Condition 10 Conclusion

- 2.65 This surface water drainage strategy demonstrates that the west of wetlands catchment site can be drained satisfactorily without increasing flood risk elsewhere.

- 2.66 Intrusive ground investigations and ground water monitoring have determined that infiltration drainage is unlikely to be practical across **much** of the site. Discharge of surface water runoff directly into the chalk, which is designated a principal aquifer, has been discounted due to high recorded groundwater levels within this material and the inability to provide a minimum standoff distance from the saturated zone.
- 2.67 There are, however parcels to the **west** of the site, (as described in paragraph 2.4) that are yet to be developed and where bespoke infiltration drainage might be feasible. Parcel specific infiltration tests will be undertaken to determine the feasibility for each future land parcel where the standing ground water level is found to be in excess of 2.0m below the surface.
- 2.68 Surface water runoff will be discharged to the Black Ditch at a peak allowable discharge of 15 litres / second / hectares for up to the 1 in 100 year return period, plus 30% allowance.
- 2.69 This proposed rate of discharge will provide considerable betterment when compared to the pre-demolition brownfield arrangement. The provision of SuDS and attenuation features will store the balance of surface water runoff.
- 2.70 The proposed discharge rates represent a significant reduction when compared to the pre-demolition 1 in 1 year discharge rate of 390 litres / second, as follows:
- Critical 1 in 100 year storm (+30% CC): 32% Reduction
 - Critical 1 in 30 year Storm: 47% Reduction
 - Critical 1 in 1 year Storm: 58% Reduction
- 2.71 The information contained within this report demonstrates that adequate surface water infrastructure will be provided to enable the consented scheme to be satisfactorily drained, and will enable the future Parcels within the west of the wetlands catchment to make a positive connection into the proposed surface water network.
- 2.72 The reserved matters planning applications for the future parcels will need to be accompanied by an individual surface water drainage strategy and technical note. Each technical note will also include this overall strategy that demonstrates the downstream receiving network has been satisfactory designed in accordance with the relevant standards.

- 2.73 Parcel specific soakaway tests will be undertaken to confirm the feasibility of using infiltration drainage on the future RM planning applications for the remaining land parcels. If feasible the infiltration drainage will be used in conjunction with the positive discharge rates described within this report.
- 2.74 Therefore, it is considered that this evidence base, when read in conjunction with the RM application for the individual parcels, will provide sufficient information to discharge the outline planning Condition 10.

3 Condition 11: Existing Watercourses & Culverts

Condition 11: *The development shall not commence until such time that arrangements for the future access to and maintenance of any watercourse or culvert (piped watercourse) crossing or abutting the site has been submitted and approved in writing by the Local Planning Authority. No construction is permitted, which will restrict current and future land owners from undertaking their riparian maintenance responsibilities of any watercourse on or adjacent to the site.*

Reason: To ensure that the proposed development is satisfactorily drained to prevent the increased risk of flooding, and improve and protect water quality, habitat and amenity, and ensure future maintenance of these in accordance national guidance and policies GEN7, GEN9 of the Arun District Local Plan.

- 3.1 There are no existing watercourses or culverts that are adversely effected by the development for most of the parcels within the 19 hectare catchment. Most of the individual parcels and the supporting road network will be constructed on the raised areas that previously contained the glasshouses and its supporting infrastructure.

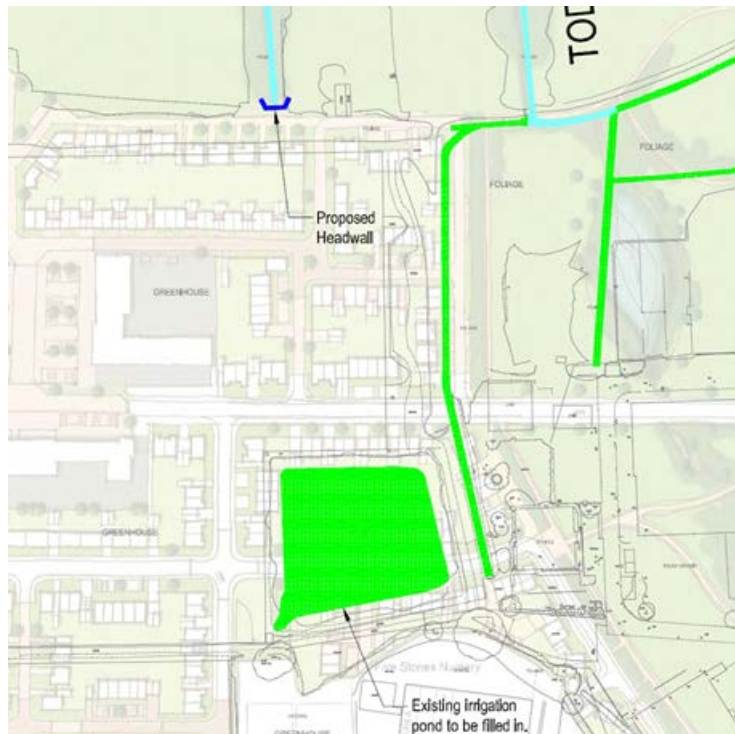


Figure 3.1 Existing Lagoon and Ditch (in green) to be filled in

- 3.2 The only exception to this are the northern and western perimeters of the parcels adjacent to the wetlands (C1, C2, B2 & B4) where the development

platform is to be extended into the wetlands. Refer to figure 3.1) This work will require the existing irrigation pond to be filled in and its associated drainage ditch that eventually ends up connecting the Black Ditch via Toddington Ditch. Refer to figure 3.1 above that shows their location.

- 3.3 This extension of the development platform into the wetlands will require flood compensation. The agreement of this are outside the scope of this document. This will be addressed under a separate outline planning Condition 9 and PHTV have appointed the Consultants White Young Green produce the relevant information that will discharge this condition.

Condition 11 Conclusion

- 3.4 The only watercourses and ditch affected by the proposed development will be the irrigation lagoon and its overflow, which are no longer required to serve the consented scheme. Therefore, it is considered that this evidence base alone provides sufficient information to discharge outline planning Condition 11.

4 Condition 12: Discharge Consents

- 4.1 **Condition 12:** *The development shall not commence until formal consent has been approved in writing from the Local Planning Authority for the discharge of any flows to watercourses, or the culverting, diversion, infilling or obstruction of any watercourse on the site.*

Reason: To ensure that the proposed development is satisfactorily drained to prevent the increased risk of flooding, and improve and protect water quality, habitat and amenity, and ensure future maintenance of these in accordance with national guidance and policies GEN7, GEN9 of the Arun District Local Plan.

- 4.2 As described in section 2.0 (Condition 10 – surface water drainage) the 19 hectare catchment will drain via a single outfall into the Black Ditch.
- 4.3 As required by Condition 12, a discharge consent for this new outfall has been obtained from the Environment Agency (EA) under Consent Number SE_WS_2015_311_2 dated 30 July 2015. The Consent is included within Appendix C of this report.
- 4.4 The description of the works within the consent is as follows:
- “Construction of 1 no. precast concrete surface water outfall (with railings and flap valve) to take discharge from new development through 525mm diameter pipe”*

Condition 12 Conclusion

- 4.5 A discharge consent for the proposed outfall has been obtained from the Environment Agency and is contained in Appendix C of this report. Therefore, it is considered that this evidence base alone provides sufficient information to discharge the outline planning Condition 12.

5 Condition 13: Foul Water Drainage

- 5.1 **Condition 13:** *Before each phase or sub phase of the development hereby permitted is commenced details of a proposed foul drainage system shall be submitted to and approved in writing by the Local Planning Authority (including details of its siting, design and subsequent management/maintenance, if appropriate) and no dwelling in that phase of development shall be occupied until works for the disposal of sewage have been fully implemented in accordance with the approved details.*
- 5.2 *Reason: To ensure adequate infrastructure is provided to enable the scheme to be satisfactorily drained. The site lies on the Upper Chalk, a Principal Aquifer and requires protection against contamination from any proposed development in accordance with national guidance and Policy GEN26 of the Arun District Local Plan.*

Offsite Foul Drainage & Connections

- 5.3 Foul drainage from the entire outline approved scheme of will drain a new foul pump station (PS) located in the south east corner of Block A Parcel, which is positioned within the 19 hectare catchment to the west of the wetlands. This foul PS will pump the effluent via a new 2.0km rising main to an existing Southern Water gravity sewer located by Fitzalan Road to the south. The location of the pump station and route of the rising main are contained in Appendix D of this report.
- 5.4 The design of the pump station compound, the optimum route of the rising main and its connection / discharge point have been decided by Southern Water under a Section 98 Agreement.
- 5.5 These works are currently being constructed by Southern Water and the pump station is scheduled to be fully operational [early 2019](#).

On Site Foul Drainage

- 5.6 All foul sewers within this catchment, to the west of the wetlands, will flow on a gravity basis (no pumps required) into the new foul PS being delivered by Southern Water.
- 5.7 The proposed routes of the foul sewers within the road network are shown on the drainage strategy drawing in Appendix L of this report. These foul sewers

have been designed with foul connection points / spurs into the individual land parcels.

Design Criteria

- 5.8 The proposed foul sewers have been designed in accordance with Sewers for Adoption, BS EN 12056 – Gravity Drainage Systems Inside buildings, and Building Regulations - part H (2015).
- 5.9 A schematic of the proposed foul sewer network, dwelling numbers and corresponding peak foul flows are shown in Appendix E of this report.

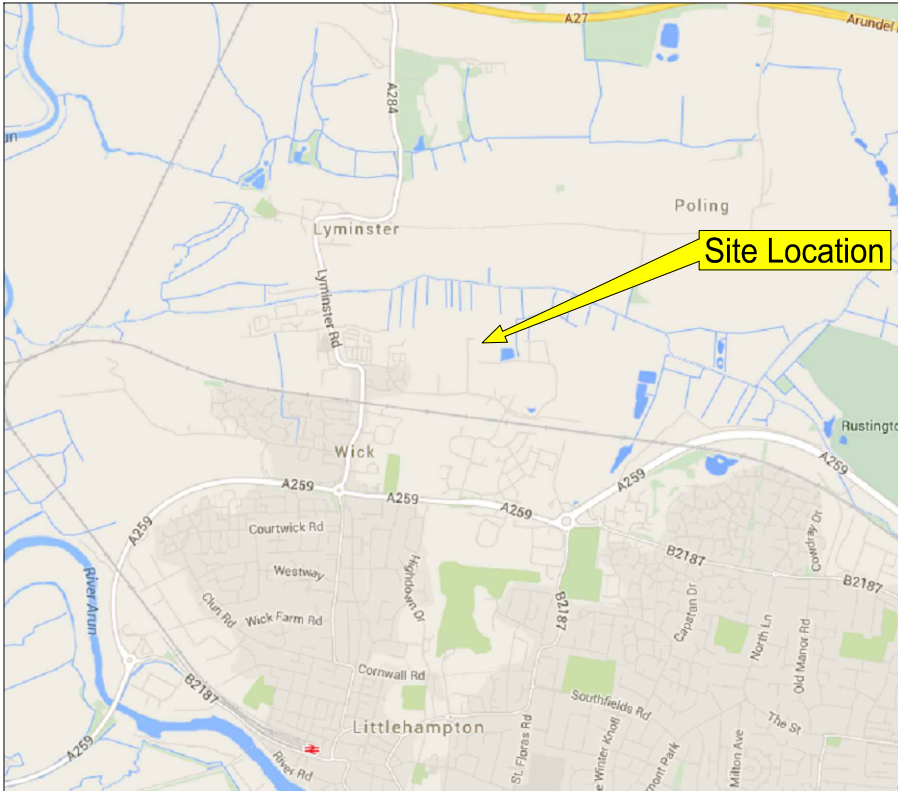
Adoption & Maintenance

- 5.10 The proposed foul sewers within the road network will be adopted by Southern Water under a Section 104 agreement, which will ensure they are maintained in perpetuity.

Condition 13 Conclusion

- 5.1 The information contained within this report demonstrates that adequate foul infrastructure will be provided to enable the consented scheme to be satisfactorily drained, and will enable the future Parcels within the west of the wetlands catchment to make a positive connection into the proposed foul sewer network.
- 5.2 The reserved matters planning applications for the future parcels will need to be accompanied by an individual foul water drainage strategy and technical note. Each technical note will also include this overall strategy that demonstrates the downstream receiving network has been satisfactorily designed in accordance with the relevant standards.
- 5.3 Therefore, it is considered that this evidence base, when read in conjunction with the RM application for the individual parcels, will provide sufficient information to discharge the outline planning Condition 13

APPENDIX A: Site Location & Pre-Demolition Layout



NOTES

1. This drawing is to be read in conjunction with all relevant documents and specifications.
2. Dimensions not to be scaled.

LOCATION

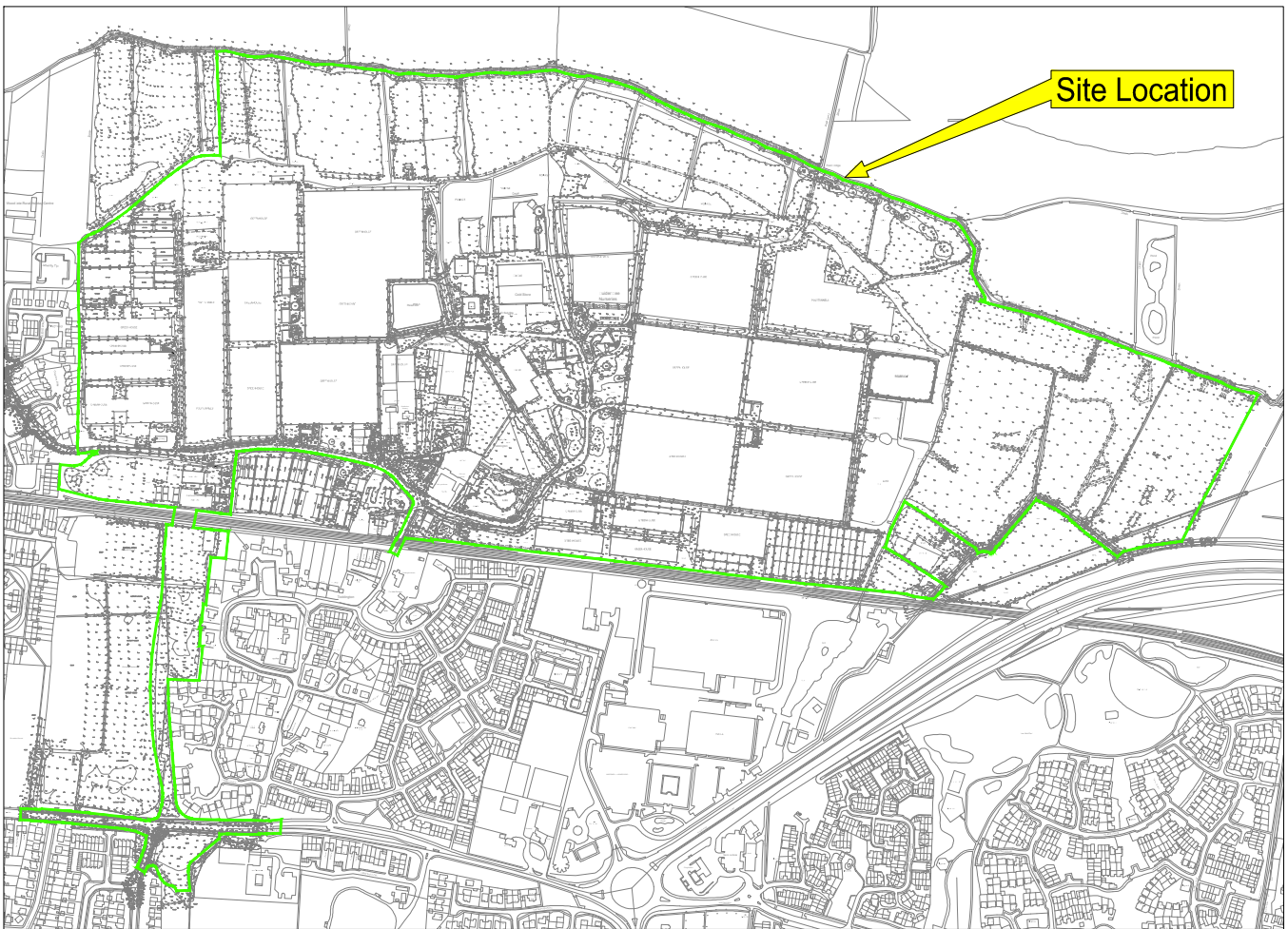
Address: Toddington Lane
Wick
Littlehampton
West Sussex
BN17 7PP

National Grid reference: TQ 03414 03979



Plan NTS

Plan 1:10000



Project :

Land North of Toddington Lane, Littlehampton

Title :

Site Location Plan

Project Engineer : J O'Kelly

Scale : As Shown@A4

Project Director : k Rayner

Date : December 14

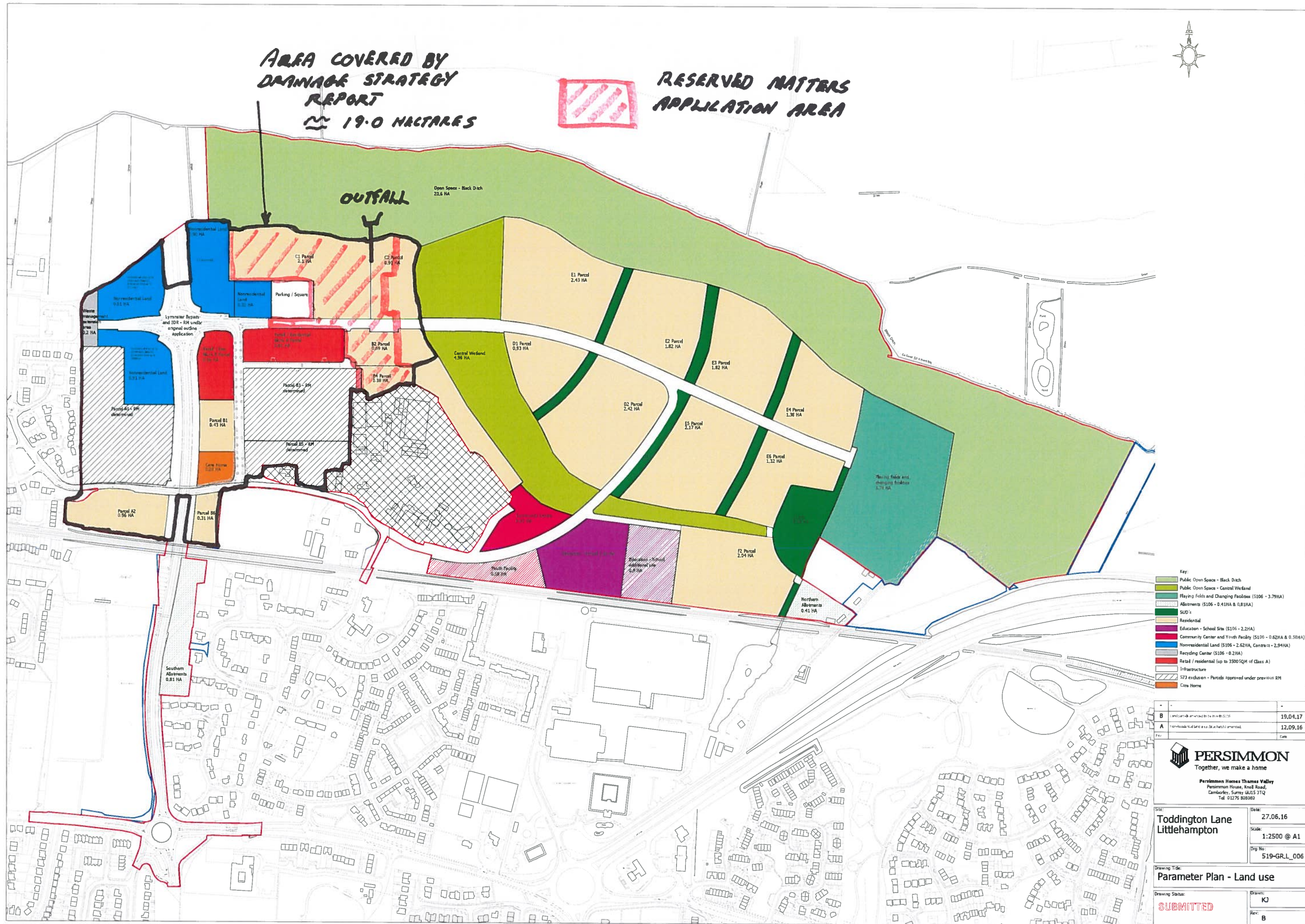
Drawing No.

N/A

Rev

-

APPENDIX B: Land Uses & Drainage Areas Covered



- Key:
- Public Open Space - Black Ditch
 - Public Open Space - Central Wetland
 - Playing Fields and Changing Facilities (S106 - 3.79HA)
 - Allotments (S106 - 0.41HA & 0.81HA)
 - SUD's
 - Residential
 - Education - School Site (S106 - 2.2HA)
 - Community Center and Youth Facility (S106 - 0.62HA & 0.58HA)
 - Non-residential Land (S106 - 2.62HA, Contrasts - 2.94HA)
 - Recycling Center (S106 - 0.2HA)
 - Retail / residential (up to 3500sqm of Class A)
 - Infrastructure
 - S73 exclusion - Parcels approved under previous RM
 - Care Home

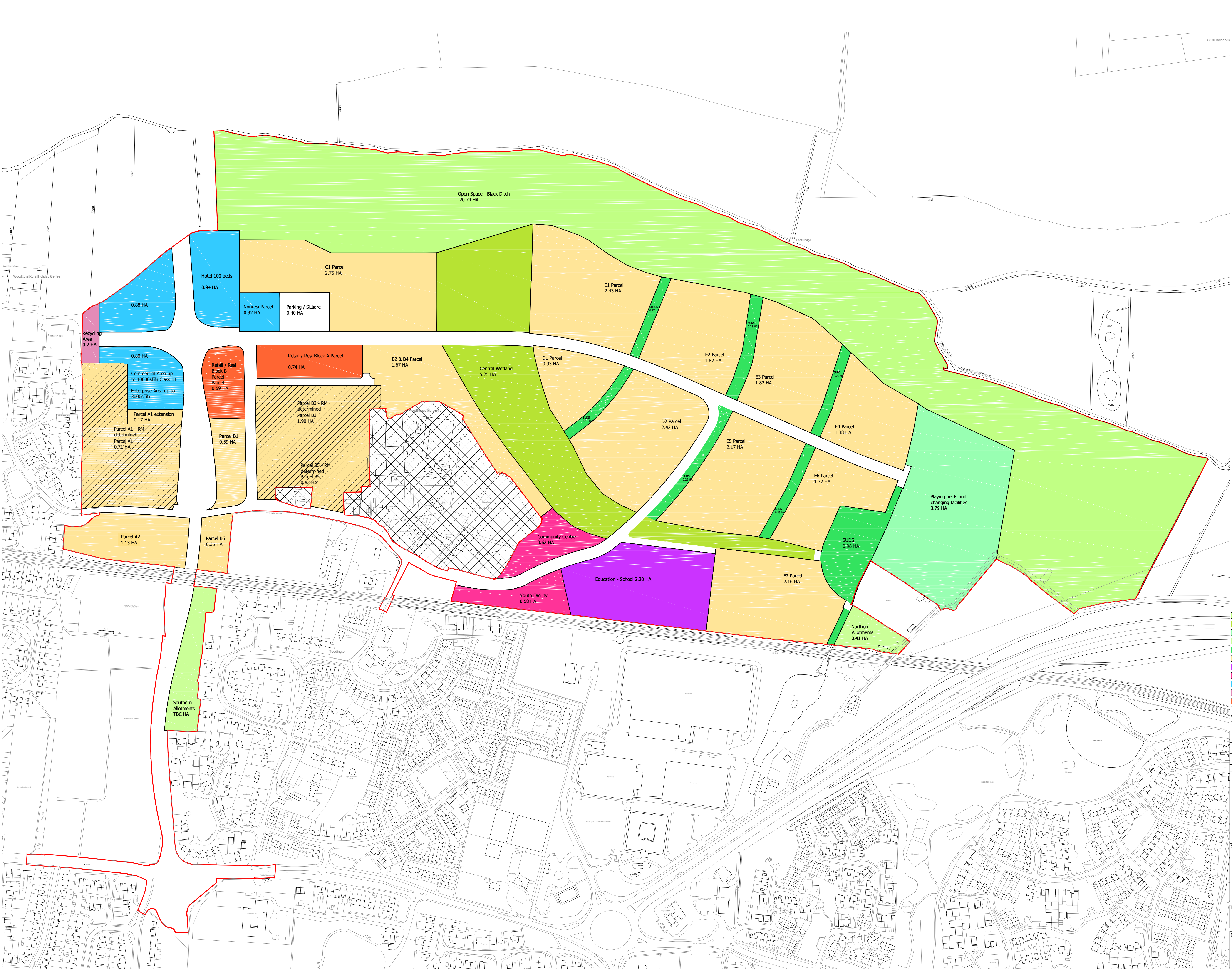
B	Land parcels approved by the Planning Committee	19.04.17
A	Non-residential Land as a Site for a new development	12.09.16

PERSIMMON
Together, we make a home

Persimmon Homes Thames Valley
Persimmon House, Knoll Road,
Canbury, Surrey GU15 3TQ
Tel: 01276 808060

Toddington Lane Littlehampton		Date: 27.06.16
Scale: 1:2500 @ A1		
Dwg No: 519-GR.L_006		

Drawing Title: Parameter Plan - Land use		
Drawing Status: SUBMITTED	Drawn: KJ	Rev: B



- Key:
- Public Open Space - Black Ditch
 - Public Open Space - Central Wetland
 - Playing fields and Changing Facilities (S106 - 3.79HA)
 - Allotments (S106 - 0.41HA & 0.81HA)
 - SUDS
 - Residential
 - Education - School Site (S106 - 2.2HA)
 - Community Center and Youth Facility (S106 - 0.62HA & 0.58HA)
 - Non-residential Land (S106 - 2.62HA, Contract - 2.94HA)
 - Recycling Center (S106 - 0.2HA)
 - Retail / residential (up to 3500sqm of Class A)
 - Infrastructure
 - S73 exclusion - Parcels approved under previous RM

Site:	-	-
Rev	-	-
A	Non-Residential land area (blue hatch) amended.	12.09.16



Persimmon Home Limited
Persimmon House, Knoll Road,
Camberley, Surrey GU15 3TQ
Tel: 01276 808080

Site:	Toddington Lane Littlehampton	Date:	27.06.16
Scale:	1:2500 @ A1	Orig No:	519-GR.L_006

Drawing Title:
Parameter Plan - Land use

Drawing Status:	Drawn:
SUBMITTED	KJ
Rev:	A

APPENDIX C: Condition 12, Flood Defence Consent

Flood Defence Consent

Section 23 of the Land Drainage Act 1991

Persimmons Homes Ltd
(Thames Valley)
Persimmon House
Knoll road
Camberley
Surrey
GU15 3TQ

**Consent applying to the
construction of 1 no.
surface water outfall to
take discharge from new
development into
Ordinary Watercourse
(within the River Arun
Internal Drainage
District)**

Land south of Black Ditch,
North Littlehampton, West
Sussex

NGR: 503413, 104302

Consent number
SE_WS_2015_311_2

Effective from
30th July 2015

Disclaimer

The Environment Agency does not accept any responsibility for the design and construction of the works referred hereto and any liability for any loss or damage which may arise out of their design, construction, maintenance or use.

Our approval is given solely on river morphology, flow, ecology, and other land drainage criteria. It should not be regarded by the applicant as in any way approving the design and soundness of the proposed structure, other than in relation to its impact on flows in the watercourse and its flood plain

This Consent does not free you from the need to obtain other licences, consents, approvals (including bye-law consents) or permissions (including planning permission) which may be required in law or in order to comply with any duties or responsibilities for conservation or protection of the environment. You should ensure that the works are carried out in a proper manner so as not to adversely affect the watercourse. A copy of the Special Requirements issued by the Environment Agency is available upon request. Work should be completed as quickly as possible once started.

The works shall be carried out at your own risk and responsibility. We accept no responsibility for any loss or damage howsoever caused arising from the carrying out or construction of the works. We may occasionally make observations on health and safety aspects of the work, however this should not be taken in any way whatsoever to imply that we have a role in ensuring site safety, nor that we have approved any contractors plans.

Land ownership is not a material consideration in determining this consent. Where you are not the owner of the land (including riverbeds and other water bodies) referred to in this consent, you must obtain suitable permission from the landowner prior to the commencement of works. This Consent does not confer any rights of entry or rights over property.

If you undertake works in contravention of Section 109 of the Water Resources Act, 1991 (Restriction on erection of structures in, over or under main river), or of the terms of this consent, we may remove, alter or pull down the works and recover from you the expenses incurred in doing so.

The responsibility to ascertain the location of any services, which may be affected by the proposed works, lies solely with the Applicant/Agent.

The contents of this consent must be brought to the attention of your contractor.

If you believe that conditions have been unreasonably imposed then you have a right of appeal.

Environment Agency Consent

Consent

Section 23 of the Land Drainage Act 1991



Flood Defence Consent

Control of works affecting watercourses and/or flood defences

Consent number **SE_WS_2015_311_2**

To Persimmon Homes Ltd (Thames Valley)
of Persimmon House, Knoll Road, Camberley, Surrey GU15 3TQ

The Environment Agency, in exercise of its powers under Section 23 of the Land Drainage Act 1991 and subject to the conditions overleaf, hereby grants its consent in relation to the works or operations described in this Consent.

Watercourse: Ordinary Watercourse within the River Arun Internal Drainage District

Location: Land south of Black Ditch, North Littlehampton, West Sussex

NGR: 503413, 104302

Description of works: Construction of 1 no. precast concrete surface water outfall (with railings and flapvalve) to take discharge from new development through 525mm diameter pipe.

For the following activities:

Construction of 1 no. surface water outfall

(1) Construction of 1 no. permanent precast concrete surface water outfall (with railings and flapvalve) to take discharge from new development through 525mm diameter pipe

As detailed on Drawings: 8140927/SK12, CV8140927/SK09 and SFA 10C Headwall Plan

The Agency does not accept any responsibility for the design and construction of the works referred hereto and any liability for any loss or damage which may arise out of their design, construction, maintenance or use.

This Consent shall come into effect on **30th July 2015**

Signed on behalf of the Environment Agency

A rectangular box containing a handwritten signature in blue ink.

Partnerships and Strategic Overview Team Leader

Date of signing

30th July 2015

Environment Agency Consent SE_WS_2015_311_2
Effective date 30th July 2015

Conditions

This consent is granted subject to the following conditions:

- 1. That the headwalls are adequately keyed into the banks and bed of the watercourse to prevent erosion.**
- 2. No excavated material or debris arising from the construction of the works shall be disposed of on the site or in the floodplain without our prior agreement. Any materials, debris etc that fall into the river channel, or onto the banks of the watercourse shall be removed immediately.**
- 3. There should be no storage of materials (or chemicals/fuels) within (EIGHT) metres of the watercourse.**
- 4. No refuelling of any machinery shall take place within (EIGHT) metres of any watercourse**
- 5. No dredging of the riverbed shall take place during the construction period.**
- 6. The banks and/or bed of the watercourse where disturbed shall be restored to our reasonable satisfaction.**
- 7. We shall be afforded access to the works at all reasonable times for the purpose of inspection during construction of the works and after completion of the works.**
- 8. The construction of the works described in this consent must be completed within three years from the date of issue of this consent. Works not completed within this time, additional works and/or amendments will require a new consent.**

Informatives

- Although the ditches involved were dry when the water vole survey/report was carried out, there are water vole populations in close proximity to this site.
- It is recommended that an ecologist looks over the works footprint prior to starting the work, to ensure no burrows are disturbed.
- Water vole burrows can normally extend up to 5 metres into the river banks.
- It is a legal offence to disturb water vole and their burrows so you should be aware of the legal implications when undertaking your work.

Other information

This Note does not form part of the Certificate of Authorisation.

Pollution Prevention

You are reminded that it is an offence under Regulation 38 of The Environmental Permitting (England and Wales) Regulations 2010 to cause or knowingly permit a water discharge activity or ground water activity. Care must be taken to ensure that neither the watercourse nor groundwater becomes polluted, particularly by, for example diesel fuel, petrol and oil from machinery. All fuels, oils and chemicals must be stored securely and any large containers left on site must be bunded. Care should also be taken when filling machinery to ensure that diesel/petrol/oil is not spilt on the ground. Spillages must not be washed away, but absorbed by some medium and then removed from site to a suitable licensed waste facility. Any such incidents must be reported to the Environment Agency immediately (Emergency Tel No 0800 807060). Copies of the Environment Agency's Pollution Prevention Guidelines (PPG5) and (PPG6) are either attached for your information or if not available upon request.

Disturbance of bed and bank material in watercourses should be minimised, including when carrying out excavations. An appropriate silt control system should also be considered if material is likely to be disturbed. In-river vehicle tracking should be kept to an absolute minimum.

Any waste generated in the course of the works must be disposed of in accordance with the provision of the Environmental Protection Act 1990. Persons carrying waste are required by law to register with the Environment Agency as a Waste Carrier (subject to certain exceptions). The deposit, keeping, treating or disposal of waste should only take place at premises licensed by the Environment Agency to receive the waste (subject to certain exceptions and exemptions). When you give waste to someone else, details of the transfer of waste should be described on a document called a Duty of Care Transfer Note.

If the waste contains any properties that are hazardous to health or the environment, the waste will be classed as 'Hazardous Waste' as defined in the Hazardous Waste Regulations 2005. These Regulations place specific requirements on the producer and carrier of such waste. Further information can be found on the Agency's website (www.environment-agency.gov.uk) or by contacting the National Customer Contact Centre on 03708 506506.

The activity of importing waste into the site for use as part of the construction process, for example hardcore, must be registered by Environment Agency as an exempt activity under the Waste Management Licensing Regulations 1994.

Flood Risk Management

The structure(s) must be removed immediately, for any reason, at the request of the Area Flood Risk Manager.

Environment Agency Consent SE_WS_2015_311_2
Effective date 30th July 2015

You must ensure that any structure is clear and free of rubbish, silt and debris at all times. Regular inspections of the structure should also be carried out and the appropriate maintenance work undertaken.

Fisheries

You are strongly advised to inform the appropriate Angling Association/Interests of your proposals (where applicable), before commencing work, since the issue of a Flood Defence Consent by this Agency will not protect you from any claim for nuisance or damage which may be attributed to your works.

The free passage of fish must be maintained at all times, unless otherwise agreed in advance with the Agency.

Under the terms of the Salmon and Freshwater Fisheries Act 1975, it is an offence to cause or knowingly permit to flow, or put, into any waters containing fish, any liquid or solid matter to such an extent as to cause the water to be poisonous or injurious to fish or the spawning grounds, spawn or food of fish.

Biodiversity

Natural environments such as watercourses are important as habitats in their own right and for the plants and animals they support. There are several Acts and Regulations that ensure these special features are protected and you should be aware of and comply with this legislation. A list of relevant legislation can be found in our working method guidance.

The list of species and actions below are not exhaustive and the applicant should consult the relevant legislation regarding other concerns.

A licence for works affecting protected species may be required from Natural England. You should consult their standing advice for more information on this.

Otters and their places of rest are protected. Otters are widespread and significant tree works or works to the banks have the risk of disturbing otters and damaging their Holts. You should make an assessment of the risk to otters and where required a survey should be undertaken by a suitably qualified ecologist. Note otters sometimes lie up in drains/small watercourses so wherever possible drain entrances should be kept clear.

Bats and their habitats are protected. Bats are often found in structures and trees on or adjacent to watercourses. If your works are likely to affect structures such as bridges, walls, culverts or buildings you must consider impacts on bats. An appropriate assessment of risk and, where required a survey should be undertaken by a suitably qualified ecologist.

Water voles and their habitat are protected. If water voles are present on your site you need to consider the impacts of your work on them and an appropriate assessment of risk and where required survey should be undertaken by a suitably qualified ecologist.

Native Crayfish are protected. When undertaking works where native crayfish are present you need to consider the impacts of your works and an appropriate assessment of risk and where required survey should be undertaken by a suitably qualified ecologist.

Vegetation

No bankside vegetation within 7m of the watercourse is to be removed unless strictly necessary. In such cases, trees/shrubs should be limbed or coppiced, and the root base to be left intact. Scrub vegetation as possible should be retained, as this provides valuable wildlife habitat.

Trees should be protected from the works in accordance with British Standard 5837, "Trees in relation to construction", and contractors' working areas shall be clearly marked out and boundaries adhered to.

Any bankside trees or vegetation damaged or removed during the works should be replaced with native species of local provenance appropriate to the local habitat.

Birds

Breeding birds and their nests are protected under the Wildlife and Countryside Act 1981. If your work is taking place within or close to the main bird breeding season (1st March to 31st July) you should consider the impacts of your works and an appropriate assessment of risk should be undertaken.

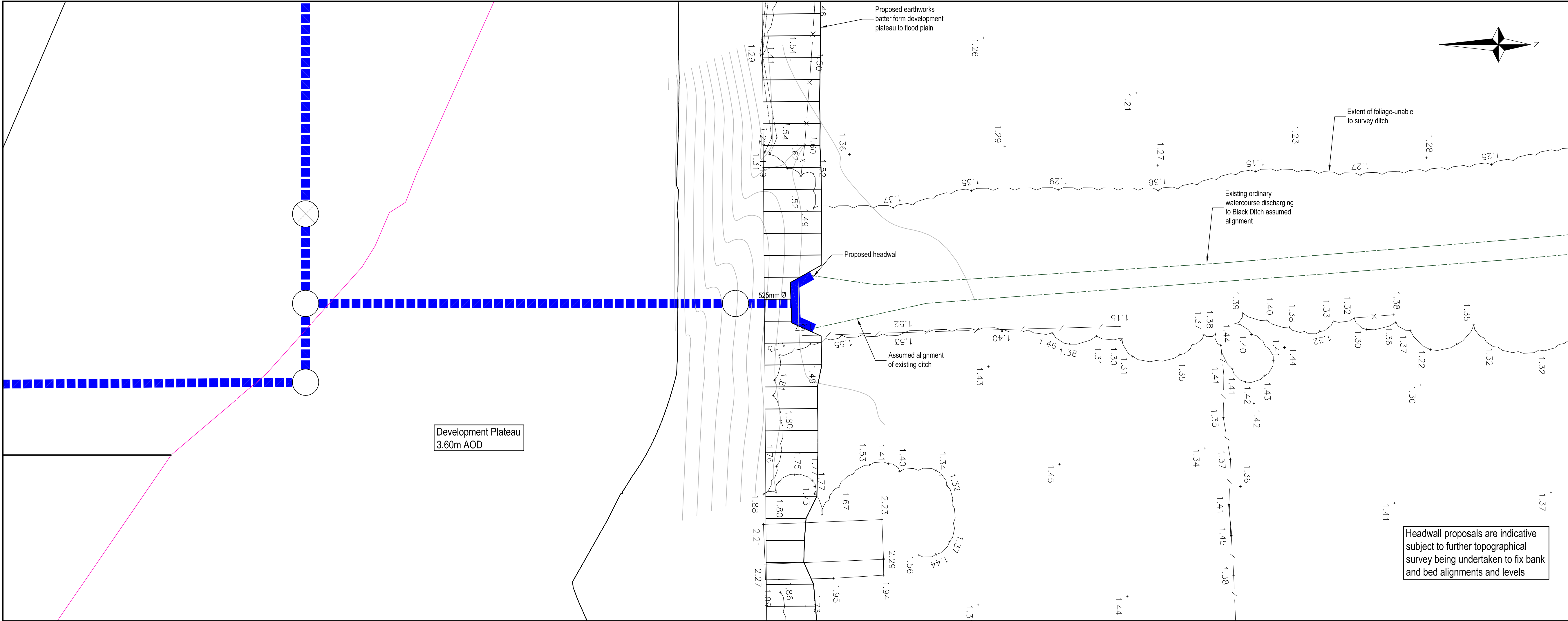
Invasive Non-native species

The Wildlife and Countryside Act makes it an offence to cause certain species to spread in the wild. If these species are present on your site you need to have a plan for how you will manage them and any waste containing them during your work.

Bio security

When travelling or working between watercourses there is a high risk of transferring problem species or diseases between watercourses.

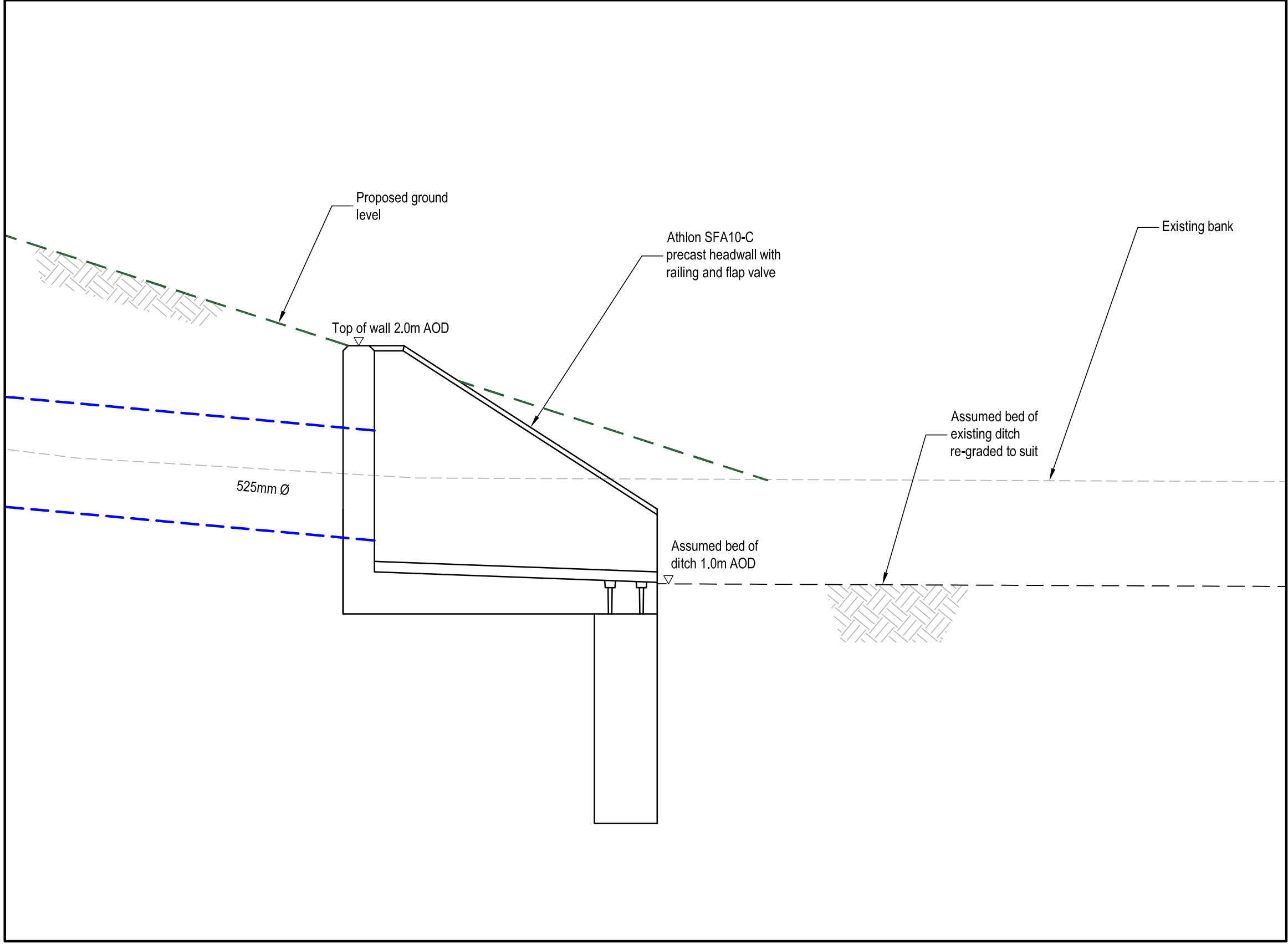
This can be avoided by following the advice of the ['check, clean, dry'](#) campaign. Simple measures such as checking for and cleaning mud and bits of vegetation from boots, equipment and machines and allowing them to dry (ideally in sunlight) can prevent the spread of problem species.



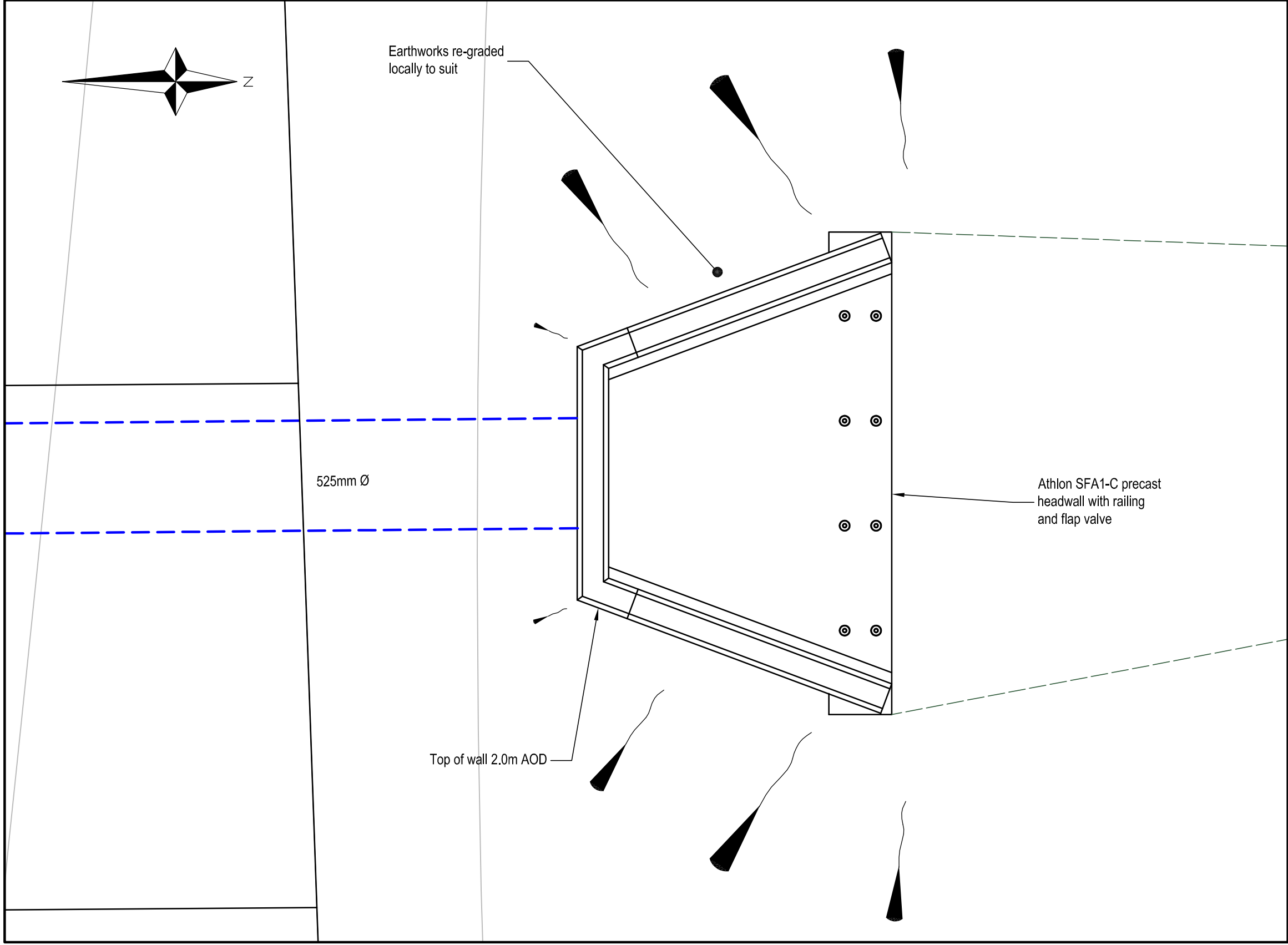
- NOTES
1. This drawing to be read in conjunction with all relevant documents and specifications
 2. Dimensions not to be scaled

Headwall proposals are indicative
subject to further topographical
survey being undertaken to fix bank
and bed alignments and levels

Location Plan
Scale 1:250



Outfall B Section
Scale 1:20



Outfall B Plan
Scale 1:20

Rev.	Description	Date	Chkd
------	-------------	------	------



Glanville
Cornerstone House
62 Foxhall Road, Didcot
Oxon, OX11 7AD
Tel: (01235) 515550 Fax: (01235) 817799
postbox@glanvillegroup.com www.glanvillegroup.com

Client :


Project :
Toddington Lane
North Littlehampton

Title :
Outfall B Headwall

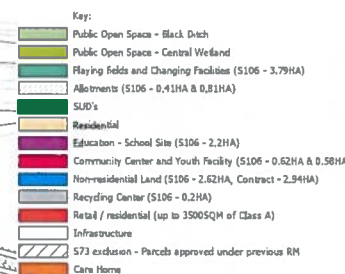
Project Engineer : S. Hudson Scale : As Shown @ A1
Project Director : K. Rayner Date : May 2015
Status : PRELIMINARY

Drawing No. CV8140927/SK09 Rev -

APPENDIX D: Condition 13, S98 Foul Pump Station & Rising Main

598 FOUR PUMP STATION & 2 KM
RISING MAIN. DELIVERED BY
SOUTHERN WATER UNDER A
598 REQUISITION

THE ENTIRE DEVELOPMENT (OUTLINE APPROVED
 CONSENTED SCHEME) WILL DRAIN INTO
 THE S98 SOIL PUMP STATION



APPROX
ROUTE OF
2 KM RISING
MAN

CONTINUES TO CONNECTION
BY FITZGERALD ROAD => REFER TO SOUTHERN WATER PLAN

B	land partly amended to be in with B106	19.04.17
A	non-residential land area (see hatched ground)	12.09.16
Per		Calls



Persimmon Homes Thames Valley
Persimmon House, Knoll Road,
Camberley, Surrey GU15 3TQ
Tel: 01276 808080

Toddington Lane
Littlehampton

Date: _____

Scale:
1:2500 @ A1

Drug No: 519-GR-L 00

Drawing Title:
Parameter Plan - Land use

Drawing Status:

SUBMITTED

Drawn by K7

Rev: **B**

