

HOOK LANE
WESTERGATE
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ARBORICULTURAL
IMPACT
ASSESSMENT
&
METHOD
STATEMENT

ACD
ENVIRONMENTAL

Ecology
Archaeology
Arboriculture
Landscape Architecture



BARRATT
HOMES

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1.0 Executive Summary

- 1.1. ACD was initially instructed, to carry out a tree survey, and present constraints details in accordance with BS5837:2012 *Trees in relation to design, demolition and construction*. This was to identify the quality and value of existing trees on site, allowing decisions to be made as to the retention or removal of trees during development. Subsequently, the subject layout has been produced and is in line with recommendations of the British Standard. Adequate protection can be provided to ensure all retained trees are protected throughout development.
- 1.2. A number of residential dwellings are proposed on this site, the layout of which can be seen on the appended tree protection plan. The frontage house 'Oakdene' is to be removed along with several smaller trees within its grounds. The frontage oak tree T1 is also to be removed. Given the obvious fungal fruiting bodies around its base, associated internal decay and close proximity to the road, this is considered good arboricultural practice and would be carried out regardless of any development.
- 1.3. Following the principles set out in the outline consent APP/C3810/A/14/2220943 the main access road will be built using a 'no-dig' surface, thus minimising impact upon the three large oak trees in Oakdene's rear garden. This will be installed during the first phase of construction to facilitate plant access to the site.
- 1.4. The relationship between the building and retained trees is sustainable and is not likely to result in any pressure to prune requests from future occupants.
- 1.5. The arboricultural method statement and tree protection plan include details of all tree protection measures required.
- 1.6. The tree protection must be erected after tree removals and surgery but before any demolition or construction contractor enter the site, and before any soil stripping takes place.
- 1.7. There will be no changes in levels, service routing, machine activity, storage of materials or site hut positioning within areas to be protected, and the protective fencing shall remain in position for the duration of the construction process.

2.0 Introduction

- 2.1. Barratt Homes instructed ACD Environmental in March 2016 to prepare the following impact assessment.
- 2.2. Following the recommendations of the British Standard¹, this report includes the necessary information to support a planning application. It demonstrates that the impact, both direct and indirect, of the proposed development within the site, has been assessed and where appropriate, mitigation and tree protection proposed.
- 2.3. The implementation of the protection methods recommended within this report are critical for ensuring the retained trees are successfully protected through the construction process and must be implemented prior to any work on site.
- 2.4. This assessment is based upon the supplied layout drawing, ref: SITE LAYOUT_35 and site survey, ref: 36WZ001A_NTS.
- 2.5. The controlling authority is Arun District Council, who can be contacted at: Arun District Council, Civic Centre, Planning Services, Maltravers Road, Littlehampton, BN17 5LF, Tel: 01243 863141.
- 2.6. This assessment considers the impact of the development on the constraints posed by the retained trees (both beneath ground: the root protection area (RPA), and above ground: the canopy).
- 2.7. Direct impact from development comes in six main forms: 1) Surface installation within RPAs, 2) Root loss from excavation for foundations, drainage and other utilities within RPAs, 3) Soil stripping, removal and level changes within RPAs, 4) Excessive access facilitation pruning to retained trees, 5) Soil compaction from storage and vehicle movements within RPAs, 6) Soil contamination.

¹ BS5837:2012 *Trees in relation to design, demolition and construction- Recommendations*, London: British Standards Institute

- 2.8. Indirect impact can come from changes to the site hydrology, future pressure to prune or fell, failure of trees exposed by removal of neighbouring trees, and other environmental changes which can take several years to manifest.
- 2.9. The RPA for each tree represents a minimum area in m² that should be left undisturbed around each retained tree. This is initially represented by a circle but is often adjusted to account for constraints to root growth within the site (primarily highways and buildings). It is therefore important to ensure the protection of trees both above and below ground. Recommendations are provided in the British Standard as to the protection of existing trees before, during and after development. This is achieved by ensuring the tree protection plan and arboricultural method statement are implemented before any commencement on site.

3.0 Arboricultural Impact Assessment

3.1. Overview of proposed development

3.1.1. A number of residential dwellings are proposed on this site, the layout of which can be seen on the appended tree protection plan. The frontage house 'Oakdene' is to be removed along with several smaller trees within its grounds.

3.2. Tree Preservation Orders

3.2.1. The four oak trees within the grounds of Oakdene, are covered by tree preservation order TPO/AL/1/14. No other tree preservation orders are present on any trees on, or adjacent to the site, nor is the site within a Conservation Area.

3.3. Previous planning applications and consents

3.3.1. Outline consent AL/39/13 was granted at appeal (ref: APP/C3810/A/14/2220943) in February 2015 for up to 79 dwellings.

3.4. Trees proposed for removal & surgery

3.4.1. The following trees are proposed for removal:

- Category U (poor quality): T11 & T12
- Category C (low quality): T1, T3, G9 and G15

3.4.2. Of the above trees, only the frontage oak tree T1 is included within the TPO. Given the obvious fungal fruiting bodies around its base, associated internal decay and close proximity to the road, its removal is considered good arboricultural practice and would be carried out regardless of any development.

3.4.3. In relation to the conception and design of development proposals, BS5837:2012 section 5.1.1 states: The constraints imposed by trees, both above and below ground should inform the site layout design, although it is recognised that the competing needs of development mean that trees are only one factor requiring consideration. Certain trees are of such importance and sensitivity as to be major

constraints on development or to justify its substantial modification. However, care should be taken to avoid misplaced tree retention; attempts to retain too many or unsuitable trees on a site can result in excessive pressure on the trees during demolition or construction work, or post-completion demands for their removal.

3.4.4. It is therefore deemed acceptable to remove the trees listed and, as part of the detailed landscape design for the scheme, include suitable and sustainable replacements as and where appropriate. This will more than mitigate any loss that may be felt from tree removals, by providing robust long-term tree cover in keeping with the proposal and surrounding properties.

3.4.5. Following the preliminary recommendations made at the time of the survey and works necessary to facilitate construction of the proposed development, tree works are recommended and listed in the method statement. This work includes the crown lifting of T6 to allow construction vehicles to pass beneath it.

3.5. Demolition, site clearance & archaeology

3.5.1. To ensure damage does not occur to trees highlighted for retention, tree protection fencing must be erected before ANY plant/vehicles entering site whatsoever. This should be subject to a pre-commencement site meeting between the developer, their project arboriculturist and a representative from the Local Authority.

3.5.2. Removal of the garden shed for Oakdene and associated hardscape will be carried out under arboricultural supervision.

3.5.3. Although the house Oakdene is within the theoretical circular RPA of T4 it is considered that the foundations will have restricted root development beneath it to such an extent that tree protection measures are not required (or proposed). The fencing must be erected as shown on the appended plan before any demolition is started though.

3.6. Construction within RPAs

3.6.1. The construction of all buildings is proposed outside the RPAs of retained trees.

3.7. Access and working room within RPAs

3.7.1. Space is required for scaffold erection and working room within the RPA of G20. Following the recommendations of 6.2.3 of the British Standard, ground protection could be employed to retain the underlying soil structure and avoid detriment to roots. However, given the operational issues with implementing ground protection, an alternative solution is proposed, in that the protection areas is extended contiguous to the RPA². We are comfortable with this approach and that it will not be deleterious to the health of the tree. Nonetheless, should the Council wish to see the installation of ground protection, this can be enforced by a suitably worded planning condition.

3.8. Permanent hard surfaces within RPAs

3.8.1. In section 7.4 of the British Standard, permanent hard surfacing within the RPAs of retained trees is addressed, and recommendations made.

3.8.2. In the case of T22, the off-site cypress, the road passes through its. Given that this tree is of low quality and value (category C) and if within the site would not be a constraint, this encroachment is considered acceptable and a no-dig surface not proposed.

3.8.3. The garden path for plot 79 is within the RPA of the oak T6 and will be laid above ground using a no-dig surface, as per the method statement section of this report.

² Section 5.3a). *BS5837:2012 Trees in relation to design, demolition and construction- Recommendations*, London: British Standards Institute.

3.9. Protection fencing

3.9.1. Figure 2 of the British Standard recommends a standard fencing design for tree protection. This is a weld mesh panel design, mounted upon a well-braced scaffold framework. This is perfectly adequate for this site and all the retained trees can be suitably protected by its erection before any works start on site whatsoever.

3.10. Shade and future pressure to prune

3.10.1. ACD have worked with the design team from the start of this project and we feel that the resulting proposed layout is both sustainable and results in juxtapositions between trees and buildings which will not bring future requests for excessive pruning and/or tree removal.

3.11. Services

3.11.1. The main service trench for this site will run on the south side of the no-dig access and the excavation will be supervised. Albeit within the circular RPA, there is no other viable route for the essential supplies and, given the distance of the trench from the tree and supervised excavation is therefore deemed acceptable.

3.11.2. Full details of the service and utility provisions for the site remain to be finalised. However, aside from the issue above, there is adequate space for utility trenches to serve the rest of the site whilst avoiding RPAs and exclusion zones.

4.0 Arboricultural Method Statement

TO BE READ IN CONJUNCTION WITH THE APPENDED TREE PROTECTION PLAN REF: BDWS20440-03

4.1. Phasing of operations & site supervision

4.1.1. The tree protection and other arboricultural works must be carried out in the following order:

	Operation	Present	Notes
1	Tree removals & surgery	Tree contractor	See Tree Protection Plan for trees to be removed
2	Protection barriers erected	Fencing contractor	See Tree Protection Plan for position and type of barriers
3	Pre-start meeting	ACD, site manager, groundwork, foreman, demolition foreman	To 'sign-off' protection prior to any plant activity, demolition & groundworks on site
4	Removal of shed and hard-scape near trees T4 & T5	ACD, demolition staff, site manager	Supervised by project arboriculturist. See method statement
5	No-dig access road installation	ACD, groundwork contractor, site manager	Groundwork staff to receive toolbox-talk from project arboriculturist. See method statement
6	Excavation of service trench through RPA of T6	ACD, groundwork staff, site manager	Supervised by project arboriculturist. See method statement
7	No-dig path installation for plot 79	ACD, groundwork contractor, site manager	Groundwork staff to receive toolbox-talk from project arboriculturist. See method statement
8	Removal of protection barriers and landscape work	ACD, landscape contractor, site manager	See method statement

4.1.2. Supervision is required should any unplanned access and/or work be required in the construction exclusion zone.

4.1.3. Supervision will require the arboriculturist to be present throughout the task, to ensure all the arboricultural objectives are met. If the task is to take a long period of time, provided the arboriculturist is satisfied, and after an initial 'tool-box talk', the supervision may be reduced to telephone contact between the site foreman/contractor and arboriculturist.

4.2. Construction exclusions zone

4.2.1. Barriers and/or ground protection must be used to protect all retained trees before any machinery or materials are brought onto the site, and before any demolition, development or stripping of soil commences.

4.2.2. Where all activity can be excluded from the RPA, vertical barriers must be erected to create the construction exclusion zone (CEZ). The default position of which is shown on the appended Tree Protection Plan.

4.2.3. Where, due to site constraints, construction activity cannot be fully or permanently excluded from all, or part of a tree's RPA, appropriate ground protection can be installed.

4.2.4. It is the responsibility of everyone engaged in the construction process to respect the tree protection measures and observe the necessary precautions within and adjacent to them.

4.2.5. Inside the exclusion zone, the following shall apply:

- No mechanical excavation whatsoever.
- No excavation by any other means without arboricultural site supervision.
- No hand digging without a written method statement having first been approved by the project arboriculturist.
- No lowering of levels for any purpose (except removal of grass sward using hand tools).

- No storage of plant or materials.
- No storage or handling of any chemical including cement washings.
- No vehicular access.
- No fire lighting.

4.2.6. In addition to the above, further precautions are necessary adjacent to trees:

- No substances injurious to tree health, including fuels, oil, bitumen, cement (including cement washings), builders sand, concrete mixing and other chemicals shall be stored or used within or directly adjacent to the protection area of retained trees.
- No fire shall be lit such that flames come within 5m of tree foliage.

4.3. Tree protection barriers

4.3.1. The construction exclusion zone will be protected as per the appended tree protection plan that shows the default alignment of the tree protection barriers, to be installed prior to any of the following taking place:

- Archaeology
- Demolition
- Plant and material delivery
- Soil stripping
- Utility installation
- Construction works
- Landscaping

4.3.2. Stages for installation of barriers:

- 1) Hand clearance of any vegetation to allow clear working access.
- 2) Setting out of node points
- 3) Barriers erected
- 4) Site meeting with project arboriculturist to 'sign-off' tree protection fencing.
- 5) Site accessible to demolition/construction traffic

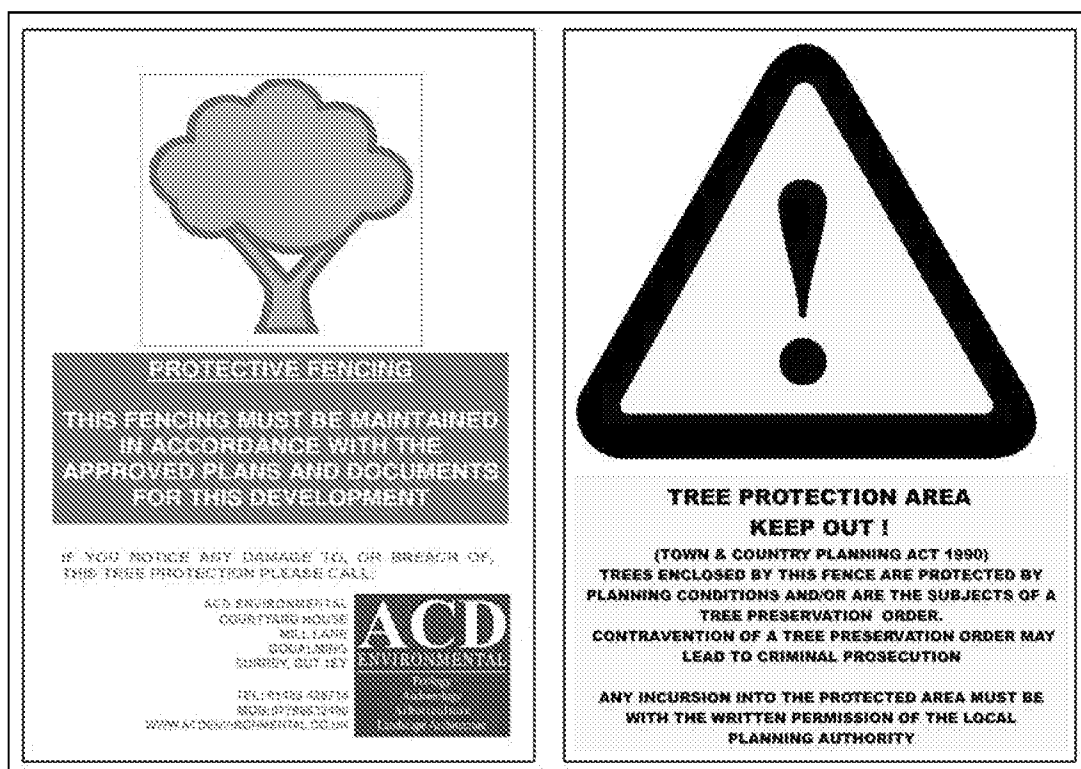
4.3.3. Once erected, all barriers will be regarded as sacrosanct, and will not be removed or altered without prior recommendation by the project arboriculturist and approval of the local planning authority.

4.3.4. The default barrier construction is suitable for areas of high intensity development, and shall comprise of interlocking weld-mesh panels, well braced to resist impacts by attachment to a scaffold framework that is set firmly into the ground. A detailed specification can be found on the TPP.

4.3.5. The images below are alternative barrier designs that have been successfully used on site and that ACD are happy to support if a variation from the default style is required. If such a variation is necessary, the approval of the project arboriculturist will be obtained prior to any implementation on site.

4.3.6. Once barriers and/or ground protection have protected the exclusion zone, construction work can commence.

4.3.7. All weather notices should be erected on the barriers (for example see figure below).



Tree protection sign (download from <http://www.acdenvironmental.co.uk>)



Weld-mesh panels on scaffold uprights



Weld-mesh panels on wooden posts



Chain-link on angle-iron uprights

4.4. Ground protection

4.4.1. If required, ground protection is to be installed as follows. It must be capable of supporting the expected loads and avoiding rutting, compaction and damage to the soil: as advised in section 6.2.3 of the British Standard.

4.4.2. Stages for ground protection installation:

- 1) No plant machinery to be used in the area of ground protection for whatever reason
- 2) Dismantle primary TPF and re-erect in secondary location as shown on TPP (if required) OR erect fencing to protect any newly exposed CEZ not to be covered by ground protection.
- 3) Any shrubs, saplings or trees to be removed, are to be cut, or ground out to just below ground level rather than grubbed or winched out, which can damage roots of retained trees.
- 4) Lay woven geotextile over existing ground surface by hand
- 5) Cover the area with compressible layer, woodchip for example, using hand tools only
- 6) Cover compressible layer with side butting scaffold boards or plywood boards
- 7) Confirm surface is acceptable for use with project arboriculturist
- 8) Area ready for construction access

4.4.3. Any scaffolding required within the area will be erected with the uprights placed on spreader boards.

4.4.4. The boarding will be left in place until the construction works are finished.

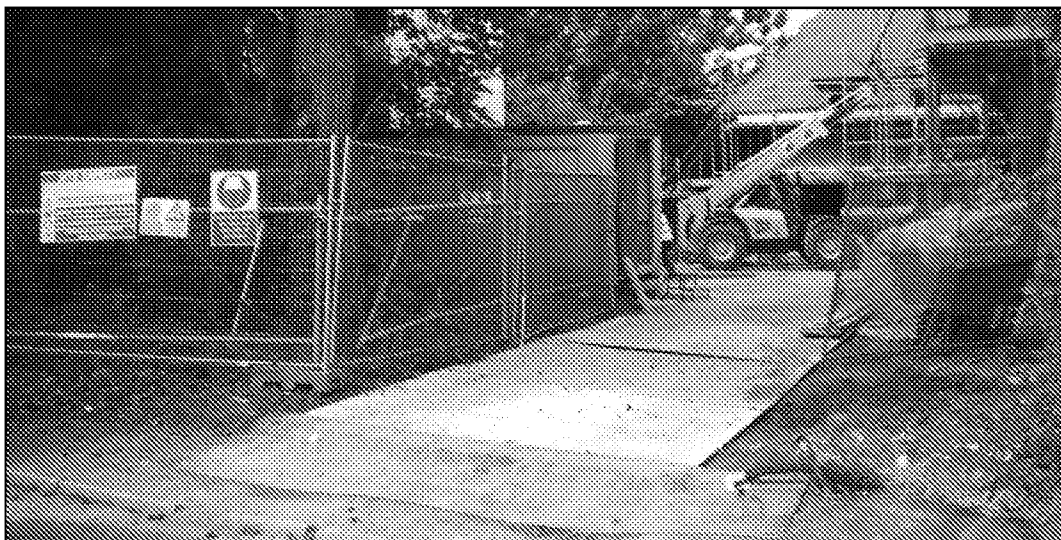
4.4.5. A single thickness of boarding laid on the soil surface will provide sufficient protection for pedestrian loads. However, for wheeled or tracked construction traffic movements within the RPA, ground protection will involve the use of temporary cellular confinement systems, reinforced concrete slabs or track-board systems details of which are to be specified by the project engineer and approved for use by the project arboriculturist and local authority before construction commences.

4.4.6. Track-boards can be sourced from Trakmats Europe Ltd, 0845 6435388, www.trakmatseurope.com, or groundguards.com

4.4.7. There is to be no-excavation within ground protection area whatsoever. This includes installation of services and associated utilities.



Scaffold board pedestrian ground protection



Vehicular ground protection trackway

4.5. Site storage, parking, welfare facilities, etc.

4.5.1. The site will require provision for; site storage, contractor parking, welfare facilities, temporary services/drainage, material drop off points, etc.

4.5.2. It is acceptable to place site cabins and walkways within the CEZ provided they are installed sensitively:

- Cabins must be placed on sleepers (or similar) to spread the load, avoiding point loading and associated soil compaction.
- The delivery of cabins should ensure that any unloading via 'hi-ab' crane can be carried out without impact on the crowns of retained trees.
- Walkways, if required, should be installed as per the ground protection specification.
- Any utilities for site compounds must be run above ground. For example, WC foul pipes/drainage and temporary electrical connections.

4.5.3. It is imperative that if cabins and walkways are installed, that fencing is erected to limit access to the protected areas. If amendments are made, the project arboriculturist should sign off the proposals prior to their implementation.

4.5.4. Contractor parking and storage areas should be sited outside the CEZ.

4.6. Tree surgery and removal

4.6.1. The following surgery works are to be carried out:

- Lift crown of oak T6 to give 5.5m ground clearance

4.6.2. All trees to be removed are indicated on the TPP.

4.6.3. If any further surgery work is proposed, details will be submitted to, and approved by, the council, before being carried out.

4.6.4. All work will be carried out in accordance with BS3998³ industry best practice and in line with any works already agreed with the council.

4.6.5. The tree surgeon shall ideally be chosen from The Arboricultural Association's Approved Contractor list. All work shall be undertaken at the appropriate time and with the consent and approval of the site agent.

4.6.6. The statutory protection^{4 5} will be adhered to. If further advice is required, particularly if bats are discovered during tree work, it will be obtained from Natural England or other competent persons and recommendations adhered to.

4.6.7. The stumps of any trees removed from within the Construction Exclusion Zone or the RPAs of retained trees will be either cut flush to ground level and left in situ or ground out using a stump grinder. They will not be winched out.

4.6.8. All operations shall be carefully carried out to avoid damage to the trees being treated or neighbouring trees. No trees to be retained shall be used for anchorage or winching purposes.

4.7. Soft landscaping

4.7.1. All landscaping and associated ground preparation within exclusion zones will be carried out sensitively to ensure root damage is minimised as much as is practicable.

4.7.2. At no time is any heavy plant to be used within any protected area.

4.7.3. Removal of existing vegetation (including turf) will be carried out with hand tools only.

4.7.4. Should the soil be compacted or have a poor structure that may hinder the development of any new planting, soil decompaction techniques may be used upon consultation with the project arboriculturist.

³ BS3998:2010- *Recommendations for Tree Work*. London: British Standards Institute

⁴ *Wildlife and Countryside Act*. (1981) London: HMSO.

⁵ *Countryside and Rights of Way Act*. (2000) London: HMSO.

4.7.5. Tree protection barriers may be removed to allow access and then replaced as required/per approved documents (in liaison with the arboricultural clerk of works)

4.7.6. Levels (high spots) will not be reduced or excavated in any way. Use good quality top-soil to level any low-lying areas and hollows, and provide a fine tilth to lay turf on. This imported soil must not result in a level increase of more than 100mm in any area.

4.7.7. Import materials by hand in wheelbarrow or using a digger sited outside the sensitive area.

4.7.8. Any excavation for planting pits must be dug using hand tools only.

4.7.9. No works will be carried out within any protected areas if the soil moisture is of a level likely to allow compaction to occur.

4.8. Installation of underground services

4.8.1. Mechanical trenching for the installation of underground apparatus and drainage severs any roots present and can change the local soil hydrology in a way that adversely affects the health of the tree. For this reason, particular care should be taken in the routing and methods of installation of all underground apparatus. Wherever possible, apparatus should be routed outside RPAs. Where this is not possible, it is preferable to keep apparatus together in common ducts. Inspection chambers should be sited outside the RPA.

4.8.2. Where underground apparatus is to pass within the RPA, detailed plans showing the proposed routeing should be drawn up in conjunction with the project arboriculturist. In such cases, trenchless insertion methods should be used: Microtunnelling, Surface-launched directional drilling, Pipe ramming or Impact moling (see BS5837:2012 Table 3), with entry and retrieval pits being sited outside the RPA. Provided that roots can be retained and protected, excavation using hand-held tools might be acceptable for shallow service runs. If this is the case, the following methodology must be followed:

4.8.3. Stages for installing services by hand within tree protection areas:

No plant machinery to be used in the area for whatever reason

- 1) Contact project arboriculturist to hold pre-start site meeting and 'toolbox' talk before starting work.
- 2) Remove just enough tree protection fencing to allow access to area and facilitate trenching.
- 3) Remove any surface vegetation or existing hard surfaces using hand tools.
- 4) Using an air-pick excavate the trench, keeping to minimum dimensions required.
- 5) Roots occurring in clumps of 25 mm diameter and over are encountered they will be retained, and kept damp by covering with hessian (re-wetted as required). If required, these should be severed only following consultation with an arboriculturist; as such roots might be essential to the tree's health and stability.
- 6) Feed in services.
- 7) Back fill trench with 200-300mm depth of excavated soil, or a mixture of excavated and imported top-soil to BS3882 (BSI, 2007), firming down with heels.
- 8) Repeat step 7 until trench is filled.
- 9) Re-erect tree protection fencing as per approved plan.

4.8.4. The method of excavation above, for trenching within RPAs, is using air excavation. This tool utilises compressed air to remove soil from around tree roots causing minimal damage and can be run off a typical site compressor. ACD can provide details of contractors supplying air excavation services if required.

4.8.5. Alternatively, trenchless technology, such as thrust boring can be used in some instances and is particularly effective as it can pass directly under the tree, at a depth which is likely to avoid almost all impact on roots of the subject tree. As no access/thrust pits will be located within the RPAs of the subject trees, the need for arboricultural supervision is limited.

4.8.6. Reference can be made to NJUG Vol 4⁶ for guidance, but any approach must be approved by the project arboriculturist and brought to the attention of the local authority tree officer.

4.9. Demolition close to trees

4.9.1. All TPF to be installed as per approved Tree Protection Plan prior to any plant arriving on site.

4.9.2. Sensitive demolition will occur under supervision from the project arboriculturist

4.9.3. Stages for demolition within tree protection areas:

- 1) No plant machinery to be sited on any exposed rooting area
- 2) Dismantle any fencing to allow work to proceed
- 3) Buildings to be folded in on themselves
- 4) Removal debris by hand or with plant machinery not located on any exposed rooting area.
- 5) Floor to be broken up with hand held breaker and pieces removed by hand. Slab floor can be lifted carefully by machinery if appropriate
- 6) Underlying ground levels to be retained. No excavation to occur
- 7) Any exposed roots and surrounding newly exposed areas to be covered with up to 100mm of topsoil, from elsewhere on site, or imported top-soil to BS3882⁷. Soil may be placed in area by plant but must be spread by hand.
- 8) Tree protection fencing to be erected in final position as shown on plan

4.9.4. No reduction in levels of the underlying soil surface will occur.

4.9.5. At no point are any heavy machinery permitted within the RPA.

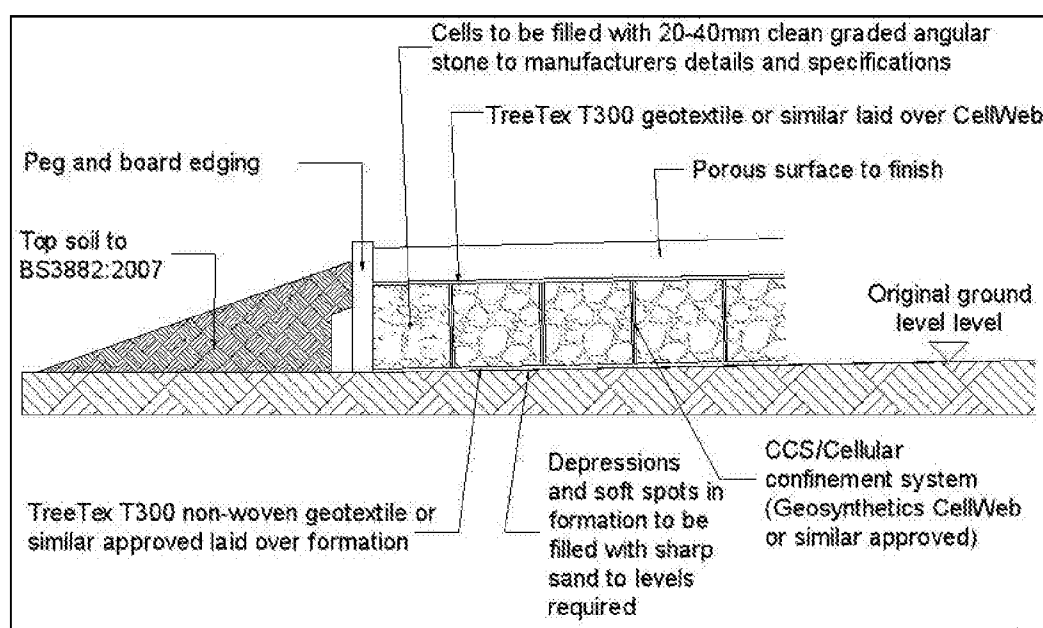
⁶ National Joint Utilities Group. (2010). *Volume 4: NJUG Guidelines For The Planning, Installation And Maintenance Of Utility Apparatus In Proximity To Trees (Issue 2) – Operatives Handbook*. NJUG.

⁷ BS3882:2007- *Specification for topsoil and requirements for use*. London: British Standards Institute.

4.9.6. Contamination of the soil by fuel and lubricant leaks must be avoided at all cost. If such a situation arises the project arboriculturist must be notified to assess the situation and prescribe remedial measures.

4.10. Installation of no-dig surface

4.10.1. To ensure that tree roots, within the ground under this proposed surface, continue to survive during and after construction a cellular system such a CellWeb⁸ of 75-200mm depth is to be used.



No-dig cross-section

4.10.2. Stages for Installation of the cellular confinement surface:

- 1) Contact project arboriculturist to hold pre-start site meeting and 'toolbox' talk before starting work
- 2) Dismantle TPF and re-erect in secondary location as shown on TPP
- 3) Remove existing vegetation by using a specific herbicide (as advised by a specialist) or manual removal with hand tools only. Agreed removal of shrubs, saplings or trees, within the protected areas of retained trees are to be cut, or ground out to just below ground level

⁸ Geosynthetics Ltd, 01455 617139, www.geosyn.co.uk

rather than grubbed or winched out, which can damage roots of retained trees.

- 4) Retain all original ground levels after vegetation removal. No excavation whatsoever.
- 5) Remove any existing hard surfaces (paving, tarmac etc.) Hand tools should be used if possible. If machinery is required for this operation, it must be used only on existing surfaces or outside the protection areas and tree canopies (approval from project arboriculturist must be sought before using machinery). The sub base of existing surfaces or foundations should be left in situ where possible to avoid unnecessary root disturbance and provide a base for the new surface.
- 6) Install a non-woven Geotextile (such as TreeTex T300) directly over soil grade level (levelled where necessary, by non-compacted washed sand) and fix in place.
- 7) Lay the cellular system over the Geotextile, which is secured open under tension during the infill process with steel staples or wooden pegs.
- 8) Install kerbs and edgings directly on top of existing soil grade level. For light structures, a treated peg and board may be acceptable. For more substantial structures, railway sleepers, haunched concrete with road pins, drilled kerbstones, gabions or cast in situ kerbs will be appropriate.
- 9) Fill the cellular system ensuring any machinery works only on already filled areas. Typical infill consists of no fines angular granular material 20-40mm, which will remain un-compacted.
- 10) Cover with a non-woven Geotextile (such as TreeTex T300).
- 11) Install porous wearing surface.

4.10.3. Any variation to the above specification must meet the following design criteria for low-invasive surfaces to provide the conditions for continued tree survival and growth:

- Maintain oxygen diffusion through new surface to rooting area (5-12% by volume⁹)
- Maintain sufficient passage of water to the rooting area (12-40% by volume¹⁰)
- Avoid compaction by maintaining a soil structure sufficient to sustain root growth (soil bulk density below 1.4g/cc¹¹).

4.10.4. Site analysis of the soil type and its structural characteristics will be required prior to determining the specific depth of products to be adopted for example, footpaths normally require a depth of 75mm and, 100mm to 200mm depths are used for residential driveways, while greater depths may be required for the passage of heavier traffic such as for construction access and delivery vehicles.

4.10.5. If ground levels are to be raised more than 150mm this should be achieved by the use of a granular material, which does not inhibit vertical gaseous diffusion. For example: no-fines gravel, washed aggregate, structural soil (min. 20% sand content) or cobbles.

4.11. Hard surface removal

4.11.1. No hard surface removal within RPAs will occur without arboricultural supervision.

4.11.2. Stages for hard surface removal within tree protection areas:

- 1) No plant machinery to be sited on any exposed rooting area
- 2) Contact project arboriculturist to hold pre-start site meeting and 'toolbox' talk before starting work
- 3) Dismantle fencing as required to access area
- 4) Plant machinery to run only on existing hard surfaces with consent from arboriculturist
- 5) Plant may be used to carefully peel up existing tarmac and concrete

⁹ Smith, R. J. (2006). *Tree Roots in the Built Environment*. HSO

¹⁰ Coder, D. K. (2000). *Tree Root Growth Requirements*. University of Georgia

¹¹ Harris, C. M. (2004). *Arboriculture, Tree Management of Shade Trees and Vines*.

- 6) Other surfaces are to be removed by hand (paving etc.)
- 7) Where any sub base is not likely to contain roots, and only on approval from project arboriculturist, it may also be carefully removed.
- 8) Underlying ground levels to be retained. No excavation to occur
- 9) Any exposed roots and surrounding newly exposed areas to be covered with up to 100mm of topsoil, from elsewhere on site, or imported top-soil to BS3882¹² Soil may be placed in area by plant but must be spread by hand.
- 10) Tree protection fencing to be erected in final position as shown on plan

4.11.3. If the area around the retained trees is to be left following the removal of the existing hard surface, before a new hard surface is laid or soft landscaping implemented, then the line of protective fencing **MUST** be correctly re-established immediately the hard surface removal work has been completed.

4.11.4. If, for whatever reason there is a delay before the area is left exposed prior to awaiting a new surface, then a temporary surface must be implemented or the area fenced off.

¹² *BS3882:2007- Specification for topsoil and requirements for use.* London: British Standards Institute.

4.12. Installation of boundary fencing within protected areas

4.12.1. Stages for installing wooden fence posts:

No plant machinery to be used in the area for whatever reason

- 1) Contact project arboriculturist to hold pre-start site meeting and 'toolbox' talk before starting work.
- 2) Remove TPF to allow access to area.
- 3) Dig postholes using hand tools, avoiding damage to the protective bark covering larger roots. Roots smaller than 25mm diameter may be pruned back using either secateurs or a hand saw, leaving a clean cut.
- 4) Damage or severance of roots above 25mm diameter must be avoided. If roots of this size are discovered, the hole should be relocated. If there are a large number of such roots it may be necessary to relocate the hole by half a fence panels length and adjust the fence panels accordingly.
- 5) Line hole with non-porous lining, for example durable polythene bag.
- 6) Insert post and fill post-hole with concrete to just below ground level.
- 7) Trim polythene to ground level and fill with clean topsoil.

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Director & principal arboriculturist
01 May 2016



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Appendix: Tree Protection Plan

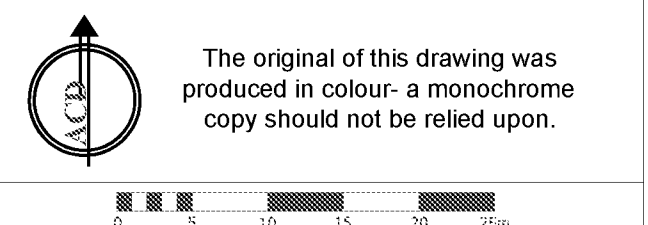
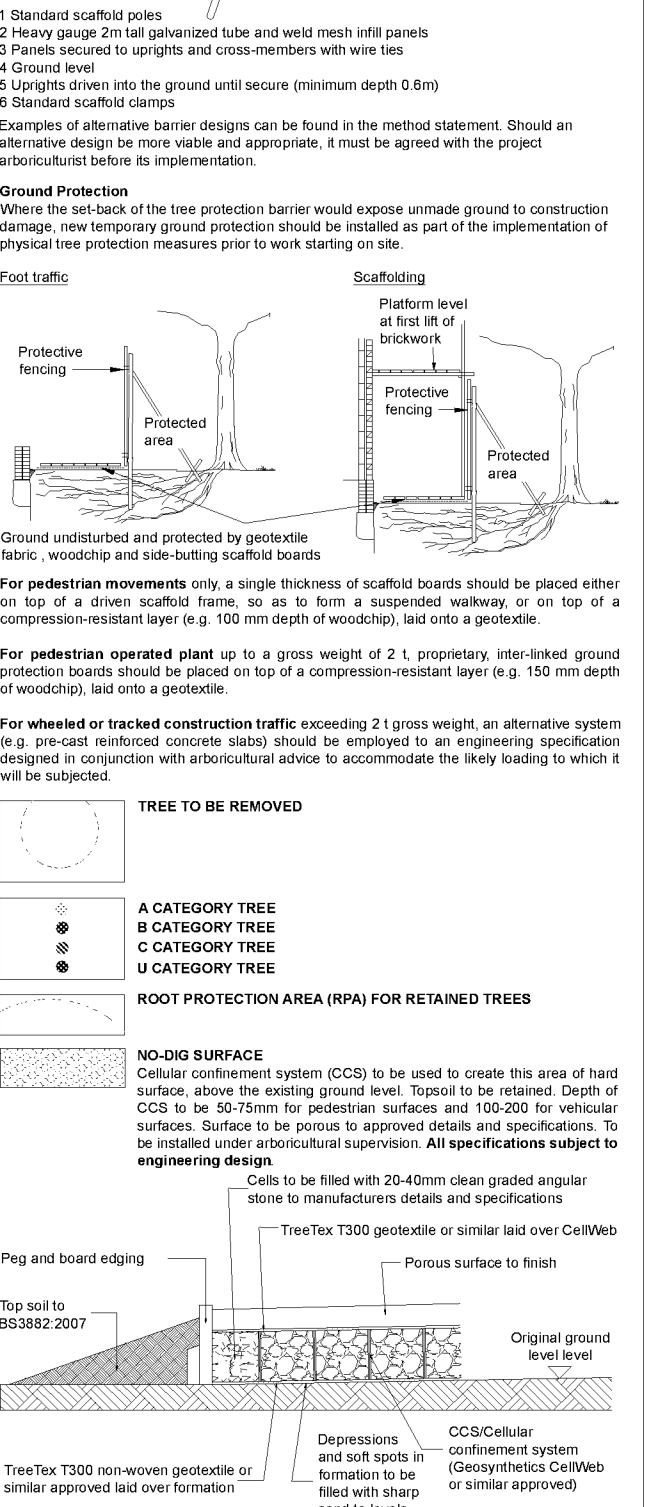
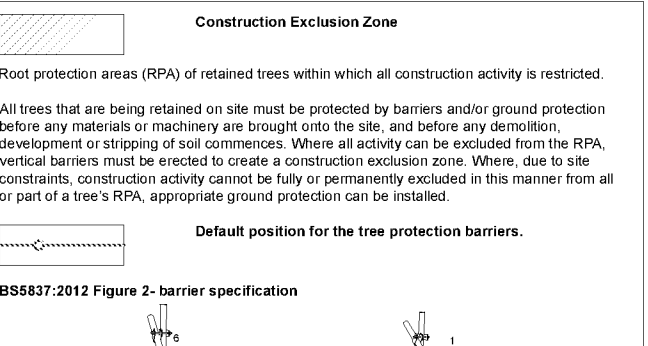
BDWS20440-03



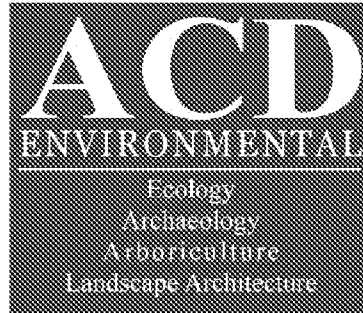
WHY TREE PROTECTION IS NEEDED

- 1) **Soil compaction kills roots**-caused by plant movement and storage of materials within protected areas.
- 2) **Trenching severs roots**-many small roots grow within the top 600mm of soil. Even the removal of the top 200mm can cause damage.
- 3) **Soil pollution kills roots**-Dripping fuel storage or cement washings can contaminate the soil resulting in root death.
- 4) **Raising & lowering levels kills roots**-the soil used to increase levels can compact the underlying soil (see point 1). Lowering levels will remove roots causing damage to the tree.
- 5) **Bark and branch damage**-bark removal and branch damage can allow disease and fungi into the tree.

The impact of any of the above can take years to show-trees can have huge reserves of food and water.



Rev	Date	Details	Drawn
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scheme: Land to east of Hook Lane Westergate, West Sussex			
client: Barratt Homes			
drawing: Tree Protection Plan			
date: May 2016			
scale: 1:500@A1			
dwg no: BDWS20440-03			
drawn: MW checked: AJB			



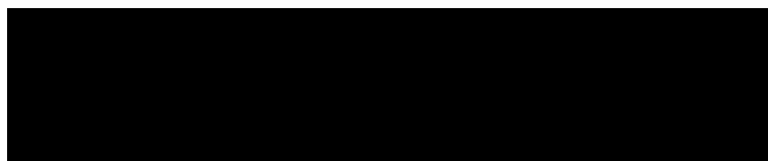
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