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Churchill Park, Glendowie

Belt of pines (*Pinus radiata*) between Evesham Ave and Forfar Rd -

Review of tree safety

February 2005

Report commissioned by:	Howell Davies Arborist Parks and Streetscape Services Auckland City Council
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Report dated:	15 February 2005

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1 Introduction and background

1.1 This report has been commissioned in response to residents' concerns about recent incidences of tree failure among a belt of radiata pine (*Pinus radiata*) in Churchill Park, Glendowie. The purpose of this report is to provide an overview of the key issues regarding the trees in terms of their safety.

1.2 A history of the park is outlined in the *Churchill Park Management Plan* prepared by Isthmus Group Landscape Architects in 1996, a copy of which is available on the Auckland City Council website. Several aspects of the *Management Plan* which have a particular bearing on the pines are flagged in section 2 of this report. The trees were apparently planted as part of a golf course in the 1920's[1].

1.3 The trees covered in this report comprise some 235 radiata pines that form the bulk of the pine belt that extends south from Evesham Ave to a wire fence that crosses the belt along a small ridgeline roughly opposite 56 to 58 Robley Crescent.

A further 34 radiata pines stand to the south of the wire fence that forms the cut-off point for the trees specifically covered in this report. These additional 34 trees define the southern extent of the belt running between Evesham Ave and Forfar Rd. Passing comment is made on these additional trees.

The belt is roughly 450m in length and 50m in width. The park contains several further large belts of radiata pine.

1.4 The belt flanks the eastern edge of a watercourse that runs along the western boundary of the park, with direct access via a footbridge at the end of Athlone Rd. The trees and setting are illustrated in the attached photo set, with the location shown in the attached site plan.

- Developed residential properties line the far (western) side of the watercourse.
- A concreted path (combined footpath and cycleway) runs below the trees and follows the eastern edge of the watercourse, with the closest access off Athlone Rd. Four park benches (seats) are spread along the path.
- An informal 'grass' track runs among the trees at the eastern edge of the stand.
- A pedestrian path between Athlone Rd and Riddell Road crosses the stand, with a staircase among the trees.
- The eastern edge of the stand is bordered by grazed paddocks (cattle).
- The area is designated as an "Off Leash Dog Exercise Area".

[1] A rough ring count of several recently dismantled trees suggests the trees in question are about 70 years old, and may therefore have been planted in the 1930's

1.5 The area beneath the trees has historically been grazed, however stock are now excluded from among the specifically assessed trees (cattle are still grazed under the 34 trees that form the southern end of the belt). An underplanting of native trees over the last five or so years has performed poorly beneath the pines.

1.6 The *Churchill Park Management Plan* refers to a 1989[2] report on the trees, noting that the report found most of the trees were healthy and safe and "*could be expected to exist for a further 20-60 years with a gradual rate of mortality and instability*". (The Langston report has not been available for review with this report).

1.7 About 90 pines were removed from the stand during the summer of 2001 following a review of their condition by Council's arborist Simon Cook (the area arborist at the time).

1.8 The regular removal of heavy deadwood and broken branches has been on-going in the stand for at least the past ten years.

1.9 On the 30th July 2004 a site inspection was undertaken by Howell Davies (ACC), Chris Scott (Vigil, Forest Health Advisory Services), and Gerald Collett (Treecare Services Ltd), in particular to examine two pines immediately north of the Athlone Rd / Riddell Rd path whose trunks had recently snapped about 10m above the ground. The stand also contained three further similarly snapped trees. Two of the snapped trees had fallen across the pathways.

Examination of the snapped trees revealed that the trunks were extensively hollowed by termite tunneling at the point of failure, with the species confirmed by Mr Scott as the native drywood termite, *Kalotermes brouni*. At the time of failure the snapped trees carried a live and relatively compact canopy in reasonable health, with the canopy confined to the upper reaches of the trunk.

Various other fallen or failed trees were also noted among the stand.

1.10 Mr Davies subsequently commissioned this report, the findings of which are based on the July 2004 site visit, together with further site inspections by Mr Collett and Mr Davies on the 21st October 2004, and on the 2nd and 15th February 2005. Several failed trunks were sectioned and examined during the latter three visits.

Between the October and February inspections two further trees snapped, again where the trunks were weakened by termite tunneling.

1.11 Field notes from the site visits are attached to this report.

[2] *Churchill Park Woodlot Assessment*, PW Langston, Ministry of Forestry

2 Churchill Park Management Plan (1996)

In 1995 the Council identified Churchill Park as one of Auckland's 'premier parks'. The following aspects of the 1996 *Churchill Park Management Plan* (CPMP) have a particular bearing on the pines in question.

2.1 The soils are heavy clays with a pan and thin top soil. The soils are poor draining and have relatively low fertility. (S 3.2, CPMP)

2.2 The main existing vegetation is the pasture which covers most of the park.

The dominant trees are stands of pines (Pinus radiata) and macrocarpa (Cupressus macrocarpa) … that were apparently planted as part of the golf course in the 1920's.

Pines create a strong wall along the south-western boundary of the site, and also screen Churchill Park School from the bulk of the park. An arborist's report in 1989 found that most of the trees were healthy and safe and could be expected to exist for a further 20-60 years with a gradual rate of mortality and instability" (Churchill Park Woodlot Assessment, PW Langston, Ministry of Forestry).

Native planting has been carried out in gullies on lower slopes of the park and under the pine trees. These areas have been fenced off from grazing. In the gullies the planting is becoming well established. However the planting beneath the pines has been unsuccessful. (S 3.4, CPMP)

2.3 The Council considered that the park would remain as a city-wide park and that its rural character would be retained without major development. Policy 1 refers to designing a development plan for gradual enhancement of the park with a "countryside in the city" character. (S 8.1, CPMP)

2.4 Some consideration could be given to replanting some pines as landmarks when designing the development plan. The existing pines cannot be retained indefinitely.

2.5 The development plan should include the following:
iii) Progressive replacement of pines with native forest or woodland. (S 8.2 iii, CPMP)

2.6 The Landscape Concept Plan (Fig 21, CPMP) defines a Lowland Bush Zone[3], tagged for:

Re-establishing indigenous vegetation. Wildlife habitats. Revegetating lower slopes and gullies. Bush walks. Rehabilitating the stream.

[3] The pines covered in this report are included in the 'Lowland Bush Zone'

3 Findings

3.1 The trees in question comprise some 235 pines (*Pinus radiata*) in late maturity, planted about 70 years ago.

3.2 Heights are typically in the order of 30-35m, with the tallest approaching 40m. Central trees within the stand are typically slender-trunked, sometimes extremely so, with more than two-fifths of the trees having a substantial lean or a heavily bowed trunk. The edge trees are typically rather one-sided, with several leaning very heavily.

3.3 Canopy health (foliage distribution and condition) varies.

- Two of the assessed trees were dead.
- Five are more than 25% dead.
- About 10% of the trees have a markedly sparse crown.
- The remainder generally carry reasonably healthy and full canopies for the age class, with a typical rating of 'fair' (on a scale of poor, fair, good, and excellent.)

3.4 Seven trees have failed at points where their trunks were weakened by termite[4] tunneling.

Four such snapped trees were sectioned and examined, with a sample illustrated in the attached photo set.

The termites have entered the trunks via dead branch stubs, with progressive tunneling gradually undermining the strength of the trunks, eventually to the point of failure. The termite tunneling was found to be highly localized within each of the individual trunks that were examined and cross-sectioned. In addition to the termite tunneling, several of the trunk sections revealed localized pockets of decayed trunkwood.

While localized sections of each trunk were decayed or termite ridden, intervening sections of trunk were found to be sound. Several of the termite sites showed no visible signs of wood decay at the point of failure, while others contained visible decay as well as termite tunneling.

Two of the snapped trunks were severed close to the ground to check for decay at their base. In both cases there was no termite activity at the base of the trees, and no visible signs of wood decay or discolouration. The decay pathogens have presumably gained entry to the trunks via the termite galleries.

Examination of several large live limbs from the crown of one of the snapped trees also revealed extensive tunneling by termites, despite the crown and affected limbs carrying a relatively full live canopy.

Of the seven snapped trees, one fell across the concrete path/cycleway to the south of the Athlone Rd access point, and a second fell across the path/staircase that crosses the stand opposite Athlone Rd. Five of the trees snapped 9m to 11m above the ground, the other two at 17m.

[4] Native drywood termite, *Kalotermes brouni*

The snapped trees had overall heights of 30m to 35m or so, with DBH's (trunk diameter at breast height) in the order of 500mm to 600mm. They are distributed throughout the stand (as opposed for example to being a confined pocket of afflicted trees).

As noted earlier, at the time of failure the snapped trees carried live and relatively compact canopies in reasonable health, with the canopies confined to the upper reaches of the trunks. The stature, form, and condition of the snapped trees is comparable to that of many of the remaining trees within the stand, with termite activity pervasively evident in stubs on many of the standing trees, as well as among shed deadwood.

3.5 Two large trees positioned centrally within the stand have entirely uprooted (both fell to the southwest, onto the cycleway/pathway). Another at the water's edge in the small gully about two-thirds of the way along the stand (east of the southern footbridge) has partially uprooted and toppled into a tree to the south.

3.6 Two large edge trees (DBH's of about 1.2m) have each failed where their trunks buckled a metre or two above ground level, with no obvious sign of structural decay or severe structural flaws at the point of failure. One fell across the cycleway/footpath and into the watercourse beside the southern footbridge in about 1998. The other fell to the southeast across the small gully that runs down to the southern footbridge.

3.7 One of the largest trees (DBH of about 1.4m) has snapped about 1m above the ground at a point that appeared to be oddly weakened by several closely-spaced embedded (but relatively small) branch stubs. The tree stood immediately north of the path (steps) that crosses the stand opposite Athlone Rd, and fell along the path and steps in late winter of 2003.

3.8 The trunks of several trees have relatively recently been severed ('topped') in response to previous failure or to address a structural flaw higher in the crown.

3.9 Five trees were noted to have particularly poorly structured unions in their primary frameworks (severe inclusions[5]), with a high likelihood of the trees splitting apart at these weak points.

3.10 Several large live limbs have recently been shed from the trees, the most recent being a 12m-long limb (250mm diameter at the point of failure) that fell onto the grass track from a height of about 20m, with the parent tree measuring about 38m in height. A large hanger remains suspended from the tree closest to the Athlone Rd footbridge (the limb failed between Oct 2004 and Feb 2005).

3.11 One of the trees (on the north side of the gully that leads to the southern footbridge) is a tall pole with a DBH of 700mm. The trunk has been ringbarked by an axe (or similar instrument) around 900mm of its 2.2m circumference (about 40% of its circumference).

3.12 There is a clear history of root damage around the base of several of the trees, with visible root decay in places.

[5] 'Inclusion' refers to a structurally flawed union of two (or more) stems or limbs, where the connection between the stems and/or limbs is compromised by the entrapment (or inclusion) of bark within the union.

4 Discussion

4.1 The trees covered in this report form one of several belts of old pines distributed through the park.

4.2 There is a clear recent history of substantial on-going tree failure among the assessed trees, with the failure mechanisms including:

- entire trees uprooting,
- healthy trunks buckling or snapping,
- entire trunks snapping where weakened by termite activity and/or decay, and
- the shedding of large limbs.

4.3 The stature, form, and condition of the termite-weakened trees are comparable to that of many of the trees within the stand. Termite tunneling is pervasively evident in stubs on the standing trees, as well as among shed deadwood. There is a very high likelihood of imminent further trunk failure induced by termite tunneling (and decay), and the likely extent of the termite activity renders many of the trees unsafe for climbing (aerial tree work).

4.4 The incidence of large limb failures will increase as the trees age and progressively deteriorate. At least five of the trees have particularly severe inclusions in their primary framework, with a high likelihood of the trees splitting apart at these weak points.

4.5 More than two-fifths of the trees have a substantial lean or heavily bowed trunk. With the 90 or so removals four years ago (summer 2001) and the progressive diminishing in numbers as further trees are lost due to failure or pre-emptive removals, there is a corresponding increase in the likelihood of wind throw or wind-induced failure among the remaining trees due to the changes in stand dynamics, in particular

- modified wind loadings on the remaining trees, and

- an overall reduction in the evapotranspirational capacity of the stand, with a consequent likely increase in soil moisture levels promoting uprooting.

4.6 The target areas in the event of failure include:

- a concrete cycleway,
- two formal walkways (one shared with the cycleway, and the second crossing the stand at the staircase and bridge opposite Athlone Rd),
- four seating areas (park benches) along the cycleway/footpath,
- an informal ‘grass’ track among the trees,
- the grazed paddocks to the east of the stand,
- several residential properties west of the stand, on the far side of the watercourse.

4.7 The 1996 *Churchill Park Management Plan* recognizes that the existing pines cannot be retained indefinitely, and flags their progressive replacement with native forest or woodland. For the area occupied by the pines, the *Landscape Concept Plan* advocates re-establishing indigenous vegetation, wildlife habitats, revegetating the lower slopes and gullies, rehabilitating the stream, and bush walks.

The *Management Plan* seeks to retain the rural character of the park, with gradual enhancement of the park with a "countryside in the city" character.

4.8 One of the difficulties in dealing with the pines is the need to reconcile:

- the contribution the trees make to the "countryside in the city" character and the bush walk feature espoused in the *Management Plan* with

- the duty of care required in relation to the safety of the trees.

The safety risks in a rural environment where remote paddocks of old shelter pines might be left to fall are very different to those at Churchill Park.

If no action is taken with the Churchill Park pines it is clear they will continue to fall and shed limbs with increasing regularity onto the various paths, tracks, and grazed areas (cattle), with further such failures inevitable and imminent. Residential properties flanking the stand are also included in the target areas.

Several approaches for dealing with the safety issue are canvassed below.

Option 1: Remove all the pines

Advantages Option 1:

i) Cost effective.
ii) Addresses safety concerns with the trees in question.
iii) Frees up a large area where replanting can occur without the competition and suppressing effect associated with planting among/beside the pines.

Disadvantages Option 1:

i) The additional 34 pines that form the southern portion of the belt (and which were not specifically included for assessment) will be left exposed, with a consequent increased likelihood of failure (see paragraphs 4.3 to 4.5).

This problem similarly applies for all the existing continuous belts of pines within the park. Where-ever whole blocks of trees are removed from among a belt, the remaining new 'edge' trees will be left exposed and vulnerable to failure.

It may be necessary to re-evaluate the cut-off point for the Option 1 'block' removals to ensure that a point is selected that minimizes the risks in terms of any increase in the likelihood of failure of the remaining trees. Measures such as pruning the new 'edge' trees, erecting warning signs, or re-routing the paths may be required. Alternatively, the additional 34 pines could be removed at the same time as the rest of the belt.

Option 2: Remove the pines that, were they to fall, would land on the existing paths (excluding the grass track) or residential properties

Advantages Option 2:

i) Secures the safety of the paths and residential properties.
ii) Frees up a fair amount of space for replanting, particularly along the existing paths (although in places the remaining pines would still have a suppressing effect on the plantings).

Disadvantages Option 2:

i) The retained trees within the stand would be left exposed and prone to a greatly increased rate of failure, with a high incidence of trees uprooting, snapping, or shedding large limbs (see paragraphs 4.3 to 4.5). Warning signs and possibly fencing would presumably be required to restrict public access within the fall zone of the remaining trees. The grass track would need to be closed off or re-routed away from the fall zones.
ii) Not as cost effective as Option 1. Removal costs for the targeted trees will be high (possibly even higher than removing all the trees) due to the need to work around the trees being retained. The remaining trees would eventually still need to be removed, resulting in further costs).
iii) Eventual removal of the remaining trees will conflict with any revegetation planting that has occurred within the felling and access paths.

Option 3: Remove only the 'worst' of the pines in the vicinity of the paths and residential properties

Advantages Option 3:

i) ???

Disadvantages Option 3:

i) There is no realistic or reliable way of determining the 'worst' trees due to the age class and failure characteristics of this stand (in particular the pervasive termite activity). Many of the trees are similar in form, stature, and condition to the trees that have recently failed.
ii) Removal of selected trees might serve only to leave other trees more prone to failure (see paragraphs 4.3 to 4.5), so that the overall risk of trees falling onto a path or residential property actually remained unchanged despite the targeted removals.
iii) Some of the trees that would presumably be targeted for removal are unsafe to be climbed, and would need to be felled in one. Many would need to be winched over. The space and maneuvering areas required for such felling operations would impact on other trees that might not have been targeted for removal.
iv) Not as cost effective as Options 1 or 2, and likely to be considerably more

expensive when taking into account the fact that the remaining trees will eventually still need to be removed.

v) Little opportunity for successful interplanting/underplanting. Eventual removal of the remaining trees will conflict with any revegetation planting that has occurred within the felling and access paths.

Option 4: Remove the bulk of the pines, but selectively retain occasional individuals or groupings where clear of the primary target areas (paths and residential properties), and where they can be satisfactorily isolated from the general public.

Trees chosen for retention would preferably be located where they can be readily and efficiently accessed for future removal without compromising any developing revegetation.

Advantages Option 4:

i) Secures the safety of the paths and residential properties.
ii) Frees up large areas for replanting, particularly along the existing paths.
iii) Relatively cost effective, provided the retained trees do not unduly impede the immediate removal works, and provided the retained trees remain readily accessible for their future removal.

Disadvantages Option 4:

i) The retained trees would be left exposed and prone to a greatly increased rate of failure (see paragraphs 4.3 to 4.5). Warning signs and possibly fencing would presumably be required to restrict public access within the fall zone of the remaining trees. The grass track would need to be closed off or re-routed away from the fall zones.

Option 5: As per Option 4, but include heavy pruning to secure the interim retention of additional (or alternative) trees. This would typically involve truncating the particular trees to half or one third of their current height.

Note:
Most of the trees are not structured in a way that would allow this option to be pursued, and some of the trees are unsafe for the sort of climbing work that would be required.

Advantages Option 5:

i) Secures the safety of the paths and residential properties.

ii) Frees up large areas for replanting, particularly along the existing paths.
iii) A few trees that would otherwise be removed near the primary target areas (paths and residential properties) could be retained (is this an advantage?).

Disadvantages Option 5:

i) Considerably more expensive than Option 4 due to the added complication of pruning.
ii) The retained trees would be left exposed and prone to a greatly increased rate of failure (except that the short term likelihood of failure would be reduced among those trees that had been substantially pruned). Warning signs and possibly fencing would presumably be required to restrict public access within the fall zone of those trees that still presented a high risk of failure. The grass track would need to be closed off or re-routed away from the fall zones of such trees.
iii) With some of the retained trees, their eventual removal might conflict with any revegetation planting that has occurred within the future felling and access paths that would be required.

5 Conclusions

5.1 The trees are old specimens in late maturity. There is a clear recent history of substantial ongoing tree failure among the stand, with the failure mechanisms including:

- entire trees uprooting,
- healthy trunks buckling or snapping,
- entire trunks snapping where weakened by termite activity and/or decay, and
- the shedding of large limbs.

5.2 Further such failures are inevitable and imminent, with the frequency of failure likely to markedly increase over the next few years.

5.3 The target areas include:

- a concrete cycleway,
- two formal walkways (one shared with the cycleway, and the second crossing the stand at the staircase and bridge opposite Athlone Rd),
- four seating areas (park benches) along the cycleway/pathway,
- an informal 'grass' track among the trees,
- the grazed paddocks to the east of the stand (and to the south),
- several residential properties west of the stand, on the far side of the watercourse.

5.4 The risks posed to the 'peopled' target areas cannot be satisfactorily addressed simply by the piecemeal removal or pruning of an occasional tree.

5.5 In the context of a frequented recreational asset in a city environment, the stand is at the end of its safe useful life, and its continued unrestricted use is no longer appropriate.

6 Recommendations

6.1 Remove the entire belt (including the additional 34 pines at the southern end of the stand), perhaps with the exception of a few individuals that could conceivably be salvaged and isolated as 'remnant landmarks'.

Replant the area in the form of native forest or woodland as advocated in the 1996 *Churchill Park Management Plan*. Plant a few pines or pine pockets as landmarks, again as advocated in the *Management Plan*.

6.2 Within the framework of Council's risk assessment and management procedures, evaluate the risks posed by the trees and undertake whatever measures may be deemed necessary to manage those risks at an acceptable level until such time as the trees can be removed.

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