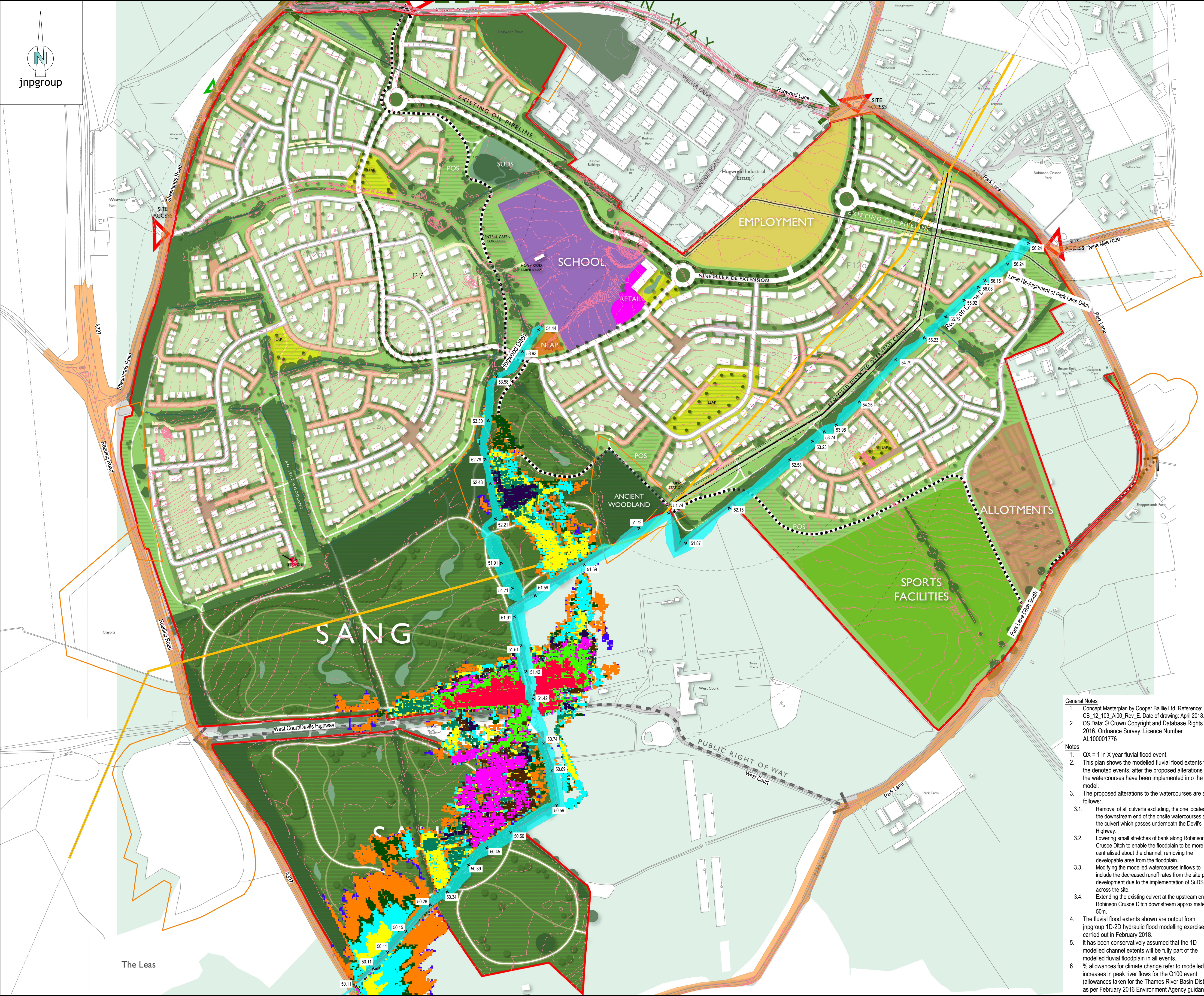


- Notes:-
- Where this drawing has been issued in electronic .dwg format it has been done so in good faith. jnpgroup do not take any responsibility for any inaccuracies in the electronic data, which should be checked against the paper (or .pdf) drawing issue. Any apparent discrepancies should be immediately reported to jnpgroup. The electronic .dwg file should not be assumed to be to scale and should not be used for 'overlying', setting out or checking of any third party information. All dimensions should be taken from the paper (or .pdf) version of the drawing. Electronic drawings may contain third party information, jnpgroup take no responsibility for this information, which should be checked against the originators paper drawing(s).
 - All working dimensions to be checked on site.
 - Do not scale.
 - Any discrepancies between drawings of different scales, and between drawings and specification where appropriate to be notified to The Engineer for decision.
 - Copyright reserved. This drawing may only be used for The Client and location specified in the title block. It may not be copied or disclosed to any third party without the prior written consent of jnpgroup.
 - This drawing should only be used for construction if the drawing status is "Construction". jnpgroup take no responsibility for construction works undertaken to drawings which are not marked with this status.

Health and Safety Note:
The details on this drawing have been prepared on the assumption that a competent contractor will be carrying out the works. If the contractor(s) considers that there is insufficient Health and Safety information on this drawing, this should immediately be brought to the attention of the designer.

- Key
- 1D Modelled Channel Extents
 - Q1000 Fluvial Flood Extents
 - Q200 Fluvial Flood Extents
 - Q100+70%Climate Change Fluvial Flood Extents
 - Q100-35%Climate Change Fluvial Flood Extents
 - Q100 Fluvial Flood Extents
 - Q50 Fluvial Flood Extents
 - Q30 Fluvial Flood Extents
 - Q20 Fluvial Flood Extents
 - Q10 Fluvial Flood Extents
 - Q5 Fluvial Flood Extents
 - Q2 Fluvial Flood Extents
 - Site Boundary
- *XX.XX In Channel Flood Levels for the 1in100+35%CC Event

A	04.18	Updated Site Layout	JC	
Rev.	Date	Amendment	By	Chk.
Status				

Preliminary



john newton & partners
Consulting Engineers
www.jnpgroup.co.uk
Chesham • Brighthelm • Hartlepool • Leamington Spa • Sheffield
Tel: 01494 771221 E-mail: chesham@jnpgroup.co.uk

Client	Legal & General Homes
Job	Hogwood Farm Finchampstead
Title	Modelled Proposed Fluvial Flood Extents

Scale 1:2500	@ A1	Date April 2018
Drawn By JC	Eng. Check POF	Tech. Check POF



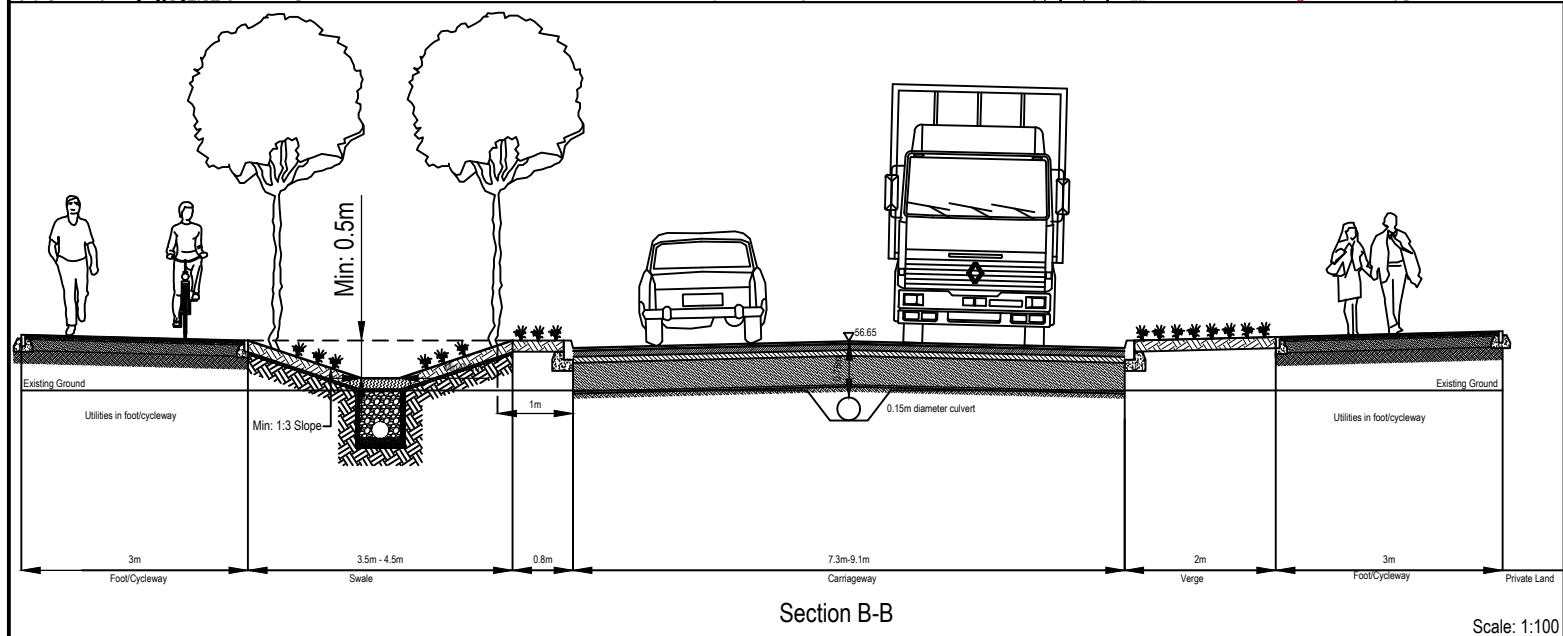
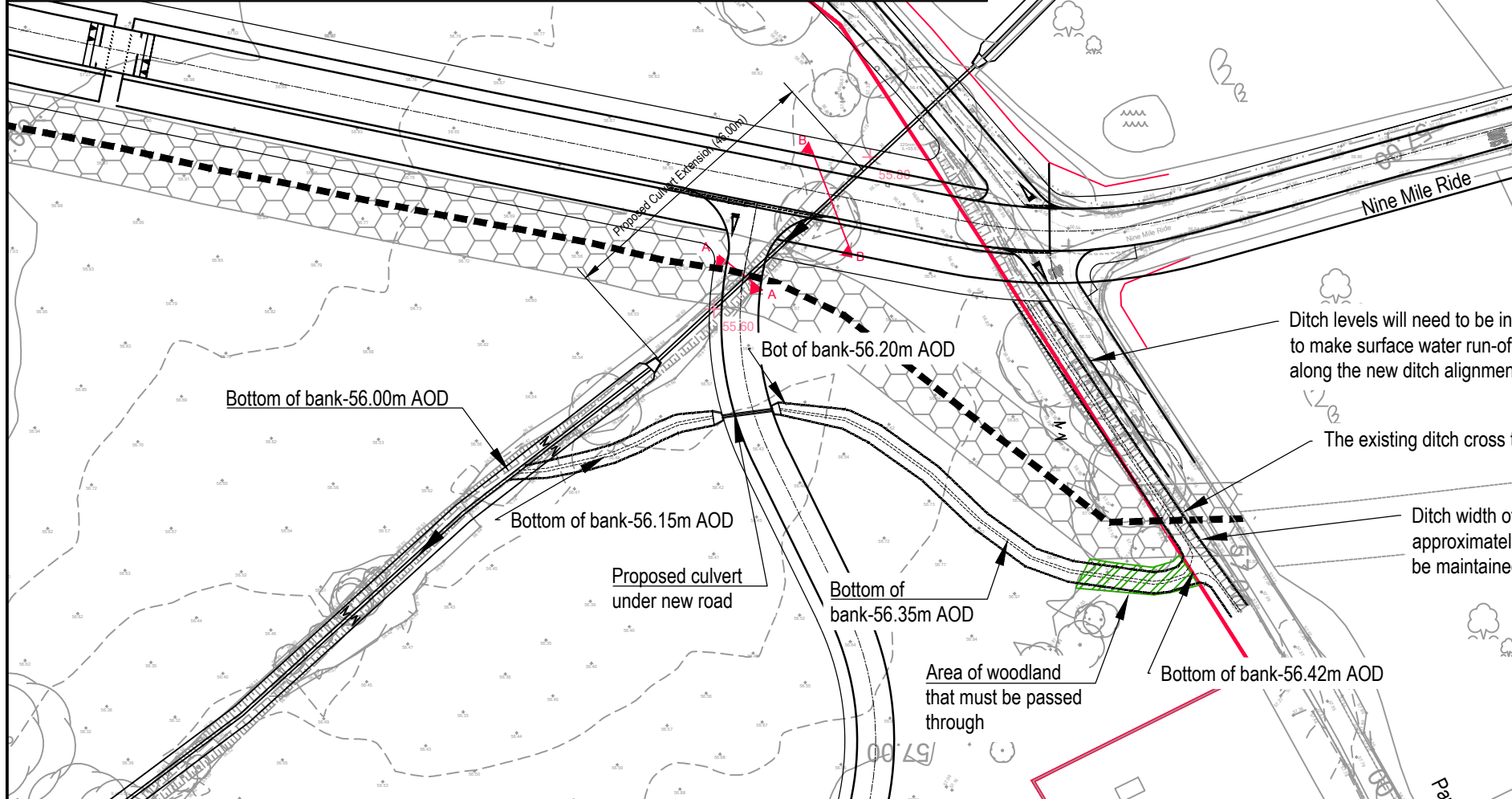
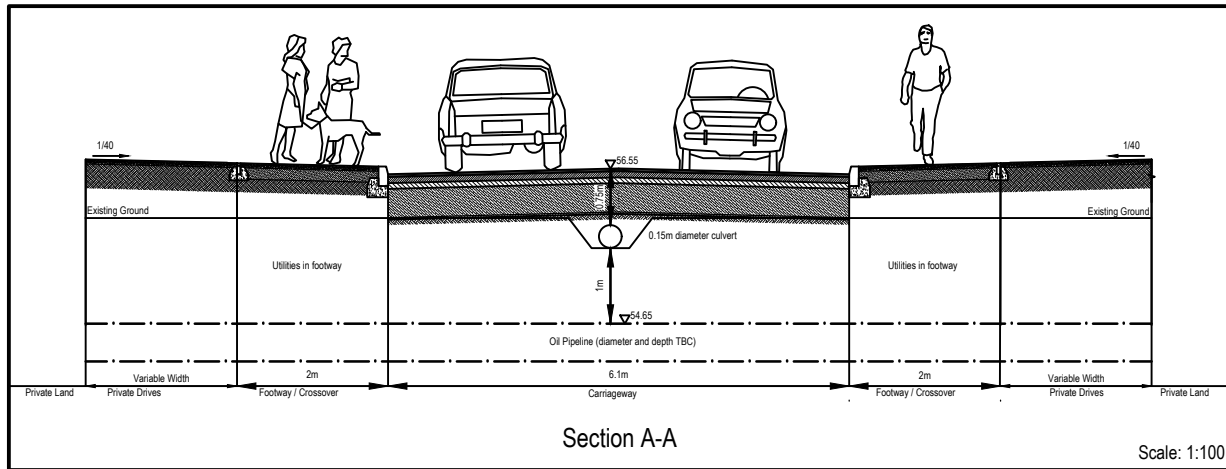
Drawing No.	C85672-SK-093	Rev.	A
-------------	---------------	------	---

- General Notes
- Concept Masterplan by Cooper Baillie Ltd. Reference: CB_12_103_A100_Rev_E. Date of drawing: April 2018.
 - OS Data: © Crown Copyright and Database Rights 2016. Ordnance Survey. Licence Number AL100001776
- Notes
- QX = 1 in X year fluvial flood event.
 - This plan shows the modelled fluvial flood extents for the denoted events, after the proposed alterations to the watercourses have been implemented into the model.
 - The proposed alterations to the watercourses are as follows:
 - Removal of all culverts excluding, the one located at the downstream end of the onsite watercourses and the culvert which passes underneath the Devil's Highway.
 - Lowering small stretches of bank along Robinson Crusoe Ditch to enable the floodplain to be more centralised about the channel, removing the developable area from the floodplain.
 - Modifying the modelled watercourses inflows to include the decreased runoff rates from the site post development due to the implementation of SuDS across the site.
 - Extending the existing culvert at the upstream end of Robinson Crusoe Ditch downstream approximately 50m.
 - The fluvial flood extents shown are output from jnpgroup 1D-2D hydraulic flood modelling exercise carried out in February 2018.
 - It has been conservatively assumed that the 1D modelled channel extents will be fully part of the modelled fluvial floodplain in all events.
 - % allowances for climate change refer to modelled increases in peak river flows for the Q100 event (allowances taken for the Thames River Basin District as per February 2016 Environment Agency guidance).

QA Ref: Q010 Rev C

Appendix I: Site Access Ditch Modification Schematic





- DRAWING REFERENCES:**
1. Site redline boundary produced by Wei Yang & Partners, June, 2015 (reference: ARB001-SMP09-RevD).
 2. OS Data: © crown copyright and database rights 2016. Ordnance Survey. Licence Number AL100001776.
 3. Topography produced by Brunel Surveys Ltd, received January 2018 (reference not provided).
- DRAWING NOTES:**
1. Watercourses observed during 2no. Site Visits carried out by JNP Group on 09th and 15th November 2017 respectively.
 2. Park Lane Ditch and Robinson Crusoe Ditch are names given by JNP Group for ease of reference.
 3. Park Lane Ditch 225mm outfall destination currently unknown. Post-development, this outfall will be removed and the ditch extended into Robinson Crusoe Ditch on-site, as it naturally forms part of this catchment.
 8. The Park Lane diversion will involve minor levels changes to the ditch. The resultant levels difference is no more than 0.3m compared to existing. The minimum ditch fall will be 1:100. This will include a small culvert beneath the secondary road shown on plan.
 9. The existing culvert connecting Robinson Crusoe Ditch onsite with its upstream offsite section beneath Park Lane was observed on site by JNP Group on 09th November 2017 as a heavily silted, approximately 150mm diameter pipe.
 10. The culvert will be extended approximately 50m further into the site than existing to facilitate the proposed primary access to the site.
 11. The culvert invert will be set to existing hard bed levels of Robinson Crusoe Ditch.
 12. Both proposed culverts require a minimum 0.75m cover to provide protection from traffic loading.
 13. Oil pipeline position and depth obtained from topographic survey.
 14. When crossing the oil pipeline, a minimum cover of 1m is required for utilities as per CLH April 2015 'Standard Requirements for Crossing or Working in Close Proximity to CLH-PS Pipelines' guidance. This is provided by the existing ground levels and as there will be no proposed lowering over the pipeline, this requirement is met.
 15. Consent for removal, diversion or culverting of any watercourse will be needed from Wokingham Borough Council in their role as Lead Local Flood Authority.

Health and Safety Note:
The details on this drawing have been prepared on the assumption that a competent contractor will be carrying out the works. If the contractor(s) considers that there is insufficient Health and Safety information on this drawing, this should immediately be brought to the attention of the designer.

- Notes:-**
1. Where this drawing has been issued in electronic .dwg format it has been done so in good faith. jnpgroup do not take any responsibility for any inaccuracies in the electronic data, which should be checked against the paper (or .pdf) drawing issue. Any apparent discrepancies should be immediately reported to jnpgroup. The electronic .dwg file should not be assumed to be to scale and should not be used for 'overlying', setting out or checking of any third party information. All dimensions should be taken from the paper (or .pdf) version of the drawing. Electronic drawings may contain third party information. jnpgroup take no responsibility for this information, which should be checked against the originators paper drawing(s).
 2. All working dimensions to be checked on site.
 3. Do not scale.
 4. Any discrepancies between drawings of different scales, and between drawings and specification where appropriate to be notified to The Engineer for decision.
 5. Copyright reserved. This drawing may only be used for The Client and location specified in the title block. It may not be copied or disclosed to any third party without the prior written consent of jnpgroup.
 6. This drawing should only be used for construction if the drawing status is "Construction". jnpgroup take no responsibility for construction works undertaken to drawings which are not marked with this status.

Rev.	Date	Amendment	By	Chk.
A	04.18	Realignment of ditch and culvert	JC	

Status: Preliminary



Client: Legal & General Homes

Job: Hogwood Garden Village

Title: Site Access Ditch Upgrade Plan

Scale: 1:1000 @ A3 Date: March 2018

Drawn By: JC Eng. Check: Tech. Check:



Drawing No.: C85672-SK-040 Rev: A

QA Ref: QD019 Rev C

Appendix J: Proposed Ditch Plan with Watercourse Enhancement Opportunities



1. Where this drawing has been issued in electronic .dwg format it has been done so in good faith. jngroup do not take any responsibility for any inaccuracies in the electronic data, which should be checked against the paper (or .pdf) drawing issue. Any apparent discrepancies should be immediately reported to jngroup. The electronic .dwg file should not be assumed to be to scale and should not be used for 'overlying', setting out or checking of any third party information. All dimensions should be taken from the paper (or .pdf) version of the drawing. Electronic drawings may contain third party information; jngroup take no responsibility for this information, which should be checked against the originators paper drawing(s).
2. All working dimensions to be checked on site.
3. Do not scale.
4. Any discrepancies between drawings of different scales, and between drawings and specification where appropriate to be notified to The Engineer for decision.
5. Copyright reserved. This drawing may only be used for The Client and location specified in the title block. It may not be copied or disclosed to any third party without the prior written consent of jngroup.
6. This drawing should only be used for construction if the drawing status is "Construction", jngroup take no responsibility for construction works undertaken to drawings which are not marked with this status.

Health and Safety Note:
The details on this drawing have been prepared on the assumption that a competent contractor will be carrying out the works. If the contractor(s) considers that there is insufficient Health and Safety information on this drawing, this should immediately be brought to the attention of the designer.

A	04.2018	Removal of meandering	JC	
Rev.	Date	Amendment	By	Ch
Status				



Client		Legal & General Homes	
Job		Hogwood Farm, Finchampstead	
Title		Proposed Ditch Plan With Watercourse Enhancement Opportunities	
Scale 1:2500	@ A1	Date April 2018	
Drawn By JC	Eng. Check POF	Tech. Check POF	
    		Accredited Contractor Supplier No. 1000	
Drawing No.			Rev
C85672-SK-024			A

CA Ref: QD019 Rev C

Appendix K: Watercourse Enhancements Technical Note



Job name: Hogwood Farm, Finchampstead
Job No: C85672
Note No: TN009A
Date: 20/04/2018
Prepared by: JC
Subject: Preliminary Watercourse Enhancements

1. Introduction

- 1.1 This technical note outlines the potential opportunities for enhancement of the watercourses located across Hogwood Farm, Finchampstead, Wokingham. The suggested locations and measures of watercourse enhancements are preliminary and will be developed throughout the planning process.
- 1.2 The following note starts with a review of potential watercourse enhancement measures in Section 2 before leading into possible enhancements for areas of the site in Section 3.

2. Potential Watercourse Enhancement Measures

- 2.1 A review of potential watercourse enhancement measures has been carried out using available topographical information, an understanding of the wider catchment hydrology, arboriculture constraints, ecological constraints and a site walkover carried out on 09th and 15th November 2017 by **jnp group**.
- 2.2 Potential watercourse enhancement measures are based on the following key guidance documents that integrate ecological benefits into watercourses and other surface water features through sympathetic and practicable engineering design:

-  Environment Agency Water Framework Directive Mitigation Measures Online Manual
-  The SuDS Manual (CIRIA report C753, 2015)
-  UK River Restoration Centre's Interactive Manual of Techniques for River Restoration
-  The New Rivers and Wildlife Handbook (RSPB, 2001).

- 2.3 Following a review of the available guidance, the measures outlined below were identified as suitable for the sites watercourses.

Measure A – Re-meandering Straightened River Sections:

- 2.4 Extended sections of the main watercourses flowing through the site are straightened. The straight channels are indicative of previous straightening that has likely taken place to increase agricultural productivity across parts of the site.
- 2.5 Presently, the watercourses are relatively uniform, mostly concealed by hedgerows, scrub or tall vegetation with occasional standard trees present along the banks.

Potential Measure

- 2.6 Enhancing morphological and flow diversity in a straightened river channel can provide better quality habitats for macrophytes and benthic invertebrates, and as a result also improve habitats for fish.
- 2.7 Bank material, substrate and vegetation on alternate sides of the bank can be removed to create a sinuous channel (see Figure 1).

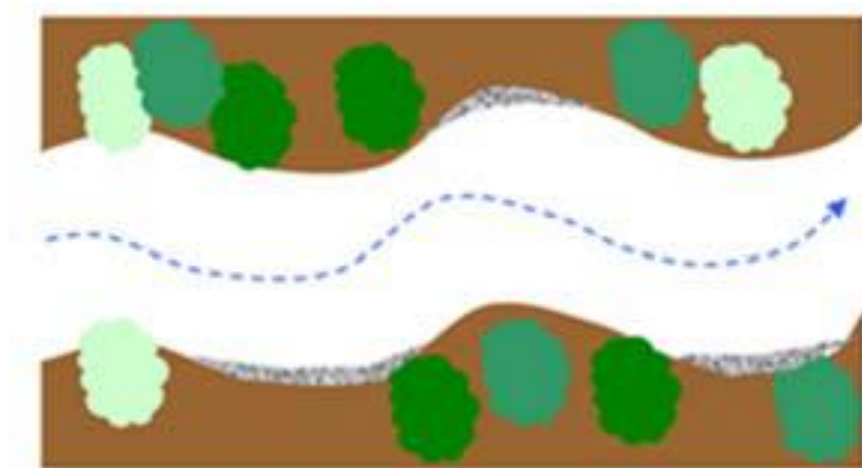


Figure 1: Schematic diagram of sinuous flow introduced into a straight channel through the selective removal of vegetation and substrate. Adapted from source: Buisson et al. (2008), p61

Safeguards and Controls:

- 2.8 Areas selected must not have existing ecological interest. Therefore, they must not affect mature trees, ancient woodland and established, species-rich ('important') hedgerows. The extensive nature of these important ecological assets and the need to protect them does limit the re-meandering potential to a few specific areas of watercourses through the site.
- 2.9 Any new meanders should not represent significant changes in direction so as not to affect the hydraulic function of the watercourses, gentle meanders can be designed within the 8m watercourses buffer either side of Hogwood/Robinson Crusoe Ditch provided within the masterplan, retaining the minimum buffer of 8m to development areas, in line with EA guidance.

Measure B – Restore backwater habitats:

Existing Conditions:

- 2.10 Backwaters are areas of aquatic habitat that are open to the channel at one end and are seasonally characterised by slow currents, shallow water and silt substrates.
- 2.11 Currently, a number of existing field boundary/land drainage ditches on site have limited water flow and in larger storm events act as backwaters to Hogwood/Robinson Crusoe Ditch.

Opportunity for Enhancement

- 2.12 There is opportunity to enhance the onsite watercourses, to provide important habitat for a range of aquatic flora and fauna, including invertebrates, macrophytes and fish.
- 2.13 At the detailed design stage, the ditches that connect into Hogwood/Robinson Crusoe Ditch throughout the site can be re-profiled to provide the following key attributes:

-  Include a range of water depths to allow a range of vegetation to establish across the hydrological profile with maximum depths sufficient to prevent emergent plants colonising the whole area.
-  Backwater entrance will be 2m width (minimum) to allow access by fish and other fauna.
-  Integrate features to enable the backwater to function hydraulically under a range of flow conditions taking into account the sediment regime and longer-term sustainability of the feature.

Safeguards and Controls:

- 2.14 The feasibility of using each ditch as a backwater will be dependent on the need to retain sensitive ecological features.
- 2.15 Only ditches that don't actively drain flows from offsite will be enhanced as the works could otherwise change the hydrological regime.

Measure C – Bank Re-profiling:

Existing Conditions:

- 2.16 Presently, the banks of Hogwood/Robinson Crusoe Ditch have a mainly steep, uniform, almost trapezoidal profile.

Opportunity for Enhancement

- 2.17 The banks of the ditches could be physically reshaped to incorporate shallow ledges just under the water line, and intermediate ledges that lead to a more stepped profile as shown in Figure 2 below.

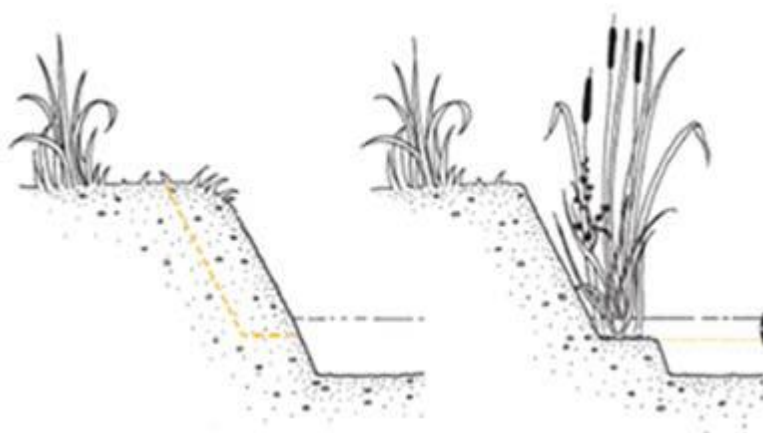


Figure 2: Schematic diagram of a bank reprofiled to create a submerged berm (Source: Buisson et al., 2008, p.82).

Safeguards and Controls:

- 2.18 The principles to be followed for any bank reprofiling would be as follows:
 -  Map and mark out any areas to be avoided following consultation with an experienced ecologist to prevent harm to existing ecological features.
 -  Cut the gradient of the reprofiled bank to approximately 35°. An asymmetric profile which incorporates shallow shelves and low berms should be aimed for.
 -  Reprofile upstream and downstream of the target section of bank to create a smooth transition.
 -  If the bank material easily erodes, it may be necessary to stabilise the bank surface using vegetation (see below).

-  Due to the potential for erosion and deposition of fine sediment whilst vegetation is re-establishing it is recommended that where possible, work is only undertaken on one bank at a time.

Measure D – Management of Trees, Marginal and Bankside Vegetation:

Existing Conditions:

- 2.19 Parts of Hogwood/Robinson Crusoe Ditch through the site are heavily vegetated with tree and hedgerow cover that limits the passage of light to the channel itself. This has resulted in sparse growth of marginal vegetation and emergent, with limited aquatic vegetation found. Away from the bank of the watercourses, pastoral vegetation quickly takes over, due to the current and historic land use; limiting the extent of natural vegetation.

Opportunity for Enhancement

- 2.20 There is opportunity for tree and shrub planting, these areas are shown in Appendix A (watercourse enhancement opportunities plan). Retained sections of the watercourse that already support existing trees and sections of hedgerow will be retained if they are of ecological significance. Accordingly, a balance will be struck between open areas with a diverse flora that receives plenty of sunlight, compared to more shaded sections of the watercourses that are cooler, less vegetated and receive high levels of leaf litter from fallen leaves. This should provide optimal conditions for wildlife.

Safeguards and Controls:

- 2.21 Planting is likely to provide the most sustainable option for stabilising the banks, compared to other engineered options. A planting scheme should take into account of the following:
-  existing water quality,
 -  water level fluctuations,
 -  channel capacity,
 -  maintenance needs,
 -  existing seed bank.
- 2.22 A strategy will be detailed to ensure successful establishment in the longer term.
- 2.23 Only plants typical of the catchment area will be selected and these will be planted during spring/summer. As this avoids the worst of the frosts and gives vegetation a significant part of the growing season to become established.
- 2.24 Seeding will be undertaken on existing banks and during construction of new banks where appropriate.
- 2.25 For existing banks, the vegetation will be stripped back and a thin layer of topsoil (<10cm) mixed with the subsoil before reseeded.
- 2.26 If necessary, soft bio-engineering measures such as geotextiles and pre-planted coir rolls could be introduced along artificially created berms at the base of slopes to promote rapid establishment of favourable habitat, whilst restricting impacts of sedimentation over the interim period whilst vegetation is stabilising.
- ### *Example Watercourse Cross-Sections*
- 2.27 Figure 3 and Figure 4 provided below shows a typical section of a watercourses before and after measures detailed above have been incorporated.

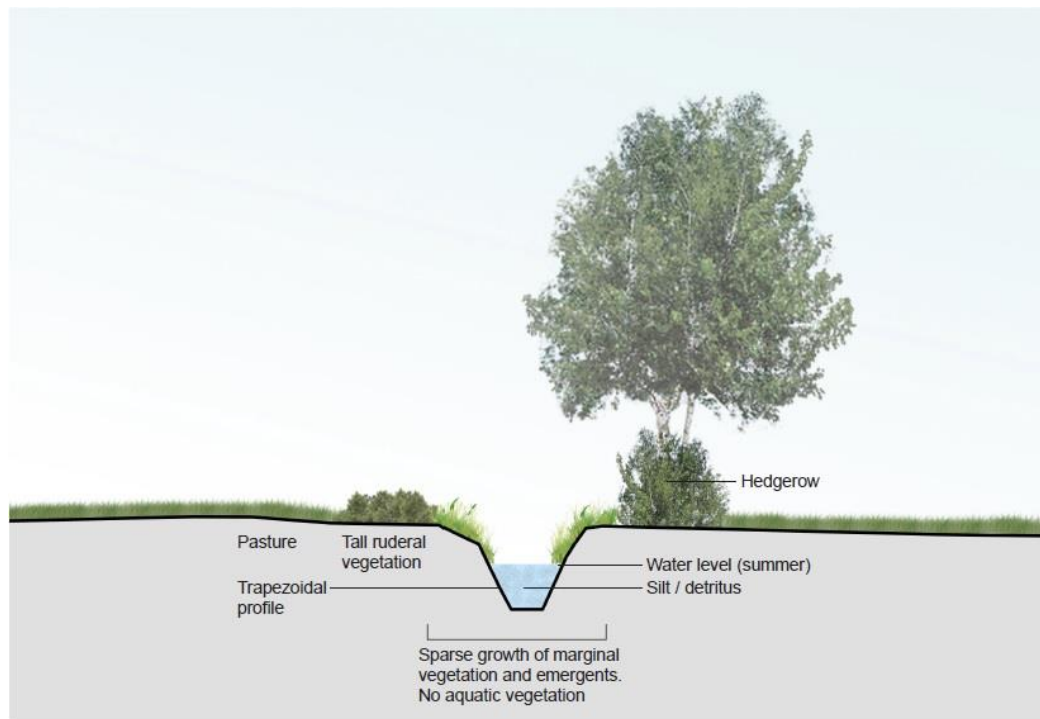


Figure 3: Typical section through watercourses before enhancements

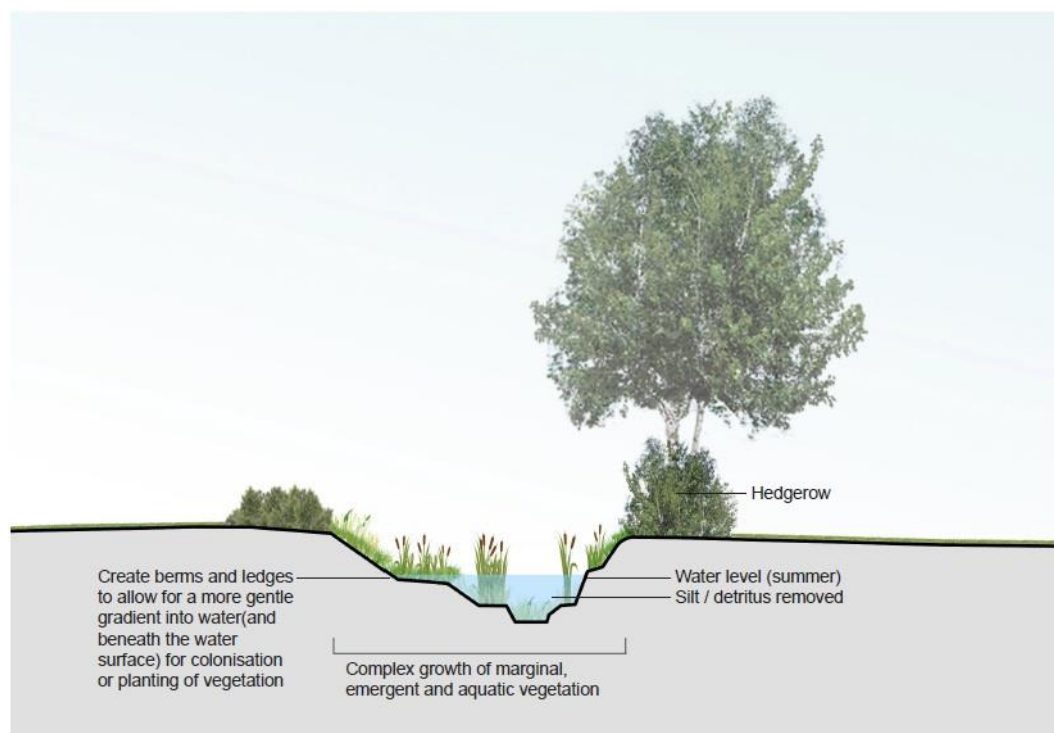


Figure 4: Typical section through watercourses after enhancements

3. Possible Watercourse Enhancements

- 3.1 After reviewing the available information for the site, Robinson Crusoe Ditch has been found to have opportunity for watercourse enhancements. The current ecological value of this ditch could be improved by re-meandering straightened stretches of the ditch in the north-eastern end of the site (See Appendix A which shows the proposed ditch plan with opportunities for watercourse enhancements). As well as re-profiling the banks for a more stepped profile which would promote biodiversity.
- 3.2 The scheme outlined above could be further aided by a tree and vegetation management scheme along the banks of Robinson Crusoe Ditch. It is important that appropriate vegetation for the area is planted in order to maximise the benefit to the environment and promote biodiversity.
- 3.3 All of the options listed above are displayed on the preliminary watercourses enhancements plan in Appendix A.
- 3.4 Hogwood Ditch could potentially benefit from re-meandering of straightened sections of the watercourses, especially in areas with sudden sharp changes of direction. However, the ditch mainly runs through areas of high ecological and arboriculture importance. Meaning that any changes to the Hogwood Ditch may be detrimental to the existing environment, areas of possible enhancement have been marked on plan in Appendix A.
- 3.5 The section of Hogwood Ditch located in the central-northern area of the site is currently low in terms of its ecological value. Appendix A shows that this area would benefit from bank re-profiling and management vegetation measures to improve the biodiversity of this area of the watercourse.
- 3.6 Some of the side ditches shown on this plan that feed into the main watercourses are known to have no flow consistent flow. Therefore, some of these ditches could be repurposed and enhanced into backwater environments. Turning some of these areas into backwaters would mean their ecological value will drastically improve (See Appendix A).
- 3.7 The opportunities for watercourse enhancements plan (Appendix A) also shows that some ditches are could be repurposed into swales. These ditches currently have no hydrological or ecological value and only convey onsite drainage flows. By incorporating the ditch network into the SuDS drainage strategy the ecological value of these ditches will be improved whilst benefiting the proposed development.

4. Summary

- 4.1 This technical note demonstrates broad principles of potential mitigation measures to enhance the watercourses, all of which are feasible within the site constraints and application proposals. These measures, which can be incorporated at detailed design stage would improve the existing watercourses, taking it from an intensively managed, straightened channel to one with increased morphological diversity, varying water depths and increased biodiversity. The enhancement of existing backwaters will provide important habitats for a range of flora and fauna.
- 4.2 Each of these measures can be provided in a way that does not impact flood risk.

Document Issue Record

Technical Note No	Rev	Date	Prepared	Reviewed	Approved
009	A	04/18	JC	MAH	MAH

List of Appendices

Appendix A *Proposed Ditch Plan with Watercourse Enhancement Opportunities*

This document is for the sole use and reliance of jnp group's client and has been prepared in accordance with the scope of the appointment of jnp group and is subject to the terms of that appointment.

jnp group accepts no liability for any use of this document other than by its client and only for the purposes for which it has been prepared.

No person other than the client may copy (in whole or in part) or use the contents of this document, without the prior written permission of jnp group.

Any advice, opinions or recommendations within this document should be read and relied upon only in the context of this document as a whole.

Any comments given within this report are based on the understanding that the proposed works to be undertaken will be as described in the introduction. The information referred to and provided by others and will be assumed to be correct and will not have been checked by jnp group, jnp group will not accept any liability or responsibility for any inaccuracy in such information.

Any deviation from the recommendations or conclusions contained in this report should be referred to jnp group in writing for comment and jnp group reserve the right to reconsider their recommendations and conclusions contained within. jnp group will not accept any liability or responsibility for any changes or deviations from the recommendations noted in this report without prior consultation and our full approval.

Appendix A: Proposed Ditch Plan with Watercourse Enhancement Opportunities

