

RPS

OLD PARK FARM, WATERLOOVILLE

**RIVER MITIGATION STRATEGY FOR
OLD PARK FARM STREAM,
WATERLOOVILLE**

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Appendix A: Stream corridor proposals (RPS)

1 INTRODUCTION

Requirement for a River Mitigation Strategy

- 1.1 The proposed development at Old Park Farm is part of the Waterlooville Major Development Area (MDA). The location of the MDA was identified by the Hampshire Structure Plan, following a rigorous site selection process which considered eleven potential sites within Hampshire, and their development potential and capacity. The allocation of Old Park Farm as part of the MDA was confirmed by the Winchester City Council Local Plan, adopted July 2006, and the Havant Borough Local Plan, adopted September 2005.
- 1.2 The master plan for the site was developed from 2000 onwards through a capacity study, adoption of a preferred option, and adoption of a Masterplan layout, known as FPCR Master Plan 25P, which was endorsed by a Forum made up of the local planning authorities and relevant stakeholders' and consultees. The parameters of the Masterplan agreed with the Forum were based on the need to achieve a minimum of 450 dwellings along with substantial business space and support facilities within a relatively limited geographic area.
- 1.3 Master Plan 25P showed residential and mixed use development across the north eastern part of the site, and provided for main and secondary accesses from Hambledon Road, open space in the western part of the site, and a green corridor along the eastern and southern site boundaries. However, the Plan made no provision for a corridor to accommodate the existing alignment of Old Park Farm Stream as it crossed the site. The Stream alignment was shown as 'washed over' by residential and mixed use development.
- 1.4 During the development of the more detailed master plan for Old Park Farm, further discussions were held with consultees, and a request was made that the whole route of Old Park Farm Stream be accommodated within a green corridor crossing the development. However, this would have fragmented the development and the quantum of development envisaged by FPCR Master Plan 25P could not have been achieved. Furthermore, much of the existing stream alignment is heavily shaded, with little aquatic or emergent vegetation. The opportunity therefore exists to divert the stream to a more appropriate corridor on the eastern site boundary and enhance its conservation value through the manipulation of levels and by native planting to create a variety of habitats. This course of action was agreed with consultees, including the Environment Agency.
- 1.5 An outline planning application for the development of the land at Old Park Farm was submitted in March 2005. The submission followed lengthy discussions with statutory and non statutory consultees, and consideration of the proposed master plan by a Design Forum made up of the local planning authorities and relevant stakeholders. The application was accompanied by an Environmental Statement which reported on the findings of detailed studies of the potential impact of the proposed development, including ecological studies. The Statement was subject to the required consultation process.
- 1.6 Changes to the proposed master plan following comments made by the local planning authorities and consultees resulted in the submission of an addendum to the application in March 2006 and an Addendum to the Environmental Statement. Comments made in respect of the detail of the diversion of Old Park Farm Stream were taken into account in the production of landscape plans

showing the proposed treatment of the stream diversion at 1:1,000 scale, and sections at 1:250 scale, which were contained within the Addendum to the Environmental Statement. The landscape plans and sections also showed the proposed location of an acoustic bund and fence to mitigate noise impact from Brambles Industrial Estate to the east of the site. The requirement for these acoustic measures has subsequently been disproven by the 'Phase 3 & 4 noise mitigation report' completed by WSP Acoustics dated 20th December 2011. The removal of the acoustic bund and associated fence has allowed for a more natural scheme to be developed, avoiding the land take previous made by this bundled feature.

- 1.7 Following further detailed discussions with the local planning authorities, and statutory and non statutory consultees, outline planning consent subject to a number of conditions was granted in January 2008. Since 2008 successful Reserved Matters Approvals have been granted for phase 1 & phase 2 of the residential development areas, with an application made for phases 3 & 4 (combined) made in December 2011. Construction on residential phases 1 & 2 have progressed considerably.

- 1.8 Condition 17 relates to the diversion of part of Old Park Farm stream and states that:

'No development approved by this planning permission shall commence, unless otherwise agreed in writing by the Local Planning Authority, until a full River Diversion and Mitigation Strategy, which shall include a timetable for their implementation, has been submitted and approved by the Local Planning Authority and implemented by the Developer in accordance with the approved details'.

- 1.9 Summary of the discussions with the EA and other interested parties, e.g. the River Restoration Trust, to provide background information on the aims and objectives of the stream diversion are listed below.

Aims and objectives

- 1.10 Condition 17 of the outline planning consent has been imposed to ensure that:

- a) any diversion of the Old Park Farm watercourse achieves real biodiversity gains;
- b) the proposals will be achievable, both in terms of high and low flows; and,
- c) a mitigation package is created that ensures ecological enhancement for the river corridor.

- 1.11 In addition to the above, this river mitigation strategy addresses landscape, public access and flood control issues, all of which are also pertinent to diverting a section of Old Park Farm stream.

Study area

- 1.12 The site comprises a series of grass fields, some of which were used to graze horses, bounded by mature hedgerows. The phased residential development continues to the east of the existing stream corridor.

- 1.13 Old Park Farm (OPF) stream cuts across the site from north to south, then turns west to form the southern boundary of the site. Brambles ditch forms the eastern boundary of the site; the ditch

and stream and not directly connected, though in the east of the site, flood waters from the two watercourses occasionally meet.

- 1.14 The development is part of the Waterloooville Major Development Area (MDA). Outline planning consent has been granted for a mixed use development over approximately two thirds of the Old Park Farm site, with the remainder set aside for open space and nature conservation, including the diversion of a section of the Old Park Farm stream.

2 OLD PARK FARM STREAM

Introduction

- 2.1 A Phase 1 Habitat survey of the Old Park Farm site was undertaken in September 2007 (RPS, 2008a). As part of the survey, a more detailed description of the stream was made than is normally the case for a standard Phase 1 Habitat survey, from which the current conservation status of the stream was assessed. The impact of the development on the stream and requirements for mitigation/compensation were also discussed in RPS (2008a). The relevant sections of the Phase 1 Habitat survey report (RPS, 2008a) are referred to below.

Description of Old Park Farm stream

- 2.2 Appendix A shows the current alignment of Old Park Farm stream.
- 2.3 Old Park Farm (OPF) stream enters the site from Hambledon Road, immediately north of the site, and flows to the southern boundary of the site, between Fields J and I. At this point, the stream turns west along the southern boundary of the site.
- 2.4 Section 1 of OPF stream, to the west of the access track into the site, was heavily shaded, with no aquatic or emergent vegetation, and the water was still. One specimen of each of Remote Sedge *Carex remota* and Pendulous Sedge *Carex pendula* were observed on the bank of the stream.
- 2.5 Section 2 of OPF stream, from the point at which it crosses under the access track to the point at which it emerges from woodland at the southern end of Field K, was similarly largely heavily shaded. Sections of the stream that were only semi-shaded by the trees were mostly overgrown with Bramble, with Broadleaved Dock and Nettle abundant. The majority of this section of the stream was inaccessible; however, at one point, it was possible to reach the stream under the canopy. Species recorded at the edge of the stream at this location included Wavy Bitter-cress *Cardamine flexuosa* (also found within the stream bed), frequent Nettle, and occasional Remote Sedge, Fool's-water-cress *Apium nodiflorum* and Hogweed.
- 2.6 A further stretch open to the light had Fool's-water-cress, Brooklime *Veronica beccabunga* and Water-pepper *Persicaria hydropiper*. At this point, the stream was around 1m wide, with very slow flowing water around 2cm deep.
- 2.7 Section 3 of OPF stream, from the point at which it emerges from the woodland, to the point at which it turns west to form the southern boundary of the site, was mostly overgrown on the western side (Field J) by tall ruderal vegetation comprising Nettle, Creeping Thistle and Broadleaved Dock, and on the eastern side by Bramble (Field I). Short stretches of stream that were more open had Fool's-water-cress, Water pepper and Gypsywort *Lycopus europaeus*. Species at the edge of the stream included Redshank *Persicaria maculosa*, Water Mint and Brooklime.
- 2.8 Section 4 of OPF stream comprised the final section of the stream, from the point at which the stream turns west along the southern boundary of the site, to the point at which the stream crosses the site boundary at the southwest corner. On the north side of the stream (i.e. within the site boundary), the stream alternated between open sections and sections overgrown with

- 2.9 Stretches of stream that were open and accessible were either open water or (in slow-flowing/still sections) dominated by Fool's-water-cress or Wavy Bitter-cress within the stream bed, with frequent Water Mint and occasional Brooklime, Gypsywort and Water-pepper towards the stream edge. Bankside species included Soft Rush, Greater Plantain *Plantago major*, Water Mint, Creeping Buttercup, Red Dead-nettle *Lamium purpureum*, Hogweed and Fleabane. A pool at the point where the stream passes from Field J to Field G had abundant Ivy leaved Duckweed *Lemna trisulca*.
- 2.10 Over the full length of the OPF stream on site, the stream depth varied from around 2cm to 10cm down a meandering course, comprising a bed of variously mud or mud and pebble, depending on the speed of the water flow. Bank height on the outside of meanders was around 0.5m.
- 2.11 At the time of the survey, the water was at most slow-flowing, and in places the water was still. However, the overall form of the stream, in terms of the presence of meanders and variation in the stream bed substrate, suggests that the stream experiences periods of high flow, sufficient to create the meanders between the low banks.

Conservation status of Old Park Farm stream

- 2.12 Old Park Farm (OPF) stream has been designated a Main River by the Environment Agency, as it is a tributary of the River Wallington. The stream enters the site from a culvert under Hambledon Road, immediately north of the site, and flows to the southern boundary of the site, between Fields J and I. At this point, the stream turns west along the southern boundary of the site. The stream has been described in four sections (see above), based on differences in its appearance and that of the surrounding vegetation.
- 2.13 Sections 1 and 2 of OPF stream are mostly heavily shaded by woodland on both banks, with no aquatic or emergent vegetation, except along a short stretch open to the light. Section 3, although not within woodland, was also mostly shaded by tall ruderal vegetation and Bramble. Short stretches open to the light had a slightly greater diversity of aquatic and emergent species than found in Section 2.
- 2.14 Section 4 was more varied than the previous three sections, alternating between stretches that were open water with a diversity of aquatic and emergent vegetation and stretches that were overgrown by tall ruderal vegetation.
- 2.15 Depth of water and speed of flow varied over the whole length of the stream on site, and the stream followed a meandering course suggestive of variations in flow.
- 2.16 Other than a concrete footbridge over the stream at the southern end of Section 2, there was no evidence of modifications to the channel bed, nor any evidence of artificial flood control measures such as reinforced stream banks. However, although the stream can be described as being an unmodified watercourse, the conservation value of the stream is greatly diminished by the fact that, for much of its length, it is heavily shaded, with no aquatic or emergent vegetation. Of the four sections of OPF stream described above, Section 4 is of greatest conservation interest, since it has suffered least from heavy shading and has the longest stretches of open water with a diversity of aquatic and emergent vegetation.

- 2.17 An invertebrate survey undertaken as part of the surveys to inform the Environmental Statement (RPS, 2005) concluded that OPF stream and adjacent habitats were of low invertebrate conservation value, based the fact that much of the stream is too heavily shaded, and that no damselflies or dragonflies were seen along the stream. No damselflies or dragonflies were seen during the recent Phase 1 Habitat survey either, despite the weather conditions being suitable (dry, sunny, warm, with little wind).
- 2.18 A more recent survey undertaken by the Environment Agency (pers. comm. Adam Fulton), comprising sampling of aquatic invertebrates at various locations within the Waterlooville Major Development Area (MDA), did not find any species of particular conservation interest from sampling stations along Old Park Farm stream or Brambles ditch. Two ponds were found to have species rich invertebrate communities; neither of these ponds is located within the Old Park Farm site, nor are they hydrologically connected to the development site.
- 2.19 Without management to reverse the decline in condition from heavy shading, it is expected that those stretches of the stream that are currently open to the light will, over time, become shaded like the remainder of the stream, and the aquatic and emergent species will eventually be lost from the stream.
- 2.20 The River Wallington catchment, along with all other major river catchments in the county, is covered under the Water and Biodiversity Topic Action Plan of the Hampshire BAP (www.hampshirebiodiversity.org.uk). The stream crossing the site is an upper tributary of this river. This catchment is not covered under a specific county habitat action plan and supports low species diversity. Old Park Farm stream is therefore considered to be of district conservation value. However, as noted above, this conservation value is likely to decline over time without appropriate management of the bank side vegetation to reverse the trend for over-shading of the stream.

Impact of the development on Old Park Farm stream

- 2.21 The development proposals would result in the loss of around one quarter of the current alignment of Old Park Farm (OPF) stream (316m of a total of 1123m on site, 28%), which is designated a Main River by the Environment Agency, resulting in a significant negative impact at the level of the district.
- 2.22 However, the development proposals include mitigation for this loss; the stream is to be diverted to the eastern edge of the site, within an artificially created floodplain in which native planting appropriate to the ground conditions is proposed, the total length of which will be 333m. The detailed design and landscaping of the diverted stream corridor is the subject of this River Mitigation Strategy, required to satisfy Condition 17 of the outline planning permission. As such, the residual impact will be minimal in the long term.

Requirements for mitigation/compensation in relation to Old Park Farm stream

- 2.23 Although the development proposals would result in the loss of around one quarter of the current alignment of Old Park Farm (OPF) stream (316m of a total of 1123m on site, 28%), which is designated a Main River by the Environment Agency, mitigation for this loss is built into the proposals. The stream is to be diverted to the eastern edge of the site, within an artificially created floodplain in which native planting appropriate to the ground conditions is proposed, the total length of which will be 333m.

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- 2.24 As specified in the original ES, the diverted section of stream will replicate the existing channel profile, described in the results section of this report, as appropriate. It is proposed that aquatic and marginal species, located in the section of OPF to be diverted, be removed from the stream prior to construction works starting, and stored on site until they can be planted into the newly created stream bed. If appropriate, gravel and mud from the existing stream bed could also be translocated to the new stream bed, to maximise the likelihood of the new section of stream being colonised by aquatic invertebrates. Refer to the diverted stream technical designs by MJA engineers and stream corridor landscape designs by RPS

3 POLICY BACKGROUND UNDERPINNING PROPOSALS

Planning Policy Statement 9

- 3.1 Planning Policy Statement 9 (PPS9) (ODPM, 2005) states that 'plan policies and planning decisions should aim to maintain, and enhance, restore or add to biodiversity and geological conservation interests'. In addition, 'plan policies should promote opportunities for the incorporation of beneficial biodiversity and geological features within the design of development'.
- 3.2 PPS9 also states that 'the aim of planning decisions should be to prevent harm to biodiversity and geological conservation interests. Where granting planning permission would result in significant harm to those interests, local planning authorities will need to be satisfied that the development cannot reasonably be located on any alternative sites that would result in less or no harm. In the absence of any such alternatives, local planning authorities should ensure that, before planning permission is granted, adequate mitigation measures are put in place. Where a planning decision would result in significant harm to biodiversity and geological interests which cannot be prevented or adequately mitigated against, appropriate compensation measures should be sought. If that significant harm cannot be prevented, adequately mitigated against, or compensated for, then planning permission should be refused'.
- 3.3 The requirements of Planning Policy Statement 9 are such that any diversion of Old Park Farm stream must result in a net gain for local biodiversity; this document sets out how this will be achieved.

Hampshire Water and Biodiversity Topic Action Plan

- 3.4 The Hampshire Water and Biodiversity Topic Action Plan (Hampshire Biodiversity Partnership, 2003) aims to provide a review of the current status of water-dependent habitats and species within the county and to provide recommendations for action.
- 3.5 The document includes an assessment of the issues causing concern within Hampshire's river catchments. The report states that the river Wallington, of which Old Park Farm stream is a tributary, is generally of low intrinsic nature conservation value and has little impact upon the conservation of wildlife sites within its catchment. It has generally fairly good biological quality, although is impacted by diffuse pollution from agricultural activities and point pollution from industrial sources.
- 3.6 There is therefore the opportunity, in diverting part of Old Park Farm stream, to deliver a net biodiversity gain, through addressing some of the issues mentioned above. In particular, the proposals for the diverted floodplain include the creation of various types of species-rich grassland that will be managed without the use of agricultural fertilizers, thereby reducing the impact of diffuse pollution on the Wallington catchment.

4 HYDROLOGY AND HYDROGEOLOGY OF SITE

Introduction

- 4.1 The proposals to divert a section of Old Park Farm stream and provide a mosaic of riparian habitats of intrinsic conservation value and/or of value to species of conservation importance rely on a sound understanding of the hydrological and hydrogeological conditions at the site, as these will determine which habitat types can successfully be created along the diverted section of stream and its floodplain.

Existing hydrological conditions

- 4.2 The following sections provide a brief overview of the prevailing hydrological conditions within the existing watercourse. The baseline conditions have been used to identify the prevailing eco-hydrological conditions and review the viability of creating the various habitat mosaics and features which are required. The available data sources to define the baseline hydrology within the site include:
- short term sewer flow monitoring (7 week period, May to July 2005) used as verification data for the urban drainage model of the sewered catchment area (monitored both twin outfalls to the OPF Stream and Brambles Watercourse);
 - high flow assessment of inflows into the OPF Stream and Brambles Ordinary watercourse from the verified urban drainage model - inflows for events ranging between 1 in 5 to 1 in 100 plus climate change are available;
 - monthly spot gauging data undertaken by EA since 2002 at the downstream and upstream ends of the OPF Stream, of minimal use for defining baseflows (the EA have recently installed continuous stage gauging data, although this has only been operational since 2005); and,
 - results of a geo-environmental investigation in which a series of boreholes, trial pits and window sample points were undertaken in October 2006, with additional groundwater monitoring undertaken until October 2007.

Surface water inflows

- 4.3 The available surface water monitoring results for the Old Park Farm Stream indicate that discharges from the urban drainage system are intermittent and respond relatively rapidly to rainfall events. This is supported by the short term monitoring work undertaken by Southern Water, which notes that the rising and recession limb of the hydrographs quickly recede down to a negligible baseflow. EA monitoring records indicate that the response of the urban drainage flows is more marked following prolonged periods of continuous rainfall rather than localised convective rainfall events.
- 4.4 In terms of high flows, the verified urban drainage model provided synthetic hydrographs for a range of storm return periods including the 1 in 5, 1 in 25, 1 in 50, 1 in 100 year, 1 in 100+CC and 1 in 200 year events for both the outfalls that discharge to the OPF Stream and Brambles

watercourse. The results of the urban drainage model range between 1 to 2 cumecs for the 1 in 5 to 1 in 200 year events respectively for both watercourses.

- 4.5 The EA continuous gauge records along the OPF Stream provide approximately 2 years of stage data, which provides an indication of the low flow behaviour of the watercourse. However, there is currently no defined rating curve to relate stage to stream flows. The River Wallington ISIS model developed by PBA could provide a tool to derive flow rates from the observed stage hydrographs. The maximum recorded stage for the three events analysed by the EA is approximately 0.2 0.4m.

Geology and hydrogeology

- 4.6 A geo-environmental site investigation was undertaken by WSP Environmental in October 2006 (ref 12220124 Dec 2006). A number of trial pits, boreholes and window samples were undertaken across the site. Standpipes have been installed in a number of the boreholes and window samplers to define the spatial and temporal variability in groundwater flows.
- 4.7 The exploratory holes generally encountered Topsoil overlying variable Head deposits overlying a weathered sequence of London Clay. Within the builder's yard, most of the exploratory holes encountered a variable thickness of Made Ground overlying Head deposits with weathered London Clay below.
- 4.8 The OPF Stream is reported by the EA to be ephemeral in nature and it is believed that the hydrological regime within the watercourse is significantly influenced by both the underlying geology, as well as the urban drainage system located upstream of the site. The EA have reported that the watercourse generally has negligible base flow during summer months and has a flashy response to rainfall events during the winter period, which is likely to be caused by the intermittent nature of discharges from the upstream urban drainage system, but could also indicate that there is limited contribution from groundwater.
- 4.9 During the site investigation, evidence of groundwater at or close to surface level was noted in the north east portion of the site during the fieldwork, and this area was very soft/wet underfoot, indicative of spring line conditions.
- 4.10 Additional ground water level monitoring was undertaken until October 2007 and is presented in WSP letter dated 20th November 2007.
- 4.11 During the initial monitoring period, the shallowest groundwater is evident in the north east of the site in the proximity of WS3, WS2 and BH1, consistent with the presence of a spring line in this area. However, groundwater levels collected during recent months indicate that the water table is shallow across the majority of the site.
- 4.12 The shallow groundwater table is likely to represent a perched water table within the River and Valley Gravel deposits that underlie the eastern section of the site.

Ground water flow

- 4.13 The direction of groundwater flow appears to tend to the south or south west over the majority of the site. However, groundwater flow is locally towards the east or south east in the north eastern quadrant of the site, in the proximity of the spring line.

4.14

The course of the OPF Stream watercourse is generally underlain by a permeable lens of River Valley Gravels. These deposits are classified as a minor aquifer. The available borehole information indicates the presence of a perched water table, which is likely to be in direct hydraulic continuity with surface water. Therefore during summer months when antecedent rainfall is likely to be low, flows entering the watercourse are likely to infiltrate into the underlying lens, which coupled with the adjacent tertiary deposits results in the absence of base flow within the OPF Stream.

5 LANDSCAPE CONCEPT AND DESIGN PRINCIPLES

Introduction - Design Code principles

5.1 Within the Design Code for the Old Park Farm development, objectives for the stream corridor were set out, with both the existing and diverted sections of the stream treated in similar ways, to provide a harmonious and rich stream habitat. The stream corridor comprises of a linear open space which seeks to create an attractive natural setting for local residents and workers to co-exist with wildlife. The focus is towards improving the biodiversity of the existing stream and also the creation of new habitat areas within the new diverted stream thorough the formation of comprehensive landscape design and management proposals. The proposals have three main objectives:-

- i. The protection, enhancement and creation of new and diverse habitats, rich in flora and fauna which is typical to wetland and marginal areas.
- ii. The diverted section of the stream should take an informal, meandering course, one that mimics naturally occurring streams in the local area.
- iii. Aesthetically, the stream should create an attractive setting for the proposed residential development; one that avoids any conflict with the biodiversity goals for the open space.

The informal design of the stream corridor seeks to merge the new habitat into the existing stream seamlessly. A gently meandering stream channel will form a series of pools and streamlets which will provide a variety of ground and soil water conditions. Locally native plant species will be sourced to complement and add to those found within the stream already; where viable, plant stock will be translocated from the diverted stream into the newly formed channel.

Opportunities and constraints in the landscaping of the diverted stream corridor

5.2 The design of the diverted stream channel is constrained a number of issues which have been taken into account in the proposals. Within the original scheme submitted as part of the ES the noise attenuation bund and fence to the east of the stream corridor could have potentially detracted from the naturalistic, informal character of the space, however the removal of this part of the scheme from the diverted stream corridor will enhance the naturalistic character of the area.

5.3 To avoid creating a narrow, engineered channel sufficient space has been afforded to the diverted stream corridor to enable flood plain areas to be included, again in a naturally contoured style. Within the planning of the site, opportunities for the stream to meander in a natural fashion have been allowed for, with narrow pinch points and more open stream sections creating a varied stream course and varied habitats.

5.4 As part of the stream diversion a comprehensive, detailed landscape design for the newly proposed channel will aim to integrate the stream into the context of the surrounding landscape. Existing topsoil will be stripped from the current stream and stored carefully until it can be reused within the newly formed stream channel, the seed bank held within these soils will be allowed to establish naturally and managed to allow locally prevalent grass and wildflower swards to establish (a measure which has proven successful on site already within the SUDS ponds within

the western open space area). If a naturally occurring sward fails to establish within the first few growing seasons native wildflower and grass seed mixes will be sown to create a series of wetland, marshy and hay meadows; these will be sown in locations related to the expected ground conditions, with damper conditions calling for species more tolerant of wetter soils. The seeding proposals will include sufficient variety to allow for seasonal difference in ground conditions, inevitably certain species will establish better than others, and as ground wetness varies *certain species* will become more prevalent than others.

- 5.5 Herbaceous marginal species including rushes, sedges and irises will be planted as informal swathes alongside the stream channel, with pockets of wetland coppice shrubs (such as willow and alder) providing some structure to the corridor and also providing habitat for birds and bats. Both shrub and herbaceous areas will be managed to maintain a free-flowing stream course. Standard and multi-stemmed trees will add further variety to the streams course, providing localised shade and opportunities for birds to nest.
- 5.6 Access to the stream corridor will be for pedestrians and cyclists only, with suitable vehicle deterrents used where the corridor passes near to roads or driveways to prevent fly parking. A hard wearing material for the footpath will provide access for all to enjoy the corridor, with occasional bridges over the stream to offer crossing points; this will also help to avoid any informal routes being sought across stream and its meadow / marginal habitats.

6 PROPOSALS FOR DIVERTED STREAM CORRIDOR IN RELATION TO ECOLOGY / BIODIVERSITY

Introduction

- 6.1 As a result of a request from the Environment Agency for further information in relation to the proposed diversion of a section of Old Park Farm stream, an Addendum to the ES was submitted to the Local Planning Authorities in 2006 (RPS, 2006). This provided information on the proposed diversion, highlighting changes to the proposals of benefit to biodiversity. The detailed design of the stream diversion is based on the information submitted as part of the ES Addendum (reproduced below) and approved as part of the outline planning consent, received in January 2008.
- 6.2 The diverted stream corridor was redesigned from a trapezoidal channel large enough to contain one-in-hundred year flood flows, to a small, meandering channel commensurate in size with dry-weather flow volumes, within a wider floodplain capable of containing both winter storm events and a one-in-hundred year flood event. Details of the proposed stream corridor are shown on Appendix A.
- 6.3 Off line swales and scrapes have been added to the diverted stream corridor and along the open space corridor which follows the existing (retained) stream. These shallow features will provide seasonally damp areas soil, which will provide a medium for a different range of grassland species to establish.
- 6.4 Within the diverted OPF floodplain, areas of marshy/wet vegetation are proposed, depending on the underlying hydrology/geology and water table. A second stage channel / shelf has been proposed along certain sections of the diverted stream, these will provide opportunities for damper soil conditions within the stream banks, and provide a more natural looking stream form

Habitat requirements of species of conservation interest associated with Old Park Farm stream

- 6.5 The current conservation status of Old Park Farm stream on site is poor and will decline further if not managed appropriately. The stream is bordered by generally species poor grass fields, and scrub encroachment has reduced the conservation value of the stream by shading it to the point that only a few, un-shaded, sections of the stream still support aquatic and emergent vegetation.
- 6.6 By diverting a section of the stream as part of the development of the site, there is an opportunity to enhance the biodiversity of both the stream and its floodplain by creating a varied mosaic of riparian habitats. This will benefit a number of species of conservation interest, some of which are known to be present on site currently and for which there is the opportunity to enhance the local population.

Habitats

- 6.7 The development will result in the loss of areas of species-poor semi-improved grassland from the site. Within the newly created section of floodplain, there is an opportunity to create three types of species-rich grassland that are collectively known as Lowland Meadows. These

comprise *Cynosurus cristatus* – *Centaurea nigra* grassland (MG5), *Alopecurus pratensis* – *Sanguisorba officinalis* floodplain (MG4) and *Cynosurus cristatus* – *Caltha palustris* flood-pasture (MG8). Lowland Meadows is a habitat listed in Section 74 of the Countryside and Rights of Way Act 2000 as being of principal importance for the conservation of biodiversity.

- 6.8 The three types of Lowland Meadows have undergone a significant decline in the 20th century, almost entirely due to changing agricultural practice. It is estimated that, by 1984 in lowland England and Wales, such grasslands had declined by 97% over the previous 50 years and an estimated extent of less than 15,000ha of species-rich neutral grassland survives in the UK today (www.ukbap.org.uk). One of the objectives of the Lowland Meadows action plan is to re-establish 500ha of lowland meadow of wildlife value by 2010 – the diversion of the Old Park Farm stream is an opportunity to contribute to this target, as well as providing high quality habitat for a number of species of conservation interest.

Invertebrates

- 6.9 An invertebrate survey of the development site, undertaken in July 2004 (RPS, 2005), found that the species-poor grasslands on site lacked the structural diversity and the diversity of flowering species that would produce an invertebrate assemblage of conservation significance. Furthermore, a recent survey undertaken by the Environment Agency (pers. comm. Adam Fulton), comprising sampling of aquatic invertebrates at various locations within the Waterlooville Major Development Area (MDA), did not find any species of particular conservation interest from sampling stations along Old Park Farm stream.
- 6.10 However, wetlands and water margins can be associated with one of the UK's most diverse invertebrate faunas, if managed appropriately. Similarly, exposed river sediment, in particular of shingle and sand in the upper and middle reaches of rivers, and eroding mini-cliffs along river banks, can support very diverse invertebrate faunal assemblages, if these are not compromised by shading from scrub encroachment or invasion by non-native species, notably Himalayan Balsam *Impatiens glandulifera* and Japanese Knotweed *Fallopia japonica*. Likewise, mosaics of habitats are very important to invertebrates, which frequently use different, adjacent habitats or microhabitats in successive life-stages (Key et al., 2000).
- 6.11 The proposed profile for the diverted section of OPF stream and the habitats proposed for its floodplain present an opportunity to create some of the habitats of value to invertebrates associated with wetlands, water margins, rivers and habitat mosaics, such that, in time, an invertebrate assemblage of conservation interest may form on site.

Reptiles

- 6.12 Two species of reptiles, Common Lizard *Zootoca vivipara* and Grass Snake *Natrix natrix*, were recorded at the Old Park Farm site during a reptile survey undertaken in September 2007 (RPS, 2008b).
- 6.13 Grass Snakes are usually strongly associated with water, and newts, frogs and toads form a large part of their diet (Beebee & Griffiths, 2000). The Grass Snakes found in the reptile survey in September 2007 were located close to Old Park Farm stream, in the southwest corner of the development site.

6.14 By including a variety of physical and habitat features in the design of the diverted section of OPF stream and its floodplain that will enhance the diversity of the local invertebrate assemblage, the population of amphibians along the stream will be boosted, thereby providing a ready supply of food for Grass Snakes. The population on site at present is very low (only two individuals were found during the surveys), so there is the potential to increase the Grass Snake population on site as a result of the stream diversion.

6.15 The mosaic of habitats that is planned for the diverted OPF floodplain will also benefit Common Lizards, which require undisturbed, topologically diverse ground, with fairly dense but short vegetation (less than 0.5m high) that is open to the sun and with at least a few exposed areas that can be used for basking. Sites near water, including grassy tussocks in marshy areas, are often favoured, perhaps because these sites often have an abundance of invertebrates (Beebee & Griffiths).

Bats

6.16 Seven species of bat (*Barbastella barbastellus*, *Noctule Nyctalus noctula*, *Daubenton's Bat Myotis daubentonii*, *Myotis species Myotis spp.*, *Common Pipistrelle Pipistrellus pipistrellus*, *Soprano Pipistrelle Pipistrellus pygmaeus* and *Brown Long-eared Bat Plecotus auritus*) were recorded at the Old Park Farm site during bat activity surveys undertaken in summer 2007 (RPS, 2008c). In addition, two of the species, Common and Soprano Pipistrelle, were recorded during emergence surveys in 2006-07 as roosting in mature trees on the site (RPS, 2008d).

6.17 The vast majority of individual bats recorded were Common and Soprano Pipistrelles, with *Noctules* and *Daubenton's* the next most common. The remaining species were recorded occasionally on site.

6.18 Common and Soprano Pipistrelles feed in habitats that include over water, marshes, in open woodland, woodland edges and along hedgerows. Favoured prey species include midges, caddis flies, mosquitoes, mayflies, lacewings and small moths, many of which are associated with water and/or wetland areas (Bat Conservation Trust, 2005a). *Noctules* feed over deciduous woodland, parkland, pasture, water and at forest edges, on moths, beetles (mainly chafer and dung beetles), mayflies and winged ants (Bat Conservation Trust, 2005b). *Daubenton's* bats are particularly associated with lakes, rivers and ponds, feeding on small flies (particularly chironomid midges), caddisflies and mayflies (Bat Conservation Trust, 2005c).

6.19 The diverted section of OPF stream presents an opportunity to create riverine habitats of value to the bat species mostly commonly recorded on site, by providing a mosaic of wetland and dry grassland areas and a varied stream morphology to encourage a diverse range of invertebrates.

Other species

6.20 Although not highlighted in the Environmental Statement for the proposed development (RPS, 2005), a number of common bird species will benefit from the proposed diversion of part of OPF stream, through the creation of a mosaic of habitats in which these species can forage and nest.

Proposed habitats for Old Park Farm stream and associated floodplain

6.21 The diversion of the stream, offers for the potential for:-

-
- The creation of different habitat types, based on water / nutrient etc requirements of different vegetation types and the likely water regime along the diverted stream corridor
 - Incorporation of habitat requirements of targeted protected species into proposals for corridor
 - delivery of the aspirations set out within the Design Code, including the constraints and opportunities within proposals

7 LONG-TERM MANAGEMENT AND MONITORING OF THE DIVERTED STREAM CORRIDOR

- 7.1 Brief description of aims and objectives for long-term management and monitoring of diverted stream corridor will be incorporated within a separate Management Plan for the site.
- 7.2 The Landscape and Ecology Management Plan for the diverted and retained stream open space corridors will include details of the management of the habitats and landscape features found within the open space stream corridors.

8 TIMETABLE FOR IMPLEMENTATION OF RIVER MITIGATION STRATEGY

8.1 The delivery of the stream diversion works will be phased to bring forward a technically achievable and ecologically sensitive programme of works. Factors which will affect the delivery of the stream are:-

- Achievement of successful consents and licences (where applicable)
- Seasonality of the protected species which maybe affected by the works (e.g. bats)
- Seasonality of the plant species which are targeted for translocation into the new stream channel
- Weather conditions during the programmed work period
- Progress of the main (residential) construction works
- Diversion of any existing services prior to commencement of works

8.2 The stream diversion works will follow the following sequence:-

1. In late summer / autumn (With due regard to any Statutory conservation requirements - including licencing) clear the diverted stream area of trees / vegetation earmarked for removal, including the trees believed to have the potential to house bat roosts. Store on site the tree trunks / lumber generated from the fellings for use within the final landscape scheme;
2. Remove the relict farm culvert (found toward Hambledon Road), recycle or cart spoil material off site;
3. During late spring / summer excavate (off line) the new stream channel to proposed gradients and alignments; including shallow scrapes, hollows and shelves. Grade stream banks to smooth even profile, establishing a clean and free draining sub soil surface medium;
4. Install any 'hard' features such as bridges, gabion mattresses and riprap stone bed areas;
5. During late summer / early autumn identify and lift carefully selected areas of vegetation (included targeted species listed within the plant schedule) from the existing stream and 'heal in' temporarily prior to formal translocation into the new stream corridor. Store marginal and aquatic plants as appropriate to their species (i.e. submerged under water permanently / set in wet soil or healed into damp soil conditions);
6. During late summer / autumn strip topsoil from existing stream (including bank areas local to the stream itself) and spread to specified depths over graded banks of diverted stream. Consolidate gently and retain a free draining and friable soil medium.
7. In autumn divert water flow from existing stream into new stream channel, securely seal / close off the existing stream channel (The existing stream will be backfilled by cohesive clay

which should prevent groundwater migrating up towards the existing route. As groundwater naturally moves towards areas where faster flow is available any groundwater interaction should migrate towards the new route) to prevent water flow along old stream route.

8. In autumn translocate temporarily stored marginal plants into new planting locations within diverted stream, to establish plants successfully water as required during dry weather conditions. Install pre-planted coir rolls.
9. In autumn / winter complete other native tree and shrub plantings (bare root and container grown stock).
10. In spring to supplement the translocated plants from the existing stream plant other marginal and aquatic plantings (plug and container grown stock);
11. During spring / summer monitor and manage emerging grass and meadow sward (naturally establishing from seed bank within existing topsoils), hand pull invasive weeds such as brambles, nettles and docks as required and cart off site arisings.
12. In late summer review natural establishment / regeneration of grassland sward, seed as required bare / sparse areas with seeding regime listed as part of landscape designs.
13. For a period of 12 months after initial implementation works manage all tree, shrub and grassland areas (include ecological features) to ensure successfully establishment of soft landscape elements.

Programme of works schedule

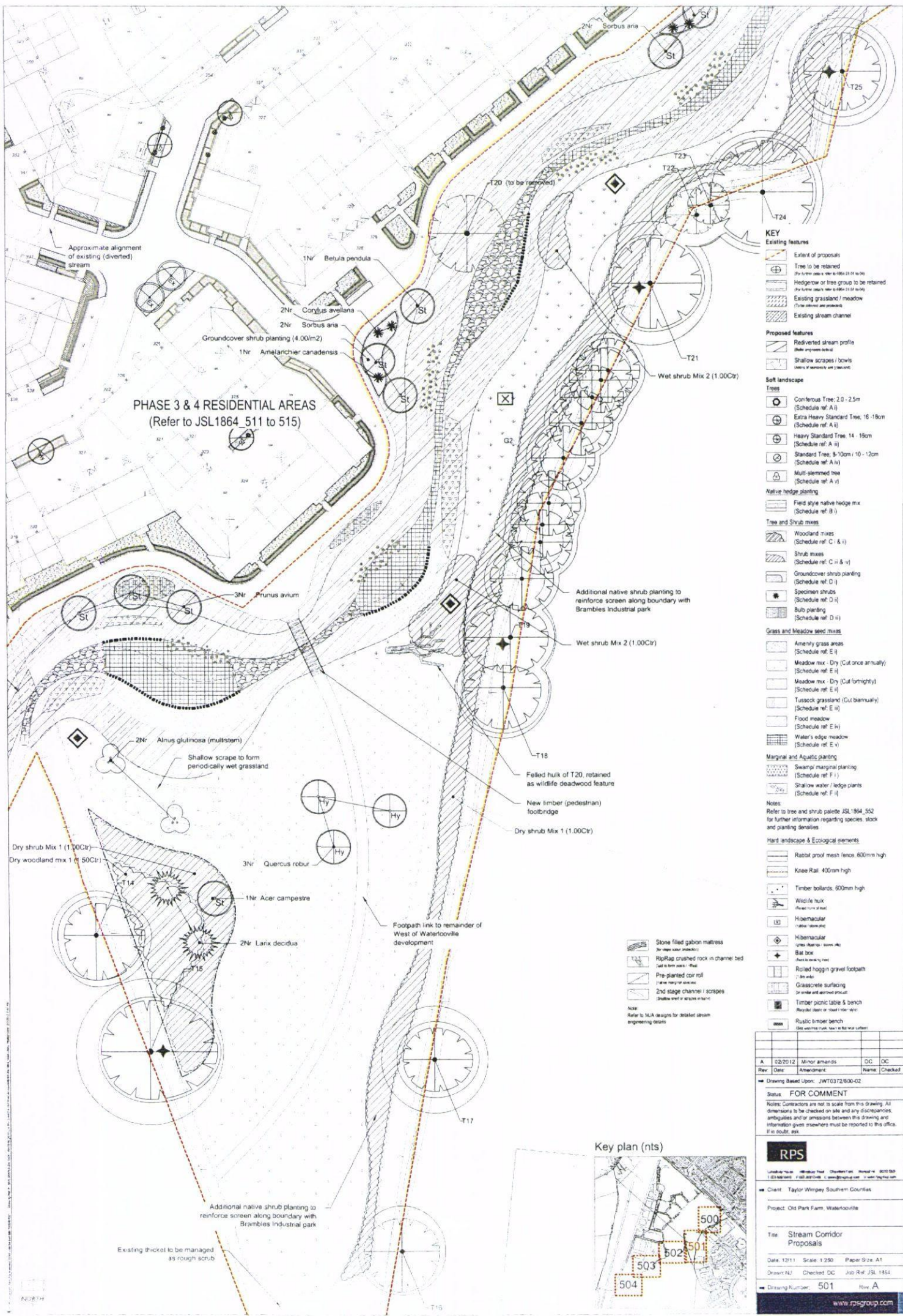
ACTIVITY	J	F	M	A	M	J	J	A	S	O	N	D
Site preparation												
Demolitions (existing stream culvert)												
Vegetation clearances												
Construction works												
Excavation of new stream channel												
Install bridges, paths, stream bed												
Topsoil strip												
Topsoil spreading												
Divert stream flow / close old stream												
Planting works:												
Marginal planting (inc lifted plants)												
Bareroot planting (trees / shrubs)												
Grass / meadow seeding (if required)												
Soft landscape:												
Tree and shrub maintenance												
Grassland management												
Ecological constraints / issues:												
Avoid roosting bats in trees												
Avoid nesting birds												
Marginal plants lifting period												

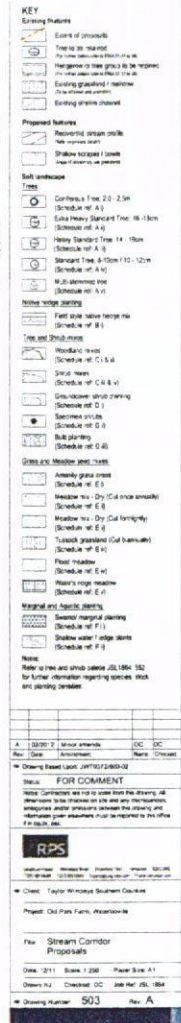
9 REFERENCES

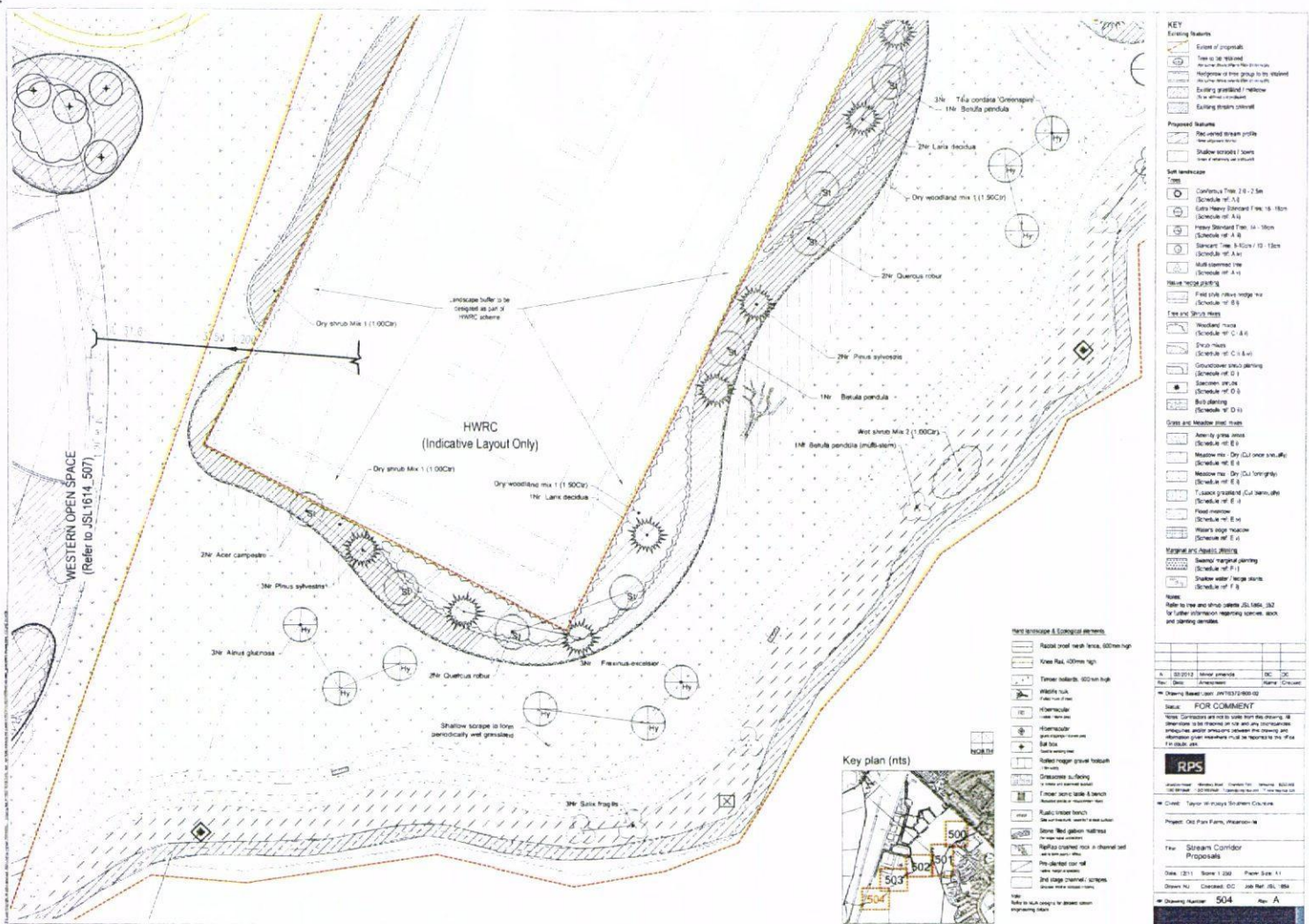
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APPENDICES

Appendix A – Stream corridor landscape designs









Tree and shrub palette (stream corridor)

Client: Taylor Wimpey Southern Counties

Status: For Comment

Project: Old Park Farm, Waterlooille (Phase 3 & 4)

Date: Feb 2012

Dwg Ref: JSL1864_500 to 504

Revision: .

Doc Ref: JSL1864_552

No	Abbr	Botanical name	Common name	Girth / size	Stock	Density / %
A. Trees						
i. Coniferous trees						
	Lar dec	European Larch	Larix decidua	2.0 - 2.5m	C / SR	
	Pin syl	Scots Pine	Pinus sylvestris	2.0 - 2.5m	C / SR	
ii. Extra heavy standard trees						
	Aln glu	Common Alder	Alnus glutinosa	16-18cm	C / SR / RB	
	Fra exc	Ash	Fraxinus excelsior	16-18cm	C / SR / RB	
	Que rob	Oak	Quercus robur	16-18cm	C / SR / RB	
	Sal alb	White Willow	Salix alba	16-18cm	C / SR / RB	
	Til pla	Broad - Leaved Lime	Tilia platyphyllos	16-18cm	C / SR / RB	
iii. Heavy standard trees						
	Ac cam	Field Maple	Acer campestre	14-16cm	C / SR / RB	
	Aln glu	Common Alder	Alnus glutinosa	14-16cm	C / SR / RB	
	Carp bet Fra	Carpinus betulus 'Frans Fontaine'	Hornbeam	14-16cm	C / SR / RB	
	Fra exc	Ash	Fraxinus excelsior	14-16cm	C / SR / RB	
	Til GS	Small - Leaved Lime	Tilia cordata 'Greenspire'	14-16cm	C / SR / RB	
iv. Standard trees						
	Ac cam	Field Maple	Acer campestre	10-12cm	C / RB	
	Aln glu	Common Alder	Alnus glutinosa	10-12cm	C / RB	
	Bet pen	Silver birch	Betula pendula	10-12cm	C / RB	
	Cra mon	Hawthorn	Crataegus monogyna	8-10cm	C / RB	
	Fra exc	Ash	Fraxinus excelsior	8-10cm	C / RB	
	Pru Ple	Wild Cherry	Prunus avium	10-12cm	C / RB	
	Que rob	Oak	Quercus robur	8-10cm	C / RB	
	Sal fra	Crack Willow	Salix fragilis	10-12cm	C / RB	
	Sorb ari	Whitebeam	Sorbus aria	10-12cm	C / RB	
v. Feathered trees						
	Ac cam	Field Maple	Acer campestre	1.75 - 2.0m	C / RB	
	Aln glu	Common Alder	Alnus glutinosa	1.75 - 2.0m	C / RB	
	Bet pen	Silver birch	Betula pendula	1.75 - 2.0m	C / RB	
	Carp bet	Hornbeam	Carpinus betulus	1.75 - 2.0m	C / RB	
	Cra mon	Hawthorn	Crataegus monogyna	1.75 - 2.0m	C / RB	
	Fra exc	Ash	Fraxinus excelsior	1.75 - 2.0m	C / RB	
	Pru Ple	Wild Cherry	Prunus avium	1.75 - 2.0m	C / RB	
	Que rob	Oak	Quercus robur	1.75 - 2.0m	C / RB	
	Sal fra	Crack Willow	Salix fragilis	1.75 - 2.0m	C / RB	
	Sorb ari	Whitebeam	Sorbus aria	1.75 - 2.0m	C / RB	
vi. Multi-stemmed trees						
	Aln glu	Common Alder	Alnus glutinosa	2.0 - 3.0m	C / RB	
	Cor ave	Hazel	Corylus avellana	2.0 - 3.0m	C / RB	
	Bet pen	Silver birch	Betula pendula	2.0 - 3.0m	C / RB	
	Sal alb	White Willow	Salix alba	2.0 - 3.0m	C / RB	

No	Abbr	Botanical name	Common name	Girth / size	Stock	Density / %
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Tree & shrub palette continued-

B. Hedge planting**i. Hedge mix 1 - Field style boundary (all hedgerow trees planted individually)**

Acer campestre	Field Maple	60 - 80cm	B	15%
Corylus avellana	Hazel	60 - 80cm	B	10%
Crataegus monogyna	Hawthorn	60 - 80cm	B	25%
Sambucus nigra	Elder	60 - 80cm	B	10%
Ligustrum vulgare	Common Privet	60 - 80cm	B	15%
Prunus spinosa	Blackthorn	60 - 80cm	B	10%
Rosa canina	Dog Rose	60 - 80cm	B	5%
Viburnum opulus	Guelder Rose	60 - 80cm	B	10%
<i>Native hedgerow planted at 6.00/m, in double staggered row.</i>				100%

C. Tree and Shrub mix planting**i. Woodland mix 1 (Dry woodland)****Shrubs**

Corylus avellana	Common Hazel	60-80cm	B	10%
Crataegus monogyna	Common Hawthorn	60-80cm	B	20%
Euonymus europaeus	Spindle	60-80cm	B	5%
Ilex aquifolium	Common Holly	60-80cm	B	5%
Ligustrum vulgare	Wild Privet	60-80cm	B	10%
Malus sylvestris	Wild Apple	60-80cm	B	5%
Prunus spinosa	Blackthorn	60-80cm	B	10%
Rosa canina	Dog Rose	60-80cm	B	5%
Viburnum opulus	Guelder Rose	60-80cm	B	5%

Trees

Acer campestre	Field Maple	60-80cm	B	5%
Fraxinus excelsior	Common Ash	60-80cm	B	2%
Fraxinus excelsior	Common Ash	8 - 10cm Std	C / RB	3%
Betula pendula	Silver Birch	60-80cm	B	5%
Fagus sylvatica	Beech	60-80cm	B	1%
Sorbus aucuparia	Rowan	60-80cm	B	1%
Carpinus betulus	Hornbeam	60-80cm	B	1%
Quercus robur	English Oak	60-80cm	B	2%
Quercus robur	English Oak	8 - 10cm Std	C / RB	5%
<i>Woodland mix planted at 1.5m/cs</i>				100%

ii. Woodland mix 2 (Wet woodland)**Shrubs**

Corylus avellana	Common Hazel	60-80cm	B	5%
Crataegus monogyna	Common Hawthorn	60-80cm	B	5%
Salix caprea	Goat Willow	60-80cm	B	20%
Salix cinerea	Grey Willow	60-80cm	B	20%
Frangula alnus	Alder Buckthorn	60-80cm	B	10%
Viburnum opulus	Guelder Rose	60-80cm	B	5%
Salix viminalis	Common Osier	60-80cm	B	10%

Trees

Acer campestre	Field Maple	60-80cm	B	5%
Ainus glutinosa	Common Alder	8 - 10cm Std	C / RB	3%
Fraxinus excelsior	Common Ash	60-80cm	B	2%
Fraxinus excelsior	Common Ash	8 - 10cm Std	C / RB	2%
Quercus robur	English Oak	60-80cm	B	3%
Salix fragilis	Crack Willow	1.0 - 1.75m Ft	C / RB	5%
Betula pubescens	Downy Birch	60-80cm	B	5%
<i>Woodland mix planted at 1.5m/cs</i>				100%

iii. Shrub mix 1 (Dry mix)

Corylus avellana	Common Hazel	60-80cm	B	10%
Crataegus monogyna	Common Hawthorn	60-80cm	B	20%
Euonymus europaeus	Spindle	60-80cm	B	5%
Malus sylvestris	Wild Apple	60-80cm	B	10%
Ligustrum vulgare	Wild Privet	60-80cm	B	10%
Prunus spinosa	Blackthorn	60-80cm	B	15%
Rosa canina	Dog Rose	60-80cm	B	10%
Viburnum opulus	Guelder Rose	60-80cm	B	15%
Ilex aquifolium	Common Holly	60-80cm	B	5%
<i>Shrub mix planted at 1.0m/cs</i>				100%

No.	Abbr	Botanical name	Common name	Girth / size	Stock	Density / %
Tree & shrub palette continued:-						
iv. Shrub mix 2 (Wet mix)						
		Rosa canina	Dog Rose	60-80cm	B	15%
		Crataegus monogyna	Common Hawthorn	60-80cm	B	15%
		Salix caprea	Goat Willow	60-80cm	B	20%
		Salix cinerea	Grey Willow	60-80cm	B	20%
		Viburnum opulus	Gelder Rose	60-80cm	B	10%
		Frangula alnus	Alder Buckthorn	60-80cm	B	10%
		Salix viminalis	Common Osier	60-80cm	B	10%
		Shrub mix planted at 1.0m/cs				100%
D. Shrub & Bulb planted areas						
i. Groundcover shrub planting						
	Mix A -	Hedera helix 'Hibernica'	Irish Ivy	2L	C	34%
		Symphoricarpos x chenaultii 'Hancock'	Snowberry	3L	C	33%
		Vinca minor	Dwarf Periwinkle	3L	C	33%
						100%
	Mix B -	Rosa 'grouse'	Groundcover Rose	3L	C	33%
		Lonicera pileata	Privet Honeysuckle	3L	C	33%
		Pyracantha 'Red Cushion'	Firethorn	3L	C	34%
						100%
ii. Specimen shrubs (within shrub planted areas)						
	Ame cana	Amelanchier canadensis	Snowy Mespil	10L	C	
	Cor ave	Corylus avellana	Hazel	10L	C	
	Cor san	Cornus sanguinea	Common Dogwood	10L	C	
	Vib opu	Viburnum opulus	Gelder Rose	10L	C	
iii. Bulb planting (within grass and meadow areas)						
	Mix A -	Crocus vernus (Cul)		5/7cm	Bl	20/m2
	Mix B -	Galanthus nivalis		5/7cm	Bl	20/m2
	Mix C -	Narcissus pseudonarcissus (Cul)		10/12cm	Bl	10/m2
E. Grass and Meadow seed mixes						
i. Amenity grass areas						
British Seed Houses - A22 Low maintenance seed mix					S	35g/m2
ii. Meadow mix - Dry					S	5g/m2
Dry grassland areas formed via utilising site won soils and the seed bank held within them, or seeded as below. Manage some areas as hay meadow (mown once/year in August) and some areas as shorter grass (mown once every two weeks in growing season)						
(If seeding regime is required base on Emorsgate mix EM4)		Achillea millefolium	Yarrow			
		Cardamine pratensis	Cuckooflower			
		Centaurea nigra	Common Knapweed			
		Galium verum	Lady's Bedstraw			
		Lathyrus pratensis	Meadow Vetchling			
		Leucanthemum vulgare	Oxeye Daisy			
		Lotus corniculatus	Bird's-foot Trefoil			
		Lychnis flos-cuculi	Ragged Robin			20% wild flowers
		Plantago lanceolata	Ribwort Plantain			
		Primula veris	Cowslip			
		Ranunculus acris	Meadow Buttercup			
		Rhinanthus minor	Yellow Rattle			
		Silene alba	Pepper-saxifrage			
		Stachys officinalis	Betony			
		Trifolium pratense	Red Clover (Wild)			
		Agrostis capillaris	Common Bent			
		Alopecurus pratensis	Meadow Foxtail			
		Anthoxanthum odoratum	Sweet Vernal Grass			
		Briza media	Quaking Grass			80%
		Carex hirta	Hairy Sedge			grasses (by weight)
		Festuca rubra ssp commutata	Red Fescue			
		Hordeum secalinum	Meadow Barley			
		Juncus compressus	Compact Rush			

No.	Abbr.	Botanical name	Common name	Girth / size	Stock	Density / %
<i>Tree & shrub palette continued:-</i>						
iii.		Tussock Grassland (based on Emorsgate mix EM10)			S	5g/m2
		Dry grassland areas alongside shrub planting				
		Tall grassland - patches mown in rotation, once every two years. Use as interface between shrub planting and hay meadow/shorter grass areas (good for invertebrates and reptiles)				
		Achillea millefolium	Yarrow			
		Agrimonia eupatoria	Agrimony			
		Centaurea nigra	Common Knapweed			
		Centaurea scabiosa	Greater Knapweed			
		Daucus carota	Wild Carrot			
		Dipsacus fullonum	Wild Teasel			
		Galium mollugo	Hedge Bedstraw			
		Geranium pratense	Meadow Crane's-bill			
		Hypericum perforatum	Perforate St John's-wort			20% wild flowers
		Lathyrus pratensis	Meadow Vetchling			
		Leucanthemum vulgare	Oxeye Daisy			
		Plantago lanceolata	Ribwort Plantain			
		Silene dioica	Red Campion			
		Torilis japonica	Upright Hedge-parsley			
		Verbascum thapsus	Great Mullein			
		Vicia cracca	Tufted Vetch			
		Vicia sativa ssp nigra	Common Vetch			
		Alopecurus pratensis	Meadow Foxtail			
		Cynosurus cristatus	Crested Dog's-tail			
		Dactylis glomerata	Cock's-foot			
		Deschampsia caespitosa	Tufted Hair-grass			
		Festuca arundinacea	Tall Fescue			80% grasses (by weight)
		Festuca pratensis	Meadow Fescue			
		Festuca rubra ssp commutata	Red Fescue			
		Holcus lanatus	Yorkshire Fog			
		Juncus compressus	Compact Rush			
		Juncus inflexus	Hard Rush			
iv.		Flood Meadow (based on Emorsgate mix EM8)			S	5g/m2
		Periodically inundated, Wet (flooded with a few cm of water) in winter, surface dry in summer though water table remains within 15 -20cm of surface				
		Managed as summer hay meadow with equivalent of spring and autumn grazing, as follows: Once grass begins to grow in spring, mow regularly to keep grass to 10-15cm high until end of April. Then leave grass to grow tall as a hay meadow, and cut a hay crop in August. After that, continue to mow regularly to keep grass at 10-15cm high. Stop mowing when weather turns cold and grass stops growing. Resume in spring as before.				
		Achillea millefolium	Yarrow			
		Cardamine pratensis	Cuckooflower			
		Centaurea nigra	Common Knapweed			
		Filipendula ulmaria	Meadowsweet			
		Galium verum	Lady's Bedstraw			
		Leucanthemum vulgare	Oxeye Daisy			
		Lotus pedunculatus	Greater Bird's-foot Trefoil			
		Lychnis flos-cuculi	Ragged Robin			
		Plantago lanceolata	Ribwort Plantain			20% wild flowers
		Primula veris	Cowslip			
		Prunella vulgaris	Selfheal			
		Ranunculus acris	Meadow Buttercup			
		Rhinanthus minor	Yellow Rattle			
		Rumex acetosa	Common Sorrel			
		Sanguisorba officinalis	Great Burnet			
		Silaum silaus	Pepper-saxifrage			
		Stachys officinalis	Betony			
		Vicia cracca	Tufted Vetch			
		Agrostis capillaris	Common Bent			
		Alopecurus pratensis	Meadow Foxtail			
		Anthoxanthum odoratum	Sweet Vernal Grass			
		Briza media	Quaking Grass			
		Carex acutiformis	Lesser Pond Sedge			
		Carex pendula	Pendulous Sedge			
		Carex riparia	Greater Pond Sedge			80% grasses (by weight)
		Cynosurus cristatus	Crested Dog's-tail			
		Deschampsia caespitosa	Tufted Hair-grass			
		Festuca rubra ssp commutata	Red Fescue			
		Juncus compressus	Compact Rush			
		Juncus inflexus	Hard Rush			

No	Abbr	Botanical name	Common name	Girth / size	Stock	Density / %
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Tree & shrub palette continued:-

v. Waters Edge (based on Emorsgate mix Ep1)

S

5g/m2

Flower, sedge and rush rich vegetation on soil that is permanently boggy. Zone at edge of ponds, ditches and streams.

i.e. the water level is such that a wellie would sink into the mud by several cm in winter, and 1-2cm in high summer)

Manage by cutting once a year in late August (may need to use hand-held strimmer to avoid sinking into soil)

Achillea ptarmica	Sneezewort		
Alisma plantago-aquatica	Water-plantain		
Angelica sylvestris	Wild Angelica		
Caltha palustris	Marsh Marigold		
Cardamine pratensis	Cuckooflower		
Eupatorium cannabinum	Hemp-agrimony		
Hypericum tetrapterum	Square-stalked St John's-wort		
Iris pseudacorus	Yellow Iris		
Lotus pedunculatus	Greater Bird's-foot Trefoil		
Lychnis flos-cuculi	Ragged Robin		
Lycopus europaeus	Gipsywort		
Lythrum salicaria	Purple Loosestrife		
Pulicaria dysenterica	Fleabane		
Scutellaria galericulata	Skullcap		
Thalictrum flavum	Common Meadow-rue		
Veronica beccabunga	Brooklime		
Vicia cracca	Tufted Vetch		
Agrostis capillaris	Common Bent		
Alopecurus pratensis	Meadow Foxtail		
Anthoxanthum odoratum	Sweet Vernal Grass		
Briza media	Quaking Grass		
Carex acutiformis	Lesser Pond Sedge		
Carex pendula	Pendulous Sedge		
Carex riparia	Greater Pond Sedge		
Cynosurus cristatus	Crested Dog's-tail		
Deschampsia caespitosa	Tufted Hair-grass		
Festuca rubra ssp commutata	Red Fescue		
Juncus inflexus	Hard Rush		

20% wild
flowers

80%
grasses (by
weight)

Plants rooted in soil where the water table is at the surface for much of the year

(i.e. a wellie would sink a few cm even in summer) Manage by occasional strimming to prevent scrub encroachment

G. Marginal and Aquatic planting

Species in orange are those that are currently present in Old Park Farm stream. At least some of the plants should be sourced from the section of OPF stream that is to be diverted.

i. Swamp / marginal planting

Plants rooted in soil where the water table is at the surface for much of the year

(i.e. a wellie would sink a few cm even in summer) Manage by occasional strimming to prevent scrub encroachment

Apium nodiflorum	Fool's-water-cress	P7 or P9	C	5%
Berula erecta	Lesser Water-parsnip	P7 or P9	C	5%
Cardamine flexuosa	Wavy Bitter-cress	P7 or P9	C	5%
Epilobium hirsutum	Great Willowherb	P7 or P9	C	5%
Filipendula ulmaria	Meadowsweet	P7 or P9	C	5%
Iris pseudacorus	Yellow Iris	P7 or P9	C	10%
Lotus pedunculatus	Greater Bird's-foot Trefoil	P7 or P9	C	5%
Lycopus europaeus	Gipsywort	P7 or P9	C	5%
Lythrum salicaria	Purple Loosestrife	P7 or P9	C	5%
Mentha aquatica	Water Mint	P7 or P9	C	5%
Persicaria hydropiper	Water-pepper	P7 or P9	C	5%
Persicaria maculosa	Redshank	P7 or P9	C	5%
Scrophularia auriculata	Water figwort	P7 or P9	C	5%
Sparganium erectum	Branched Bur-reed	P7 or P9	C	5%
Veronica beccabunga	Brooklime	P7 or P9	C	5%
Carex riparia	Greater Pond Sedge	P7 or P9	C	10%
Phalaris arundinacea	Reed Canary-grass	P7 or P9	C	10%
				100%

ii. Shallow water / ledge plants

Plants rooted in mud on a ledge 25cm below expected surface of water through most of year

Manage by occasional strimming to prevent scrub encroachment

Apium nodiflorum	Fool's-water-cress	P7 or P9	C	10%
Hippuris vulgaris	Mare's-tail	P7 or P9	C	10%
Myosotis scorpioides	Water Forget-me-not	P7 or P9	C	15%
Polygonum amphibium	Amphibious Bistort	P7 or P9	C	15%
Potamogeton pectinatus	Fennel-like Pondweed	P7 or P9	C	15%
Ranunculus lingua	Greater Spearwort	P7 or P9	C	15%
Veronica beccabunga	Brooklime	P7 or P9	C	20%
				100%

Notes: Species listed above are subject to commercial availability / viability

Any alterations to species, stock sizes or planting densities shall only be with prior consent of the CA / LA

Stock Abbreviations:

C = Container grown
SR = Spring ringed
RB = Root balled
B = Bagged

S = Seeded
T = Turfed
Cl = Cell grown
Bl = Bulb