Forest Audit Program: 2011-12reporting period
Module 7 audit of coupe regeneration and finalisation

Final report: August 03, 2012

Department of Sustainability and Environment

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Executive summary

Audit scope

The Department of Sustainability and Environment (DSE) commissioned Sinclair Knight Merz (SKM) to conduct an audit of coupe regeneration and finalisation as part of its Forest Audit Program (FAP) activities for the 2011-12 financial year. The audit was conducted as a statutory environmental audit under the auspices of the *Environment Protection Act 1970* and considered the risk of harm to the environment resulting from coupe regeneration and finalisation activities and thinning operations conducted by VicForests in State forests in eastern Victoria.

The segment of the environment that was audited comprised 315 regeneration coupes and 40 thinning coupes located across seven Victorian Forest Management Areas (FMAs); Benalla-Mansfield, Central, Central Gippsland, Dandenong, East Gippsland, North East and Tambo. VicForests proposes to transfer or "hand back" management responsibility for these coupes to DSE. The audit directly considered the vegetation and land or soils of regeneration and thinning coupes and the multiple beneficial uses of State forests, including: timber production, biodiversity or nature conservation, recreation, provision of visual amenity, protection of cultural heritage values and generation of water for environmental and consumptive uses.

Criteria for the audit are established by:

- *Code of Practice for Timber Production* (2007);
- Native Forest Silviculture Guidelines (NFSGs) relating to logging coupe regeneration and the management of thinning operations in native forests (#10, 13 and 14)

They relate to the rehabilitation of coupe infrastructure (landings, snig tracks etc), the development and application of guidelines for coupe finalisation and regeneration, the adequacy of regeneration and post-thinning stocking, site disturbance, source of seed for regeneration and pest animal controls. An audit manual for coupe regeneration and finalisation had previously been developed for the FAP. This was revised prior to the commencement of the formal audit.

Risk of harm to the environment of non-compliance with key audit criteria was assessed using standard risk assessment processes (AS/NZS ISO 31000:2009), based on DSE's (2007) *Risk management framework* (Appendix B). The scope of the assessment was confined to 32 regeneration coupes and five thinning coupes proposed by VicForests for hand back which were included in the detailed field component of this audit.

Direct stakeholder involvement in the audit was limited to DSE's Regulation and Compliance Unit and VicForests staff involved in environmental systems management and logging coupe regeneration.

The audit team was lead by Craig Clifton, an environmental auditor (natural resources) appointed pursuant to the *Environment Protection Act 1970*. The support team included Mark Poynter, Anthony Brinkley, Shelly Ada and Chloe Hanson-Boyd. The audit did not require support from Craig Clifton's formal environmental audit support team.

Revision of FAP Module 7

DSE commissioned the development of various "modules" to guide the conduct of statutory environmental audits undertaken as part of its FAP, including Module 7 for coupe regeneration and finalisation. This module was extensively revised prior to the formal audit being undertaken, although the work formed part of DSE's overall terms of reference. The revised FAP Module 7 for coupe regeneration and finalisation includes three main components:

- **Module 7 overview:** which provides an overview of the module, introduces the compliance elements and workbooks and outlines the approach to the desk-top and field audit components that is described in detail in Workbooks 7A and 7B.

- **Module 7 Workbook 7A:** this component is a completely new addition to Module 7. It describes a process by which VicForests reporting on coupe regeneration and finalisation is verified and compared against standards specified in the Code and relevant NFSGs. Its scope extends to all regeneration and thinning coupes nominated by VicForests for hand back to DSE and is based on a desk-top assessment of data provided by VicForests.
- **Module 7 Workbook 7B:** this component is substantially revised from the original Module 7 and includes detailed assessments of compliance of regeneration and thinning coupes with relevant audit criteria derived from the Code and NFSGs. It is based on an analysis of information from coupe files, VicForests Coupe Information System (CIS), DSE's FireWeb and data gathered in field surveys in a selection of regeneration and thinning coupes.

Module 7 and its workbooks were reviewed again following their use in this audit and several further changes made. The final, revised version of FAP Module 7 is provided with this report.

Review of VicForests assessments of suitability for finalisation

At the time of the audit, VicForests reported to DSE on the outcomes of its surveys of regeneration and thinning coupes. This information is intended to confirm that coupes have been regenerated according to standards set in NFSG #10, that thinning has been conducted to the standards set in NFSG #13 (for ash eucalypt forests) or #14 (for mixed species forests) and that coupes may be handed back to DSE for on-going management. VicForests' finalisation reporting was audited using the revised FAP Module 7 and its Workbook 7A.

In their 2011-12 finalisation list, VicForests proposed 315 even-aged regeneration coupes and 40 thinning coupes for hand back. Details of coupe regeneration and thinning coupe surveys were provided in a spreadsheet (VicForests 2011 coupe handback.xlsx) which was intended to enable DSE to verify that regeneration and thinning activities comply with the relevant NFSGs.

Of the 315 regeneration coupes nominated by VicForests for hand back, this assessment has identified just three that do not meet NFSG #10 standards for coupe stocking levels. Standards were not met as a result of: stocking being below the standard for the survey intensity; an unstocked area greater than 1 ha being observed; or all of the species present in the coupe prior to harvest not being identified in the survey. The two coupes with below standard stocking and unstocked areas greater than 1 ha were part of a joint DSE-VicForests trial and were not required to meet NFSG stocking standards.

The main area of non-compliance with NFSG #10 was not in relation to the level of stocking, but in the timing of stocking surveys. A total of 51 of 315 coupes were identified as not having stocking surveys undertaken within three years of coupe treatment[1]. This was assessed to pose no material risk for hand back.

VicForests thinning operations frequently did not comply with the relevant NFSGs. Only six of 40 thinning coupes proposed for hand back fully complied with NFSG standards for basal area retention, thinning damage and bay and outrow width.

Regeneration and thinning coupe finalisation reporting by VicForests to DSE was found to generally be consistent with the underpinning coupe file or other records. Variances between coupe records and finalisation reports to DSE were detected for 10 of the 32 regeneration coupes and one of the four thinning coupes included in this part of the audit. In only two cases for regeneration coupes did mistranslation of information result in coupes being incorrectly reported as having stocking that was compliant with NFSG #10. The translation error for the thinning coupe resulted in it being incorrectly labelled as non-compliant in relation to the percentage of live basal area (BA) retained after thinning.

[1] NSFG #10 actually specifies that stocking surveys are to be undertaken within 30 months of regeneration. However, as the Code species 3 years, this was adopted as the audit criterion.

Field assessments of regeneration and thinning coupes

Field assessments were conducted to confirm the data being reported to DSE as part of the finalisation process using the revised FAP Module 7 and its Workbook 7B. These assessments audited regeneration and finalisation operations against Code and NFSG requirements and sought to confirm, in the field, the results of VicForests' regeneration and post-thinning surveys.

Information reported to DSE in VicForests' finalisation list was found to be completely consistent with the results reported in stocking surveys for 28 of the 32 audited coupes. The four exceptions were all coupes that included areas where stocking was reassessed using intensive survey methods. The results included in the finalisation report to DSE were either not equal to the overall plot stocking rate or represented the results of just one of the two or more stocking surveys. In each case, the coupes were found to be acceptably stocked and differences were no more than a few percent. The pre-thinning BA reported in the finalisation list for one coupe was incorrect and as a result, the coupe was wrongly assessed to have exceeded the NFSG target for the percentage of live BA removed.

Regeneration coupes were assessed to satisfy the requirements of approximately 97% of applicable mandatory criteria and 84% of applicable guidance criteria. Thinning coupes were assessed to satisfy the requirements of approximately 84% of applicable mandatory criteria and 100% of the applicable guidance criteria.

No material (or high) risks of harm to the environment were identified as a result of these incidences of non-compliance. Based on DSE's 2007 risk management framework, all but two of the risks from non or partial compliance with audit criteria based on the Code and NFSGs were assessed to be low. The two medium risks related to single incidences of stocking standards not having been met and a regeneration burn escaping from control lines.

Audit findings

The audit made the following key findings:

- **Risk of harm to the environment:** no material risk of harm to the environment was identified. A small number of instances of partial or non-compliance with audit criteria based on the Code and NFSGs were identified, however these were assessed to pose a low or, at most, medium risk to the environment, based on DSE's risk management framework. The greatest risk of harm to the environment identified was where a regeneration burn escaped (assessed as medium risk).
- **Acceptability of regeneration coupes for hand back:** all 315 regeneration coupes proposed for hand back are considered to be acceptable in that they either comply with NFSG standards, do not comply, but were part of an accepted trial conducted with DSE and were not required to be regenerated to NFSG standards or are understocked in one confined location that is no longer accessible for treatment.
- **Acceptability of thinning coupes for hand back:** frequent instances of non-compliance of VicForests' thinning operations with NFSG standards were detected. These were in relation to damage to retained trees, retained BA and bay and outrow width. As none of the material issues can be remediated it is recommended that all coupes be accepted for hand back and that VicForests and DSE work to improve compliance with NFSGs. VicForests report that the contractors responsible for the majority of poor results have been dismissed.
- **VicForests finalisation and hand back reporting:** VicForests reporting meets DSE requirements and guidelines for finalisation reporting, however it not sufficiently comprehensive to fully assess compliance with NFSG standards. VicForests records had all of the required information and, once provided to the auditors, it was used to identify that most coupes proposed for hand back met NFSG standards.

  A small number of errors and omissions were identified in VicForests finalisation reporting to DSE (7% of the total number of audit criteria), although these omissions and errors had no material impact on the acceptability of coupes for hand back.

- **Harvest coupe regeneration and finalisation:** activities that were assessed during detailed field audits complied with 97% of applicable audit criteria. Only one instance was detected among 32 coupes and over 340 applicable audit criteria where non-compliance was assessed to pose more than a low risk of harm to the environment.

Recommendations

Recommendations arising from this audit include the following.

#	Recommendation
4.1	It is recommended that future requests for information on finalisation of VicForests coupes include all of the information needed to assess compliance with NFSG standards.
4.2	Differences in species composition between the gross coupe area and the area actually harvested may legitimately result in species found to be present in coupe planning not being detected in stocking surveys. It is recommended that for coupes in which stocking surveys do not detect all of the species identified in planning, an annotation explaining any legitimate reasons for this (e.g. species uncommon in coupe area, species only present in unharvested area) be provided in VicForests finalisation reporting.
6.1	It is recommended that Part A of Workbook 7A be adopted for use in future audits without further modification.
6.2	It is recommended that Part B of Workbook 7A be removed and not be included in future audit programs.
6.3	It is recommended that Part A of Workbook 7B be modified for use in future audit programs as follows: ▪ Provision is made to separately capture information from multiple regeneration coupe stocking surveys. For several of the audited coupes, a standard survey was followed up by one or more intensive surveys to either check stocking in lightly or unstocked areas or to follow up on remedial work to improve regeneration. ▪ The tables require cells that confirm the results of the assessment. ▪ For thinning coupes, Table 3 requires cells into which NFSG standard values for BA retention, bay and outrow width applicable to the stand age, type and slope can be entered, so that an assessment of compliance can also be made and included in the reporting
6.4	It is recommended that any future review of the *Code of Practice for Timber Production* consider introducing prescriptions that at least support compliance with commercial thinning standards and specifications in the relevant NFSGs.
6.5	It is recommended that Part B of Workbook 7B be modified to include more explicit guidance on how to treat “partial” and non compliance with audit criteria in completing Tables 4 and 5.
6.6	As unambiguous assessments of the effectiveness of particular environmental impact control measures cannot be made during audits that occur several years after regeneration it is recommended that criteria 14, 18 and 21) be deleted from Table 4 (for regeneration coupes). For similar reasons, criterion 10 in Table 4 and criterion 3 in Table 5 of Workbook 7B, relating to the spatial distribution and composition of regeneration and thinning coupe should be removed.
6.7	Formal, detailed field assessments of coupes with reported stocking above approximately 75% add little value to the audit. It is recommended that in future audits: ▪ For coupes with reported stocking of 75% and above, an initial reconnaissance survey should be undertaken to confirm that the coupe is adequately stocked. This could be based on an on-ground survey along snig tracks and other access points, or, where high resolution aerial photography is available, it could be based in interpretation of such images;

#	Recommendation
	▪ Formal surveys (using the method described in Workbook 7B) are only used to assess stocking in those coupes with reported stocking of less than 75% and in coupes where the initial reconnaissance survey identifies that they may not be as well stocked as suggested by VicForests' surveys. Coupes to be included in the detailed field assessments would be selected (largely) at random, as was the case in the current audit.
6.8	It is recommended that DSE accept all of the regeneration and thinning coupes proposed by VicForests for hand back.
6.9	It is recommended that the revised version of FAP Module 7 that was prepared on the basis of the 2011-12 audit is used in any future Coupe Regeneration and Finalisation audits.
6.10	It is recommended that the Department of Primary Industries (DPI) work with VicForests to strengthen the planning and implementation of forest thinning operations to achieve better compliance with relevant NFSGs.
6.11	It is recommended that DSE and DPI develop protocols for the reporting of coupe stocking in instances where multiple surveys, potentially of differing intensities, have been undertaken to assess coupe stocking.
6.12	Relatively poor compliance with the requirement to assess regeneration coupe stocking within three years of coupe treatment may reflect VicForests reporting of the latest rather than earliest established seedling survey. In future finalisation reporting, VicForests should ensure that the earliest such survey date be reported. VicForests should also ensure it complies with the Code requirement to conduct stocking surveys within three years of coupe treatment for regeneration. It should also ensure that such surveys are conducted within the timeframe required by the Code.
6.13	It is recommended that VicForests and DSE review the comments on perceived procedural shortcomings with coupe records and FireWeb entries and amend their practices as appropriate.
6.14	It is recommended that DPI review NFSG standards for thinning to appropriately allow for sampling and measurement uncertainty.

Audit summary information for EPA

EPA File reference	**68515-5**
Auditor	Craig Clifton
Auditor term of appointment	02/10/2008-25/07/2014
Name of person requesting audit	Duncan Pendrigh Executive Director, Forests and Parks, DSE
Relationship to premises/location	DSE is the management authority for State forest in Victoria and State government regulator of timber production operations in State forests.
Date of request	14/12/2011
Date EPA notified of audit	14/12/2011
Completion date of the audit	30/06/2012
Reason for audit	The audit forms part of DSE's annual Forest Audit Program to assess compliance with Code of Practice for Timber Production and related regulations.
Description of activity	Logging coupe regeneration and finalisation.
Current land use zoning	State forest
EPA region	Various: Gippsland, Metro, North-East
Municipality	Various local government areas in eastern Victoria
Lot and site details	Not applicable, various logging coupes in State forests in eastern Victoria
GIS coordinates of site centroid	Not applicable, various sites
Site area (ha)	Not applicable, various sites
Members and categories of support team utilised	Support team not required.
Outcome of the audit	Audit report with recommendations
Further work or requirements	Sixteen recommendations made regarding methodology for future audits, a consideration for future reviews of the *Code of Practice for Timber Production* and *Native Forest Silviculture Guidelines*, VicForests finalisation reporting processes, recording of coupe management information, management of thinning operations and DSE acceptance of thinning and regeneration coupes proposed for hand back

Contents

Glossary

Ash eucalypt forests	Forests dominated by "ash" eucalypt species, including Mountain Ash (*Eucalyptus regnans*), Alpine Ash (*E.delegatensis*), Shining Gum (*E.nitens*) and Erinunderra Shining Gum (*E.denticulata*).
Audit criteria	Criteria used to assess whether coupe regeneration and thinning activities are consistent with mandatory and guidance prescriptions of the Code and NFSG's.
BA	Basal area, the total cross sectional area of tree stems (m^2) at breast height (1.3 m) per hectare of the stand.
Bay width	The width of a bay, which in thinning coupes are the strips of retained trees located between outrows. Bays are thinned on a selective basis.
CIS	Coupe Information System, the information system used by VicForests to maintain digital records of harvest coupe planning, operations, monitoring etc.
Code	The *Code of Practice for Timber Production* 2007, which outlines mandatory prescriptions and guidelines for how timber production activities in native forests and plantations should be conducted.
Coupe	An individual management unit within forests and plantations where timber harvesting or thinning activities are planned and conducted.
DBH	Diameter of a tree (over bark) at breast height (1.3 m above ground on upslope side of tree)
Dominant/co-dominant trees	The main and more vigorous trees that form the canopy of a forest stand
FAP	Forest Audit Program – an annual program of statutory environmental audits coordinated by DSE to ensure that timber production operations in State forests provide for sustainable forest management.
Finalisation	The process of ensuring regeneration and thinning coupes are successfully regenerated and otherwise in a suitable condition for hand back to DSE.
FireWeb	DSE managed information system for maintaining digital records of prescribed burning activities undertaken in State forests.
Gross coupe area	The coupe area or boundary originally defined in the Timber Release Plan. This area is used as the starting point for harvest planning. The actual harvested area may be significantly less than this, due to the application of forest management zoning rules or prescriptions on harvesting buffers or exclusions relating to the protection of sensitive environmental features.
Hand back	The process whereby VicForests returns harvested and successfully regenerated coupes to DSE for on-going management.
Mixed species forests	Forests that generally comprising a mix of commercially desirable, non-ash eucalypt species.
Outrow width	The width of outrows, which are the strips created in thinned coupes by harvesting all trees in line at a specified spacing. They also allow access for harvest machinery to selectively thing the bays of retained trees.
Productive plots	In regeneration or stocking surveys, these are sampling points that are considered to be potentially suitable for regenerating trees to grow on.
Regeneration coupes	Regenerated even-aged and uneven-aged harvest coupes proposed by VicForests for finalisation and hand back to DSE.
Statutory environmental audit	An environmental audit conducted under the *Environment Protection Act* 1970.

Stocking	Relates to measures of the density and species composition of regrowth and thinned forests and coupes. Regeneration coupe stocking relates specifically to the percentage of sampling points in which an “acceptable seedling” (according to NFSG #10) has been identified. For thinning coupes, stocking considers the retained BA and width of bays and outrows.
Thinning coupes	Coupes that have undergone commercial thinning operations and have been proposed by VicForests for hand back to DSE.

1 Introduction

Sinclair Knight Merz (SKM) was commissioned by the Department of Sustainability and Environment (DSE) to conduct an audit of logging coupe regeneration and finalisation as part of its Forest Audit Program (FAP). The FAP's overall objective is to assess the risk of harm to the environment resulting from timber production activities in State forests. This particular audit considers the risk of harm to the environment resulting from coupe regeneration and finalisation activities and thinning operations managed by VicForests in State forests in eastern Victoria. It applies audit tools from the FAP's Module 7 for coupe regeneration and finalisation.

The objective of the audit is to assess whether forest regeneration, thinning and coupe finalisation processes are appropriately conducted to achieve sustainable forest management and are managed in accordance with relevant legislation, regulations, policies and practice guidance, particularly the *Code of Practice for Timber Production* 2007 (the Code [1]) and *Native Forest Silviculture Guidelines* (NFSGs; numbers 10, 13 and 14 [2-4]). The audit is being conducted as a statutory environmental audit under the auspices of the *Environment Protection Act 1970* (EP Act).

This is the final report on the audit project. It reports on both the statutory audit components of the project and preliminary work to review and revise FAP Module 7 and its workbooks. Its contents include:

- Section 2 Audit approach – which outlines the formal scope of the statutory audit and broader audit project and outlines the approach undertaken
- Section 3 Revision of FAP Module 7 – which describes the review of FAP Module 7 and the revisions made to the workbooks. The revised Module 7 document and workbooks, which were used to conduct this audit have been included in Appendix A.
- Section 4 Review of VicForests assessments of suitability for finalisation – which describes an assessment of VicForests reporting of its stocking surveys to determine whether regeneration and thinning coupes meet NFSG standards and are suitable for finalisation and hand back to DSE. The assessment also considers the consistency between information reported by VicForests to DSE and the underpinning regeneration coupe stocking surveys and post-thinning surveys.
- Section 5 Field assessments of regeneration and thinning coupes – 32 regeneration and five thinning coupes that were proposed by VicForests for hand back were reviewed in detail to assess: whether post-regeneration stocking and thinning operations meet relevant NFSG standards, the consistency of VicForests reporting of this with the underpinning data and the compliance of coupe regeneration and finalisation activities with audit criteria based on the Code and NFSGs. This section also includes an assessment of the risk of harm to the environment resulting from non or partial compliance with audit criteria.
- Section 6 Discussion – in which the audit methodology, based on the revised FAP Module 7 and its workbooks, is reviewed and recommendations made on further modifications. The final revised methodology is provided in Appendix C. This section also describes the major audit findings in the context of its initial objectives.
- Section 7 Conclusions and recommendations – the audit project's conclusions are presented and recommendations from previous sections collated.

The analysis and discussion in this report refers, at times, to specific VicForests regeneration or thinning coupes. To maintain confidentiality regarding audit details, coupe identifiers have not been used here. An alternative coupe numbering scheme has been used for public reporting.

2 Audit approach

2.1 Audit scope

The intended scope of the statutory environment audit was documented in a work plan which was provided to EPA on 14th December 2011. The following text updates this scope to reflect the actual work undertaken.

Activity undertaken

The audit is concerned with aspects of timber production operations conducted by VicForests in State forest areas located in eastern Victoria, specifically:

- Regeneration and finalisation of harvest coupes (hereafter "regeneration" coupes);
- Residual stocking and damage in thinning coupes;
- VicForests' processes to assess and report on compliance with the Code and relevant NFSGs.

Segments of the environment

The segment of the environment that has been audited comprises 315 regeneration coupes and 40 thinning coupes located across seven Victorian Forest Management Areas (FMAs); Benalla-Mansfield, Central, Central Gippsland, Dandenong, East Gippsland, North East and Tambo. VicForests proposes to transfer or "hand back" management responsibility for these coupes to DSE.

Elements of the environment

The audit directly considers the vegetation and land or soils of regeneration and thinning coupes and, to a limited extent, the native fauna associated with logging and thinning coupes.

Beneficial uses

State forest in which timber production activities occur are managed for multiple beneficial uses and values, including: timber production, biodiversity or nature conservation, recreation, provision of visual amenity, protection of cultural heritage values and generation of water for environmental and consumptive uses.

Audit criteria

Criteria for the audit are established by the following documents:

- *Code of Practice for Timber Production* (2007) [1];
- Native Forest Silviculture Guidelines, #10, 13 and 14 [2-4]

Criteria relate to the rehabilitation of coupe infrastructure (landings, snig tracks etc), the development and application of guidelines for coupe finalisation and regeneration, the adequacy of regeneration and post-thinning stocking, site disturbance, source of seed for regeneration and pest animal controls.

An audit manual for Coupe regeneration and finalisation had previously been developed for the FAP [5]. This was revised as part of the overall audit project commissioned by DSE. This revised document [6] and its associated worksheets specify the audit criteria.

Stakeholder participation

Direct stakeholder engagement in the audit was limited to DSE's Regulation and Compliance Unit and a small group of VicForests staff involved in environmental systems management and logging coupe regeneration.

Timing of audit

The audit commenced December 2011. The field and data gathering component of the audit was completed in March 2012.

2.2 Audit methodology

The overall audit project commissioned by DSE included four main components:

1. Revision of the FAP Toolbox, *Coupe regeneration and finalisation module* (Module 7) and its associated work books [6].
2. Review of VicForests own assessments of regeneration in logging coupes and residual stocking and damage in thinning coupes and its finalisation reporting to DSE. This assessment considers evidence of coupe regeneration and stocking adequacy in all thinning and regeneration coupes that were proposed for hand back to DSE[2].
3. Field assessments of selected regeneration and thinning coupes to confirm their stocking and suitability for hand back from VicForests to DSE. These assessments were conducted in Central and East Gippsland FMAs.
4. A trial in the use of high resolution aerial photography in assessments of stocking adequacy in regeneration coupes. The trial is intended to determine whether at least some elements of the field assessment of regeneration coupes may be replaced by analysis of remotely sensed images.

The second and third components form the scope of the statutory environmental audit component of the overall audit project. The aerial stocking survey trial has been reported separately [10], although some of its findings have been incorporated into the discussion in section 6.1.

2.3 Audit team

The audit team was lead by Craig Clifton, an environmental auditor (natural resources) appointed pursuant to the EP Act. The support team for the statutory component of the audit included Mark Poynter (TreePoynt Pty Ltd), Anthony Brinkley, Shelly Ada and Chloe Hanson-Boyd (SKM). The audit did not require support from Craig Clifton's formal environmental audit support team.

2.4 Risk assessment approach

Risk of harm to the environment of non-compliance with key audit criteria was assessed using standard risk assessment processes (AS/NZS ISO 31000:2009 [8]), based on DSE's (2007) *Risk management framework* ([9]; Appendix B). The assessment is confined to the 32 regeneration coupes and five thinning coupes proposed by VicForests for hand back that were included in the detailed field component of this audit (section 5). Risk of harm was assessed in relation to instances of non-compliance with audit criteria derived from the Code and NFSG standards.

[2] The audit did not consider roadline coupes nor regeneration coupes that had been burnt by wildfire.

3 Revision of FAP Module 7

3.1 Overview

DSE's terms of reference for the overall audit project included reviewing and revising, as necessary, the original FAP Module 7 [5]. The review considered the compliance elements documented in the workbooks and opportunities to improve the efficiency and comprehensiveness of coupe regeneration and finalisation audits. The latter included incorporating data from VicForests' own post-thinning and regeneration coupe stocking surveys into evidence gathering components of the audits.

The revised FAP Module 7 for coupe regeneration and finalisation [6] includes three main components, as outlined below and trialled during the audit.

- Module 7 overview – this component provides an overview of the module, introduces the compliance elements and workbooks and outlines the approach to the desk-top and field audit components that is described in detail in Workbooks 7A and 7B.
- Module 7 Workbook 7A - this component is a completely new addition to Module 7. It describes a process by which VicForests reporting on coupe regeneration and finalisation is verified and compared against standards specified in the Code and relevant NFSGs. Its scope extends to all regeneration and thinning coupes nominated by VicForests for hand back to DSE and is based on a desk-top assessment of data provided by VicForests.
- Module 7 Workbook 7B – this component is substantially revised from the original Module 7 and includes detailed assessments of compliance of regeneration and thinning coupes with relevant audit criteria derived from the Code and NFSGs. It is based on an analysis of information from coupe files, VicForests Coupe Information System (CIS), DSE's FireWeb and data gathered during field surveys in a selection of regeneration and thinning coupes.

A copy of this version of Module 7 is provided in Appendix A. An overview of methodology for the two components of the audit, based on Workbooks 7A and 7B are provided in the following sections.

Module 7 and its workbooks were reviewed again following their use in this audit (section 6.1) and several further changes were made. The final, revised version of FAP Module 7, which is recommended for use in any future audit of coupe regeneration and finalisation, is given in Appendix C.

3.2 Assessment of the suitability of coupes nominated for finalisation

As part of the finalisation and hand back process, VicForests reports on the outcomes of its regeneration stocking and post-thinning surveys. This information is intended to confirm that logging coupes have been successfully regenerated (according to standards set in NFSG #10 [2]) and that thinning has been conducted to the standards set in NFSG #13 (for Ash forests [3]) or #14 (for mixed species forests [4]). At the time of the audit, VicForests reported on coupe regeneration and finalisation to DSE. The Department of Primary Industries (DPI) are now the State government custodians of the coupe finalisation process and will be the recipients of any future VicForests reporting in relation to these matters.

This component of the audit comprised a review of the information provided to DSE by VicForests and an assessment of its consistency with records stocking and post-thinning surveys held in coupe files and the CIS. It used Workbook 7A and was an entirely desk-based analysis of data provided by VicForests.

Part A: Review of coupe data

VicForests provided DSE with a consolidated spreadsheet report on outcomes of its regeneration stocking and post-thinning surveys as part of the finalisation and hand back process. The spreadsheet was intended to

demonstrate that relevant NFSG compliance requirements were met for all coupes or that there were extenuating circumstances for specific coupes such that the requirements could be waived or delayed.

Part A of Workbook 7A (Appendix A) documents how the review was undertaken. The data required to assess compliance with relevant NFSG requirements is specified in Table 1 (of the workbook). For the 2011-12 hand back coupes, VicForests' reporting spreadsheet contained most, but not all of the information required. Any additional information that was required was supplied on request.

Compliance requirements of the relevant NFSGs include:

Regeneration coupes:

- Coupe stocking assessed within three years of treatment[3];
- Stocking of productive plots meets standard (based on intensity of sampling grid): typically 65% of stocked plots for standard 80×20 m survey;
- No unstocked areas >1 ha (even-aged coupes) or 2 ha (uneven-aged coupes);
- At least 10 individual trees of all eucalypt species present on coupe prior to harvesting are present in regenerating coupe.
- Non-merchantable basal area (BA) does not exceed target (for uneven-aged stands only) of 5-7% of reference BA.

Thinning coupes:

- Retained BA is not less than 50% of initial live BA;
- Retained BA of regrowth trees exceeds target for age class and forest type (see Annex 1 of Workbook 7A);
- Average coupe outrow width does not exceed 7 m for 1939 Ash forests or 4.5 m for all other forest types;
- Average coupe bay width equals or exceeds target for slope and forest type (12, 14 or 20 m; see Annex 1 of Workbook 7A
- Dominant and co-dominant trees retained, except on access tracks and outrows;
- No more than 15% of retained trees sustain damage to their crowns or boles during thinning.

In addition to the above, information was also gathered on the incidence of weed and browsing damage in regeneration coupes. This information was gathered to support assessments of whether pest management was consistent with Code and other relevant requirements during the detailed field assessment component of the audit.

Summaries for each FMA and forest type were collated using Tables 2 (regeneration coupes) and 3 (thinning coupes) of Workbook 7A. A list of any or all coupes in each FMA that did not fully meet NFSG requirements and the relevant compliance issues was compiled using Table 4 of Workbook 7A.

Part B: Review of regeneration and post-thinning survey results

The second main element of this component of the audit involved comparing the finalisation data reported by VicForests with the original stocking and post-thinning survey information held in coupe files or CIS. This assessment was carried out on 10% of regeneration and thinning coupes proposed for hand back. Stocking and post-thinning survey results were requested from VicForests to support this element of the audit. Individual comparisons of data from coupe files or CIS with VicForests hand back data were reported using Tables 5-7 of Workbook 7A (for even-aged, uneven-aged and thinning coupes, respectively).

3.3 Field assessments of Code and NFSG compliance

The original Workbooks 7A and 7B were to be used in field-based audits of compliance of coupe regeneration and finalisation with the Code, NFSGs and DSE's *Coupe Finalisation Procedures* [7]. Audit criteria were to be assessed

[3] NFSG #10 actually specifies stocking surveys are to be undertaken within 30 months of coupe treatment for regeneration. The Code requirement for such surveys is three years post-treatment, which has been adopted here as the relevant audit criterion.

using material held in the coupe file and CIS, as well as field surveys of regeneration and thinning coupes. The latter were to be undertaken using the methods described in NFSGs #10, 13 and 14 [2-4].

The workbooks and audit methodology were reviewed and restructured and a new Workbook (7B) was developed as part of the current audit project. Compliance criteria were restricted to the Code and NFSGs[4] and the field assessment method simplified to improve the efficiency of the field audit component.

The number of coupes included in the field component of the audit is likely to be limited by available resources. A minimum of 10% of coupes in a selection of FMAs will be audited in any one year. For the 2011-12 audit program, two FMAs were selected for audit (East Gippsland FMA, which had the majority of coupes nominated for hand back; Central FMA, with the second largest number of coupes) and 10% of East Gippsland FMA coupes (17 regeneration coupes and four thinning coupes) and over 20% of Central FMA coupes (15 regeneration coupes and the single thinning coupe) were included.

Part A: Assessment of stocking and post-thinning surveys

This activity corresponds with Part B of Workbook 7A and was undertaken for all of the coupes included in the field component of the audit. Data from stocking surveys in regeneration coupes and post-thinning surveys were assessed against the data reported by VicForests to DSE as part of the coupe finalisation and hand-back process.

Individual comparisons of data from coupe files or CIS with VicForests hand-back data were reported using Tables 1-3 of Workbook 7B (for even-aged, uneven-aged and thinning coupes, respectively).

Part B: Assessment against Code requirements

Relevant audit criteria included in the original Workbooks were substantially revised and collated in Tables 4 and 5 (Workbook 7B) for regeneration and thinning coupes, respectively. Audit criteria for regeneration coupes are derived directly from the Code, which in sections 2.1.3 (Forest Coupe Plans), 2.3.1 (Regeneration) and 2.3.2 (Stocking assessment) provides explicit mandatory prescriptions and guidance. Section 2.5.2 also provides mandatory prescriptions on rehabilitation of coupe infrastructure, which is best assessed at coupe finalisation. A total of 39 audit criteria were identified, based on both mandatory (34 criteria) and guidance prescriptions (5 criteria). Depending on the circumstances of an individual coupe, some of the criteria may not be applicable.

The Code includes few explicit references to thinning operations. Audit criteria for thinning coupes were almost exclusively derived from Code prescriptions relating to regeneration that were also considered to be relevant to the finalisation and hand-back of thinning coupes. Just 15 mandatory criteria and one guidance criterion were developed.

Tables 4 and 5 were completed for each of the coupes selected for field audit on the basis of data and information either held in the coupe files, CIS, and FireWeb or obtained from the field audits.

Part C: Field assessment of regeneration and coupe stocking

The original Module 7 proposed that regeneration and thinning coupe surveys be conducted using the procedures used by VicForests (and prescribed in NFSGs #10, 13 and 14). Since the intent of this component was to *audit* stocking adequacy (and thinning damage etc.) rather than replicate detailed surveys already undertaken by VicForests, a simplified and more efficient survey method was developed for the revised Module 7.

Using the new audit method for regeneration coupes, stocking assessments (following standard NFSG #10 procedures) were conducted at up to 50 randomly located sampling points in each coupe (depending on its size), with the results reported and summarised in Tables 6 and 7 for even-aged coupes and Tables 8 and 9 for uneven-

[4] As DSE's Coupe Finalisation Procedures [7] are now obsolete and have no particular status in the regulation of timber production operations.

aged coupes, respectively. The recording sheet notes details of sampling point location, whether the plot is stocked with a suitable seedling, the species of any seedlings present in the plot and, if the plot is unstocked, the condition of the seedbed. The existence of any large unstocked areas (>1 ha for even-aged coupes and >2 ha for uneven-aged coupes) is also noted. For uneven-aged coupes, the BA of retained stems is also assessed.

Sampling procedures for thinning coupes followed NFSGs #13 (Ash-type forests) and 14 (mixed species forests), except that a total of 12 plots are assessed per coupe rather than three per 6 ha as prescribed. Field records were taken using Table 10 and then summarised for the coupe as a whole. The assessments considered species composition, stocking rate, residual BA, bay and outrow width and the extent of damage to retained trees resulting from thinning.

4 Review of VicForests assessments of suitability for finalisation

At the time of the audit, VicForests reported to DSE on the outcomes of their surveys of regeneration and thinning coupes. As discussed in section 3.2, this information was intended to confirm that coupes have been regenerated according to standards set in NFSG #10 or that thinning has been conducted to the standards set in NFSG #13 (for ash eucalypt forests) or #14 (for mixed species forests).

This component of the audit reviewed the information reported to DSE and its consistency with both the standards set in the relevant NFSGs and the original information held in coupe files or on CIS. It was conducted using Workbook 7A.

4.1 Part A: Review of VicForests coupe finalisation data set

In their 2011-12 finalisation list, VicForests proposed that 315 even-aged regeneration coupes and 40 thinning coupes be finalised and handed back to DSE. Details of coupe regeneration and thinning coupe surveys were provided in a spreadsheet (VicForests 2011 coupe handback.xlsx) which is intended to enable DSE to verify that regeneration and thinning activities comply with the relevant NFSGs.

Regeneration coupes

The NFSG compliance criteria covered in VicForests' finalisation report were:

- Stocking rate and associated survey intensity;
- Presence or absence of >1ha unstocked areas in the coupe;
- Presence of all required eucalypt species (i.e. those identified in the pre-logging assessments) in the regenerated stand.

Further information was requested of VicForests to determine whether the final compliance requirement, that stocking surveys were undertaken within 3 years of coupe regeneration, was met. A summary of the assessment of this information against NFSG #10 requirements is given in Table 1.

Table 1 Assessment of VicForests' finalisation reporting for regeneration coupes against NFSG #10 requirements

	Coupes complying with NFSG requirement		Coupes not complying with NFSG requirement	
Compliance criteria:	**#**	**%**	**#**	**%**
Stocking rate meets or exceeds the target for the relevant survey intensity (75% for extensive, 65% for standard, 55% for intensive)	313	99%	2	1%
No unstocked areas >1 ha for even-aged coupes	312	99%	3	1%
All required eucalypt species present in regenerating coupe	315	100%	0	0%
Stocking surveys completed within 3 years of coupe treatment	270	86%	50	16%

The two coupes not meeting the stocking rate standard (376 and 377; Table 2) were reportedly part of a trial that was undertaken with DSE and were excused from the NFSG stocking requirement. These two coupes and one other (085) were found to have unstocked areas greater than 1 ha. The unstocked area in non-trial coupe was estimated to be 1.2ha. VicForests commented that correcting this would most likely damage surrounding good quality regrowth and proposed that no further action was undertaken. This coupe was assessed in the field survey (section 5.4) and the auditors agreed with VicForests' recommendation.

Data provided to the auditors indicates that for 45 of 315 coupes the latest stocking survey was not completed within 3 years the coupe being treated for regeneration. For a further five coupes, information on the timing of the stocking survey was not provided and the coupe was assessed to be non compliant in this respect. Half of the four

coupes in Dandenong FMA and over a quarter of the 19 coupes in North East FMA did not comply with the requirement to undertake an initial established seedling stocking survey within three years of coupe treatment.

The field audits (section 5) and review of actual stocking survey data (section 4.2) found several instances where multiple stocking surveys were undertaken on an individual coupe. This typically occurred when either: the observed stocking was marginal in part of the coupe and an intensive survey was subsequently undertaken in those areas to confirm stocking; or where poor initial stocking led to further action to promote regeneration and was followed up by a another full or partial survey. The initial stocking survey may or may not have been within the three year window and, in some cases, the latest survey was not.

Table 2 Breakdown of hand back coupe compliance with NFSG #10 standards by FMA

FMA (# coupes)	Stocking rate < NFSG standard	Unstocked areas >1 ha	Required species missing	Stocking survey time		
				Average months	# coupes >3y	% coupes >3y
Benalla-Mansfield (1)	0	0	0	20	0	
Central (56)	0	1	0	24	3	5%
Central Gippsland (18)	0	0	0	30	3	17%
Dandenong (4)	0	0	0	35	2	50%
East Gippsland (166)	2	2	0	30	31	19%
North East (19)	0	0	0	32	5	26%
Tambo (49)	0	0	0	27	6	12%

The supplementary data on the timing of stocking surveys provided by VicForests only indicated if the latest established seedling survey was conducted within the three year window and not the date of the earliest survey. Some of the 45 coupes reported as being surveyed over 3 years from coupe treatment may actually have complied if the earliest stocking survey was considered. While such coupes are not strictly compliant with NFSG #10, this has no bearing on the success of regeneration or their suitability for finalisation.

Rehabilitated log landing and successfully regenerated harvesting coupes

Thinning coupe operations

The NFSG compliance criteria covered in the finalisation report for thinning coupes included:

- Retained basal area (BA) of regrowth;
- Percentage live BA removed;
- Width of bays and outrows;

- Percentage of stems damaged during thinning.

The spreadsheet provides the information previously required by DSE for the hand back process. However, it does not report the age of the thinned stand or its slope and so does not, on its own, provide sufficient information to assess compliance with NFSG #13 or 14 standards. Supplementary information was provided for some coupes to enable this assessment. A summary of the assessment for each compliance criterion is given in Table 3. As 35 of 40 thinning coupes were located in East Gippsland FMA, results from the analysis of thinning coupes have not been broken down into FMAs.

VicForests' reporting shows significant non-compliance of thinning operations with NFSG standards. This is particularly true for the requirement that no more than 50% of live BA is removed. Half of the coupes proposed for finalisation were assessed to have been thinned to a greater extent than the standard, three of them with less than 40% of the original live BA retained (Figure 1). The reported target retained BA in VicForests coupe finalisation reporting was actually less than the 50% standard for 13 of 40 coupes.

VicForests thinning coupe and an example of damage sustained during thinning

Retained regrowth BA standards for ash and mixed species forests is age dependent [3,4]. As a result of the stand age not being reported, it was only possible to assess compliance for this criterion on 23 of the 40 coupes. On only 10 of these did the retained BA meet or exceed the NFSG standard. In one case (coupe 354) retained BA was just 59% of the target BA for the age and forest type.

Table 3 Assessment of VicForests' finalisation reporting for even and uneven-aged logging coupes against NFSG #10 requirements

	Coupes complying with NFSG requirement		Coupes not complying with NFSG requirement	
Compliance criteria:	**#**	**%**	**#**	**%**
Not more than 50% of live BA is removed	20	50%	20	50%
Retained BA of regrowth exceeds NFSG standard for age of stand and forest type	10[1]	43%	13[1]	57%
Outrow width does not exceed maximum specified in NFSG for forest type	31	78%	9	22%
Bay width exceeds NFSG specified minimum for slope[2] and forest type	28	70%	12	30%
% stems damaged <15%	34	85%	6	15%

Note:

1. Coupe age information available for only 23 of 40 thinning coupes
2. Slope assumed to be <15°

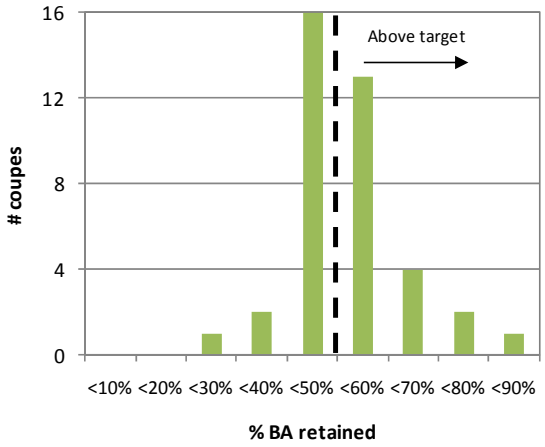


Figure 1 Graph of reported % live basal area removed during thinning operations in VicForests coupes

Average outrow width was within the NFSG standard range in 31 of the coupes and the average bay width exceeded the minimum for 28 coupes. The auditors' observation during the field assessments was that outrow and bay width were difficult to determine precisely, particularly where some years had elapsed between thinning and the survey or there had been further disturbance (e.g. due to firewood harvesting) after thinning had been completed. Our assessment was that measurement uncertainty for outrow and bay width was at least 0.5 m.

Differences between actual and NFSG standard outrow widths were within the interpreted 0.5 m measurement uncertainty for all but one of the 40 thinning coupes (coupe 405). However, in only four of the 12 coupes in which average bay width was less than that required by the NFSG standard, was the difference within the interpreted 0.5 m measurement uncertainty.

In six of the 40 coupes, more than 15% of stems in post-thinning assessment plots were reported to have bole or crown damage as the result of thinning.

4.2 Part B: Review of data supporting VicForests' finalisation reporting

The second element of this component of the audit involved comparing the finalisation data reported by VicForests with the original regeneration and thinning coupe survey data. This assessment was carried out on a random selection of 10% of regeneration coupes (32 coupes) and the 10% of thinning coupes (5 coupes) included in the field assessment.

Regeneration coupes

The review of data on regeneration coupe stocking considered the same audit criteria as the review of the finalisation list (section 4.1). This assessment (Table 4) focuses on two points:

- Whether there is a variance between the data (relating to audit criteria) reported to DSE in VicForests' finalisation list and that held on coupe files;
- Whether any such difference would affect the level of compliance with NFSG #10 standards.

Four coupes were identified in which the stocking rate reported in the VicForests' finalisation spreadsheet could not be reconciled with the stocking survey data. In all four cases, two or more partial, intensity stocking surveys had been undertaken and the differences were within a few percent. The stocking surveys indicated that all four coupes met NFSG #10 standards.

Required eucalypt species were not identified in stocking surveys on one coupe (coupe 328) and this was not recorded in VicForests finalisation list. The auditors' experience during the field assessments suggests several reasons why "required" species may not be detected in the regenerating coupe, including:

- They did not regenerate successfully within the harvested area of the coupe;

- The species was uncommon in the coupe prior to logging and remains uncommon and was not detected during the survey;
- The species was present in the (gross) coupe area identified at planning stage, but not in the (net) areas actually harvested and regenerated. The species would not be expected to have been found in the stocking survey.

Gross coupe area for coupe 328 was 30 ha, but only 1.6 ha were actually harvested. Information provided by VicForests indicates that the two missing species comprised just 5% of the original species mix. While they were not detected in the stocking survey, they were almost certainly present in the unharvested area.

Table 4 Summary of comparison of VicForests' finalisation reporting for regeneration coupes with stocking survey data in 10% of finalisation coupes (32 coupes). Reporting only considers NFSG #10 compliance requirements

Compliance criteria	# coupes with variance in reporting	# coupes with variance that affects compliance assessment	Comment
Stocking rate exceeds the NFSG standard for the relevant survey intensity	4	0	In all cases parts of the coupe were resurveyed using an intensive survey. All coupes adequately stocked.
No unstocked areas >1 ha	0	0	
All required eucalypt species present in regenerating coupe	1	1	The assessment of coupe 328 found 4 of 6 species present – which was not reported to DSE.
Stocking surveys completed within 3 years of regeneration	5	1	

Five instances were identified in which there was variance in the timing of the stocking survey after regeneration between the supplementary information provided by VicForests and that recorded in coupe files. In one case this indicated that the stocking had not actually been assessed within 3 years of regeneration, making non-compliance on this issue a feature of 51 of 315 regeneration coupes.

Thinning coupe operations

The review of data on thinning coupes considered the same compliance criteria as the review of the finalisation spreadsheet. As above, the assessment focused on whether there was a variance between the data reported to DSE and that held on coupe files and whether any difference affect the level of compliance with NFSG standards reported.

For one of the four coupes (coupe 428; East Gippsland FMA), the pre-thinning BA reported in the finalisation spreadsheet was 42 m^2/ha, whereas the coupe file reported only 27 m^2/ha. As a result, the coupe was incorrectly reported to have exceeded the NFSG target for the percentage of live BA removed. In all other cases the data were consistent between the coupe records and VicForests' finalisation report to DSE.

While it was intended that this review would consider the 5 of 40 thinning coupes proposed for hand-back, the coupe file and stocking survey record for one of these (coupe 397; Central FMA) was reported to have been lost in the February 2009 bushfires.

4.3 Summary and discussion

Of the 315 regeneration coupes nominated by VicForests for hand back, this assessment has identified just four that do not meet NFSG #10 standards for coupe stocking. Standards were not met as a result of: stocking being below the standard for the survey intensity; an unstocked area greater than 1 ha being observed; or all of the

species present in the coupe prior to harvest not being identified in the survey. Two of these coupes were part of a joint DSE-VicForests trial and were not required to meet NFSG stocking standards.

One was reported to DSE as having met NFSG stocking standards, when it did not appear to do so on the basis of the direct evidence presented. Two of the six species found to be present in the gross coupe area prior to harvesting were not detected in the stocking survey. However, as these species comprised just 5% of the original stocking and only 1.6 ha of the 30 ha gross coupe was harvested, it is likely that these species have been retained in the harvest area.

The main area of non-compliance with NFSG #10 was not in relation to stocking rate, but in the timing of stocking surveys. A total of 51 of 315 coupes were identified as not having stocking surveys undertaken within the required[5] three years of coupe treatment. Surveys were delayed six years or more after treatment in several coupes. Delays in the timing of the regeneration surveys have no impact on the success of regeneration or the suitability of coupes for finalisation.

VicForests thinning operations frequently did not comply with the relevant NFSGs. Only six of the 40 thinning coupes proposed for hand back fully complied with NFSG standards for basal area retention, thinning damage and bay and outrow width. The most common area of non-compliance identified was removing more than 50% of live BA during thinning. This was identified on 20 of 40 coupes. On 13 of the 23 coupes for which stand age data was obtained, the retained BA of regrowth trees was lower than required by the relevant NFSG standard (for the particular stand age).

Outrow widths frequently exceeded the NFSG standards (nine coupes), although in most cases the differences were within the measurement uncertainty. Bay widths were frequently narrower than the NFSG standards (12 of 40 coupes), generally by a greater amount than the measurement uncertainty. Damage to the bole or crown of retained trees exceeded the maximum of 15% of trees in six of the 40 coupes.

Regeneration and thinning coupe finalisation reporting by VicForests to DSE was found to generally be consistent with the underpinning coupe file or other records. Variances between coupe records and finalisation reports to DSE were detected for 10 of 32 regeneration coupes and one of four thinning coupes (7% of compliance criteria). In only two cases for regeneration coupes did mistranslation of information result in coupes being incorrectly reported as having stocking that was compliant with NFSG #10. The translation error for the thinning coupe resulted in it being incorrectly labelled as non-compliant in relation to the percentage of live BA retained after thinning.

Data provided by VicForests in their finalisation list to DSE does not, on its own, provide all of the details required to assess compliance with relevant NFSGs. While most of the required data was subsequently provided by VicForests, it is recommended that future reporting address all of the information required. Key gaps identified in the 2011-12 finalisation reporting were:

- Regeneration coupes
  - Report date of first stocking survey to enable an assessment of compliance with the requirement to undertake stocking surveys within 3 years of coupe treatment for regeneration
- Thinning coupes
  - Provide details of stand age to enable the NFSG standard for retained BA to be determined
  - Provide details of average coupe slope to determine the outrow width and bay width (ash forests only)
  - Provide information to confirm that the coupes' post-thinning species composition match those prior to thinning

[5] As per previous comments, three years is required by the Code and has been adopted as the audit criterion. NFSG requires the stocking surveys be first conducted within 30 months of regeneration treatment.

- Provide information on the retention of dominant or co-dominant trees.

Recommendation 4.1
VicForests reporting met DSE requirements and guidelines for finalisation reporting, however it did not have all of the details required to enable compliance against NFSGs to be fully assessed. It is recommended that future requests for information on finalisation of VicForests coupes include all of the information needed to assess compliance with NFSG standards.
Recommendation 4.2
Differences in species composition between the gross coupe area and the area actually harvested may legitimately result in species found to be present in coupe planning not being detected in stocking surveys. It is recommended that for coupes in which stocking surveys do not detect all of the species identified in planning, an annotation explaining any legitimate reasons for this (e.g. species uncommon in coupe area, species only present in unharvested area) be provided in VicForests finalisation reporting.

5 Field assessments of regeneration and thinning coupes

As described in section 3.3, field assessments were conducted using Workbook 7B and included three main elements:

1. Review of VicForests stocking and post-thinning surveys – to confirm the data being reported to DSE as part of the finalisation process and to familiarise the audit team with the status of the coupes they would be assessing;
2. Assessment of regeneration and finalisation operations against Code requirements;
3. Field surveys of regeneration and thinning coupes to assess compliance with NFSG standards for coupe stocking and thinning operations.

The first and second elements of the field assessment were largely desk top exercises and were mostly conducted in VicForests offices in Healesville and Orbost. They were based on information held in coupe files or on the CIS or FireWeb information systems.

5.1 Selection of field audit coupes

The field component of the audit was consolidated into the two FMAs with the largest number of coupes nominated for hand back, East Gippsland and Central. Ten percent of regeneration and thinning coupes (17 and four, respectively) were selected in East Gippsland FMA (of 168 and 35 coupes, respectively) and approximately 20% of coupes in Central FMA (15 regeneration coupes and the single thinning coupe) were selected for the audit. Overall, 10% of regeneration and thinning coupes proposed for hand back were included in this component of the audit. Coupes were mostly selected at random, although a small number of marginally stocked regeneration coupes and coupes with relatively high thinning damage were also selected.

Desk-top components of the audit were conducted for all coupes from VicForests' offices in Healesville (Central FMA) and Orbost (East Gippsland FMA). Field elements of the audit were assessed on all coupes that could be accessed within a two week field program. A total of 25 regeneration coupes (12 in Central FMA and 13 in East Gippsland FMA) and all five thinning coupes were assessed. The remaining coupes were either inaccessible, unsafe to work on at the time or could not be assessed within the time available.

5.2 Part A: Assessments of VicForests stocking and post-thinning surveys

These assessments followed the methods developed for Part B of Workbook 7A and used the relevant reporting tables (see section 4.2). Results were collated using Tables 1 and 3, for regeneration and thinning coupes, respectively.

Regeneration coupes

Stocking survey results held in coupe files were reviewed for all 32 of the selected regeneration coupes. The compliance elements were based on NFSG #10 and included:

- Coupe stocking: stocking rate and associated survey intensity, presence or absence of >1 ha unstocked areas in the coupe and presence of all required eucalypt species (i.e. those identified in the pre-logging assessments) in the regenerated stand.
- Timing of stocking survey: following treatment of the coupe for regeneration.

Information reported to DSE in VicForests' finalisation list was found to be completely consistent with the results reported in stocking surveys for 28 of the 32 coupes. The four exceptions were all in East Gippsland FMA (221, 292, 352 and 358) and were coupes that included areas where stocking was reassessed using intensive survey methods. The results included in the finalisation report to DSE were either not equal to the overall plot stocking rate or represented the results of just one of the two or more stocking surveys. In each case, the coupes were found to be acceptably stocked and differences were no more than a few percent.

Thinning coupe post-thinning stocking and damage surveys

The coupe file for one thinning coupe in Central Highlands FMA (316) was reported to have been lost during the February 2009 bushfires and so it was not possible to compare VicForests' post-thinning survey records with the data reported to DSE.

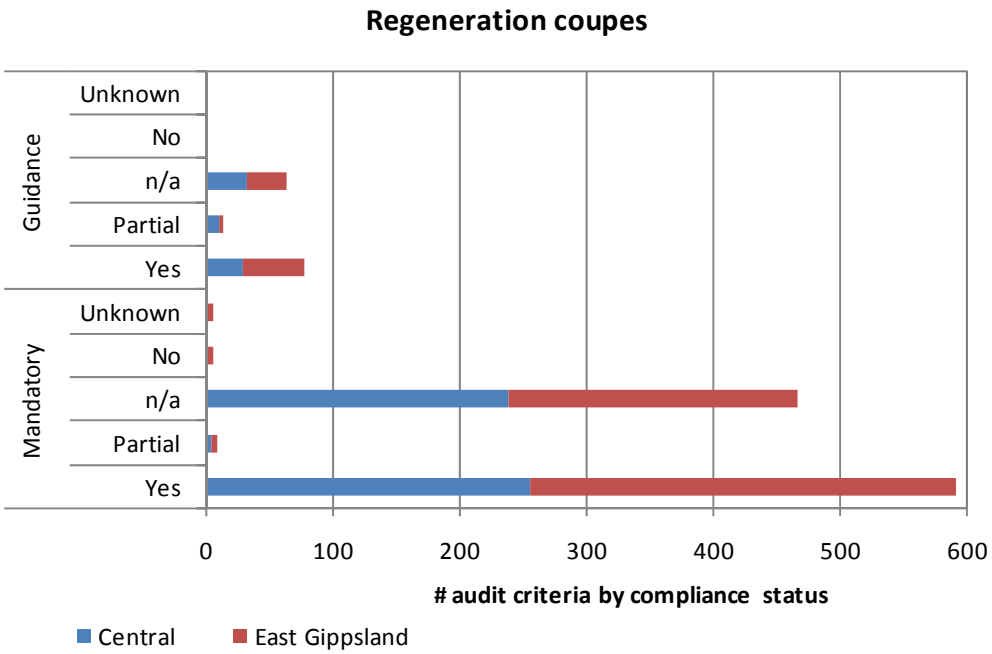
As noted in section 4.2, for one of the four coupes (428), the pre-thinning BA reported in the finalisation spreadsheet was 42 m^2/ha, whereas the coupe file reported only 27 m^2/ha. As a result, the coupe was wrongly reported to have exceeded the NFSG target for the percentage of live BA removed. The data were consistent between the coupe records and VicForests' finalisation list for remaining coupes.

5.3 Part B: Assessment against Code requirements

The assessment against Code requirements included significantly more elements for regeneration coupes than thinning coupes due to the limited number of compliance elements for the latter. Assessments of each type of coupe were recorded using Tables 4 and 5 of Workbook 7B.

Regeneration coupes

A total of 34 mandatory and five guidance audit criteria were identified in the Code and incorporated into Table 4 of Workbook 7B. Most criteria were assessed from information contained in coupe files or the CIS or FireWeb information systems. Several were based on the field assessments of coupe stocking and other conditions. Summaries of the results of the assessment are given in Figure 2 and Table 5.



Note: Unknown - no assessment against the criterion was possible; No – coupe was assessed as not complying with the criterion; n/a – criterion was assessed as not applicable to coupe; Partial – coupe partly satisfied criterion; Yes – coupe satisfied criterion. The assessment was made against a total of 1088 mandatory criteria (34 criteria × 32 coupes) and 160 guidance criteria (5 criteria × 32 coupes).

Figure 2 Summary of assessments for compliance against mandatory and guidance audit criteria based largely on the *Code of Practice for Timber Production 2007* for selected regeneration coupes in Central and East Gippsland FMAs.

The audit criteria included in Table 4 of Workbook 7B covered a broad range of activities connected to coupe regeneration and finalisation, but which are not necessarily relevant to any individual coupe. For the 32 coupes included in this component of the audit, approximately 43% of mandatory criteria and 41% of guidance criteria were assessed as not applicable. Examples included sets of criteria relating to management of erosion resulting

from mechanical disturbance during regeneration, protection of indigenous heritage and use of pesticides or other measures in managing weed or browsing damage during coupe regeneration.

Coupes were assessed as satisfying the requirements of approximately 97% of applicable mandatory criteria and 84% of applicable guidance criteria. Non or partial compliance was assessed for only 2% of applicable mandatory criteria and 16 % of applicable guidance criteria. In a small number of cases, the lack of a site inspection for the coupe or other factors meant that there was insufficient information to make an assessment against individual criteria.

A summary of the main partial or non-compliance issues for this component of the audit is given in Table 5. Compliance issues were identified for a total of eight mandatory and two guidance criteria. A brief analysis for each criterion is provided below. The risk of harm to the environment resulting from non or partial compliance with audit criteria is assessed in section 5.5.

Table 5 Audit criteria for regeneration coupes assessed not to have or to only partly have complied with audit criteria.

	# coupes with non or partial compliance	
Audit criteria:	Non-compliance	Partial compliance
Mandatory		
6. Coupe has been regenerated to standard consistent with Native Forest Silviculture Guidelines (NFSG) #10.		1
13. Impact of regeneration burning on areas excluded from harvesting was assessed.	1	
14. Protection of areas excluded from harvesting has been effective.		3
19. Measures were taken to protect Indigenous cultural heritage sites or places located within harvested areas during regeneration.		1
27. Coupe regeneration was assessed within three years of treatment.	5	
30. Remedial work has been undertaken to achieve acceptable regeneration where stocking, spatial distribution, health or early growth was initially found to be below the applicable standard.		2
33. Rehabilitation of coupe infrastructure has been assessed within three years of initial treatment.		1
Guidance		
37. A survey of seedbed quality was undertaken prior to use of natural seed fall or sowing to regenerate the coupe.	1	1
38. Seed and planting stock are screened for weeds, pathogens or pests prior to coupe regeneration.		13

Compliance issues with mandatory criteria

#6 Coupe regeneration: two of the 32 coupes (085, 110) did not fully satisfy stocking requirements specified in NFSG #10. VicForests stocking survey and the field assessment identified that coupe 085 (Central FMA) included an area greater than 1 ha that was understocked with eucalypt regrowth. This contributed to the low stocking reported in the audit field assessment. As the remainder of the coupe was generally well stocked and this area could not be accessed by machinery to encourage regeneration, VicForests recommended that the coupe be considered to be adequately regenerated and handed back to DSE. The auditors concur with these observations and conclusion.

The VicForests stocking assessment identified an unstocked area exceeding 1 ha in the vicinity of a landing on coupe 110. This was identified on the stocking survey, but not reported to DSE as part of the finalisation reporting.

Following the field audit, VicForests undertook a further intensive stocking assessment and found that the actual unstocked area was no more than 0.6 ha.

#13 Assessment of impact regeneration burning: the file for coupe 085 records that the regeneration burn escaped from control lines. No record was found of any assessment of the impact of this on areas excluded from harvesting.

#14 Protection of unharvested areas from regeneration burns: three instances were recorded (coupes 085, 221, 246) of regeneration burns escaping control lines and burning relatively small areas of adjacent forest. On this basis, it has been assessed that these coupes only partly comply with the requirement to protect unharvested areas from impacts of regeneration burning.

#19 Protection of Indigenous cultural heritage sites: no record could be found in the coupe file or on CIS of the presence of Indigenous cultural heritage sites having been assessed as being present or not being present on or near coupe 318. Partial compliance with this criterion was assessed as a result.

#27 Timing of regeneration surveys: five coupes were identified for which the earliest recorded established seedling survey was not conducted within the 3 years required by the Code and NFSG #10.

#30 Remedial work where coupe stocking below acceptable standard: coupe 085 was assessed to have a 1.2 ha unstocked area within the coupe (see note on criterion #6, above). No actual remedial work was undertaken to redress this (as required by the Code), however any such work was assessed to be counterproductive. As a result partial compliance rather than non-compliance was assessed. An initial stocking survey found coupe 318 to be understocked. No remedial work was undertaken to address this. However, as coupe stocking was subsequently assessed to have become acceptable, partial rather than non-compliance was recorded.

#33 Assessment of rehabilitation of coupe infrastructure: the file for coupe 106 identifies that snig tracks were assessed and successfully rehabilitated, however there is no record of similar assessments for landings. The coupe was assessed to partly comply with this criterion as a result. The lack of evidence of such an assessment and rehabilitation meant that the following criterion (#34 Remedial action where infrastructure rehabilitation was inadequate) was assessed as “unknown”.

Compliance with guidance criteria

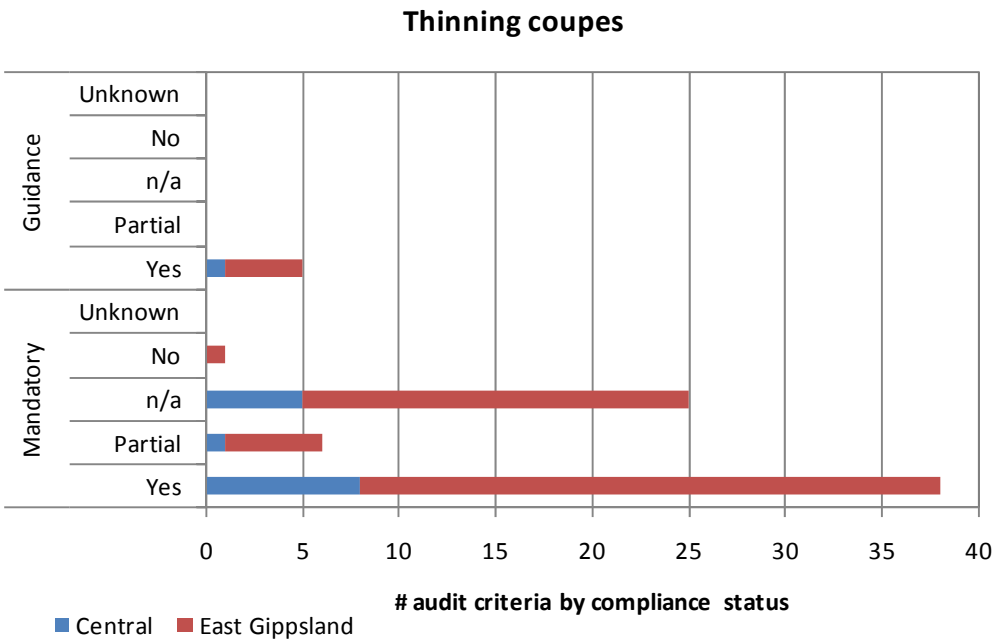
#37 Seedbed quality survey: two coupes were identified for which there was either no evidence of a seedbed survey (292, non-compliance) or only evidence of an informal survey (300, partial compliance).

#38 Seed screening and treatment prior to coupe regeneration: VicForests have established practices to ensure the quality and condition of seed used in coupe regeneration where natural seed fall needs to be supplemented. However, while these may be considered to be good practice, as these processes do not specifically involve “screening” for pathogens, they cannot be considered to fully comply with this guidance element.

Thinning coupes

A total of 14 mandatory and one guidance audit criteria were identified in the Code and incorporated into Workbook 7B for this element of the audit. The prescriptions from which the criteria were derived mostly do not explicitly refer to thinning, but have been adapted for this audit.

As with regeneration coupes, the audits were based on evidence contained in coupe files, VicForests CIS or the field assessment of thinning coupes. Summaries of the results of the assessment are given in Figure 3 and Table 6.



Note: Unknown - no assessment against the criterion was possible; No – coupe was assessed as not complying with the criterion; n/a – criterion was assessed as not applicable to coupe; Partial – coupe partly satisfied criterion; Yes – coupe satisfied criterion. The assessment was made against a total of 70 mandatory criteria (14 criteria × 5 coupes) and 5 guidance criteria (1 criterion × 5 coupes).

Figure 3 Preliminary summary of assessments for compliance against mandatory and guidance audit criteria based on the *Code of Practice for Timber Production 2007* for selected thinning coupes in Central and East Gippsland FMAs.

As was the case for the audit criteria included in Table 4 of Workbook 7B, those in Table 5 relating to thinning coupes covered a broad range of activities, some of which may not necessarily be relevant to an individual coupe. For the five coupes included in this component of the audit, approximately 36% of mandatory criteria were assessed as not being applicable. The main examples were sets of criteria relating to the use of pesticides or other measures in managing weed or browsing damage following thinning.

Coupes were assessed as satisfying the requirements of approximately 84% of applicable mandatory criteria and all of the applicable guidance criteria. Non or partial compliance was assessed for 15% of applicable mandatory criteria. A summary of the main partial or non-compliance issues is given in Table 6. Compliance issues were identified for three mandatory criteria. A brief analysis for each criterion is provided below. The risk of harm to the environment resulting from non or partial compliance with audit criteria is assessed in section 5.5.

Compliance issues with mandatory criteria

#3 Retention of original species: on three of the five thinning coupes included in this component of the audit, minor discrepancies were recorded in the species composition of the coupes post thinning. Small numbers of Shining Gum regrowth were identified in coupe 397, however no retained stems of this species were observed. Mountain Grey Gum was assessed to comprise about 27% of the stand in coupe 402, but was uncommon following thinning. In both cases, partial compliance with the criterion (which also reflects NFSG requirements) was recorded.

#8 Timing of post-thinning surveys: the post-thinning survey for coupe 421 was undertaken six years after thinning took place. Non-compliance with this criterion was recorded.

#14 Thinning operations meet standards from NFSGs #13 and 14: partial compliance was assessed for four of the five coupes. Based on VicForests post-thinning surveys and audit field assessments, only in coupe 397 did BA

retention, thinning damage, bay and outrow width satisfy the NFSG standards[6]. In the remaining coupes one or two elements of these standards were not met according to the VicForests surveys. The surveys conducted as part of this audit confirmed this partial compliance, although in some cases NFSG standard values were within the 90% confidence interval of the coupe average.

Table 6 Audit criteria for thinning coupes assessed not to have or to only partly have complied with mandatory audit criteria

	# coupes with non or partial compliance	
Audit criteria:	Non-compliance	Partial compliance
3. All tree species originally present on the coupe have been retained following thinning with a similar density and distribution.		2
8. Coupe stocking and thinning damage was assessed within three years of treatment.	1	
14. Assessments show that thinning operations meet the specifications for basal area, damage, outrow and bay width, species composition and tree retention in NFSG #13 or #14.		4

5.4 Part C: Field assessments of regeneration and thinning coupes

Regeneration and thinning coupes included in the field component of the audit were assessed using modified versions of the survey techniques described in NFSGs #10, 13 and 14 (see Appendix A for details). Results of the assessments were captured in Workbook 7B Tables 7 and 10 for regeneration and thinning coupes, respectively.

Regeneration coupes

Stocking assessments were conducted in 25 of the 32 selected regeneration coupes. Access issues and limits on the time available for field work meant that seven of the coupes (three in Central FMA and four in East Gippsland FMA) could not be assessed. The exceptional density of eucalypt and wattle regrowth or of dodder laurel or vine undergrowth in some coupes meant that sampling procedures were sometimes modified from those described in Workbook 7A. Specifically, the distances between sampling points were sometimes reduced to enable coupes to be surveyed within a reasonable time.

A summary of the results of the stocking surveys is given in Figure 4. The graph shows both the stocking survey results reported by VicForests to DSE in their finalisation reporting and those obtained from this audit. In most cases there is good agreement between the two surveys. In 10 of the 32 coupes, stocking was assessed to be significantly higher than found in VicForests' stocking surveys. This could, in part, reflect continued regeneration following the VicForests surveys (which had taken place up to three years previously).

[6] When pre and post thinning BA were adjusted for reporting errors. For both variables, regrowth BA was also entered as overwood BA.

The stocking rate in two of the audited coupes fell short of the 65% standard from NFSG #10. However, in only one of these (coupe 085) was the 65% stocking standard outside the 90% confidence interval for coupe stocking. This coupe in Central FMA was difficult to access (due to safety issues associated with retained stags and extremely dense wattle regrowth) and as a result, sampling tended to be concentrated in a large patch of wattle-dominated regrowth, with poor eucalypt stocking. While the audit stocking survey results suggest below target regeneration, this is most likely an artefact of sampling. VicForests survey identified that an area of over 1 ha in this coupe was unstocked, but that over 65% of stocking survey plots were stocked.

Dense eucalypt, wattle and understorey regrowth, which in some coupes was interspersed with dodder laurel and vines resulted in sampling procedures being modified from that outlined in the revised Module 7 and Workbook 7A

No other instances of unstocked areas of 1 ha or more were identified in any of the coupes. Eucalypt and wattle regrowth was so advanced in the majority of coupes that it was not possible to identify large unstocked areas that were not directly traversed during the stocking assessment.

The main required species were observed in all coupes. There were several instances where required species that were originally uncommon in coupes were not identified in the audit stocking survey. This is not taken to indicate that the species were not present, only that they were uncommon. In a few instances, species that were not reported in VicForests' stocking surveys were identified during the audit survey.

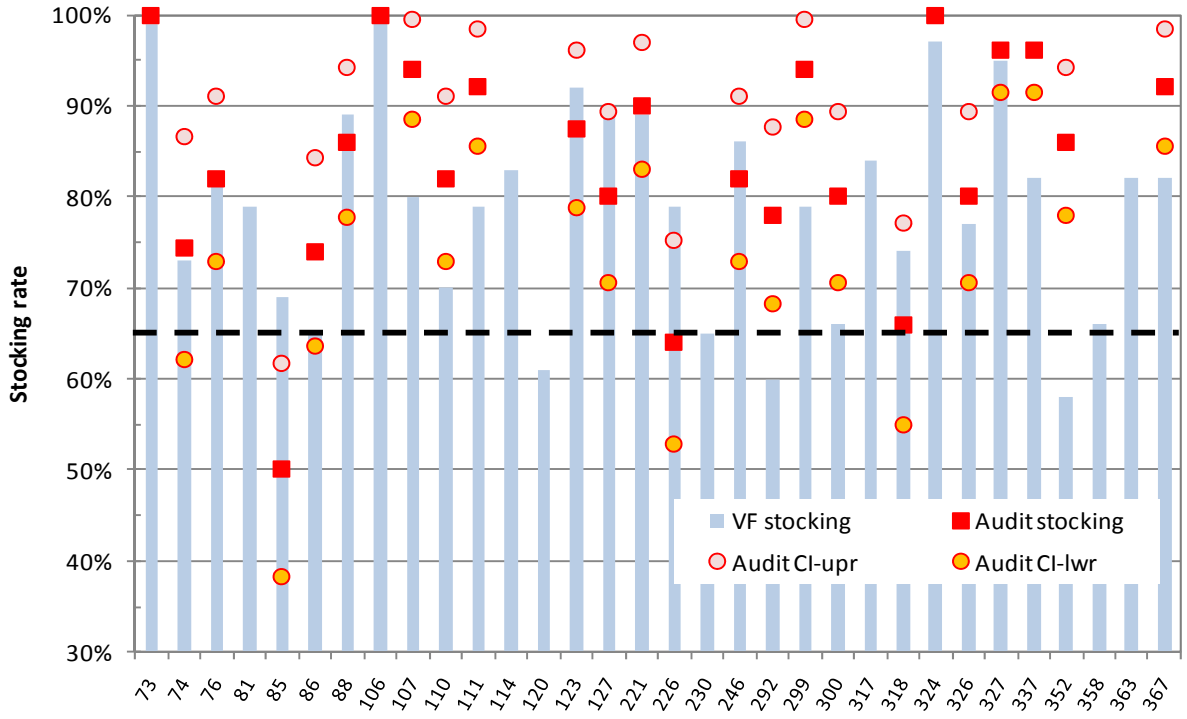


Figure 4 Comparison of regeneration coupe stocking between data reported by VicForests to DSE as part of their finalisation and hand back reporting (VF stocking) and results of field stocking surveys undertaken as part of this audit (Audit stocking). The graph shows the acceptable stocking rate of 65% for standard stocking assessments. Audit CI upr and lwr are the upper and lower 90% confidence intervals for the audit stocking survey, respectively. VicForests stocking survey results for coupes 120, 292, 299 and 352 were intensive surveys, whose acceptable stocking standard is 55%. Coupes with only VF stocking results were those that were unable to be included in the field assessment program.

Thinning coupes

The assessments conducted in thinning coupes found that none of the five coupes fully met the relevant standards specified in NFSG #13 (ash forests) or #14 (mixed species forests), based on coupe average values (Table 7). When sampling uncertainties were taken into account (90% confidence interval of coupe mean), two coupes (397 and 427) were found to meet all relevant NFSG standards.

The most common issues observed were bay widths being narrower than standards for slope and forest type and outrow widths being wider that standards based on forest type. Outrow and bay width are difficult to determine accurately in the field, particularly for coupes where a significant time had elapsed since thinning operations took place or there had been other disturbances on the coupe (e.g. firewood harvesting). With the exception of one coupe each, bay and outrow width complied with NFSG standards when the 90% confidence interval of the coupe mean was taken into account (Table 7).

The assessed frequency of thinning damage to retained stems exceeded the 15% standard for one coupe (427), although the standard was complied with when the 90% confidence interval of the coupe mean was taken into account.

All of the species identified on the coupes prior to thinning were found to be present during the surveys. Small numbers of individuals of additional species were identified on two coupes (397, 402). In coupe 397, these were advanced seedlings of Shining Gum rather than regrowth trees that had been thinned. The source of seed was not apparent as no regrowth Shining Gum trees were observed on the coupe.

Table 7 Summary of results of field assessments of thinning coupes against targets from NFSGs #13 and #14. Pale green shading highlights instances where 90% confidence interval around coupe average did not meet NFSG standards.

	Central	East Gippsland			
Criteria	**397**	**402**	**421**	**427**	**428**
% live BA removed	40%	39%	29%	34%	49%
Target	[50%	[50%	[50%	[50%	[50%
Retained BA	37.6	22.7	30.3	26.4	21.6
(90% confidence interval)	(35.4-40.6)	(21.6-24.9)	(28.5-33.0)	(24.9-28.0)	(19.2-23.9)
Target for age and forest type	/32	/25	/25	/21	/21
Average bay width	19.5	13.9	11.3	11.2	11.1
(90% confidence interval)	(17.4-20.8)	(12.3-14.6)	(9.7-12.0)	(9.9-12.1)	(10.3-11.7)
Target for slope and forest type	/20	/12	/12	/12	/12
Average out row width	6.6	4.7	5.2	4.4	4.5
(90% confidence interval)	(6.1-7.0)	(4.4-5.0)	(5.0-5.5)	(4.1-4.6)	(4.3-4.7)
Target for slope and forest type	[7	[4.5	[4.5	[4.5	[4.5
% Trees damaged	4.5%	0.0%	7.5%	15.4%	9.7%
(90% confidence interval)	(0.7-8.8%)	(0)	(3.2-11.4%	(11.6-21.7%)	(5.0-14.4%)
Target	[15%	[15%	[15%	[15%	[15%

NFSGs require that, with the exception of outrows and extraction tracks, dominant and co-dominant trees are retained. This is difficult to assess post-thinning. However, it appeared that the thinned stands comprised such trees. A few individual suppressed trees, comprising no more than a few percent of the retained BA, were observed on some coupes.

5.5 Risk of harm to the environment

Risk of harm to the environment from activities associated with coupe regeneration and finalisation is assessed in the context of the field component of the audit, specifically the 32 regeneration coupes and five thinning coupes selected. Risk to the environment is assessed in relation issues of non or partial compliance with audit criteria derived from the Code and relevant NFSGs. This scope captures the main compliance issues from the desk top component of the audit – which relates to consistency of coupe stocking with NFSG standards.

DSE's strategic *Risk management framework* 2007 (Appendix B) provides the consequence and likelihood descriptors for the assessment, as well as the overall risk rating table. Results of the risk assessment are presented in Table 8.

All but one of the risks were assessed to be in the "low" category. The one risk in the medium category (failure to protect unharvested areas from regeneration burns [criterion #14]) was one whose impacts were assessed to potentially extend over several years. None of the non or partial compliance issues were considered to pose a material risk of harm to the environment ("high" category).

Table 8 Assessment of risk of harm to the environment associated with non or partial compliance with audit criteria derived from the Code and NFSGs (and reported in Table 5 and Table 6.

Audit criteria	Coupe	Consequence	Likelihood	Risk	Comment
Mandatory: Regeneration coupes					
6. Coupe has been regenerated to standard consistent with Native Forest Silviculture Guidelines (NFSG) #10.	085	1	2	Low	Highly localised, no lasting effect
13. Impact of regeneration burning on areas excluded from harvesting was assessed.	085	1	1	Low	Compliance issue related to assessment of burning impact and not impact of burning.
14. Protection of areas excluded from harvesting has been effective.	All	3	3	Medium	Localised scale, but medium term impact on burnt areas.
19. Measures were taken to protect Indigenous cultural heritage sites or places located within harvested areas during regeneration.	318	3	1	Low	Legal and reputation risk rather than environmental.
27. Coupe regeneration was assessed within three years of treatment.	All	1	1	Low	No direct environmental impact of delay in stocking surveys
30. Remedial work has been undertaken to achieve acceptable regeneration where stocking, spatial distribution, health or early growth was initially found to be below the applicable standard.	085	1	2	Low	Highly localised, no lasting effect: same risk as for this coupe under criterion #6
33. Rehabilitation of coupe infrastructure has been assessed within three years of initial treatment.	106	1	2	Low	No direct environmental impact of failure to assess rehabilitation. Risk of failure to rehabilitate assessed to be Medium (moderate-50/50)on basis of duration of any impact)
Guidance: Regeneration coupes					
37. A survey of seedbed quality was undertaken prior to use of natural seed fall or sowing to regenerate the coupe.	299 300	1	2	Low	Minimal direct environmental impact of seedbed not being formally assessed
38. Seed and planting stock are screened for weeds, pathogens or pests prior to coupe regeneration.	All	3	2	Low	Potential for medium scale impact, although low likelihood
Mandatory: Thinning coupes					
3. All tree species originally present on the coupe have been	397	2	1	Low	No long term effect on plant populations

Audit criteria	Coupe	Consequence	Likelihood	Risk	Comment
retained following thinning with a similar density and distribution.	402				
8. Coupe stocking and thinning damage was assessed within three years of treatment.	421	1	1	Low	No direct environmental impact of delay in surveys
14. Assessments show that thinning operations meet the specifications for basal area, damage, outrow and bay width, species composition and tree retention in NFSG #13 or #14.	All	3	2	Low	Potential medium term impacts on productivity

6 Discussion

6.1 Audit methodology

This was the first audit of coupe regeneration and finalisation undertaken as part of the FAP and as such it was the first trial of the relevant FAP Module. As previously discussed, that module was extensively revised as part of the initial phase of the audit. It is appropriate then to provide an assessment of the Workbooks and field methodology.

Desktop analysis

The desk top analysis (using Workbook 7A) provided a comprehensive review of the key data reported by VicForests to DSE as part of the finalisation and hand back process. The methodology enables an assessment of whether the regeneration and thinning coupes proposed for hand back meet the standards set in relevant NFSGs (Part A). It also seeks to confirm whether all coupes proposed for hand back are reported to meet NFSG standards and whether VicForests reporting is consistent with the underpinning data from stocking and post-thinning surveys (Part B).

The main limitation of Part A related to the spreadsheet VicForests used to report to DSE on coupe finalisation and hand back rather than the audit methodology itself. While the spreadsheet met DSE's reporting requirements, it did not have all of the information needed to fully assess compliance with the NFSGs relating to both regeneration and thinning coupes. While VicForests readily provided the additional information required, it would be preferable in any future finalisation and hand back reporting for DSE to request (and VicForests provide) all of the information required to assess compliance with NFSGs. It is recommended that Part A be adopted in future audits without amendment.

Workbook 7A Part B provided a useful check on the consistency of coupe finalisation and hand back reporting with the underpinning data. However, Part A of the field component of the audit (using Workbook 7B) used the same procedures and worksheets to assess data consistency on a similar number of coupes. The doubling up involved in this process is considered to be unnecessary and it is recommended that Part B of the desk top of the audit be removed from Workbook 7A and not used in any future audit.

Similar work undertaken in Part A of Workbook 7B should continue. While it may not sample all of the FMAs, it provides an auditor-driven sampling of the data underpinning VicForests reporting to DSE. Undertaking the assessment of this information while reviewing the coupe file helps to ensure that all of the underpinning information is assessed at one time and that the auditors are appropriately familiarised with coupe conditions.

Recommendation 6.1
It is recommended that Part A of Workbook 7A be adopted for use in future audits without further modification.
Recommendation 6.2
Part B of the desktop analysis unnecessarily replicates Part A of the field component of the audit. It is recommended that Part B of Workbook 7A be removed and not be included in future audit programs.

Field audit

The field component of the audit included both office (largely regional VicForests offices) and field components. It used Workbook 7B and included an assessment of stocking and post-thinning survey information (Part A), compliance with audit criteria derived from the Code and NFSGs (Part B) and field surveys of coupe stocking and thinning activities (Part C). All of the elements provided useful information and remain important components of the audit.

As discussed above, Part A of the field audit was essentially a doubling up of Part B of the desk top analysis based on Workbook 7A. Experience suggests that the worksheets (Tables 1-3) require some modification to improve useability, as follows:

- Provision should be made to separately capture information from multiple regeneration coupe stocking surveys. For several of the audited coupes, a standard survey was followed up by one or more intensive surveys to either check stocking in lightly or unstocked areas or to follow up on remedial work to improve regeneration.
- The tables require cells that confirm the results of the assessment.
- For thinning coupes, Table 3 requires cells that enable the entry of NFSG standard values for BA retention, bay and outrow width applicable to the stand age, type and slope, so that an assessment of compliance can also be made and included in the reporting.

Part B of the field audit involves assessing compliance of regeneration and coupe finalisation activities with relevant Code prescriptions and NFSG standards. While there is explicit authority from the Code for the audit criteria derived for regeneration coupes, with the exception of compliance with NFSG standards, this is largely lacking for thinning coupes. Audit criteria were developed for a significantly reduced set of Code prescriptions where there is an implicit application to thinning coupes. It is recommended that this issue be addressed in the next update of the Code.

Overall the workbooks were considered to provide a relevant and comprehensive assessment of Code compliance. The worksheets (particularly Table 4 for regeneration coupes) have many criteria that while applicable to the Code are frequently not applicable to individual coupes. Given the requirements of the Code and diversity of coupes, this situation is considered to be unavoidable.

The workbook requires more explicit guidance on how to treat “partial” compliance with audit criteria and what to do when evidence to support an assessment is not available. The assessment “unknown” was introduced in some circumstances where findings would have been confirmed by field assessment, but was not because access or time limitations meant that the field assessment could not be undertaken. In the few instances where evidence could not be obtained, an assessment of “no” (non-compliance) was made.

Completion of the worksheets was sometimes hampered by poor or ambiguous records in the coupe files (discussed below).

Several audit criteria require field assessments of the effectiveness of particular environmental impact control measures (e.g. in relation to regeneration burning and mechanical disturbance). In this audit, regrowth on the coupes was generally too advanced to make meaningful assessments against these criteria. It is recommended that they (criteria #14, 18 and 21) be deleted from Table 4 (for regeneration coupes).

Similar difficulties associated with accessing or viewing the coupes were experienced in assessing whether the spatial distribution and composition of regeneration and thinning coupes (criterion 10 in Table 4 and criterion 3 in Table 5 of Workbook 7B) approximated that of the original stand. Since unambiguous observation evidence cannot be obtained, it would be better for the assessment of this prescription be confined to VicForests management actions and its surveys.

The main issue with the field audit was with the field assessments of regeneration coupe stocking. Access to many of the coupes was extremely difficult due to the very dense eucalypt, wattle and scrub regrowth. The sampling methodology was simplified from that proposed in the revised FAP Module 7 to help expedite the surveys. While 50 points were sampled (in coupes over 10 ha), the distances between sampling points were reduced to ensure an adequate number of coupes could be included in the sampling program within the time available.

The long delay between regeneration and proposal for hand back for some coupes (up to 7 years) contributed to the advanced development of regrowth (which exceeded 6-8 m in height in some cases) and understorey. It made

coupe access difficult in some instances (exceptionally so at times). Some access roads had also become overgrown or otherwise unusable, thereby hampering or preventing coupe access.

Dense regrowth, difficult terrain and logging debris contribute to physical hazards and slow progress in stocking survey components of field audits

Dense regrowth, combined with sometimes difficult terrain, the presence of logs on the ground and dead stags through the stand also meant that the surveys were physically demanding and, at times, hazardous for the auditors. Tripping hazards, particularly, needed to be carefully managed by the auditors.

Formal assessments of coupes with reported stocking above about 75% were considered to add little value to the audit (which is confirmed by Figure 4). While such coupes should be included (via the largely random selection process described in Workbook 7B) in future audits, it is recommended that this be done by reconnaissance along access roads and snig tracks or confirmed using aerial photography (where recent, high resolution images area available; [10]).

Only in marginally stocked coupes (below 75% stocking) and those "failing" the reconnaissance survey, should formal audit surveys be undertaken. This would increase the number of coupes that could be inspected and provide better value for the resources invested in the audit process.

Recommendation 6.3

It is recommended that Part A of Workbook 7B be modified for use in future audit programs as follows:

- Provision is made to separately capture information from multiple regeneration coupe stocking surveys. For several of the audited coupes, a standard survey was followed up by one or more intensive surveys to either check stocking in lightly or unstocked areas or to follow up on remedial work to improve regeneration.
- The tables require cells that confirm the results of the assessment.
- For thinning coupes, Table 3 requires cells into which NFSG standard values for BA retention, bay and outrow width applicable to the stand age, type and slope can be entered, so that an assessment of compliance can also be made and included in the reporting.

Recommendation 6.4

The *Code of Practice for Timber Production* includes few prescriptions relating specifically to the conduct of thinning operations in native forests. It is recommended that any future review of the Code consider introducing prescriptions that at least support compliance with commercial thinning standards and specifications in the relevant NFSGs.

Recommendation 6.5

It is recommended that Part B of Workbook 7B be modified to include more explicit guidance on how to treat "partial" and non compliance with audit criteria in completing Tables 4 and 5.

Recommendation 6.6

Several audit criteria require field assessments of the effectiveness of particular environmental impact control measures (e.g. in relation to regeneration burning and mechanical disturbance). Based on the experience of this audit, regrowth on the coupes will generally be too advanced to make meaningful assessments against these criteria in future audits. It is recommended that such criteria (#14, 18 and 21) be deleted from Table 4 (for regeneration coupes).

Further, unambiguous assessments of the spatial distribution and composition of regeneration and thinning coupes (criterion 10 in Table 4 and criterion 3 in Table 5 of Workbook 7B) cannot be obtained during audit and, as a result, it is proposed that these criteria also be removed from the respective tables in Workbook 7B.

Recommendation 6.7

Formal, detailed field assessments of coupes with reported stocking above approximately 75% add little value to the audit. It is recommended that in future audits:

- For coupes with reported stocking of 75% and above, an initial reconnaissance survey should be undertaken to confirm that the coupe is adequately stocked. This could be based on an on-ground survey along snig tracks and other access points, or, where high resolution aerial photography is available, it could be based in interpretation of such images;
- Formal surveys (using the method described in Workbook 7B) are only used to assess stocking in coupes with reported stocking of less than 75% and in coupes where the initial reconnaissance survey identifies that they may not be as well stocked as suggested by VicForests' surveys.

Coupes to be included in the detailed field assessments would be selected (largely) at random, as was the case in the current audit.

Use of high resolution aerial imagery in assessing regeneration coupe stocking

A trial was undertaken to determine the potential role of aerial surveys using high resolution imagery to audit harvest coupe regeneration as part of an audit of logging coupe regeneration and finalisation under DSE's Forest Audit Program. Aerial survey techniques were considered to offer the prospect of improving the cost-effectiveness and coverage of the FAP's coupe regeneration and finalisation audit. The trial is reported in a companion document to this audit report [10].

Two sets of aerial imagery were acquired from VicMap's Coordinated Imagery Program: 15 cm resolution imagery from parts of Central FMA (flown 2009) and 50 cm resolution imagery from much of East Gippsland FMA (flown 2010). GIS scripts were developed to set up a consistent sampling approach and support data capture analysis. Stocking of regrowth in 2.27 m radius plots on an 80 ×20 m grid was assessed on seven regeneration coupes, two using the 15 cm resolution imagery and five using the 50 cm imagery. Time elapsed between coupe regeneration and image acquisition ranged between 2 and 5 years.

The coupe harvest area, infrastructure (landings, snig tracks etc) and retained seed and habitat trees were clearly distinguishable in both sets of imagery. Regenerating trees could be readily distinguished in 15 cm resolution imagery only 2 years after regeneration. While regeneration could be detected in 50 cm resolution imagery, even at 5 years post-regeneration, it was sometime difficult to distinguish. In neither form of imagery was it possible to separate eucalypt from non-eucalypt regrowth or to distinguish between different eucalypt species.

Results from the assessment of regeneration coupe stocking were broadly similar to those obtained from VicForests' ground-based surveys using the same grid size (but different directions and starting points). In four of the seven coupes included in this trial, results from the VicForests' surveys were within the 90% confidence interval of the aerial survey results.

The aerial surveys typically (although not always) overestimated coupe stocking, compared with VicForests' ground-based surveys. This most likely reflects the inability of the imagery to distinguish between sampling plots stocked with non-eucalypts only and those stocked with eucalypts. The aerial surveys proved to be effective in identifying areas with no eucalypt (or other) regrowth within the coupes.

Even with 15 cm resolution imagery, it is not possible for an aerial survey to replace ground-based surveys of stocking to assess whether coupes have meet the standards required by NFSG #10. Key criteria require eucalypt and non-eucalypt regrowth to be distinguished and each eucalypt species present in the coupe to be identified: 15 cm resolution imagery cannot do this.

As part of an overall audit approach that draws on multiple lines of evidence, including VicForests stocking survey results, aerial survey techniques could contribute to audit processes for coupe regeneration and finalisation. Where it can be demonstrated from a ground-based survey (such as VicForests stocking assessments) or rapid appraisal that a regenerating coupe is dominated by eucalypt rather than non-eucalypt regeneration, aerial survey could be used to provide a rapid, low-cost and safe means of auditing stocking (including the presence of large unstocked areas within the coupe). While both forms of imagery could be used for this task, 15 cm resolution imagery (or better) is recommended.

Use of high resolution aerial photography in regeneration and finalisation audits is likely to be opportunistic, in that it will not be cost-effective to acquire it solely for auditing purposes. If it is available, it could be used as a substitute for the ground-based rapid survey technique proposed in the revised coupe regeneration and finalisation audit methodology that was developed following the experience of the 2011-12 audit program (Appendix C).

Updated FAP module 7

A revised version of Module 7 has been prepared on the basis of the above recommendations and is included as Appendix C. This version of FAP Module 7 should be used in any future audits of coupe regeneration and finalisation.

Recommendation 6.8

It is recommended that the revised version of FAP Module 7 that was prepared on the basis of the 2011-12 audit is used in any future Coupe Regeneration and Finalisation audits.

6.2 Audit findings

Risk of harm to the environment

Risks of harm to the environment resulting from the coupe regeneration and finalisation activities included within the scope of this audit were assessed during the field (Workbook 7B) component of the audit. The assessment was made in circumstances where coupe regeneration and finalisation activities were not fully compliant with the Code. While individual instances of non compliance with audit criteria derived from the Code and NFSGs were identified, these were generally assessed to pose a low or at most moderate risk to the environment, based on DSE's risk management framework. Their implications were generally assessed to be confined to the immediate environs surrounding the coupe and, at worst, *potentially* lasting for no more than a few years. No material (or "high") risks to the environment identified through this audit.

The non-compliance issue assessed to pose the greatest risk was an instance where regeneration burns escaped control lines into adjacent unharvested forest.

Acceptability of coupes for hand back

All 315 regeneration coupes proposed by VicForests for hand back to DSE are clearly acceptable in that they either: comply with NFSG standards (312 coupes); do not comply, but were part of an accepted trial conducted with DSE (coupes 376 and 377); or are understocked in one confined location that is no longer accessible for treatment (coupe 085).

Frequent instances of non-compliance with NFSG thinning standards were reported by VicForests and detected in this audit. As none of the material issues (i.e. instances excessive damage to retained stems, underwidth bays, overwidth outrows, insufficient retained BA) can be remediated, it is recommended that the 40 thinning coupes be accepted for hand back.

Recommendation 6.9

It is recommended that DSE accept all of the regeneration and thinning coupes proposed by VicForests for hand back.

Recommendation 6.10

It is recommended that DPI work with VicForests to strengthen the planning and implementation of forest thinning operations to achieve better compliance with relevant NFSGs.

VicForests finalisation and hand back reporting to DSE

VicForests finalisation reporting meets DSE requirements and guideline for finalisation reporting. It provides a generally accurate, but insufficiently comprehensive record with which to assess compliance with NFSG standards. It is recommended that future information requests for finalisation reporting seek all of the information that is required to assess compliance with NFSGs (see recommendation 4.1).

A small number of instances were identified where VicForests finalisation reporting to DSE was inconsistent with the underpinning data. While this is not unexpected in a large data set and had no material impact on acceptability of coupes for hand back, VicForests may consider instituting further checks of the consistency of information it reports to DSE with the basic, underpinning information.

The handling of data from coupes where stocking surveys were undertaken (particularly where standard surveys were followed up by intensive surveys of parts of coupes) needs to be codified to ensure it is an unambiguous statement of the overall coupe stocking and what types of survey the result is derived from.

VicForests reporting of dates of stocking surveys should be of the earliest rather than the latest surveys. Reporting of the latest survey may account for the poor compliance with the Code requirement that stocking be assessed within three years of coupe treatment for regeneration.

Recommendation 6.11

It is recommended that DSE and DPI develop protocols for the reporting of coupe stocking in instances where multiple surveys, potentially of differing intensities, have been undertaken to assess coupe stocking.

Recommendation 6.12

Relatively poor compliance with the requirement to assess regeneration coupe stocking within three years of coupe treatment may reflect VicForests reporting of the latest rather than earliest established seedling survey. In future finalisation reporting, VicForests should ensure that the earliest such survey date be reported. It should also ensure that such surveys are conducted within the timeframe required by the Code.

Harvest coupe regeneration and finalisation

Harvest coupe regeneration and finalisation activities that were assessed within this audit were assessed to generally comply with audit criteria derived from the Code and NFSGs. Full compliance was assessed against 97% of applicable criteria and partial compliance assessed for a further 1% of criteria. All but one instance of non or partial compliance was assessed to have low risk of harm to the environment.

While the coupe files, CIS and FireWeb provided a useful evidence base for the audits, several procedural shortcomings were identified, the more significant of which included:

- **Inconsistent coupe labelling of burns in FireWeb**: records of regeneration burn approvals were difficult to track through FireWeb due to inconsistent application of coupe naming conventions. DSE naming conventions should be applied consistently in all coupes.
- **Implementation of decision support systems (DSS)**: while the inclusion of the DSS on file demonstrated that an appropriate silvicultural system had been used for the coupe, it was rarely annotated to provide auditable evidence that the intended pathway or an alternative had been followed.
- **Notation of obsolete records**: several instances were detected where coupe files included burn plans that were never implemented (e.g. due to the 2009 bushfires intervening). This made it difficult for the auditors to track the regeneration process and assess some compliance elements. Obsolete plans or similar information in coupe files should be annotated as such to improve the clarity of coupe management practice for audit.
- **Assessment of impacts of regeneration burns or mechanical disturbance**: the Code requires that "where fire is used in regeneration, all practicable measures must be taken to protect all areas excluded from harvesting from the impacts of fire". In this audit, the lack of reporting of escapes of regeneration burns from control lines was taken as evidence of compliance with this requirement. However this is an inadequate evidence base. A formal note should be made and retained in the coupe file of the outcome of the regeneration burn, including an assessment of any impact on unharvested areas.

Recommendation 6.13

It is recommended that VicForests and DSE review the above comments on perceived procedural shortcomings with coupe records and FireWeb entries and amend their practices as appropriate.

Thinning coupe operations

Thinning coupe operations were assessed to generally comply with NFSG standards for damage, retained BA and bay and outrow width. However, numerous instances were detected where operations did not comply, including where thinning targets (for retained BA) were not compliant with NFSG standards. Risk of harm to the environment from such non-compliance issues was considered to be low.

Recommendation 6.10 addresses issues relating to the compliance of VicForest's thinning operations with NFSG standards.

Native Forest Silviculture Guidelines

It is considered that NFSG standards for thinning require review. Standards for damage, retained BA and bay and outrow width do not appear to allow for sampling uncertainty, which for most of these variables is significant. Bay and outrow width cannot be defined precisely, due in part to the random nature of regeneration in native forests and the delay between thinning and post-thinning surveys. Specification of standard outrow widths to the nearest 0.5 m (without an allowance for sampling uncertainty) suggests a level of precision in determining the start and finish of outrows and bays that cannot be attained in the field.

Recommendation 6.14

It is recommended that DPI review NFSG standards for thinning to appropriately allow for sampling and measurement uncertainty.

7 Conclusions and recommendations

7.1 Conclusions

An audit was undertaken of coupe regeneration and finalisation activities conducted on 315 regeneration coupes and 40 thinning coupes proposed by VicForests for hand back to DSE. The audit was undertaken as a statutory environmental audit under the *Environment Protection Act* 1970 and formed part of DSE's 2011-12 Forest Audit Program (FAP). It considered:

- Regeneration and finalisation of harvest coupes;
- Residual stocking and damage in thinning coupes;
- VicForests' processes to assess and report on compliance with the *Code of Practice for Timber Production* (2007) and relevant Native Forest Silviculture Guidelines.

The FAP module for coupe regeneration and finalisation was extensively modified prior to the commencement of the audit itself.

The audit made the following key findings:

- **Risk of harm to the environment:** no material risk of harm to the environment was identified. A small number of instances of partial or non-compliance with audit criteria based on the Code and NFSGs were identified, however these were assessed to pose a low or at most medium risk to the environment, based on DSE's risk management framework. The greatest risks of harm to the environment identified were regeneration burn escapes and failure to successfully rehabilitate log landings (both assessed as medium risk).
- **Acceptability of regeneration coupes for hand back:** all of the 315 regeneration coupes proposed for hand back are considered to be acceptable in that they either comply with NFSG standards, do not comply, but were part of an accepted trial conducted with DSE and were not required to be regenerated to NFSG standards or are understocked in one confined location that is no longer accessible for treatment.
- **Acceptability of thinning coupes for hand back:** frequent instances were detected where VicForests' thinning operations did not comply with NFSG standards. These were in relation to damage to retained trees, retained BA and bay and outrow width. As none of the material issues can be remediated it is recommended that all coupes be accepted for hand back and that VicForests and DPI work to improve compliance of thinning operations with NFSGs.
- **VicForests finalisation and hand back reporting:** the finalisation list provided by VicForests to DSE is a generally accurate, but insufficiently comprehensive record with which to assess compliance with NFSG standards. In its 2011-12 finalisation report, VicForests provided the information that has traditionally been required of it by DSE. However that information, in its own right, is not sufficient to assess compliance with NFSG standards. VicForests records had all of the required information and, once provided to the auditors, it was used to identify that most coupes proposed for hand back met NFSG standards.

  A small number of errors and omissions were identified in VicForests finalisation reporting to DSE (7% of the total number of audit criteria), although these omissions and errors had no material impact on the acceptability of coupes for hand back.
- **Harvest coupe regeneration and finalisation:** activities that were assessed during detailed field audits complied with 97% of applicable audit criteria. Only one instance was detected among 32 coupes and over 340 applicable audit criteria where non-compliance was assessed to pose more than a low risk of harm to the environment.

7.2 Recommendations

Recommendations arising from this report were identified in the body of the text, as follows.

#	Recommendation
4.1	It is recommended that future requests for information on finalisation of VicForests coupes include all of the information needed to assess compliance with NFSG standards.
4.2	Differences in species composition between the gross coupe area and the area actually harvested may legitimately result in species found to be present in coupe planning not being detected in stocking surveys. It is recommended that for coupes in which stocking surveys do not detect all of the species identified in planning, an annotation explaining any legitimate reasons for this (e.g. species uncommon in coupe area, species only present in unharvested area) be provided in VicForests finalisation reporting.
6.1	It is recommended that Part A of Workbook 7A be adopted for use in future audits without further modification.
6.2	It is recommended that Part B of Workbook 7A be removed and not be included in future audit programs.
6.3	It is recommended that Part A of Workbook 7B be modified for use in future audit programs as follows: ▪ Provision is made to separately capture information from multiple regeneration coupe stocking surveys. For several of the audited coupes, a standard survey was followed up by one or more intensive surveys to either check stocking in lightly or unstocked areas or to follow up on remedial work to improve regeneration. ▪ The tables require cells that confirm the results of the assessment. ▪ For thinning coupes, Table 3 requires cells into which NFSG standard values for BA retention, bay and outrow width applicable to the stand age, type and slope can be entered, so that an assessment of compliance can also be made and included in the reporting
6.4	It is recommended that any future review of the *Code of Practice for Timber Production* consider introducing prescriptions that at least support compliance with commercial thinning standards and specifications in the relevant NFSGs.
6.5	It is recommended that Part B of Workbook 7B be modified to include more explicit guidance on how to treat "partial" and non compliance with audit criteria in completing Tables 4 and 5.
6.6	As unambiguous assessments of the effectiveness of particular environmental impact control measures cannot be made during audits that occur several years after regeneration it is recommended that criteria 14, 18 and 21) be deleted from Table 4 (for regeneration coupes). For similar reasons, criterion 10 in Table 4 and criterion 3 in Table 5 of Workbook 7B, relating to the spatial distribution and composition of regeneration and thinning coupe should be removed.
6.7	Formal, detailed field assessments of coupes with reported stocking above approximately 75% add little value to the audit. It is recommended that in future audits: ▪ For coupes with reported stocking of 75% and above, an initial reconnaissance survey should be undertaken to confirm that the coupe is adequately stocked. This could be based on an on-ground survey along snig tracks and other access points, or, where high resolution aerial photography is available, it could be based in interpretation of such images; ▪ Formal surveys (using the method described in Workbook 7B) are only used to assess stocking in those coupes with reported stocking of less than 75% and in coupes where the initial reconnaissance survey identifies that they may not be as well stocked as suggested by VicForests' surveys. Coupes to be included in the detailed field assessments would be selected (largely) at random, as was the case in the current audit.

#	Recommendation
6.8	It is recommended that DSE accept all of the regeneration and thinning coupes proposed by VicForests for hand back.
6.9	It is recommended that the revised version of FAP Module 7 that was prepared on the basis of the 2011-12 audit is used in any future Coupe Regeneration and Finalisation audits.
6.10	It is recommended that the Department of Primary Industries (DPI) work with VicForests to strengthen the planning and implementation of forest thinning operations to achieve better compliance with relevant NFSGs.
6.11	It is recommended that DSE and DPI develop protocols for the reporting of coupe stocking in instances where multiple surveys, potentially of differing intensities, have been undertaken to assess coupe stocking.
6.12	Relatively poor compliance with the requirement to assess regeneration coupe stocking within three years of coupe treatment may reflect VicForests reporting of the latest rather than earliest established seedling survey. In future finalisation reporting, VicForests should ensure that the earliest such survey date be reported. VicForests should also ensure it complies with the Code requirement to conduct stocking surveys within three years of coupe treatment for regeneration. It should also ensure that such surveys are conducted within the timeframe required by the Code.
6.13	It is recommended that VicForests and DSE review the comments on perceived procedural shortcomings with coupe records and FireWeb entries and amend their practices as appropriate.
6.14	It is recommended that DPI review NFSG standards for thinning to appropriately allow for sampling and measurement uncertainty.

8 References

1. Department of Sustainability and Environment 2007. Code of practice for timber production. DSE.
2. Department of Natural Resources and Environment 1997. Native Forest Silviculture Guideline No. 10. Eucalypt stocking surveys. NRE.
3. Department of Sustainability and Environment 2006a. Native Forest Silviculture Guideline No. 13. Thinning of Ash eucalypt regrowth. DSE.
4. Department of Sustainability and Environment 2006b. Native Forest Silviculture Guideline No. 14. Thinning of mixed species regrowth. DSE.
5. Department of Sustainability and Environment 2010. Forest Audit Program Toolbox – Module 7 Regeneration and finalisation. DSE.
6. Department of Sustainability and Environment 2012. Forest Audit Program Toolbox – Module 7 Regeneration and finalisation. DSE.
7. Department of Sustainability and Environment 2008. Coupe finalisation procedures. DSE.
8. Standards Australia 2009. AS/NZS ISO 31000:2009 Risk management: principles and guidelines. Standards Australia.
9. Department of Sustainability and Environment 2007. DSE Risk management framework. DSE.
10. Sinclair Knight Merz 2012. Forest Audit Program 2011-12 reporting period. Module 7 audit of coupe regeneration and finalisation. Report on the potential use of aerial photography in coupe regeneration and finalisation audits. Consultancy report to Department of Sustainability and Environment. Project VW06499.

Appendix A: Forest Audit Program Module 7

This appendix contains the module and workbooks for Coupe regeneration and finalisation auditing that were used in this (2011-12) audit. Further modifications to the module and workbooks were made following this audit. The updated module and workbooks, which are proposed for use in any future Coupe regeneration and finalisation audits are given in Appendix E.

CONTENTS

Document and Version Control

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Revision History

Date	Reviewer	Summary of changes	Replaces
18/1/2012		Full revision of coupe regeneration and finalisation audit procedures. Audit scope confined to finalisation of regeneration and thinning coupes and draws on VicForests' regeneration surveys	Version 1.0
30/5/2012		Revisions to methodology based on application of module in 2011-12 FAP	Version 2.0

Module 1
Overview

Module 2
Audit Process

Module 3
Tactical Planning

Module 4
Operational Planning

Module 5
Harvesting and Closure

Module 6
Harvesting Performance

Module 7
Regeneration and Finalisation

1 MODULE 7 – REGENERATION AND FINALISATION

1.1 INTRODUCTION

Regeneration of native forest following completion of harvesting is an important part of the forest lifecycle and critical to achieving the environmental outcomes envisaged by the timber production regulatory framework.

Regeneration involves the use of techniques to provide suitable soil conditions for the establishment and growth of vegetation existing on the site prior to harvesting, and may encompass aerial or hand sowing of seed, or the planting of seedlings or other growing stock to establish new vegetation in harvested areas.

The method used for regeneration may change in consideration of the total area involved, the resources available, the characteristics of the site and seasonal conditions. The species composition of the regeneration stock is also of importance and will be determined in response to the management objectives and characteristics of each site.

Finalisation is the process of confirming that regeneration of a harvested coupe is adequate in relation to the conditions that were put in place as part of the approval process for the commercial timber harvesting operation. In the case of VicForests, finalisation is undertaken prior to the Department of Sustainability and Environment (DSE) resuming management responsibilities for sections of State forest that were vested to VicForests through the Allocation Order process.

1.2 OBJECTIVE OF MODULE 7

The objective of this module is to assess whether forest regeneration and finalisation processes, required after commercial timber harvesting and thinning operations in State forests have ceased, have been conducted to achieve sustainable forest management and are in accordance with relevant legislation and regulations.

Results of the audit are used in decisions by DSE to accept or reject harvest or thinning coupes nominated by VicForests for finalisation.

1.3 SCOPE OF MODULE 7

Module 7 – Regeneration and Finalisation aims to provide users with the necessary information and tools to enable an audit of coupe finalisation activities including:

- coupe regeneration;
- post-harvest or thinning stocking assessment; and
- rehabilitation of coupe infrastructure.

Due to the time interval between harvesting and the requirements for various regeneration processes, some compliance sub-elements (i.e. pest control, seed bed preparation) may also be audited within Module 5 – Harvesting and Closure.

Specifically excluded from the scope of Module 7 – Regeneration and Finalisation is the audit of:

- silvicultural practices conducted in State forests that are not associated with commercial timber production (i.e. fire recovery silviculture and ecological thinning);
- seed source, collection, storing and cleaning undertaken prior to sowing seed beds; and
- seed crop monitoring.

1.4 STRUCTURE OF MODULE

Module 7 – Regeneration and Finalisation includes:

- *Chapter 1 Introduction*: provides an introduction to the scope, objectives and structure of the audit module as part of the Forest Audit Program;
- *Chapter 2 Compliance Elements*: provides a list of elements suitable for inclusion in the annual Forest Audit Program as part of regeneration and finalisation;
- *Chapter 3 Audit Approach and Tools*: provides a preferred audit approach and methodology and refers to the use of supporting tools, including the Audit Workbooks; and
- *Chapter 4 References*: provides a description of the key regulatory documents supporting each of the Workbooks.

2 COMPLIANCE ELEMENTS

The compliance elements associated with *Module 7 – Regeneration and Finalisation* coupe regeneration or stocking and the methods used to assess this.

2.1 STOCKING ASSESSMENT

Stocking and early seedling growth on harvested coupes that have been regenerated must be assessed within three years of treatment. The assessment is undertaken to determine whether regeneration has been successful and, if necessary, to guide remedial action to ensure successful regeneration.

Post-harvest stocking is also assessed in coupes subject to thinning. These assessments are undertaken to ensure thinning complies with management standards and address any excessive damage to retained stems.

VicForests undertakes stocking and post-thinning assessments in all regeneration and thinning coupes that have been nominated for finalisation, except those that have been burnt in a wildfire following site establishment or thinning.

This compliance element considers the appropriateness of survey methods used to assess stocking, the adequacy of the data provided and the accuracy of its reporting back to DSE.

2.2 COUPE REGENERATION OR STOCKING

Unless required for another authorised purpose, all harvest coupes in State forest in Victoria must be regenerated to approximately the same species composition that was present prior to harvesting.

Following harvesting, coupes are managed to ensure that the forest is regenerated and that the production of timber and other ecosystem goods and services is maintained. Regeneration standards require that vegetation composition is maintained when regenerating native forests by using appropriate seed sources and a mixture of dominant species.

Where fire is used in regeneration operations, all practicable measures must be taken to protect all areas that were not harvested from the impacts of fire. Weeds and browsing animals may also need to be managed at this time to ensure successful regeneration.

Thinning operations are conducted in some forest types to enhance the quality and growth of retained trees. Standards have been developed to ensure stands are thinned to an appropriate residual stocking rate, to contain damage to retained stems and ensure the original species composition is approximately maintained.

This compliance element considers the outcomes of coupe regeneration activities and thinning operations in terms of stand composition, stocking, damaged to retained trees (in thinning coupes), rehabilitation of coupe infrastructure and the management of weeds and browsing animal impacts.

3 AUDIT APPROACH AND TOOLS

An audit of regeneration and finalisation compliance elements will require:

- sourcing of relevant information and evidence;
- desktop audit;
- field audit; and
- completion of Audit Workbooks.

This audit makes extensive use of stocking (or regeneration) and post-thinning surveys undertaken by VicForests. These surveys are conducted for all coupes nominated for finalisation. Given the comprehensiveness of these surveys, this audit includes only a limited program of field work.

3.1 SUPPORTING DOCUMENTATION

Module 1 – Overview, and Module 2 – Audit Process should be read in conjunction with this module.

Module 2 outlines a method for selecting audit targets, assessing risk and guidelines for preparing an audit report. This approach predated this revision to Module 7 and has now been superseded by the approaches outlined in section 3.5 of this module.

3.2 SOURCING INFORMATION

Information should be collected through interviews, examination of Forest Coupe Plans and other documents, review of data from VicForests stocking surveys and observation of regeneration and coupe finalisation activities. Instances of non-conformity against the specified audit criteria should be recorded.

Information gathered through interviews should be verified by acquiring supporting information from independent sources where possible, such as observations, records and results of existing activities or measurements.

The following list outlines information that may be requested in order to complete an audit under Module 7:

- list of coupes submitted by VicForests for finalisation;
- Forest Couple Plan for each coupe selected for field audit;
- complete and current records of regeneration progress;
- records from stocking and post-thinning surveys;
- relevant maps and aerial photographs;
- pre and post harvest basal area and species composition;
- harvest records;
- instances of non-conformity;
- fire occurrences;

- reports on weed and browsing animal management activities; and
- relevant intra- and inter- agency correspondence.

3.3 DESKTOP ASSESSMENT

The desk-based component of the audit program includes the assessment of VicForests regeneration and stocking survey results and their conformance with Native Forest Silviculture Guidelines (NFSGs; which are subordinate documents to the Code of Practice for Timber Production [the Code]). The target selection methods for the desk top assessment are outlined in section 3.5.

The procedures for the desk-based assessment should include:

- examination and review of legislative requirements, management prescriptions and procedures relating to the conduct of regeneration and coupe finalisation activities as they relate to the compliance elements;
- review of regeneration processes against the requirements of relevant NFSGs; and
- review of stocking and other relevant data captured during field surveys conducted by or for VicForests;

Forest Coupe Plans for coupes included in the field assessment component of the audit will be reviewed at the time of the field assessment.

The desktop assessment component of the audit has two main parts, as follows:

- **Part A: Review of coupe data** – a review of summary information from all coupes nominated for finalisation to check that they meet stocking or other specifications from the NFSGs (# 10, 13 and 14).

- **Part B: Review of regeneration and post-thinning survey results** – an audit of stocking and post-thinning surveys on a selection of coupes nominated for finalisation. The review is intended to confirm whether the summary information provided by VicForests during the finalisation process is consistent with the base information and whether stocking and other attributes meet specifications contained in relevant NFSGs.

The target selection methods for the desktop assessment are outlined in section 3.5.1.

3.4 FIELD ASSESSMENT

The field-based component of the audit program includes the assessment of regeneration success in selected regeneration and thinning coupes that have been nominated by VicForests for finalisation.

Activities to be undertaken during the field audit may include:

- a short briefing in each Forest Management Area (FMA) at the start of the field program to introduce the audit team and outline the audit process to the auditee's representatives and other interested forestry staff from the district;

- recording the assessment in the relevant audit workbooks;
- reviewing shape files and a map of each coupe visited;
- reviewing Forest Coupe Plans, remedial treatment plans, coupe diaries and any other coupe specific documentation;
- conducting interviews, where appropriate, with DSE, VicForests and operator managerial and technical staff;
- debriefing with the operational staff at the conclusion of the field program in each FMA/OA, to provide a preliminary assessment of coupe compliance and summarise any identified issues.

The field assessment component of the audit has three main parts, as follows:

- **Part A: Assessment of stocking and post-thinning surveys** – this repeats Part B of the desktop assessment for all coupes included in the field assessment (excluding any that have already been audited). This audit component is intended to confirm whether the summary information provided by VicForests during the finalisation process is consistent with the base information and whether stocking and other attributes meet specifications contained in relevant NFSGs.
- **Part B: Assessment of compliance against the Code** – based on coupe records, compliance of coupe regeneration and finalisation with Code requirements is assessed. This part of the audit mostly addresses regeneration coupes, as the Code does not specifically address issues associated with finalisation of thinning coupes. While most elements are based on Forest Coupe Plans (FCPs) and other documentary evidence, some elements must be assessed in the field.
- **Part C: Field assessment of regeneration and coupe stocking** – this audit component requires a limited program of stocking assessment in regeneration and thinning coupes that have been proposed for finalisation.

The target selection method for the field assessment component of this Module 7 is outlined in section 3.5.2.

3.5 AUDIT TARGET SELECTION

3.5.1 Desktop assessment

The desktop assessment has two components, as outlined in section 3.3. Target selection for each component is outlined below:

- **Part A: Review of coupe data** – the review includes all coupes nominated by VicForests for finalisation.
- **Part B: Review of regeneration and post-thinning survey results** – 10% (each) of regeneration and thinning coupes nominated for finalisation (rounded up to the next whole number) are selected at random, with a minimum of 10 coupes of each type selected.

3.5.2 Field assessment

The number of coupes included in this component is likely to be limited by resources available. A minimum of 10% of coupes in a selection of FMAs will be audited in any one year. It is recommended that the FMA with the largest proportion of coupes nominated for finalisation be a priority for field auditing and that the field audit also include one or two other FMAs with significant numbers of coupes nominated for finalisation.

Where the field assessment for regeneration coupes shows that stocking does not meet the standard required (i.e. stocking rate + the 90% confidence interval is less than 65%; see Workbook 7B), the coupe will be resurveyed using the grid-based sampling design of NFSG #10 and the sampling intensity used by VicForests.

3.6 AUDIT WORKBOOKS

This module is supported by two audit workbooks for each compliance element, which are included as Annexures A and B. The Audit Workbooks outline the audit criteria, relevant prescription(s), and provide detailed instruction on audit protocol guides. They include:

- Workbook 7A: Desktop analysis; and
- Workbook 7B: Field assessment.

Each of these workbooks outline the audit criteria, associated regulatory and management prescriptions, audit protocol guides and audit methodologies, where relevant.

Auditors should record audit information and findings in the Audit Workbooks along with supporting evidence and information. Audit findings should then be collated and presented in an audit report prepared in accordance with the requirements outlined in Module 2.

4 REFERENCES

Relevant references to this module include the following.

Legislation, policy and Codes of Practice

Catchment and Land Protection Act 1994

Code of Forest Practice for Timber Production, Department of Sustainability and Environment, 2007

Code of Practice for Fire Management on Public Land, Department of Sustainability and Environment, 2006

Conservation, Forest and Lands Act 1987

Environmental Protection Act 1970

Flora and Fauna Guarantee Act 1988 (FFG Act)

Sustainability Charter for Victoria's State Forests, Department of Sustainability and Environment, 2007

Sustainable Forests (Timber Harvesting) Regulations 2006

Sustainable Forests (Timber) Act 2004

Wildlife Act 1975

Guidelines and management procedures

Management Procedures for Timber Harvesting, Reading and Regeneration in Victoria's State Forests, Department of Sustainability and Environment, Victoria, 2009.

Monitoring Annual Harvesting Performance in Victoria's State Forest, Department of Sustainability and Environment, 2008.

NFSG #1 -Native Forest Silviculture Guideline No.1, Seed Crop Monitoring and Assessment, Department of Conservation and Natural Resources, 1993.

NFSG #2 - Native Forest Silviculture Guideline No.2, Eucalypt Seed Collection, Department of Conservation and Natural Resources, 1994.

NFSG #3 - Native Forest Silviculture Guideline No.3, Seed Extraction, Cleaning and Storage, Department of Conservation and Natural Resources, 1994.

NFSG #4 - Native Forest Silviculture Guideline No.4, Eucalypt Seed Sampling and Testing, Department of Conservation and Natural Resources, 1995.

NFSG #5 - Native Forest Silviculture Guideline No.5, Eucalypt Seed Coating, Department of Natural Resources and Environment, 2001.

NFSG #6 - Native Forest Silviculture Guideline No.6, Site Preparation, Department of Natural Resources and Environment, 1998.

NFSG #7 - Native Forest Silviculture Guideline No. 7, Browsing Management, Department of Sustainability and Environment, Victoria, 2005.

NFSG #8 - Native Forest Silviculture Guideline No.8, Eucalypt Sowing and Seedfall, Department of Natural Resources and Environment, 2001.

NFSG #9 - Native Forest Silviculture Guideline No.9, Eucalypt Planting, Department of Conservation and Natural Resources, 1993.

NFSG #10- Native Forest Silviculture Guideline No.10, Eucalypt Stocking Surveys, Department of Natural Resources and Environment, 1997.

NFSG #13- Native Forest Silviculture Guideline No.13, Thinning of Ash Eucalypt Regrowth, Department of Sustainability and Environment, Victoria, 2006.

NFSG #14- Native Forest Silviculture Guideline No.14, Thinning of Mixed Species Regrowth, Department of Sustainability and Environment, Victoria, 2006.

Management plans and prescriptions

Fire Salvage Harvesting Prescriptions 2009, Department of Sustainability and Environment, Victoria, 2009.

Forest Management Plan for the Central Highlands, Department of Natural Resources and Environment, 1998.

Forest Management Plan for East Gippsland, Department of Natural Resources and Environment, 1995.

Forest Management Plan for the Floodplain State Forests of the Mildura Forest Management Area, Department of Sustainability and Environment, Victoria, 2004.

Forest Management Plan for Gippsland, Department of Sustainability and Environment, Victoria, 2004.

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Silviculture Reference Manual No. 3 - Low Elevation Mixed Species in Victoria's State Forests, Department of Sustainability and Environment, Victoria, 2010.

Annexures A – B

Electronic CD

Annex A

Workbook 7A: Desktop Assessment

Annex B

Workbook 7B: Field Assessment

ENVIRONMENTAL AUDIT
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TIMBER PRODUCTION IN STATE FORESTS

«FMA» FMA

Module 7 Regeneration and Finalisation

Workbook 7A: Desktop analysis of VicForests' assessments of regeneration and thinning coupe stocking and their conformance with Native Forest Silviculture Guideline standards

Summary Page

Positive observations:	Non-compliances identified and acted on by DSE / VicForests in their supervisor capacity (include contractor penalties allocated)
•	•
Summary of non-compliance and/or potential risk of harm to the environment:	
•	
Areas for improvement:	Further evidence required:
•	•

Auditors:		Date of audit:	

Previous Key Audit Findings

What key findings were observed during any previous desktop analysis of VicForests' assessments of coupe regeneration and stocking?
The auditor will require an understanding of previous key findings in order to provide commentary on current practices and improvements over time. Comments:

Part A: Review of coupe data

Source the information listed in **Table 1** from coupe records held by VicForests. Information is required for **all** regeneration and thinning coupes being proposed for finalisation.

The information requested is used to assess compliance against the requirements of the Code of Practice for Timber Production (Code) prescriptions and subordinate documents such as the Native Forest Silviculture Guidelines (NFSGs; # 10, 13 and 14). The information required varies, depending on whether the coupes are even and/or uneven-aged logging coupes or thinning coupes.

Targets for relevant criteria (marked with * in **Table 1**) are provided in Annex 1 to this Workbook.

Once the information is obtained from VicForests the review of coupe data is completed for regeneration coupes using **Table 2** and for thinning coupes using **Table 3**. Reporting using these tables is undertaken for each FMA. Any coupes failing to meet finalisation standards are to be listed in **Table 4**. The table will be prepared for each FMA and specify the audit criteria for which the coupe failed to meet the required standard.

Table 1 VicForests data request for coupe summary information

			Type of stand/coupe		
#	Criteria	Qualifier	Even-aged	Uneven-aged	Thinning
1	FMA		✓	✓	✓
2	District		✓	✓	✓
3	Coupe address		✓	✓	✓
4	Forest type		✓	✓	✓
5	Silvicultural system		✓	✓	✓
6	Area (ha)		✓	✓	✓
7	Date sown/planted/thinned		✓	✓	✓
8	Date of survey		✓	✓	✓
9	Target stocking rate		✓	✓	
10	# stocked plots (S)		✓	✓	
11	# non-productive plots (N)		✓	✓	
12	Total # plots (T)		✓	✓	
13	% productive plots stocked*		✓	✓	
14	Species originally present		✓	✓	
15	# individuals found of each of above species	≥10 or <10	✓	✓	
16	Coupe has unstocked areas greater than target	1 ha for even-aged or 2 ha for uneven-aged stands	✓	✓	
17	Weed presence at time of stocking survey	As per coupe hand back spreadsheet	✓	✓	

#	Criteria	Qualifier	Type of stand/coupe		
			Even-aged	Uneven-aged	Thinning
18	Browsing intensity	As per coupe hand back spreadsheet	✓	✓	
19	Basal area of retained trees (m^2/ha)*	Non-merchantable		✓	
20	Age of stand				✓
21	Average thinning damage*				✓
22	Average outrow width*				✓
23	Average bay width*				✓
24	Dominant/co-dominant trees retained*				✓
25	Pre-harvest basal area				✓
26	Post-harvest basal area*				✓
27	Retained regrowth basal area*				✓
28	Pre-thinning species composition	# trees of each species in pre-thinning survey			✓
29	Post-thinning species composition	# trees of each species in post-thinning survey			✓

Note: Shading in type of stand/coupe cells indicates that data is not required. A tick indicates that data is required.

Information from the review of coupe records is collated for each FMA using **Table 2** (for regeneration coupes) and **Table 3** (for thinning coupes).

Table 2 Summary of coupe assessments: regeneration coupes

FMA						
Forest type	**#1**	**#2**	**#3**	**#4**	**#5**	
Criteria	**<FT1>**	**<FT2>**	**<FT3>**	**<FT4>**	**<FT5>**	**Comments**
Total # coupes						
Total area of coupes (ha)						
# coupes where regeneration assessed> 3 years after treatment						
# coupes with stocking of productive plots < target %						
# coupes with unstocked areas exceeding target						
# coupes with inadequate species representation						
# coupes with widespread weed infestations at regeneration survey						
# coupes with > low intensity browsing						
# uneven aged coupes with non-merchantable tree basal area > target						

Other comments

Audit details:					
Auditor and audit team		**Auditees**		**Date of audit**	

Table 3 Summary of coupe assessments: thinning coupes

FMA						
Forest type	**#1**	**#2**	**#3**	**#4**	**#5**	
Criteria	**<FT1>**	**<FT2>**	**<FT3>**	**<FT4>**	**<FT5>**	**Comments**
Total # coupes						
Total area of coupes (ha)						
# coupes with basal area of retained trees < target						
# coupes with basal area of regrowth trees < target						
# coupes with outrow width > target						
# coupes with bay width > target						
# coupes with dominant and co-dominant trees inappropriately removed						
# coupes with >15% of retained trees with damage to bole or crown						

Other comments

Audit details:					
Auditor and audit team		**Auditees**		**Date of audit**	

Table 4 List of coupes failing to meet standards for audit criteria and details of non-conformance

FMA						
Coupe address	**District**	**Forest type**	**Silvicultural system**	**Coupe type[1]**	**Audit criterion**	**Details of non-conformance and associated circumstances**

1. Coupe type: even-aged regeneration (EA); uneven-aged regeneration (UEA); thinning (TH)

Other comments

Audit details:					
Auditor and audit team		**Auditees**		**Date of audit**	

Part B: Review of regeneration and post-thinning survey results

From the list of regeneration and thinning coupes nominated for finalisation by VicForests, **10%** in each category are selected at random for auditing. Digital or hard copies of the stocking or pre and post-thinning surveys, respectively, will be requested from VicForests. Raw data from each survey will be processed to confirm whether the information reported in Part A and in the coupe finalisation nomination spreadsheet is accurate and that the coupe meets audit criteria drawn from the Code and NFSGs.

Details of each assessment are recorded using **Table 5**, **Table 6** (for even-aged and uneven aged regeneration coupes, respectively) and **Table 7** (for thinning coupes). Reporting is undertaken coupe by coupe. Acceptable stocking for regeneration and thinning coupes are described in Annex 1 of this Workbook.

The process for selecting coupes to be included in this desktop review is described in Module 7 of the Forest Audit Program Toolbox.

Table 5 Assessment of coupe regeneration/stocking surveys: even-aged coupes

FMA			**District**				**Coupe address**	
Date of survey			**Area (ha)**				**Date planted/sown**	
Species required	<Spp #1>	<Spp #2>	<Spp #3>	<Spp #4>	<Spp #5>	<Spp #6>		
Are ≥ 10 individuals present?							**Stocking survey intensity**	

Stocking survey results: number of plots in each category

Stocked	Unstocked: receptive seedbed	Unstocked: Non-productive	Total unstocked	Total plots	% stocked receptive plots
				Coupe stocking acceptable?	

# unstocked areas > 1 ha		**Weed abundance**		**Management action required?**	
		Browsing animal impact		**Management action required?**	

Consistency with summary information:

Date of survey	# stocked plots	Total # plots	% productive plots stocked	Species present	Species with <10 individuals	Unstocked area(s) > 1 ha	Widespread weed presence	Browsing > low intensity

Other comments

Audit details:

Auditor and audit team		**Auditees**		**Date of audit**	

Table 6 Assessment of coupe regeneration/stocking surveys: uneven-aged coupes

FMA			**District**				**Coupe address**	
Date of survey			**Area (ha)**				**Date planted/sown**	
Species required	<Spp #1>	<Spp #2>	<Spp #3>	<Spp #4>	<Spp #5>	<Spp #6>		
Are ≥ 10 individuals present?							**Stocking survey intensity**	
Stocking survey results: number of plots in each category								
Stocked	Unstocked: receptive seedbed		Unstocked: Non-productive		Total unstocked		Total plots	% stocked receptive plots
							Coupe stocking acceptable?	

# unstocked areas > 2 ha:		**Weed abundance:**		**Management action required?**	
Non-merchantable basal area:		**Browsing animal impact:**		**Management action required?**	

Consistency with summary information:

Date of survey	**# stocked plots**	**Total # plots**	**% plots stocked**	**Species present**	**Species with <10 individuals**	**Unstocked area(s) > 2 ha**	**Widespread weed presence**	**Browsing > low intensity**	**Non-merch BA ≤ 5-7% reference BA**

Other comments

Audit details:					
Auditor and audit team		**Auditees**		**Date of audit**	

Table 7 Assessment of post-thinning surveys

FMA			**District**				**Coupe address**	
Date of survey			**Area (ha)**				**Slope**	
Species present	<Spp #1>	<Spp #2>	<Spp #3>	<Spp #4>	<Spp #5>	<Spp #6>	**Pre-thinning basal area**	
% of trees pre-thinning							**% live BA removed**	
% of trees post thinning							**Retained regrowth BA**	
Post-thinning survey results: number of plots in each category								
Average outrow width	Average bay width		% retained crop trees with damage to bole or crown		Dominant/co-dominant trees retained where appropriate?		Age of stand	

	Weed abundance		**Management action required?**
Consistency with summary information:	**Browsing impact**		**Browsing action required?**

Age of stand	**Species composition**	**Ave thinning damage**	**Ave bay width**	**Ave outrow width**	**% live BA removed**	**Retained BA for regrowth**	**Widespread weed presence**	**Browsing > low intensity**	**Slope**

Other comments

Audit details:					
Auditor and audit team		**Auditees**		**Date of audit**	

Annex 1: Coupe stocking specifications

NFSGs (#10 for regeneration coupes; #13 for thinning coupes in ash forests; #14 for thinning coupes in mixed species forests) provide specifications of acceptable stocking rates and coupe conditions prior to finalisation. This information is summarised below.

Even-aged silvicultural systems - stocking requirements:

Acceptable stocking, based on stocking survey methodologies outlined in NFSG #10 are:

- Minimum 65% of plots on potentially productive coupe area are stocked using a standard plot intensity (80m x 20m);
- Minimum 55% of plots on potentially productive coupe area are stocked using an intensive survey (40m x 20m); and
- Minimum 75% of plots on potentially productive coupe area are stocked using an extensive survey (100m x 30m).

Additional stocking requirements include:

- A minimum of 10 acceptable plants of each species originally found on the coupe
- No unstocked areas greater than 1 ha in area

Uneven-aged silvicultural systems - stocking requirements:

Acceptable stocking, based on stocking survey methodologies outlined in NFSG #10 are:

- Minimum 75% of plots on potentially productive coupe area are stocked (standard plot intensity);
- Minimum 65% of plots on potentially productive coupe area are stocked (intensive survey)

Additional stocking requirements include:

- A minimum of 10 acceptable plants of each species originally found on the coupe
- No unstocked areas greater than 2 ha in area
- Basal area of non-merchantable trees should not exceed 5-7% of the reference basal area (RBA)

Thinning coupe stocking requirements

Stocking requirements differ between Ash and mixed species forests.

Coupes in Ash forests (NFSG #13):

- Not more than 50% of the live basal area is to be removed
- Retained basal area of regrowth trees (not including live overwood) in stands of:
  - Age 14-20 years is ≥ 17 m^2/ha
  - Age 21-30 years is ≥ 20 m^2/ha
  - Age 31-35 years is ≥ 23 m^2/ha
  - Age 36-40 years is ≥ 28 m^2/ha
  - Age 41 years and greater is ≥ 32 m^2/ha
- On slopes ≤15°, average outrow width does not exceed 4.5 m (7 m for 1939 Ash) and average bay width is a minimum 14 metres (20 metres for 1939 Ash).
- On slopes >15°, outrow width does not exceed 4.5 m and bay width is a minimum 12 m
- Not more than 15% of retained crop trees have damage to boles and/or crowns
- Dominant and co-dominant trees are retained unless on defined outrows or extraction tracks.
- Species composition is similar to that prior to thinning

Coupes in mixed species forests (NFSG #14):

- Not more than 50% of the live basal area is to be removed and retained basal area for regrowth crop trees (not including live overwood) in stands of:
  - Age 20-24 years is ≥ 17 m^2/ha
  - Age 25-34 years is ≥ 21 m^2/ha
  - Age 35 years and greater is ≥ 25 m^2/ha
- In natural regrowth areas, outrows are a maximum of 4.5 m and bays are a minimum width of 12 m, unless uniform thinning has been adopted.
- Not more than 15% of retained crop trees have damage to boles and/or crowns
- Dominant and co-dominant trees are retained unless on defined outrows or extraction tracks.
- Species composition is similar to that prior to thinning

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Module 7 Regeneration and Finalisation

Workbook 7B: Field assessment of coupe regeneration and finalisation and compliance with the Code and Native Forest Silviculture Guidelines

Summary Page

Positive observations:	Non-compliances identified and acted on by DSE / VicForests in their supervisor capacity (include contractor penalties allocated)
•	•
Summary of non-compliance and/or potential risk of harm to the environment:	
•	
Areas for improvement:	Further evidence required:
•	•

Auditors:		Date of audit:	

Previous Key Audit Findings

What key findings were observed during any previous field assessments of coupe regeneration and stocking?
The auditor will require an understanding of previous key findings in order to provide commentary on current practices and improvements over time. Comments:

Part A: Assessment of stocking and post-thinning surveys

The auditor is required to conduct an assessment of stocking and post-thinning survey results for all coupes selected for the field assessment. The method to be used follows that applied in Part B of the desktop assessment (for 10% of regeneration and thinning coupes proposed for finalisation; Workbook 7A). As previously stated, the assessment is conducted to confirm whether the information reported in Part A of the desktop assessment and in the coupe finalisation nomination spreadsheet is accurate and that the coupe meets audit criteria drawn from the Native Forest Silviculture Guidelines (NFSGs).

Data from the stocking or post-thinning surveys are recovered from Forest Coupe Plan (FCPs) or other records. Details of each assessment are recorded using **Table 1** and **Table 2** (for even-aged and uneven aged regeneration coupes, respectively) and **Table 3**, (for thinning coupes). Reporting is undertaken coupe by coupe. Acceptable stocking for regeneration and thinning coupes are described in Annex 1 of this Workbook. Any coupe that was assessed in Part B of the desktop assessment need not be reassessed.

The process for selecting coupes for the field assessment is described in Module 7 of the Forest Audit Program Toolbox.

Table 1 Summary sheet for desktop audit of even-aged regeneration coupes selected for field audit

FMA:		**Coupe address:**				
District:		**Coupe area:**	ha			
Forest type:		**Silvicultural system:**				
Tree species present in original stand	**Spp #1**	**Spp #2**	**Spp #3**	**Spp #4**	**Spp #5**	**Spp #6**

Regeneration method:							**Date sown/planted**	

From stocking survey								
Species required:	<Spp #1>	<Spp #2>	<Spp #3>	<Spp #4>	<Spp #5>	<Spp #6>		
Are ≥ 10 individuals present?							**Stocking survey intensity:**	
Stocking survey results: number of plots in each category								
Stocked	Unstocked: receptive seedbed		Unstocked: Non-productive		Total unstocked		Total plots	% stocked receptive plots

Summary information								
# unstocked areas > 1 ha:			**Weed abundance:**				**Management action required?**	
Coupe stocking acceptable?			**Browsing animal impact:**				**Management action required?**	
Consistency with summary information:								

Date of survey	**# stocked plots**	**Total # plots**	**% plots stocked**	**Species present**	**Species with <10 individuals**	**Unstocked area(s) > 1 ha**	**Widespread weed presence**	**Browsing > low intensity**

Audit details:					
Auditor and audit team		**Auditees**		**Date of audit**	

Table 2 Summary sheet for desktop audit of uneven-aged regeneration coupes selected for field audit

FMA:			**Coupe address:**			
District:			**Coupe area:**	ha		
Forest type:			**Silvicultural system:**			
Tree species present in original stand	**Spp #1**	**Spp #2**	**Spp #3**	**Spp #4**	**Spp #5**	**Spp #6**

Regeneration method:		**Date sown/planted**	

From stocking survey

Species required:	<Spp #1>	<Spp #2>	<Spp #3>	<Spp #4>	<Spp #5>	<Spp #6>
Are ≥ 10 individuals present?						

Stocking survey intensity:

Stocking survey results: number of plots in each category

Stocked	Unstocked: receptive seedbed	Unstocked: Non-productive	Total unstocked	Total plots	% stocked receptive plots

Summary information

				Coupe stocking acceptable?	
# unstocked areas > 2 ha:		**Weed abundance:**		**Management action required?**	
Non-merchantable basal area		**Browsing animal impact:**		**Management action required?**	

Consistency with summary information:

Date of survey	**# stocked plots**	**Total # plots**	**% plots stocked**	**Species present**	**Species with <10 individuals**	**Unstocked area(s) > 2 ha**	**Widespread weed presence**	**Browsing > low intensity**	**Non-merch BA ≤ 5-7% reference BA**

Audit details:

Auditor and audit team		**Auditees**		**Date of audit**	

Table 3 Summary sheet for desktop audit of thinning coupes selected for field audit

FMA:			**Coupe address:**			
District:			**Coupe area:**	ha	**Slope**	
Forest type:			**Silvicultural system:**			
Tree species present in original stand	**Spp #1**	**Spp #2**	**Spp #3**	**Spp #4**	**Spp #5**	**Spp #6**

Aged of stand		**Date thinned**	

From post-thinning survey						
Species required:	<Spp #1>	<Spp #2>	<Spp #3>	<Spp #4>	<Spp #5>	<Spp #6>
% of trees pre-thinning						
% of trees post thinning						

Post-thinning survey results: number of plots in each category				
Average outrow width	Average bay width	% retained crop trees with damage to bole or crown	Dominant/co-dominant trees retained where appropriate?	Age of stand

Summary information					
Pre-thinning basal area		**Weed abundance:**		**Management action required?**	
% live BA removed		**Browsing animal impact:**		**Management action required?**	
Consistency with summary information:					

Age of stand	**Species composition**	**Ave thinning damage**	**Ave bay width**	**Ave outrow width**	**% live BA removed**	**Retained BA for regrowth**	**Widespread weed presence**	**Browsing > low intensity**	**Slope**

Audit details:					
Auditor and audit team		**Auditees**		**Date of audit**	

Part B: Assessment against Code requirements

The auditor is to conduct an assessment of regeneration and thinning coupes selected for the field assessment. This stage of the audit considers compliance with the Code of Practice for Timber Production (the Code), other relevant regulations and the Native Forest Silviculture Guidelines. The information may be derived from: interviews with VicForests staff; reviews of information from the FCPs, the Coupe Information System or other relevant VicForests records; and the field assessment. **Table 4** is used to record details of the results of each coupe audit for regeneration coupes. **Table 5** is used in a similar manner for thinning coupes. Details are reported on a coupe-by-coupe basis. The Code provides minimal explicit comment on thinning coupe finalisation and so there are significantly fewer audit elements for the former than is the case for regeneration coupes.

Compliance with audit criteria is assessed as: yes (fully complies); no (does not comply); partial (partly satisfies the audit criterion) and not applicable (where the audit criterion is not relevant to the condition or management of the coupe). The auditor should enter comments in the field provided, particularly where the coupe was assessed to not or only partially comply with the audit criterion.

The process for selecting coupes to be included in the field audit and this assessment is described in Module 7 of the Forest Audit Program Toolbox. Stocking acceptability criteria for regeneration and thinning coupes is given in Annex 1 of this Workbook.

Table 4 Detailed audit of regeneration coupe compliance with the Code of Practice for Timber Production

FMA:		**Coupe address:**	
District:		**Coupe area:**	ha
Forest type:		**Silvicultural system:**	

Regeneration method:		**Date sown/planted**	

Audit details:					
Auditor and audit team		**Auditees**		**Date of audit**	

Source	Section	Prescription	Audit Criteria	Compliance (yes/no/partial/not applicable)	Auditor Comments
Mandatory actions and legal requirements					
Code of Practice for Timber Production 2007	2.1.3 Forest Coupe Plans	The Forest Coupe Plan must describe regeneration procedures to be applied.	1. Forest Coupe Plan describes regeneration procedures applied to coupe.		
Code of Practice for Timber Production 2007	2.3.1 Regeneration	State forest available for timber production must not be cleared to provide land for the establishment of plantations	2. Coupe has not been regenerated with plants grown from non-indigenous or exotic forestry species.		
			3. Coupe has not been replanted on a regular grid.		
Code of Practice for Timber Production 2007	2.3.1 Regeneration	Action must be taken to ensure the successful regeneration of a harvested coupe, except where: - the land is to be used for an authorised/ approved purpose for which native vegetation is not compatible; - timber has been harvested by thinning a stand; or - the stocking of seedlings or regrowth is assessed as sufficient through natural regeneration processes	4. Evidence can be provided of action taken to ensure successful regeneration.		
			5. Post-regeneration stocking has been assessed.		
			6. Coupe has been regenerated to standard consistent with the Code and Native Forest Silviculture Guidelines (NFSG) #10.		

Source	Section	Prescription	Audit Criteria	Compliance (yes/no/partial/not applicable)	Auditor Comments
Code of Practice for Timber Production 2007	2.3.1 Regeneration	Following timber harvesting, State forest must be regenerated with species native to the area, wherever possible using the same provenances, or if not available, from an ecologically similar locality. Regeneration operations must aim to approximate the composition and spatial distribution of canopy species common to the coupe prior to harvesting, where they can be determined	7. Original tree species found in coupe were recorded prior to harvesting, as was their approximate density and spatial distribution.		
			8. Local or similar provenance seed (only) was used in coupe regeneration.		
			9. All tree species originally present on coupe have been successfully regenerated to standard consistent with the Code and NFSG #10.		
			10. The spatial distribution of regenerating tree species approximates that of the original forest.		
Code of Practice for Timber Production 2007	2.3.1 Regeneration	Silvicultural methods for regeneration must be appropriate to the forest type (including understorey species) and local conditions.	11. Evidence is available to demonstrate that the silvicultural system used is appropriate to the forest type, understorey and local conditions.		
Code of Practice for Timber Production 2007	2.3.1 Regeneration	Where fire is used in regeneration operations, all practicable measures must be taken to protect all areas excluded from harvesting from the impacts of fire. The use of fire must be in accordance with the Code of Practice for Fire Management on Public Land (2006). A regeneration burn is a prescribed burn and requires an approved Burn Plan under that Code.	12. Measures were taken to protect areas excluded from harvesting from damage as a result of use of fire in regeneration.		
			13. Impact of regeneration burning on areas excluded from harvesting was assessed.		
			14. Protection of areas excluded from harvesting has been effective.		
			15. Any use of fire in regeneration was subject to an approved Burn Plan under the Code of Practice for Fire Management on Public Land (2006).		

Source	Section	Prescription	Audit Criteria	Compliance (yes/no/partial/not applicable)	Auditor Comments
Code of Practice for Timber Production 2007	2.3.1 Regeneration	Where mechanical disturbance is used, it must be undertaken with due consideration of erosion risk potential and proximity of waterways.	16. Measures were undertaken to manage erosion risk and potential sediment movement to waterways in coupes with mechanical disturbance.		
			17. Effectiveness of erosion control measures was assessed.		
			18. Erosion control measures were effective in managing sediment movement into waterways.		
Code of Practice for Timber Production 2007	2.3.1 Regeneration	Action must be taken to ensure that any Aboriginal cultural heritage places located within harvested coupe areas are appropriately protected and managed during regeneration activities.	19. Measures were taken to protect Indigenous cultural heritage sites or places located within harvested areas during regeneration.		
			20. Effectiveness of protection measures was assessed.		
			21. Aboriginal heritage places were effectively protected during regeneration.		
Code of Practice for Timber Production 2007	2.3.1 Regeneration	The source of seed used must be recorded in a manner that allows for future reference	22. The source of seed used for regeneration is recorded on the Forest Coupe Plan.		
Code of Practice for Timber Production 2007	2.3.1 Regeneration	The use of poisons to control wildlife browsing is prohibited. The use of pesticides in site preparation and/or seedling or advanced growth liberation must comply with Commonwealth and State legislation and regulations. Under the *Wildlife Act* 1975, browsing native animals may only be controlled under permits and in accordance with any associated conditions as issued by relevant authorities.	23. A register of chemicals used in the management of the coupe exists and has been maintained; as has a record of how they were used.		
			24. Procedures to ensure any pesticide use on the coupe complies with Commonwealth and State regulations are documented. All personnel using pesticides on the coupe have been inducted into their use.		
			25. Poisons have not been used to control wildlife browsing.		
			26. Any native animal control activities were conducted in accordance with permits issued by relevant authorities.		

Source	Section	Prescription	Audit Criteria	Compliance (yes/no/partial/not applicable)	Auditor Comments
Code of Practice for Timber Production 2007	2.3.2 Stocking Assessment	Stocking on harvested coupes must be assessed within three years of treatment, to determine whether regeneration has been successfully achieved and to ensure that re-treatment occurs where necessary	27. Coupe regeneration was assessed within three years of treatment.		
			28. The assessment determined the success of regeneration and the need for re-treatment where necessary.		
Code of Practice for Timber Production 2007	2.3.2 Stocking Assessment	The results of (coupe regeneration) assessment must be recorded for future reference.	29. The results of assessments and details of any further silvicultural treatments are recorded on the Coupe Information System or equivalent database.		
Code of Practice for Timber Production 2007	2.3.2 Stocking Assessment	Where stocking, health or early growth is inadequate, remedial work must be conducted as soon as practicable to obtain adequate regeneration. Further assessment must be undertaken following remedial treatment to ensure that it has been successfully regenerated.	30. Remedial work has been undertaken to achieve acceptable regeneration where stocking, spatial distribution, health or early growth was initially found to be below the applicable standard.		
			31. A second regeneration survey was undertaken following remedial work to improve stocking to an acceptable level.		
Code of Practice for Timber Production 2007	2.5.2 Coupe Infrastructure	Infrastructure must be rehabilitated on completion of operations, where not required for future operations, using rehabilitation techniques that provide suitable soil conditions for the regeneration and growth of vegetation existing on the site prior to harvesting. Rehabilitation of coupe infrastructure must be assessed within three years of initial treatment and, where found inadequate, remedial action must be taken.	32. Coupe infrastructure has been rehabilitated in ways that provided suitable soil conditions for the regeneration and growth of vegetation existing on the site prior to harvesting.		
			33. Rehabilitation of coupe infrastructure has been assessed within three years of initial treatment.		
			34. Remedial action was taken where rehabilitation was inadequate.		
Guidance					
Code of Practice for Timber Production 2007	2.3.1 Regeneration	The regeneration of understorey species should be facilitated where possible, using harvesting and regeneration methods that provide appropriate disturbance to ensure	35. Harvesting and regeneration methods are designed to protect understorey elements or provide appropriate disturbance to ensure they survive.		

Source	Section	Prescription	Audit Criteria	Compliance (yes/no/partial/not applicable)	Auditor Comments
		understorey elements can survive or that protect understorey patches.			
Code of Practice for Timber Production 2007	2.3.1 Regeneration	DSE maintains guidelines and standards against which regeneration may be assessed, that may provide a useful reference for forest operators.	36. Coupe regeneration was assessed in a manner consistent with relevant Native Forest Silviculture Guidelines (#10).		
Code of Practice for Timber Production 2007	2.3.1 Regeneration	Where natural seedfall or sowing is used, surveys may be conducted to assess the quality of the seedbed before seed is applied.	37. A survey of seedbed quality was undertaken prior to use of natural seedfall or sowing to regenerate the coupe.		
Code of Practice for Timber Production 2007	2.3.1 Regeneration	The screening or treatment of seed and nursery stock used in regeneration should ensure that the risk of spreading weeds, pathogens or pests is minimised.	38. Seed and planting stock are screened for weeds, pathogens or pests prior to coupe regeneration.		
Code of Practice for Timber Production 2007	2.3.2 Stocking Assessment	Where selection (uneven-aged) silvicultural systems are used, stocking assessments should take account of retained trees.	39. The stocking assessment took account of retained trees (uneven-aged coupes only).		

Additional comments:

Table 5 Detailed audit of thinning coupe compliance with the Code of Practice for Timber Production

FMA:		**Coupe address:**			
District:		**Coupe area:**	ha	**Slope**	
Forest type:		**Silvicultural system:**			

Audit details:					
Auditor and audit team		**Auditees**		**Date of audit**	

Source	Section	Prescription	Audit Criteria	Compliance (yes/no/partial/not applicable)	Auditor Comments
Mandatory actions and legal requirements					
Code of Practice for Timber Production 2007	2.3.1 Regeneration	State forest available for timber production must not be cleared to provide land for the establishment of plantations	1. Coupe has not been cleared and replaced with plants grown from non-indigenous or exotic forestry species.		
Code of Practice for Timber Production 2007	2.3.1 Regeneration	Following timber harvesting, State forest must be regenerated with species native to the area, wherever possible using the same provenances, or if not available, from an ecologically similar locality. Regeneration operations must aim to approximate the composition and spatial distribution of canopy species common to the coupe prior to harvesting, where they can be determined	2. Original tree species found in coupe were recorded prior to thinning, as was their approximate density and spatial distribution.		
			3. All tree species originally present on the coupe have been retained following thinning with a similar density and distribution.		
Code of Practice for Timber Production 2007	2.3.1 Regeneration	The use of poisons to control wildlife browsing is prohibited. The use of pesticides in site preparation and/or seedling or advanced growth liberation must comply with Commonwealth and State legislation and regulations. Under the *Wildlife Act* 1975, browsing native animals may only	4. A register of chemicals used in the management of the coupe exists and has been maintained; as has a record of how they were used.		
			5. Procedures to ensure any pesticide use on the coupe complies with Commonwealth and State regulations are documented.		

Source	Section	Prescription	Audit Criteria	Compliance (yes/no/partial/not applicable)	Auditor Comments
		be controlled under permits and in accordance with any associated conditions as issued by relevant authorities.	6. All personnel using pesticides on the coupe have been inducted into their use.		
			7. Poisons have not been used to control wildlife browsing.		
			8. Any native animal control activities were conducted in accordance with permits issued by relevant authorities.		
Code of Practice for Timber Production 2007	2.3.2 Stocking Assessment	Stocking on harvested coupes must be assessed within three years of treatment, to determine whether regeneration has been successfully achieved and to ensure that re-treatment occurs where necessary	9. Coupe stocking and thinning damage was assessed within three years of treatment.		
Code of Practice for Timber Production 2007	2.3.2 Stocking Assessment	The results of (coupe regeneration) assessment must be recorded for future reference.	10. The results of post-thinning assessments were recorded on the Coupe Information System or equivalent database.		
Code of Practice for Timber Production 2007	2.5.2 Coupe Infrastructure	Infrastructure must be rehabilitated on completion of operations, where not required for future operations, using rehabilitation techniques that provide suitable soil conditions for the regeneration and growth of vegetation existing on the site prior to harvesting. Rehabilitation of coupe infrastructure must be assessed within three years of initial treatment and, where found inadequate, remedial action must be taken.	11. Coupe infrastructure has been rehabilitated in ways that provided suitable soil conditions for the regeneration and growth of vegetation existing on the site prior to harvesting.		
			12. Rehabilitation of coupe infrastructure has been assessed within three years of initial treatment.		
			13. Remedial action was taken where rehabilitation was inadequate.		
Native Forest Silviculture Guidelines 13 and 14	Appendix 2 Post-thinning stand assessment Commercial thinning. 1. Regular systematic stocking and damage assessment of thinned stands is	During thinning, regular assessments/audits must be carried out to ensure that the prescriptions are complied with.	14. Pre and post thinning assessments were carried in on the coupe in a manner consistent with NFSG #13 or #14.		
			15. Assessments show that thinning operations meet the specifications for basal area, damage, outrow and bay width, species composition and tree retention in NFSG #13 or #14.		

Source	Section	Prescription	Audit Criteria	Compliance (yes/no/partial/not applicable)	Auditor Comments
	required.				
Guidance					
Code of Practice for Timber Production 2007	2.3.1 Regeneration	The regeneration of understorey species should be facilitated where possible, using harvesting and regeneration methods that provide appropriate disturbance to ensure understorey elements can survive or that protect understorey patches.	16. Thinning methods are designed to protect understorey elements or provide appropriate disturbance to ensure they survive.		

Additional comments:

Part C: Field assessment of regeneration and coupe stocking

Stocking and post-thinning surveys conducted by VicForests were conducted using the sampling and assessment methodologies described in NFSGs #10, 13 and 14, respectively. The intent of this field audit (for stocking adequacy in regeneration coupes) is not to replicate those surveys, but to confirm their findings regarding acceptable stocking (etc). For this reason, a reconnaissance survey methodology has been developed using a randomised sampling point approach rather than a systematic survey design.

Regeneration coupe sampling approach

Stocking assessments in field audit coupes is recorded using modified versions of field record sheets included in Appendices to the NFSG # 10. **Table 6** and **Table 7** are used for even-aged coupes and **Table 8** and **Table 9** are used for uneven-aged coupes. An overall assessment of whether the coupe meets with stocking standards from NFSG #10 and details of any non-conformance is provided in the comments box. Definitions of acceptable seedlings and seedbed conditions are given in Annex 1.

Stocking in regeneration coupes is to be assessed at up to 50 sampling points per coupe. Assessment procedures are to follow NFSG #10.

Sampling points are to be located at random using the following method (rather than using the systematic grid approach described in NFSG #10). It is assumed that sampling will be undertaken by two auditors.

Auditors will commence the survey at opposite ends of the coupe. A random number table (with numbers between 1 and 80) will be used to locate the initial sampling point. The first number determines the distance to travel into the coupe in a northerly or southerly direction (depending on the starting location) and the second number will be used to determine the distance to be travelled into the coupe in an easterly or westerly direction (again, depending on the starting location). The first stocking assessment will be conducted at this point. Random numbers will then be used to determine the distance to be walked north/south and east/west to the second sampling point and so on.

When a coupe boundary is reached through this process, the auditor will use the opposite direction (e.g. south if they were previously heading north) to ensure sampling is conducted within the coupe. A schematic of the approach is given in **Figure 1**.

Each auditor will assess stocking on up to 25 points per coupe. On coupes smaller than 10 ha, the number of sampling points would be reduced to 15 per auditor or 30 overall.

A table of random numbers is provided in Annex 2 to this Workbook.

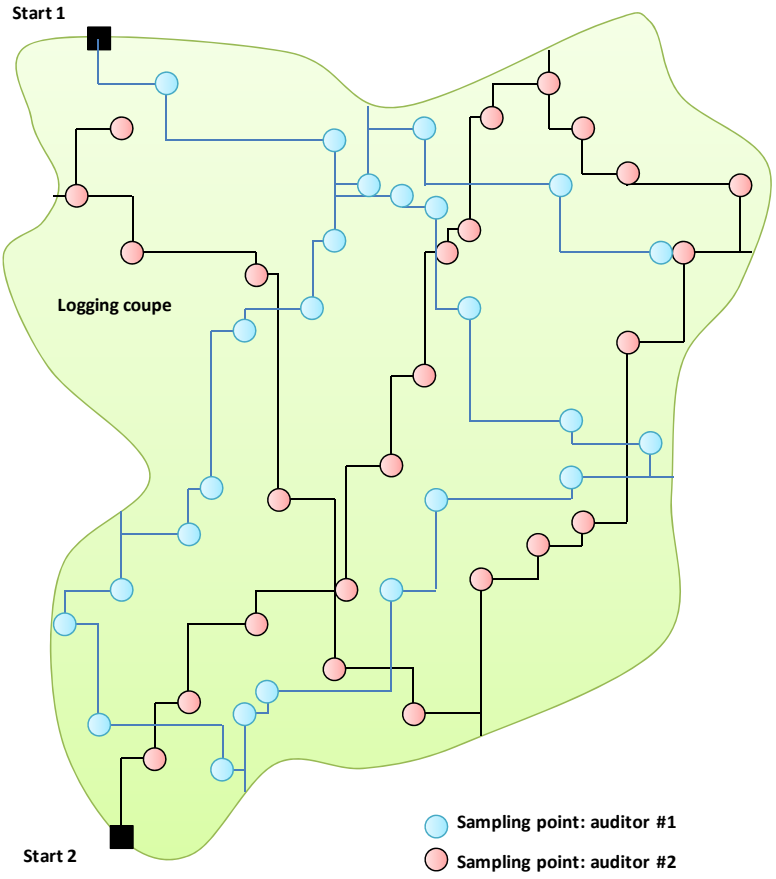

Figure 1 Schematic of random sampling design for field audit of regeneration coupes.

Following the assessment, the average stocking rate for the coupe is calculated, as is the 90% confidence interval (using **Equation 1**). Stocking will be considered to be acceptable if average stocking rate + the 90% confidence interval is equal to or greater than 65% (the acceptable stocking rate for the standard stocking survey).

Eq 1 90% confidence interval for mean stocking rate = $1.66 \sqrt{[A (1 – A) / B]}$ where:

A is the proportion of stocked plots (number of stocked plots / number of productive plots); and

B is the number of productive plots.

Field assessment of thinning coupes

The method used for the field assessment of thinning coupes follows that described in NFSG #13 and 14, with the exception that a maximum of 12 plots will be assessed per coupe, rather than three per 6 ha as prescribed.

Stocking assessments are recorded using field record sheets (**Table 10**) based on those included in NFSG # 13. An overall assessment of whether the coupe meets with stocking standards from NFSG #13 or 14 and details of any non-conformance is provided in the comments box.

Criteria used to assess damage to retained trees are provided in Annex 1.

Table 6 Field survey sheet for regeneration coupe stocking field audit: even-aged coupe

						Page		Of			
Coupe address							Area		ha		
Auditor							Date				
Species required											
>10 present											
# unstocked area >1 ha observed?											

Coordinates of sampling point						
N-S	E-W	Plot #	Stocking	Seed bed	Species	Comments
		1				
		2				
		3				
		4				
		5				
		6				
		7				
		8				
		9				
		10				
		11				
		12				
		13				
		14				
		15				
		16				
		17				
		18				
		19				
		20				
		21				
		22				
		23				
		24				
		25				

Stocking: Stocked with acceptable seedling – S; Unstocked or no acceptable seedling – N
Seedbed: Non-productive area – N; Soil damaged – D; Colonised – C; Slash, litter or debris – L

Table 7 Summary sheet for regeneration coupe stocking field audit: even-aged coupes

FMA				District						
Coupe address								Area		ha
Auditors								Date		
Species required										
>10 present										
# unstocked area >1 ha observed?										
Total # plots				Total # productive plots						
Total # stocked plots				% productive plots stocked				95% confidence interval		
Comments:										

Table 8 Field survey sheet for regeneration coupe stocking field audit: uneven-aged coupe

					Page		Of		
Coupe address						Area		ha	
Auditor						Date			
Species required									
>10 present									
# unstocked area >2 ha observed?			BAF		RBA		RBA×0.3		

Sampling point coordinates			Angle sweep				Fixed plots				
N-S	E-W	Plot #	Merch or potential merch	Non-merch	Total BA	BA Stocking	Sapling/ coppice	Seedling	Stocking status	Seedbed	Comments
		1									
		2									
		3									
		4									
		5									
		6									
		7									
		8									
		9									
		10									
		11									
		12									
		13									
		14									
		15									
		16									
		17									

Sampling point coordinates			Angle sweep				Fixed plots				
N-S	E-W	Plot #	Merch or potential merch	Non-merch	Total BA	BA Stocking	Sapling/ coppice	Seedling	Stocking status	Seedbed	Comments
		18									
		19									
		20									
		21									
		22									
		23									
		24									
		25									

Stocking status: Stocked by basal area – B; stocked by fixed plots – R; Unstocked – X

Seedbed: Receptive – R; Non-productive – N; Soil damaged – D; Colonised – C; Slash, litter or debris – L

Merch – merchantable: BA – Basal area; RBA – Reference basal area of coupe; BAF – Basal area factor of device used for angle sweep.

Table 9 Summary sheet for regeneration coupe stocking field audit: uneven-aged coupes

FMA				District						
Coupe address								Area		ha
Auditors								Date		
Species required										
>10 present										
# unstocked area >2 ha observed?										
Total # plots				Total # productive plots						
Total # stocked plots				% productive plots stocked				95% confidence interval		
Comments:										

Table 10 Field audit sheet for thinning coupes

Coupe address				Date				Auditors			
Slope & terrain						Pre-thinning BA					
Transect #				Transect #				Transect #			
Transect length		Transect width		Transect length		Transect width		Transect length		Transect width	
		Damage				Damage				Damage	
Species	DBH (cm)	Bole	Crown	Species	DBH (cm)	Bole	Crown	Species	DBH (cm)	Bole	Crown
Basal areas				Basal area				Basal area			
Bay widths				Bay width				Bay width			
Outrow widths				Outrow width				Outrow width			
% damaged trees				% damaged trees				% damaged trees			
Crop trees/ha				Crop trees/ha				Crop trees/ha			
BA (m^2/ha)				BA (m^2/ha)				BA (m^2/ha)			
Average bay width				Average bay width				Average bay width			
Average outrow width				Average outrow width				Average outrow width			
Average on 6 ha											
% damage				BA				Trees/ha			
Bay width				Outrow width							
Comments:											

General notes:

Mandatory actions and legal requirements:

Mandatory actions and other legal requirements specified in the Code of Practice for Timber Production (2007) form the mandatory compliance elements of the audit.

Guidance:

The Code of Practice for Timber Production (2007) also includes guidance elements that have been used here to define audit criteria. Guidance elements of the Code are not mandated, but are recommended practice in most situations.

Key operational goals

2.3.1 Regeneration: Harvested native forest is managed to ensure that the forest is regenerated and the biodiversity of the native forest is perpetuated. The natural floristic composition and representative gene pools are maintained when regenerating native forests by using appropriate seed sources and mixes of dominant species.

2.3.2 Stocking assessment and remedial treatment Stocking and early seedling growth is monitored and remedial action is taken where necessary to successfully regenerate harvested areas of native forests.

2.1.3 Forest Coupe Plans: A Forest Coupe Plan, which specifies operational requirements, is prepared in accordance with this Code prior to the commencement of each timber harvesting operation

2.5.2 Coupe infrastructure: Timber harvesting is conducted in a manner appropriate to the site, and manages the impact on soil, water and other values, including biodiversity and cultural heritage.

Annex 1: Coupe stocking specifications

NFSGs (#10 for regeneration coupes; #13 for thinning coupes in ash forests; #14 for thinning coupes in mixed species forests) provide specifications of acceptable stocking rates and coupe conditions prior to finalisation. This information is summarised below.

Even-aged silvicultural systems - stocking requirements:

Acceptable stocking, based on stocking survey methodologies outlined in NFSG #10 are:

- minimum 65% of plots on potentially productive coupe area are stocked using a standard plot intensity (80m x 20m);
- minimum 55% of plots on potentially productive coupe area are stocked using an intensive survey (40m x 20m); and
- minimum 75% of plots on potentially productive coupe area are stocked using an extensive survey (100m x 30m).

Additional stocking requirements include:

- a minimum of 10 acceptable plants of each species originally found on the coupe; and
- no unstocked areas greater than 1 ha in area.

Uneven-aged silvicultural systems - stocking requirements:

Acceptable stocking, based on stocking survey methodologies outlined in NFSG #10 are:

- minimum 75% of plots on potentially productive coupe area are stocked (standard plot intensity); and
- minimum 65% of plots on potentially productive coupe area are stocked (intensive survey).

Additional stocking requirements include:

- a minimum of 10 acceptable plants of each species originally found on the coupe;
- no unstocked areas greater than 2 ha in area; and
- basal area of non-merchantable trees should not exceed 5-7% of the reference basal area (RBA).

Definition of acceptable seedlings for stocking survey

An acceptable seedling, as defined in NFSG #10 is:

- species: native to that forest type;
- vigour: must have a healthy, vigorous growing tip. If damage has occurred to the growing tip, the surveyor must judge, based on local knowledge and experience, whether the plant is likely to recover apical dominance;
- origin: seedlings, lignotubers, and coppice (of all species) are acceptable. For coppice, the base of the stem must be within 20 cm of ground level, and likely to remain attached to the stump;
- stem damage: must be free of severe damage to the cambium (e.g. frost kill, insect attack, or rubbing on logging slash) and have a clear path for future growth; and
- height and competitive position: at least 40 cm tall, and should be above any competing understorey. Healthy seedlings in an intermediate position may be tallied where field experience has demonstrated that they will outgrow their competitors. Suppressed seedlings, where understorey, grass or bracken competition is strong, should not be included.

If a plot contains at least one acceptable seedling it is classified as stocked and entered as such (S) on the field sheet (**Table 6** or **Table 8** for even-aged and uneven-aged coupes, respectively). *Care must be taken to ensure that seedlings close to the boundary of the plot actually are in the plot.* If no acceptable seedlings are located within the plot, it is classified as unstocked (enter X in the field sheet).

Seedbed classification

The seedbed of unstocked plots is classified for all unstocked plots according to criteria from NFSG #10. If the plot has the potential to support eucalypt growth, either in its present state or with extra site preparation, a seedbed assessment should be made as follows:

- the plot is classified as receptive (R) if at least 50% of the area is uncompacted, exposed mineral earth or ashbed;
- if less than 50% of the plot is receptive, the reason should be recorded as either:
  - soil compacted or damaged in some other way (D);
  - colonised by non-eucalypts (C); or
  - covered by slash/litter/debris (L);
- if the plot has no potential, in its present state, for successful eucalypt establishment and growth, or is reserved from further seedbed preparation, it should be classed as non-productive (N) and the reasons noted in the 'Comments' section. Examples of non-productive areas include major rock outcrops, internal roading (excluding snig tracks), filter strips, retained understorey 'islands', and permanently saturated zones.

Thinning coupe stocking requirements

Stocking requirements differ between Ash and mixed species forests.

Coupes in Ash forests (NFSG #13):

- not more than 50% of the live basal area is to be removed;
- retained basal area of regrowth trees (not including live overwood) in stands of:
  - age 14-20 years is ≥ 17 m^2/ha;
  - age 21-30 years is ≥ 20 m^2/ha;
  - age 31-35 years is ≥ 23 m^2/ha;
  - age 36-40 years is ≥ 28 m^2/ha;
  - age 41 years and greater is ≥ 32 m^2/ha;
- on slopes ≤15°, average outrow width does not exceed 4.5 m (7 m for 1939 Ash) and average bay width is a minimum 14 metres (20 metres for 1939 Ash);
- on slopes >15°, outrow width does not exceed 4.5 m and bay width is a minimum 12 m;
- not more than 15% of retained crop trees have damage to boles and/or crowns;
- dominant and co-dominant trees are retained unless on defined outrows or extraction tracks;
- species composition is similar to that prior to thinning .

Coupes in mixed species forests (NFSG #14):

- not more than 50% of the live basal area is to be removed and retained basal area for regrowth crop trees (not including live overwood) in stands of:
  - age 20-24 years is ≥ 17 m^2/ha;
  - age 25-34 years is ≥ 21 m^2/ha;
  - age 35 years and greater is ≥ 25 m^2/ha;
- in natural regrowth areas, outrows are a maximum of 4.5 m and bays are a minimum width of 12 m, unless uniform thinning has been adopted;
- not more than 15% of retained crop trees have damage to boles and/or crowns;
- dominant and co-dominant trees are retained unless on defined outrows or extraction tracks; and
- species composition is similar to that prior to thinning.

Assessment of damage from thinning activities (based on NFSG #13 and #14)

During thinning operations, damage to retained trees may be caused if trees being felled or processed, hit or brush against the bark of retained trees. Damage can also be caused by machinery contacting trees. Damage inflicted by the current operation must be restricted to no more than an average of 15% of retained 'crop' trees (those that contain or are likely in the future to contain merchantable timber) as assessed for each coupe.

Damage is defined as:

- breakage or splitting of the bark-wood bond of any size anywhere on the main bole, whether bark is removed or not;
- severe impact on bole (bark-wood bond breakage not apparent), as indicated by bad bruising or rubbing of the inner bark (only 20% of any such trees on a transect counted); or
- breakage or removal of 30% or more of the original crown.

Annex 2 Random number table

7	77	50	11	2	38	74	33	70	48	34	72
67	44	48	33	48	44	46	30	18	53	32	76
38	7	29	76	73	65	45	49	42	26	2	37
50	76	76	73	1	32	13	50	34	65	36	63
34	65	46	44	27	58	45	54	45	71	12	2
10	29	37	41	64	75	24	8	59	70	76	49
33	71	59	26	34	69	70	63	51	8	48	31
13	64	56	43	52	78	50	40	52	58	32	6
15	52	64	6	57	59	35	55	69	36	50	3
59	29	4	64	28	39	55	25	61	43	44	13
61	56	69	13	37	65	67	32	29	79	70	68
5	68	33	49	72	24	3	21	51	48	48	68
47	10	39	65	73	16	56	54	21	13	3	66
66	32	59	64	57	2	69	41	56	33	31	16
2	75	79	70	25	2	24	4	8	74	73	77
21	2	58	29	71	70	3	35	13	26	32	65
50	42	34	52	27	60	22	21	61	43	49	54
77	64	80	50	68	3	40	58	48	57	6	37
14	49	40	70	12	59	37	42	6	25	79	49
15	27	43	64	34	36	75	11	52	43	33	47
43	13	30	46	54	13	45	36	59	60	15	42
48	43	26	23	35	13	5	64	77	30	44	51
48	18	27	15	56	71	51	67	79	47	30	78
18	71	37	73	77	68	8	76	30	29	54	32
50	8	63	11	68	63	12	68	74	6	49	16
64	11	39	63	39	46	35	9	4	11	53	48
40	75	2	66	43	2	61	19	47	44	27	71
55	73	6	20	55	28	20	76	61	15	33	3
49	61	40	14	7	37	58	21	12	2	45	62
68	52	16	64	53	57	72	38	43	62	22	7
50	56	73	55	67	33	28	8	32	17	15	7
39	52	67	10	43	41	1	37	17	25	8	35
78	54	26	62	33	66	43	45	72	73	57	78
2	28	45	74	38	7	59	35	42	63	71	49
62	76	48	59	27	12	58	38	34	80	64	64
13	56	18	20	8	1	22	31	72	60	33	40
47	36	71	76	34	27	57	10	6	44	29	17
39	12	28	10	8	68	62	37	28	71	36	52
4	9	46	68	40	50	76	33	65	42	41	8
24	20	37	76	49	11	38	49	31	45	15	23
31	36	23	71	13	11	62	37	70	21	58	65
49	25	80	35	77	43	29	44	34	77	13	28
31	4	16	53	29	14	63	39	45	29	11	28
30	8	68	35	73	70	57	46	63	15	34	38
23	1	59	56	20	1	40	27	8	64	9	25
15	7	30	67	56	19	75	5	13	37	57	9
38	18	65	13	65	50	2	38	53	28	38	1
55	70	43	69	73	54	24	42	8	61	21	46
13	63	54	62	33	36	35	77	12	38	79	10
5	18	42	54	12	28	11	79	28	53	11	36
26	46	39	32	77	28	7	55	9	24	29	46
67	28	34	36	80	41	39	65	13	20	72	9
8	40	42	8	68	47	35	32	50	71	20	14
29	25	68	18	44	60	47	53	73	80	77	11
14	27	25	25	5	26	49	8	56	56	60	15
79	53	4	47	11	40	76	51	79	51	51	48
6	20	12	74	35	5	3	17	30	24	72	43
31	61	4	64	62	43	60	45	21	52	49	70
46	32	41	55	57	8	60	38	19	5	75	41
36	8	73	15	2	11	65	59	50	63	28	19

Appendix B: DSE 2007 Risk management framework

DSE's *Strategic Risk Management Framework* (2007) provides descriptors for consequence, likelihood and level of risk that may be used in assessing risk of harm to the environment from non-compliance with audit criteria derived from the Code and NFSGs. They are applied in a conventional risk assessment and management framework based on AS/NZS ISO 31000:2009.

Consequence descriptors

Two consequence descriptor scales from the risk management framework are relevant to this assessment of risk of harm to the environment from activities associated with coupe regeneration and finalisation, as follows:

	Very serious (5)	Serious (4)	Moderate (3)	Minor (2)	Insignificant (1)
Environmental	Regional scale (>100 km2). Long term/permanent impact. Species extinction may occur	Large scale (10-100 km2). Long term (decades) impact. Serious reduction in animal/plant populations may occur	Medium scale (1-10km2). Medium term (years) impact. Some reduction in animal/plant populations may occur	Localised (<1km2). Short term (weeks) impact. No long-term reduction in animal/plant populations	Localised (immediate area). Temporary impact (days)
Reputation	Serious public or media outcry (International or national coverage)	Significant adverse attention by media, public, or NGO (State based)	Media attention of local concern	Minor, adverse local public or media attention or complaints	

Likelihood descriptors

Likelihood is described on a five point scale, as follows:

5. Almost certain
4. Likely
3. 50/50
2. Unlikely
1. Rare

As per standard risk processes, likelihood pertains to the likelihood of the assessed level of consequence occurring.

Overall risk rating

The overall risk rating reflects the combination of consequence and likelihood assessments, as per the following table.

	Consequence				
Likelihood	*Insignificant (1)*	*Minor (2)*	*Moderate (3)*	*Serious (4)*	*Very serious (5)*
Almost certain (5)	Low	Medium	High	High	High
Likely (4)	Low	Medium	High	High	High
50/50 (3)	Low	Low	Medium	High	High
Unlikely (2)	Low	Low	Medium	Medium	High
Rare (1)	Low	Low	Low	Low	Medium

Appendix C: Revised FAP Module 7 and workbooks

This appendix contains the final revised version of Module 7 and its workbooks. It is the version that is recommended for use in any future audits of Coupe regeneration and finalisation.

CONTENTS

Document and Version Control

Title	Forest Audit Program Toolbox – Module 7
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Revision History

Date	Reviewer	Summary of changes	Replaces
18/1/2012		Full revision of coupe regeneration and finalisation audit procedures. Audit scope confined to finalisation of regeneration and thinning coupes and draws on VicForests' regeneration surveys	Version 1.0
30/7/2012		Revisions to methodology based on application of module in 2011-12 FAP	Version 2.0

Module 1
Overview

Module 2
Audit Process

Module 3
Tactical Planning

Module 4
Operational Planning

Module 5
Harvesting and Closure

Module 6
Harvesting Performance

Module 7
Regeneration and Finalisation

1 MODULE 7 – REGENERATION AND FINALISATION

1.1 INTRODUCTION

Regeneration of native forest following completion of harvesting is an important part of the forest lifecycle and critical to achieving the environmental outcomes envisaged by the timber production regulatory framework.

Regeneration involves the use of techniques to provide suitable soil conditions for the establishment and growth of vegetation existing on the site prior to harvesting, and may encompass aerial or hand sowing of seed, or the planting of seedlings or other growing stock to establish new vegetation in harvested areas.

The method used for regeneration may change in consideration of the total area involved, the resources available, the characteristics of the site and seasonal conditions. The species composition of the regeneration stock is also of importance and will be determined in response to the management objectives and characteristics of each site.

Finalisation is the process of confirming that regeneration of a harvested coupe is adequate in relation to the conditions that were put in place as part of the approval process for the commercial timber harvesting operation. In the case of VicForests, finalisation is undertaken prior to the Department of Sustainability and Environment (DSE) resuming management responsibilities for sections of State forest that were vested to VicForests through the Allocation Order process.

1.2 OBJECTIVE OF MODULE 7

The objective of this module is to assess whether forest regeneration and finalisation processes, required after commercial timber harvesting and thinning operations in State forests have ceased, have been conducted to achieve sustainable forest management and are in accordance with relevant legislation and regulations.

Results of the audit are used in decisions by DSE to accept or reject harvest or thinning coupes nominated by VicForests for finalisation.

1.3 SCOPE OF MODULE 7

Module 7 – Regeneration and Finalisation aims to provide users with the necessary information and tools to enable an audit of coupe finalisation activities including:

- coupe regeneration;
- post-harvest or thinning stocking assessment; and
- rehabilitation of coupe infrastructure.

Due to the time interval between harvesting and the requirements for various regeneration processes, some compliance sub-elements (i.e. pest control, seed bed preparation) may also be audited within Module 5 – Harvesting and Closure.

Specifically excluded from the scope of Module 7 – Regeneration and Finalisation is the audit of:

- silvicultural practices conducted in State forests that are not associated with commercial timber production (i.e. fire recovery silviculture and ecological thinning);
- seed source, collection, storing and cleaning undertaken prior to sowing seed beds; and
- seed crop monitoring.

1.4 STRUCTURE OF MODULE

Module 7 – Regeneration and Finalisation includes:

- *Chapter 1 Introduction*: provides an introduction to the scope, objectives and structure of the audit module as part of the Forest Audit Program;
- *Chapter 2 Compliance Elements*: provides a list of elements suitable for inclusion in the annual Forest Audit Program as part of regeneration and finalisation;
- *Chapter 3 Audit Approach and Tools*: provides a preferred audit approach and methodology and refers to the use of supporting tools, including the Audit Workbooks; and
- *Chapter 4 References*: provides a description of the key regulatory documents supporting each of the Workbooks.

2 COMPLIANCE ELEMENTS

The compliance elements associated with *Module 7 – Regeneration and Finalisation* coupe regeneration or stocking and the methods used to assess this.

2.1 STOCKING ASSESSMENT

Stocking and early seedling growth on harvested coupes that have been regenerated must be assessed within three years of treatment. The assessment is undertaken to determine whether regeneration has been successful and, if necessary, to guide remedial action to ensure successful regeneration.

Post-harvest stocking is also assessed in coupes subject to thinning. These assessments are undertaken to ensure thinning complies with management standards and address any excessive damage to retained stems.

VicForests undertakes stocking and post-thinning assessments in all regeneration and thinning coupes that have been nominated for finalisation, except those that have been burnt in a wildfire following site establishment or thinning.

This compliance element considers the appropriateness of survey methods used to assess stocking, the adequacy of the data provided and the accuracy of its reporting back to DSE.

2.2 COUPE REGENERATION OR STOCKING

Unless required for another authorised purpose, all harvest coupes in State forest in Victoria must be regenerated to approximately the same species composition that was present prior to harvesting.

Following harvesting, coupes are managed to ensure that the forest is regenerated and that the production of timber and other ecosystem goods and services is maintained. Regeneration standards require that vegetation composition is maintained when regenerating native forests by using appropriate seed sources and a mixture of dominant species.

Where fire is used in regeneration operations, all practicable measures must be taken to protect all areas that were not harvested from the impacts of fire. Weeds and browsing animals may also need to be managed at this time to ensure successful regeneration.

Thinning operations are conducted in some forest types to enhance the quality and growth of retained trees. Standards have been developed to ensure stands are thinned to an appropriate residual stocking rate, to contain damage to retained stems and ensure the original species composition is approximately maintained.

This compliance element considers the outcomes of coupe regeneration activities and thinning operations in terms of stand composition, stocking, damaged to retained trees (in thinning coupes), rehabilitation of coupe infrastructure and the management of weeds and browsing animal impacts.

3 AUDIT APPROACH AND TOOLS

An audit of regeneration and finalisation compliance elements will require:

- sourcing of relevant information and evidence;
- desktop audit;
- field audit; and
- completion of audit Workbooks.

This audit makes extensive use of stocking (or regeneration) and post-thinning surveys undertaken by VicForests. These surveys are conducted for all coupes nominated for finalisation. Given the comprehensiveness of these surveys, this audit includes only a limited program of field work.

3.1 SUPPORTING DOCUMENTATION

Module 1 – Overview, and Module 2 – Audit Process should be read in conjunction with this module.

Module 2 outlines a method for selecting audit targets, assessing risk and guidelines for preparing an audit report. This approach predated this revision to Module 7 and has now been superseded by the approaches outlined in section 3.5 of this module.

3.2 SOURCING INFORMATION

Information should be collected through interviews, examination of Forest Coupe Plans and other hard copy or digital records, review of data from VicForests stocking surveys and observation of regeneration and coupe finalisation activities. Instances of non-conformity against the specified audit criteria should be recorded.

Information gathered through interviews should be verified by acquiring supporting information from independent sources where possible, such as observations, records and results of existing activities or measurements.

The following list outlines information that may be requested in order to complete an audit under Module 7:

- list of coupes submitted by VicForests for finalisation and hand back to DSE;
- Forest Couple Plan for each coupe selected for field audit;
- complete and current records of regeneration progress;
- records from stocking and post-thinning surveys;
- relevant maps and aerial photographs;
- pre and post harvest basal area and species composition;
- harvest records;
- instances of non-conformity;
- planning and execution of regeneration burns;

- reports on weed and browsing animal management activities; and
- relevant intra- and inter- agency correspondence.

3.3 DESKTOP ASSESSMENT

The desk-based component of the audit program includes the assessment of VicForests regeneration and stocking survey results and their conformance with Native Forest Silviculture Guidelines (NFSGs; which are subordinate documents to the Code of Practice for Timber Production [the Code]). The target selection methods for the desk top assessment are outlined in section 3.5.

The procedures for the desk-based assessment should include:

- examination and review of legislative requirements, management prescriptions and procedures relating to the conduct of regeneration and coupe finalisation activities as they relate to the compliance elements;
- review of regeneration processes against the requirements of relevant NFSGs; and
- review of stocking and other relevant data captured during field surveys conducted by or for VicForests;

Forest Coupe Plans and coupe files for coupes included in the field assessment component of the audit will be reviewed at the time of the field assessment.

The desktop assessment component of the audit comprises a review of summary information from all coupes nominated for finalisation and hand back to check that they meet stocking or other specifications from the NFSGs (# 10, 13 and 14).

3.4 FIELD ASSESSMENT

The field-based component of the audit program includes the assessment of regeneration success in selected regeneration and thinning coupes that have been nominated by VicForests for finalisation.

Activities to be undertaken during the field audit may include:

- a short briefing in each Forest Management Area (FMA) at the start of the field program to introduce the audit team and outline the audit process to the auditee's representatives and other interested forestry staff from the district;
- recording the assessment in the relevant audit workbooks;
- reviewing shape files and a map of each coupe visited;
- reviewing coupe files, including Forest Coupe Plans, remedial treatment plans, regeneration burn plans, coupe diaries, as well as relevant records on digital information systems;
- conducting interviews, where appropriate, with DSE, VicForests and operator managerial and technical staff;

- debriefing with the operational staff at the conclusion of the field program in each FMA/OA, to provide a preliminary assessment of coupe compliance and summarise any identified issues.

The field assessment component of the audit has three main parts, as follows:

- **Part A: Assessment of stocking and post-thinning surveys** – this audit component is intended to confirm whether the summary information provided by VicForests during the finalisation process is consistent with the base information and whether stocking and other attributes meet specifications contained in relevant NFSGs.

- **Part B: Assessment of compliance against the Code** – based on coupe records, compliance of coupe regeneration and finalisation with Code requirements is assessed. This part of the audit mostly addresses regeneration coupes, as the Code does not specifically address issues associated with finalisation of thinning coupes. Most elements are based on information held in coupe files or digital information systems. Some elements must be assessed in the field.

- **Part C: Field assessment of regeneration and coupe stocking** – this audit component requires a limited program of stocking assessment in regeneration and thinning coupes that have been proposed for finalisation.

The target selection method for the field assessment component of this Module 7 is outlined in section 3.5.2.

3.5 AUDIT TARGET SELECTION

3.5.1 Desktop assessment

The desktop review of coupe data includes all coupes nominated by VicForests for finalisation and hand back.

3.5.2 Field assessment

The number of coupes included in this component is likely to be limited by resources available for the field component. A minimum of 10% of coupes in a selection of FMAs will be audited in any one year. It is recommended that the FMA with the largest proportion of coupes nominated for finalisation be a priority for field auditing and that one or two other FMAs with significant numbers of coupe nominated for finalisation also be included in the field audit program.

Where the field assessment for regeneration coupes shows that stocking does not meet the standard required (i.e. stocking rate + the 90% confidence interval is less than 65%; see Workbook 7B), the coupe will be resurveyed using the grid-based sampling design of NFSG #10 and the sampling intensity used by VicForests.

3.6 AUDIT WORKBOOKS

This module is supported by two audit workbooks for each compliance element, which are included as Annexures A and B. The Audit Workbooks outline the audit criteria,

relevant prescription(s), and provide detailed instruction on audit protocol guides. They include:

- Workbook 7A: Desktop analysis; and
- Workbook 7B: Field assessment.

Each of these workbooks outline the audit criteria, associated regulatory and management prescriptions, audit protocol guides and audit methodologies, where relevant.

Auditors should record audit information and findings in the Audit Workbooks along with supporting evidence and information. Audit findings should then be collated and presented in an audit report prepared in accordance with the requirements outlined in Module 2.

4 REFERENCES

Relevant references to this module include the following.

Legislation, policy and Codes of Practice

Catchment and Land Protection Act 1994

Code of Forest Practice for Timber Production, Department of Sustainability and Environment, 2007

Code of Practice for Fire Management on Public Land, Department of Sustainability and Environment, 2006

Conservation, Forest and Lands Act 1987

Environmental Protection Act 1970

Flora and Fauna Guarantee Act 1988 (FFG Act)

Sustainability Charter for Victoria's State Forests, Department of Sustainability and Environment, 2007

Sustainable Forests (Timber Harvesting) Regulations 2006

Sustainable Forests (Timber) Act 2004

Wildlife Act 1975

Guidelines and management procedures

Management Procedures for Timber Harvesting, Reading and Regeneration in Victoria's State Forests, Department of Sustainability and Environment, Victoria, 2009.

Monitoring Annual Harvesting Performance in Victoria's State Forest, Department of Sustainability and Environment, 2008.

NFSG #1 -Native Forest Silviculture Guideline No.1, Seed Crop Monitoring and Assessment, Department of Conservation and Natural Resources, 1993.

NFSG #2 - Native Forest Silviculture Guideline No.2, Eucalypt Seed Collection, Department of Conservation and Natural Resources, 1994.

NFSG #3 - Native Forest Silviculture Guideline No.3, Seed Extraction, Cleaning and Storage, Department of Conservation and Natural Resources, 1994.

NFSG #4 - Native Forest Silviculture Guideline No.4, Eucalypt Seed Sampling and Testing, Department of Conservation and Natural Resources, 1995.

NFSG #5 - Native Forest Silviculture Guideline No.5, Eucalypt Seed Coating, Department of Natural Resources and Environment, 2001.

NFSG #6 - Native Forest Silviculture Guideline No.6, Site Preparation, Department of Natural Resources and Environment, 1998.

NFSG #7 - Native Forest Silviculture Guideline No. 7, Browsing Management, Department of Sustainability and Environment, Victoria, 2005.

NFSG #8 - Native Forest Silviculture Guideline No.8, Eucalypt Sowing and Seedfall, Department of Natural Resources and Environment, 2001.

NFSG #9 - Native Forest Silviculture Guideline No.9, Eucalypt Planting, Department of Conservation and Natural Resources, 1993.

NFSG #10- Native Forest Silviculture Guideline No.10, Eucalypt Stocking Surveys, Department of Natural Resources and Environment, 1997.

NFSG #13- Native Forest Silviculture Guideline No.13, Thinning of Ash Eucalypt Regrowth, Department of Sustainability and Environment, Victoria, 2006.

NFSG #14- Native Forest Silviculture Guideline No.14, Thinning of Mixed Species Regrowth, Department of Sustainability and Environment, Victoria, 2006.

Management plans and prescriptions

Fire Salvage Harvesting Prescriptions 2009, Department of Sustainability and Environment, Victoria, 2009.

Forest Management Plan for the Central Highlands, Department of Natural Resources and Environment, 1998.

Forest Management Plan for East Gippsland, Department of Natural Resources and Environment, 1995.

Forest Management Plan for the Floodplain State Forests of the Mildura Forest Management Area, Department of Sustainability and Environment, Victoria, 2004.

Forest Management Plan for Gippsland, Department of Sustainability and Environment, Victoria, 2004.

Forest Management Plan for the Mid-Murray Forest Management Area, Department of Natural Resources and Environment, Victoria, 2002.

Forest Management Plan for the Midlands Forest Management Area, Department of Natural
Resources and Environment, Victoria, 1996.

Forest Management Plan for the North East Forest Management Area, Department of Natural Resources and Environment, Victoria, 2001.

Forest Management Plan for the Otway Forest Management Area, Department of Conservation and Environment, Victoria, 1992.

Management Prescriptions for Timber Production and Other Forest Uses, Gippsland Region, Department of Natural Resources and Environment, Victoria, 1998.

Management Procedures for Timber Harvesting and Associated Activities in State Forests in Victoria, Department of Sustainability and Environment, Victoria, 2009.

Prescriptions For the Management of Harvesting and Regeneration in Native Forests, Central Forest Management Area, Department of Sustainability and Environment, Victoria, 2002.

Other references

Action Statements for Communities of Flora and Fauna

Action Statements for Potentially Threatening Processes

Rainforests and Cool Temperate Mixed Forests of Victoria, Flora and Fauna Programme, 1999.

Road Management Agreement, Department of Sustainability and Environment, Victoria, 2008

Silviculture Reference Manual No. 1 - Mountain Ash in Victoria's State Forests, Department of Sustainability and Environment, Victoria, 2007.

Silviculture Reference Manual No. 2 - High Elevation Mixed Species in Victoria's State Forests, Department of Sustainability and Environment, Victoria, 2009.

Silviculture Reference Manual No. 3 - Low Elevation Mixed Species in Victoria's State Forests, Department of Sustainability and Environment, Victoria, 2010.

Annexures A – B

Annex A

Workbook 7A: Desktop Assessment

Annex B

Workbook 7B: Field Assessment

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Module 7 Regeneration and Finalisation

Workbook 7A: Desktop analysis of VicForests' assessments of regeneration and thinning coupe stocking and their conformance with Native Forest Silviculture Guideline standards

Summary Page

Positive observations:	Non-compliances identified and acted on by DSE / VicForests in their supervisor capacity (include contractor penalties allocated)
•	•
Summary of non-compliance and/or potential risk of harm to the environment:	
•	
Areas for improvement:	Further evidence required:
•	•

Auditors:		Date of audit:	

Previous Key Audit Findings

What key findings were observed during any previous desktop analysis of VicForests' assessments of coupe regeneration and stocking?
The auditor will require an understanding of previous key findings in order to provide commentary on current practices and improvements over time. Comments:

Part A: Review of coupe data

Source the information listed in **Table 1** from coupe records held by VicForests. Information is required for **all** regeneration and thinning coupes being proposed for finalisation.

The information requested is used to assess compliance against the requirements of the Code of Practice for Timber Production (Code) prescriptions and subordinate documents such as the Native Forest Silviculture Guidelines (NFSGs; # 10, 13 and 14). The information required varies, depending on whether the coupes are even and/or uneven-aged logging coupes or thinning coupes.

Targets for relevant criteria (marked with * in **Table 1**) are provided in Annex 1 to this Workbook.

Once the information is obtained from VicForests the review of coupe data is completed for regeneration coupes using **Table 2** and for thinning coupes using **Table 3**. Reporting using these tables is undertaken for each FMA. Any coupes failing to meet finalisation standards are to be listed in **Table 4**. The table will be prepared for each FMA and specify the audit criteria for which the coupe failed to meet the required standard.

Where multiple established seedling surveys have been undertaken in regeneration coupes, data are required for each of the surveys (points #6,8-17)

Table 1 VicForests data request for coupe summary information

			Type of stand/coupe		
#	Criteria	Qualifier	Even-aged	Uneven-aged	Thinning
1	FMA		✓	✓	✓
2	District		✓	✓	✓
3	Coupe address		✓	✓	✓
4	Forest type		✓	✓	✓
5	Silvicultural system		✓	✓	✓
6	Area (ha)		✓	✓	✓
7	Date sown/planted/thinned		✓	✓	✓
8	Date of survey		✓	✓	✓
9	Stocking survey intensity		✓	✓	
10	Target stocking rate		✓	✓	
11	# stocked plots (S)		✓	✓	
12	# non-productive plots (N)		✓	✓	
13	Total # plots (T)		✓	✓	
14	% productive plots stocked*		✓	✓	
15	Species originally present		✓	✓	
16	# individuals found of each of above species	≥10 or <10	✓	✓	

#	Criteria	Qualifier	Type of stand/coupe		
			Even-aged	Uneven-aged	Thinning
17	Coupe has unstocked areas greater than target	1 ha for even-aged or 2 ha for uneven-aged stands	✓	✓	
18	Weed presence at time of stocking survey	As per coupe hand back spreadsheet	✓	✓	
19	Browsing intensity	As per coupe hand back spreadsheet	✓	✓	
20	Basal area of retained trees (m^2/ha)*	Non-merchantable		✓	
21	Age of stand				✓
22	Average coupe slope				
23	Average thinning damage*				✓
24	Average outrow width*				✓
25	Average bay width*				✓
26	Pre-harvest basal area				✓
27	Post-harvest basal area*				✓
28	Retained regrowth basal area*				✓
29	Dominant and co-dominant trees retained*	Confirmation that dominant/co-dominant trees retained except on outrows and extraction tracks			✓
30	Pre-thinning species composition	Species present in pre-thinning survey			✓
31	Post-thinning species composition	Species identified during post-thinning survey			✓

Note: Shading in type of stand/coupe cells indicates that data is not required. A tick indicates that data is required.

Information from the review of coupe records is collated for each FMA using **Table 2** (for regeneration coupes) and **Table 3** (for thinning coupes).

Table 2 Summary of coupe assessments: regeneration coupes

FMA						
Forest type	**#1**	**#2**	**#3**	**#4**	**#5**	
Criteria	**<FT1>**	**<FT2>**	**<FT3>**	**<FT4>**	**<FT5>**	**Comments**
Total # coupes						
Total area of coupes (ha)						
# coupes where regeneration first assessed> 3 years after treatment						
# coupes with stocking of productive plots < target %						
# coupes with unstocked areas exceeding target						
# coupes with inadequate species representation						
# coupes with widespread weed infestations at regeneration survey						
# coupes with > low intensity browsing						
# uneven aged coupes with non-merchantable tree basal area > target						

Other comments

Audit details:					
Auditor and audit team		**Auditees**		**Date of audit**	

Table 3 Summary of coupe assessments: thinning coupes

FMA						
Forest type	**#1**	**#2**	**#3**	**#4**	**#5**	
Criteria	**<FT1>**	**<FT2>**	**<FT3>**	**<FT4>**	**<FT5>**	**Comments**
Total # coupes						
Total area of coupes (ha)						
# coupes with basal area of retained trees < target						
# coupes with basal area of regrowth trees < target						
# coupes with outrow width > target						
# coupes with bay width < target						
# coupes with dominant and co-dominant trees inappropriately removed						
# coupes with >15% of retained trees with damage to bole or crown						

Other comments

Audit details:					
Auditor and audit team		**Auditees**		**Date of audit**	

Table 4 List of coupes failing to meet standards for audit criteria and details of non-conformance

FMA						
Coupe address	**District**	**Forest type**	**Silvicultural system**	**Coupe type[1]**	**Audit criterion**	**Details of non-conformance and associated circumstances**

1. Coupe type: even-aged regeneration (EA); uneven-aged regeneration (UEA); thinning (TH)

Other comments

Audit details:					
Auditor and audit team		**Auditees**		**Date of audit**	

Annex 1: Coupe stocking specifications

DSE's CFS and NFSGs (#10 for regeneration coupes; #13 for thinning coupes in ash eucalypt forests; #14 for thinning coupes in mixed species forests) provide specifications of acceptable stocking rates and coupe conditions prior to finalisation. This information is summarised below.

Even-aged silvicultural systems - stocking requirements:

Acceptable stocking, based on stocking survey methodologies outlined in NFSG #10 are:

- Minimum 65% of plots on potentially productive coupe area are stocked using a standard plot intensity (80m x 20m);
- Minimum 55% of plots on potentially productive coupe area are stocked using an intensive survey (40m x 20m); and
- Minimum 75% of plots on potentially productive coupe area are stocked using an extensive survey (100m x 30m).

Additional stocking requirements include:

- A minimum of 10 acceptable plants of each species originally found on the coupe
- No unstocked areas greater than 1 ha in area

Uneven-aged silvicultural systems - stocking requirements:

Acceptable stocking, based on stocking survey methodologies outlined in NFSG #10 are:

- Minimum 75% of plots on potentially productive coupe area are stocked (standard plot intensity);
- Minimum 65% of plots on potentially productive coupe area are stocked (intensive survey)

Additional stocking requirements include:

- A minimum of 10 acceptable plants of each species originally found on the coupe
- No unstocked areas greater than 2 ha in area
- Basal area of non-merchantable trees should not exceed 5-7% of the reference basal area (RBA)

Thinning coupe stocking requirements

Stocking requirements differ between Ash and mixed species forests.

Coupes in Ash forests (NFSG #13):

- Not more than 50% of the live basal area is to be removed
- Retained basal area of regrowth trees (not including live overwood) in stands of:
  - Age 14-20 years is ≥ 17 m^2/ha
  - Age 21-30 years is ≥ 20 m^2/ha
  - Age 31-35 years is ≥ 23 m^2/ha
  - Age 36-40 years is ≥ 28 m^2/ha
  - Age 41 years and greater is ≥ 32 m^2/ha
- On slopes ≤15°, average outrow width does not exceed 4.5 m (7 m for 1939 Ash) and average bay width is a minimum 14 metres (20 metres for 1939 Ash).
- On slopes >15°, outrow width does not exceed 4.5 m and bay width is a minimum 12 m
- Not more than 15% of retained crop trees have damage to boles and/or crowns
- Dominant and co-dominant trees are retained unless on defined outrows or extraction tracks.
- Species composition is similar to that prior to thinning

Coupes in mixed species forests (NFSG #14):

- Not more than 50% of the live basal area is to be removed and retained basal area for regrowth crop trees (not including live overwood) in stands of:
  - Age 20-24 years is ≥ 17 m^2/ha
  - Age 25-34 years is ≥ 21 m^2/ha
  - Age 35 years and greater is ≥ 25 m^2/ha
- In natural regrowth areas, outrows are a maximum of 4.5 m and bays are a minimum width of 12 m, unless uniform thinning has been adopted.
- Not more than 15% of retained crop trees have damage to boles and/or crowns
- Dominant and co-dominant trees are retained unless on defined outrows or extraction tracks.
- Species composition is similar to that prior to thinning

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Module 7 Regeneration and Finalisation

Workbook 7B: Field assessment of coupe regeneration and finalisation and compliance with the Code and Native Forest Silviculture Guidelines

Summary Page

Positive observations:	Non-compliances identified and acted on by DSE / VicForests in their supervisor capacity (include contractor penalties allocated)
•	•
Summary of non-compliance and/or potential risk of harm to the environment:	
•	
Areas for improvement:	Further evidence required:
•	•

Auditors:		Date of audit:	

Previous Key Audit Findings

What key findings were observed during any previous field assessments of coupe regeneration and stocking?
The auditor will require an understanding of previous key findings in order to provide commentary on current practices and improvements over time. Comments:

Part A: Assessment of stocking and post-thinning surveys

The auditor is required to conduct an assessment of stocking and post-thinning survey results for all coupes selected for the field assessment. The assessment is conducted to confirm whether the information reported in Part A of the desktop assessment and in the coupe finalisation nomination spreadsheet is accurate and that the coupe meets audit criteria drawn from relevant Native Forest Silviculture Guidelines (NFSGs).

Data from the stocking or post-thinning surveys are recovered from coupe files or other records. Details of each assessment are recorded using **Table 1** and **Table 2** (for even-aged and uneven aged regeneration coupes, respectively) and **Table 3** (for thinning coupes). Reporting is undertaken coupe by coupe. Acceptable stocking for regeneration and thinning coupes are described in Annex 1 of this Workbook.

If more than one established seedling survey (ESS) has been undertaken in the coupe, the results of all surveys should be reported. The overall coupe stocking rate is the total number of stocked plots divided by the number of productive plots, across all surveys. The only exception is where an entire coupe has been resurveyed: in that case the stocking rate for the latter survey will be the final result.

The process for selecting coupes for the field assessment is described in Module 7 of the Forest Audit Program Toolbox.

Table 1 Summary sheet for desktop audit of even-aged regeneration coupes selected for field audit

FMA:		**Coupe address:**	
District:		**Coupe area:**	ha
Forest type:		**Silvicultural system:**	

Regeneration method:		**Date sown/planted**	

From stocking survey on coupe file							**Weed abundance**	
Species required:	<Spp #1>	<Spp #2>	<Spp #3>	<Spp #4>	<Spp #5>	<Spp #6>	**Browsing animal impact**	
Are ≥ 10 individuals present?[1]							**# established seedling surveys undertaken**	

Stocking survey results: number or % of plots in each category

ESS #	Area surveyed	Date of survey	Stocked	Unstocked: receptive seedbed	Unstocked: Non-productive	Total unstocked	Total plots	% stocked receptive plots	Survey intensity	Unstocked areas >1 ha
							Overall stocking		**Stocking acceptable?**	

VicForests summary information

# unstocked areas > 1 ha:	
Coupe stocking acceptable?	

Reported results: number or % of plots in each category

Date of survey	# stocked plots	Total # plots	% plots stocked	Species present	Species with <10 individuals[1]	Unstocked area(s) > 1 ha	Widespread weed presence	Browsing > low intensity

Note: #1 Presence of at least 10 individuals of each required species on the coupe needs only be assessed once

Overall assessment			
Coupe stocking acceptable?		**Data consistent between sources?**	

Table 2 Summary sheet for desktop audit of uneven-aged regeneration coupes selected for field audit

FMA:		**Coupe address:**	
District:		**Coupe area:**	ha
Forest type:		**Silvicultural system:**	

Regeneration method:		**Date sown/planted**	

From stocking survey on coupe file							**Weed abundance**	
Species required:	<Spp #1>	<Spp #2>	<Spp #3>	<Spp #4>	<Spp #5>	<Spp #6>	**Browsing animal impact**	
Are ≥ 10 individuals present?[1]							**# established seedling surveys undertaken**	

Stocking survey results: number or % of plots in each category

ESS #	Area surveyed	Date of survey	Non-merch BA <5-7% reference BA	Stocked	Unstocked: receptive seedbed	Unstocked: Non-productive	Total unstocked	Total plots	% stocked receptive plots	Survey intensity	Unstocked areas >2 ha
								Overall stocking		**Stocking acceptable?**	

VicForests summary information

# unstocked areas > 1 ha:	
Coupe stocking acceptable?	

Reported results: number or % of plots in each category

Date of survey	# stocked plots	Total # plots	% plots stocked	Species present	Species with <10 individuals	Unstocked area(s) > 2 ha	Widespread weed presence	Browsing > low intensity	Non-merch BA ≤ 5-7% reference BA

Note: #1 Presence of at least 10 individuals of each required species on the coupe needs only be assessed once

Overall assessment			
Coupe stocking acceptable?		**Data consistent between sources?**	

Table 3 Summary sheet for desktop audit of thinning coupes selected for field audit

FMA:		**Coupe address:**			
District:		**Coupe area:**	ha	**Slope**	
Forest type:		**Silvicultural system:**			

Aged of stand		**Date thinned**	

From post-thinning survey on coupe file

Species required:	<Spp #1>	<Spp #2>	<Spp #3>	<Spp #4>	<Spp #5>	<Spp #6>	**Pre-thinning BA**	
% of trees pre-thinning							**Average slope**	
% of trees post thinning								

Post-thinning survey results:

	Average outrow width	Average bay width	% retained crop trees with damage to bole or crown	Retained regrowth BA	% live BA removed	Dominant/co-dominant trees retained where appropriate?	Age of stand	Date of survey
Target								
Actual								

VicForests summary information

Pre-thinning basal area		**Weed abundance:**		**Management action required?**	
Dominant/co-dominants retained?		**Browsing animal impact:**		**Management action required?**	

Reported survey results:

Age of stand	Slope	Species present	Ave bay width	Ave outrow width	Ave thinning damage	Retained regrowth BA	% live BA removed	Widespread weed presence	Browsing > low intensity
		Target							

Overall assessment:

Meets NFSGs standards?

Ave bay width		**Ave outrow width**		Thinning damage	
Retained regrowth BA		**% live BA removed**		**Species composition**	
Dominants/co-dominants retained					

Consistency between sources?	

Part B: Assessment against Code requirements

The auditor is to conduct an assessment of regeneration and thinning coupes selected for the field assessment. This stage of the audit considers compliance with the Code of Practice for Timber Production (the Code), other relevant regulations and Native Forest Silviculture Guidelines. The information may be derived from: interviews with VicForests staff; reviews of information from the FCPs, the Coupe Information System or other relevant VicForests records; and the field assessment. **Table 4** is used to record details of the results of each coupe audit for regeneration coupes. **Table 5** is used in a similar manner for thinning coupes. Details are reported on a coupe-by-coupe basis. The Code provides minimal explicit comment on thinning coupe finalisation and so there are significantly fewer audit elements for the former than is the case for regeneration coupes.

Compliance with audit criteria is assessed as follows:

- yes - fully complies
- no - does not comply with or satisfy any component of the audit criterion
- partial – partly, but not fully satisfies the audit criterion
- not applicable - where the audit criterion is not relevant to the condition or management of the particular coupe
- unknown - where field assessment of the criterion is required, but has not been possible

If the coupe file or other relevant sources does not provide typically available evidence to enable an assessment of compliance, the assessment is to be “no”.

The auditor should enter comments in the field provided, particularly where the coupe was assessed to not or only partially comply with the audit criterion.

The process for selecting coupes to be included in the field audit and this assessment is described in Module 7 of the Forest Audit Program Toolbox. Stocking acceptability criteria for regeneration and thinning coupes is given in Annex 1 of this Workbook.

Table 4 Detailed audit of regeneration coupe compliance with the Code of Practice for Timber Production and Native Forest Silviculture Guidelines

FMA:		**Coupe address:**	
District:		**Coupe area:**	ha
Forest type:		**Silvicultural system:**	

Regeneration method:		**Date sown/planted**	

Audit details:					
Auditor and audit team		**Auditees**		**Date of audit**	

Source	Section	Prescription	Audit Criteria	Compliance (yes/no/partial/not applicable)	Auditor Comments
Mandatory actions and legal requirements					
Code of Practice for Timber Production 2007	2.1.3 Forest Coupe Plans	The Forest Coupe Plan must describe regeneration procedures to be applied.	1. Forest Coupe Plan describes regeneration procedures applied to coupe.		
Code of Practice for Timber Production 2007	2.3.1 Regeneration	State forest available for timber production must not be cleared to provide land for the establishment of plantations	2. Coupe has not been regenerated with plants grown from non-indigenous or exotic forestry species.		
			3. Coupe has not been replanted on a regular grid.		
Code of Practice for Timber Production 2007	2.3.1 Regeneration	Action must be taken to ensure the successful regeneration of a harvested coupe, except where: - the land is to be used for an authorised/ approved purpose for which native vegetation is not compatible; - timber has been harvested by thinning a stand; or - the stocking of seedlings or regrowth is assessed as sufficient through natural regeneration processes	4. Evidence can be provided of action taken to ensure successful regeneration.		
			5. Post-regeneration stocking has been assessed.		
			6. Coupe has been regenerated to standard consistent with Code and Native Forest Silviculture Guidelines (NFSG) #10.		

Source	Section	Prescription	Audit Criteria	Compliance (yes/no/partial/not applicable)	Auditor Comments
Code of Practice for Timber Production 2007	2.3.1 Regeneration	Following timber harvesting, State forest must be regenerated with species native to the area, wherever possible using the same provenances, or if not available, from an ecologically similar locality. Regeneration operations must aim to approximate the composition and spatial distribution of canopy species common to the coupe prior to harvesting, where they can be determined	7. Original tree species found in coupe were recorded prior to harvesting, as was their approximate density and spatial distribution.		
			8. Local or similar provenance seed (only) was used in coupe regeneration.		
			9. All tree species originally present on coupe have been successfully regenerated to standard consistent with the Code and NFSG #10.		
Code of Practice for Timber Production 2007	2.3.1 Regeneration	Silvicultural methods for regeneration must be appropriate to the forest type (including understorey species) and local conditions.	10. Evidence is available to demonstrate that the silvicultural system used is appropriate to the forest type, understorey and local conditions.		
Code of Practice for Timber Production 2007	2.3.1 Regeneration	Where fire is used in regeneration operations, all practicable measures must be taken to protect all areas excluded from harvesting from the impacts of fire. The use of fire must be in accordance with the Code of Practice for Fire Management on Public Land (2006). A regeneration burn is a prescribed burn and requires an approved Burn Plan under that Code.	11. Measures were taken to protect areas excluded from harvesting from damage as a result of use of fire in regeneration.		
			12. Impact of regeneration burning on areas excluded from harvesting was assessed.		
			13. Any use of fire in regeneration was subject to an approved Burn Plan under the Code of Practice for Fire Management on Public Land (2006).		

Source	Section	Prescription	Audit Criteria	Compliance (yes/no/partial/not applicable)	Auditor Comments
Code of Practice for Timber Production 2007	2.3.1 Regeneration	Where mechanical disturbance is used, it must be undertaken with due consideration of erosion risk potential and proximity of waterways.	14. Measures were undertaken to manage erosion risk and potential sediment movement to waterways in coupes with mechanical disturbance.		
			15. Effectiveness of erosion control measures was assessed.		
Code of Practice for Timber Production 2007	2.3.1 Regeneration	Action must be taken to ensure that any Aboriginal cultural heritage places located within harvested coupe areas are appropriately protected and managed during regeneration activities.	16. Measures were taken to protect Indigenous cultural heritage sites or places located within harvested areas during regeneration.		
			17. Effectiveness of protection measures was assessed.		
Code of Practice for Timber Production 2007	2.3.1 Regeneration	The source of seed used must be recorded in a manner that allows for future reference	18. The source of seed used for regeneration is recorded on the Forest Coupe Plan.		
Code of Practice for Timber Production 2007	2.3.1 Regeneration	The use of poisons to control wildlife browsing is prohibited. The use of pesticides in site preparation and/or seedling or advanced growth liberation must comply with Commonwealth and State legislation and regulations. Under the *Wildlife Act* 1975, browsing native animals may only be controlled under permits and in accordance with any associated conditions as issued by relevant authorities.	19. A register of chemicals used in the management of the coupe exists and has been maintained; as has a record of how they were used.		
			20. Procedures to ensure any pesticide use on the coupe comply with Commonwealth and State regulations are documented. All personnel using pesticides on the coupe have been inducted into their use.		
			21. Poisons have not been used to control wildlife browsing.		
			22. Any native animal control activities were conducted in accordance with permits issued by relevant authorities.		
Code of Practice for Timber Production 2007	2.3.2 Stocking Assessment	Stocking on harvested coupes must be assessed within three years of treatment, to determine whether regeneration has been successfully achieved and to ensure that re-treatment occurs where necessary	23. Coupe regeneration was assessed within three years of treatment.		
			24. The assessment determined the success of regeneration and the need for re-treatment where necessary.		

Source	Section	Prescription	Audit Criteria	Compliance (yes/no/partial/not applicable)	Auditor Comments
Code of Practice for Timber Production 2007	2.3.2 Stocking Assessment	The results of (coupe regeneration) assessment must be recorded for future reference.	25. The results of assessments and details of any further silvicultural treatments are recorded on the Coupe Information System or equivalent database.		
Code of Practice for Timber Production 2007	2.3.2 Stocking Assessment	Where stocking, health or early growth is inadequate, remedial work must be conducted as soon as practicable to obtain adequate regeneration. Further assessment must be undertaken following remedial treatment to ensure that it has been successfully regenerated.	26. Remedial work has been undertaken to achieve acceptable regeneration where stocking, spatial distribution, health or early growth was initially found to be below the applicable standard.		
			27. A second regeneration survey was undertaken following remedial work to improve stocking to an acceptable level.		
Code of Practice for Timber Production 2007	2.5.2 Coupe Infrastructure	Infrastructure must be rehabilitated on completion of operations, where not required for future operations, using rehabilitation techniques that provide suitable soil conditions for the regeneration and growth of vegetation existing on the site prior to harvesting. Rehabilitation of coupe infrastructure must be assessed within three years of initial treatment and, where found inadequate, remedial action must be taken.	28. Coupe infrastructure has been rehabilitated in ways that provided suitable soil conditions for the regeneration and growth of vegetation existing on the site prior to harvesting.		
			29. Rehabilitation of coupe infrastructure has been assessed within three years of initial treatment.		
			30. Remedial action was taken where rehabilitation was inadequate.		
Guidance					
Code of Practice for Timber Production 2007	2.3.1 Regeneration	The regeneration of understorey species should be facilitated where possible, using harvesting and regeneration methods that provide appropriate disturbance to ensure understorey elements can survive or that protect understorey patches.	31. Harvesting and regeneration methods are designed to protect understorey elements or provide appropriate disturbance to ensure they survive.		
Code of Practice for Timber Production 2007	2.3.1 Regeneration	DSE maintains guidelines and standards against which regeneration may be assessed, that may provide a useful reference for forest operators.	32. Coupe regeneration was assessed in a manner consistent with relevant Native Forest Silviculture Guidelines (#10).		

Source	Section	Prescription	Audit Criteria	Compliance (yes/no/partial/not applicable)	Auditor Comments
Code of Practice for Timber Production 2007	2.3.1 Regeneration	Where natural seedfall or sowing is used, surveys may be conducted to assess the quality of the seedbed before seed is applied.	33. A survey of seedbed quality was undertaken prior to use of natural seedfall or sowing to regenerate the coupe.		
Code of Practice for Timber Production 2007	2.3.1 Regeneration	The screening or treatment of seed and nursery stock used in regeneration should ensure that the risk of spreading weeds, pathogens or pests is minimised.	34. Seed and planting stock are screened for weeds, pathogens or pests prior to coupe regeneration.		
Code of Practice for Timber Production 2007	2.3.2 Stocking Assessment	Where selection (uneven-aged) silvicultural systems are used, stocking assessments should take account of retained trees.	38. The stocking assessment took account of retained trees (uneven-aged coupes only).		

Additional comments:

Table 5 Detailed audit of thinning coupe compliance with the Code of Practice for Timber Production and Native Forest Silviculture Guidelines

FMA:		**Coupe address:**			
District:		**Coupe area:**	ha	**Slope**	
Forest type:		**Silvicultural system:**			

Audit details:					
Auditor and audit team		**Auditees**		**Date of audit**	

Source	Section	Prescription	Audit Criteria	Compliance (yes/no/partial/not applicable)	Auditor Comments
Mandatory actions and legal requirements					
Code of Practice for Timber Production 2007	2.3.1 Regeneration	State forest available for timber production must not be cleared to provide land for the establishment of plantations	1. Coupe has not been cleared and replaced with plants grown from non-indigenous or exotic forestry species.		
Code of Practice for Timber Production 2007	2.3.1 Regeneration	Following timber harvesting, State forest must be regenerated with species native to the area, wherever possible using the same provenances, or if not available, from an ecologically similar locality. Regeneration operations must aim to approximate the composition and spatial distribution of canopy species common to the coupe prior to harvesting, where they can be determined	2. Original tree species found in coupe were recorded prior to thinning, as was their approximate density and spatial distribution.		
			3. All tree species originally present on the coupe have been retained following thinning.		
Code of Practice for Timber Production 2007	2.3.1 Regeneration	The use of poisons to control wildlife browsing is prohibited. The use of pesticides in site preparation and/or seedling or advanced growth liberation must comply with Commonwealth and State legislation and regulations. Under the *Wildlife Act* 1975, browsing native animals may only	4. A register of chemicals used in the management of the coupe exists and has been maintained; as has a record of how they were used.		
			5. Procedures to ensure any pesticide use on the coupe complies with Commonwealth and State regulations are documented.		

Source	Section	Prescription	Audit Criteria	Compliance (yes/no/partial/not applicable)	Auditor Comments
		be controlled under permits and in accordance with any associated conditions as issued by relevant authorities.	6. All personnel using pesticides on the coupe have been inducted into their use.		
			7. Poisons have not been used to control wildlife browsing.		
			8. Any native animal control activities were conducted in accordance with permits issued by relevant authorities.		
Code of Practice for Timber Production 2007	2.3.2 Stocking Assessment	Stocking on harvested coupes must be assessed within three years of treatment, to determine whether regeneration has been successfully achieved and to ensure that re-treatment occurs where necessary	9. Coupe stocking and thinning damage was assessed within three years of treatment.		
Code of Practice for Timber Production 2007	2.3.2 Stocking Assessment	The results of (coupe regeneration) assessment must be recorded for future reference.	10. The results of post-thinning assessments were recorded on the Coupe Information System or equivalent database.		
Code of Practice for Timber Production 2007	2.5.2 Coupe Infrastructure	Infrastructure must be rehabilitated on completion of operations, where not required for future operations, using rehabilitation techniques that provide suitable soil conditions for the regeneration and growth of vegetation existing on the site prior to harvesting. Rehabilitation of coupe infrastructure must be assessed within three years of initial treatment and, where found inadequate, remedial action must be taken.	11. Coupe infrastructure has been rehabilitated in ways that provided suitable soil conditions for the regeneration and growth of vegetation existing on the site prior to harvesting.		
			12. Rehabilitation of coupe infrastructure has been assessed within three years of initial treatment.		
			13. Remedial action was taken where rehabilitation was inadequate.		
Native Forest Silviculture Guidelines 13 and 14	Appendix 2 Post-thinning stand assessment Commercial thinning. 1. Regular systematic stocking and damage assessment of thinned stands is	During thinning, regular assessments/audits must be carried out to ensure that the prescriptions are complied with.	14. Pre and post thinning assessments were carried in on the coupe in a manner consistent with NFSG #13 or #14.		
			15. Assessments show that thinning operations meet the specifications for basal area, damage, outrow and bay width, species composition and tree retention in NFSG #13 or #14.		

Source	Section	Prescription	Audit Criteria	Compliance (yes/no/partial/not applicable)	Auditor Comments
	required.				
Guidance					
Code of Practice for Timber Production 2007	2.3.1 Regeneration	The regeneration of understorey species should be facilitated where possible, using harvesting and regeneration methods that provide appropriate disturbance to ensure understorey elements can survive or that protect understorey patches.	16. Thinning methods are designed to protect understorey elements or provide appropriate disturbance to ensure they survive.		

Additional comments:

Part C: Field assessment of regeneration and coupe stocking

Stocking and post-thinning surveys conducted by VicForests were conducted using the sampling and assessment methodologies described in NFSGs #10, 13 and 14, respectively. The intent of this field audit (for stocking adequacy in regeneration coupes) is not to replicate those surveys, but to confirm their findings regarding acceptable stocking (etc). For this reason, a reconnaissance survey methodology has been developed rather than a systematic survey design.

Regeneration coupe sampling approach

Two reconnaissance survey options have been developed for use, depending on the VicForests' final assessment of coupe stocking. For coupes with established seedling survey (ESS) stocking of 75% or more (standard or intensive surveys only; 90% for extensive survey), option 1 applies. Option 2 applies to coupes with <75% stocking from standard or intensive surveys (<90% for extensive surveys).

Option 1

A rapid assessment is undertaken to confirm that actual coupe stocking is similar to that reported in VicForests stocking surveys. Each of the two auditors must walk along at least 400 m of the coupe perimeter, snig tracks and/or access roads (200 m for any coupes smaller than 5 ha) and observe stocking. At least half of that distance must be on internal tracks. Observations of stocking must be made at 50 m intervals along the survey route. Where the height and density of regrowth limits visibility, the auditors will also assess stocking at a point 20 m into the coupe (roughly perpendicular to their route). The auditors' routes will be marked on a map of the coupe.

If the auditors consider that stocking may not be acceptable, a stocking survey using option 2 must be undertaken. *As a guide*, if stocking appears to be low (acceptable seedlings spaced at more than ~5 m centres[1]) at more than a third of observation points, the coupe should be surveyed using option 2. Results of the assessment are recorded using **Table 6.**

Auditors are to record the eucalypt species present on the coupe and comment on why any observation points appear to be poorly stocked.

Option 2

Stocking assessments in field audit coupes is recorded using modified versions of field record sheets included in Appendices to the NFSG # 10. **Table 7** and **Table 8** are used for even-aged coupes and **Table 9** and **Table 10** are used for uneven-aged coupes. An overall assessment of whether the coupe meets with stocking standards from NFSG #10 and details of any non-conformance is provided in the comments box. Definitions of acceptable seedlings and seedbed conditions are given in Annex 1.

Stocking in regeneration coupes is to be assessed at up to 50 sampling points per coupe. Assessment procedures at each sampling point are to follow NFSG #10.

Sampling points are to be located at random using the following method (rather than using the systematic grid approach described in NFSG #10). It is assumed that sampling will be undertaken by two auditors.

Auditors will commence the survey at opposite ends of the coupe. A random number table (with numbers between 10 and 80) will be used to locate the initial sampling point. The first number determines the distance to travel into the coupe (in a direction appropriate to the coupe layout and location of the starting point). The first stocking assessment will be conducted at this point. Random numbers will then be used to determine the distance to be walked to the second sampling point and so on. Auditors will alternate from walking in a N-S or E-W direction between each sampling point.

When a coupe boundary is reached through this process, the auditor will use the opposite direction (e.g. south if they were previously heading north) to ensure sampling is conducted within the coupe. A schematic of the approach is given in **Figure 1**.

Each auditor will assess stocking on up to 25 points per coupe. On coupes smaller than 10 ha, the number of sampling points would be reduced to 15 per auditor or 30 overall.

A table of random numbers is provided in Annex 2 to this Workbook.

[1] Which roughly corresponds with <400 regrowth trees per ha

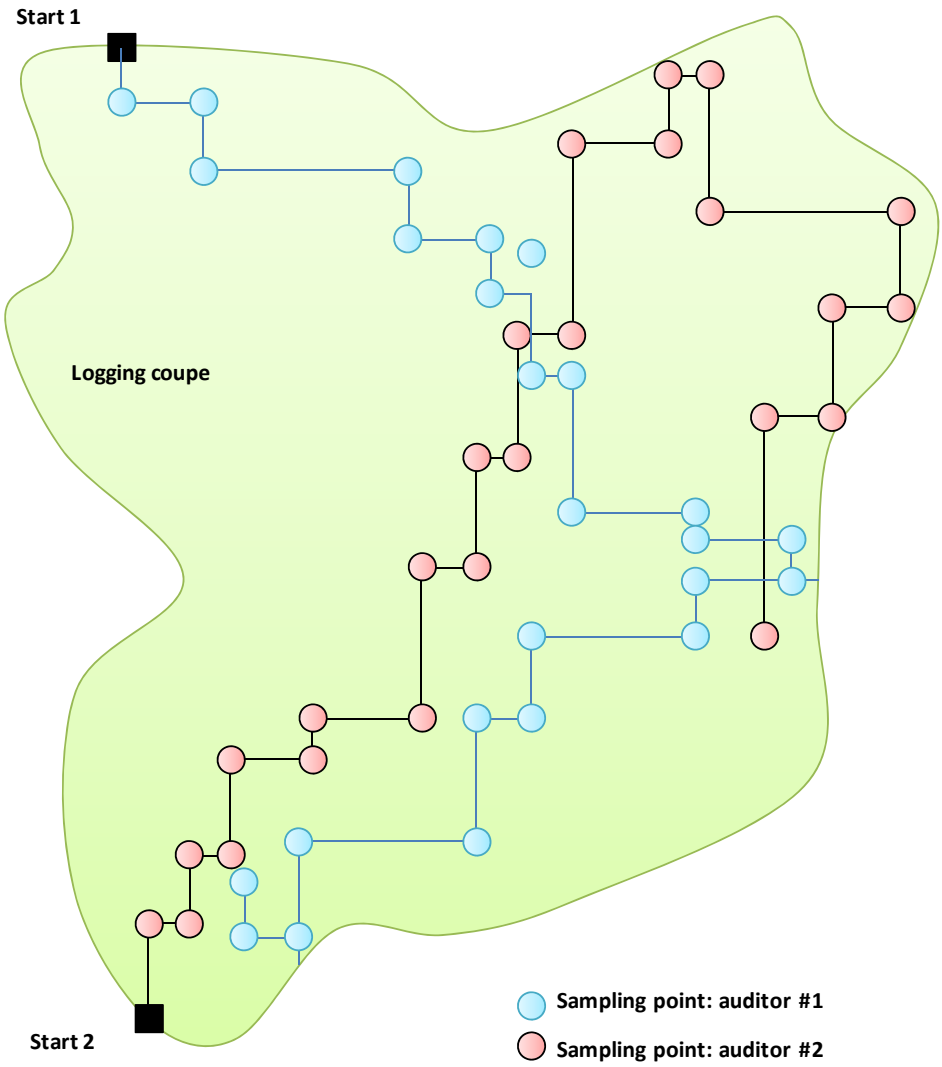

Figure 1 Schematic of random sampling design for field audit of regeneration coupes.

Following the assessment, the average stocking rate for the coupe is calculated, as is the 90% confidence interval (using **Equation 1**). Stocking will be considered to be acceptable if average stocking rate + the 90% confidence interval is equal to or greater than 65% (the acceptable stocking rate for the standard stocking survey).

Eq 1 90% confidence interval for mean stocking rate = $1.66 \sqrt{[A (1 – A) / B]}$ where:

A is the proportion of stocked plots (number of stocked plots / number of productive plots); and

B is the number of productive plots.

Field assessment of thinning coupes

The method used for the field assessment of thinning coupes follows that described in NFSG #13 and 14, with the exception that a maximum of 12 plots will be assessed per coupe, rather than three per 6 ha as prescribed.

Stocking assessments are recorded using field record sheets (**Table 11**) based on those included in NFSG # 13. An overall assessment of whether the coupe meets with stocking standards from NFSG #13 or 14 and details of any non-conformance is provided in the comments box.

Criteria used to assess damage to retained trees are provided in Annex 1.

Table 6 Field survey sheet for regeneration coupe stocking field audit: rapid assessment of coupe with ⩾75% stocking

						Page			Of		
Coupe address								Area		ha	
Auditor								Date			
Species required											
>10 present											
# unstocked area >1 ha observed?											

Observation point	Stocking	Comments
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Overall assessment	

Stocking at a sampling point is considered to be acceptable if trees are located at approximately 5 m centres.

Table 7 Field survey sheet for regeneration coupe stocking field audit: even-aged coupe

						Page		Of			
Coupe address							Area		ha		
Auditor							Date				
Species required											
>10 present											
# unstocked area >1 ha observed?											

Coordinates of sampling point						
N-S	E-W	Plot #	Stocking	Seed bed	Species	Comments
		1				
		2				
		3				
		4				
		5				
		6				
		7				
		8				
		9				
		10				
		11				
		12				
		13				
		14				
		15				
		16				
		17				
		18				
		19				
		20				
		21				
		22				
		23				
		24				
		25				

Stocking: Stocked with acceptable seedling – S; Unstocked or no acceptable seedling – N
Seedbed: Non-productive area – N; Soil damaged – D; Colonised – C; Slash, litter or debris – L

Table 8 Summary sheet for regeneration coupe stocking field audit: even-aged coupes

FMA				District						
Coupe address								Area		ha
Auditors								Date		
Species required										
>10 present										
# unstocked area >1 ha observed?										
Total # plots				Total # productive plots						
Total # stocked plots				% productive plots stocked				90% confidence interval		
Comments:										

Table 9 Field survey sheet for regeneration coupe stocking field audit: uneven-aged coupe

					Page		Of		
Coupe address						Area		ha	
Auditor						Date			
Species required									
>10 present									
# unstocked area >2 ha observed?			BAF		RBA		RBA×0.3		

Sampling point coordinates			Angle sweep				Fixed plots				
N-S	E-W	Plot #	Merch or potential merch	Non-merch	Total BA	BA Stocking	Sapling/ coppice	Seedling	Stocking status	Seedbed	Comments
		1									
		2									
		3									
		4									
		5									
		6									
		7									
		8									
		9									
		10									
		11									
		12									
		13									
		14									
		15									
		16									
		17									

Sampling point coordinates			Angle sweep				Fixed plots				
N-S	E-W	Plot #	Merch or potential merch	Non-merch	Total BA	BA Stocking	Sapling/ coppice	Seedling	Stocking status	Seedbed	Comments
		18									
		19									
		20									
		21									
		22									
		23									
		24									
		25									

Stocking status: Stocked by basal area – B; stocked by fixed plots – R; Unstocked – X

Seedbed: Receptive – R; Non-productive – N; Soil damaged – D; Colonised – C; Slash, litter or debris – L

Merch – merchantable: BA – Basal area; RBA – Reference basal area of coupe; BAF – Basal area factor of device used for angle sweep.

Table 10 Summary sheet for regeneration coupe stocking field audit: uneven-aged coupes

FMA				District						
Coupe address								Area		ha
Auditors								Date		
Species required										
>10 present										
# unstocked area >2 ha observed?										
Total # plots				Total # productive plots						
Total # stocked plots				% productive plots stocked				90% confidence interval		
Comments:										

Table 11 Field audit sheet for thinning coupes

Coupe address				Date				Auditors			
Slope & terrain						Pre-thinning BA					
Transect #				Transect #				Transect #			
Transect length		Transect width		Transect length		Transect width		Transect length		Transect width	
		Damage				Damage				Damage	
Species	DBH (cm)	Bole	Crown	Species	DBH (cm)	Bole	Crown	Species	DBH (cm)	Bole	Crown
Basal areas				Basal area				Basal area			
Bay widths				Bay width				Bay width			
Outrow widths				Outrow width				Outrow width			
% damaged trees				% damaged trees				% damaged trees			
Crop trees/ha				Crop trees/ha				Crop trees/ha			
BA (m^2/ha)				BA (m^2/ha)				BA (m^2/ha)			
Average bay width				Average bay width				Average bay width			
Average outrow width				Average outrow width				Average outrow width			
Average on 6 ha											
% damage				BA				Trees/ha			
Bay width				Outrow width							
Comments:											

General notes:

Mandatory actions and legal requirements:

Mandatory actions and other legal requirements specified in the Code of Practice for Timber Production (2007) form the mandatory compliance elements of the audit.

Guidance:

The Code of Practice for Timber Production (2007) also includes guidance elements that have been used here to define audit criteria. Guidance elements of the Code are not mandated, but are recommended practice in most situations.

Key operational goals

2.3.1 Regeneration: Harvested native forest is managed to ensure that the forest is regenerated and the biodiversity of the native forest is perpetuated. The natural floristic composition and representative gene pools are maintained when regenerating native forests by using appropriate seed sources and mixes of dominant species.

2.3.2 Stocking assessment and remedial treatment Stocking and early seedling growth is monitored and remedial action is taken where necessary to successfully regenerate harvested areas of native forests.

2.1.3 Forest Coupe Plans: A Forest Coupe Plan, which specifies operational requirements, is prepared in accordance with this Code prior to the commencement of each timber harvesting operation

2.5.2 Coupe infrastructure: Timber harvesting is conducted in a manner appropriate to the site, and manages the impact on soil, water and other values, including biodiversity and cultural heritage.

Annex 1: Coupe stocking specifications

DSE's CFS and NFSGs (#10 for regeneration coupes; #13 for thinning coupes in ash forests; #14 for thinning coupes in mixed species forests) provide specifications of acceptable stocking rates and coupe conditions prior to finalisation. This information is summarised below.

Even-aged silvicultural systems - stocking requirements:

Acceptable stocking, based on stocking survey methodologies outlined in NFSG #10 are:

- minimum 65% of plots on potentially productive coupe area are stocked using a standard plot intensity (80m x 20m);
- minimum 55% of plots on potentially productive coupe area are stocked using an intensive survey (40m x 20m); and
- minimum 75% of plots on potentially productive coupe area are stocked using an extensive survey (100m x 30m).

Additional stocking requirements include:

- a minimum of 10 acceptable plants of each species originally found on the coupe; and
- no unstocked areas greater than 1 ha in area.

Uneven-aged silvicultural systems - stocking requirements:

Acceptable stocking, based on stocking survey methodologies outlined in NFSG #10 are:

- minimum 75% of plots on potentially productive coupe area are stocked (standard plot intensity); and
- minimum 65% of plots on potentially productive coupe area are stocked (intensive survey).

Additional stocking requirements include:

- a minimum of 10 acceptable plants of each species originally found on the coupe;
- no unstocked areas greater than 2 ha in area; and
- basal area of non-merchantable trees should not exceed 5-7% of the reference basal area (RBA).

Definition of acceptable seedlings for stocking survey

An acceptable seedling, as defined in NFSG #10 is:

- species: native to that forest type;
- vigour: must have a healthy, vigorous growing tip. If damage has occurred to the growing tip, the surveyor must judge, based on local knowledge and experience, whether the plant is likely to recover apical dominance;
- origin: seedlings, lignotubers, and coppice (of all species) are acceptable. For coppice, the base of the stem must be within 20 cm of ground level, and likely to remain attached to the stump;
- stem damage: must be free of severe damage to the cambium (e.g. frost kill, insect attack, or rubbing on logging slash) and have a clear path for future growth; and
- height and competitive position: at least 40 cm tall, and should be above any competing understorey. Healthy seedlings in an intermediate position may be tallied where field experience has demonstrated that they will outgrow their competitors. Suppressed seedlings, where understorey, grass or bracken competition is strong, should not be included.

If a plot contains at least one acceptable seedling it is classified as stocked and entered as such (S) on the field sheet (**Table 7** or **Table 9** for even-aged and uneven-aged coupes, respectively). *Care must be taken to ensure that seedlings close to the boundary of the plot actually are in the plot.* If no acceptable seedlings are located within the plot, it is classified as unstocked (enter X in the field sheet).

Seedbed classification

The seedbed of unstocked plots is classified for all unstocked plots according to criteria from NFSG #10. If the plot has the potential to support eucalypt growth, either in its present state or with extra site preparation, a seedbed assessment should be made as follows:

- the plot is classified as receptive (R) if at least 50% of the area is uncompacted, exposed mineral earth or ashbed;
- if less than 50% of the plot is receptive, the reason should be recorded as either:
  - soil compacted or damaged in some other way (D);
  - colonised by non-eucalypts (C); or
  - covered by slash/litter/debris (L);
- if the plot has no potential, in its present state, for successful eucalypt establishment and growth, or is reserved from further seedbed preparation, it should be classed as non-productive (N) and the reasons noted in the 'Comments' section. Examples of non-productive areas include major rock outcrops, internal roading (excluding snig tracks), filter strips, retained understorey 'islands', and permanently saturated zones.

Thinning coupe stocking requirements

Stocking requirements differ between Ash and mixed species forests.

Coupes in Ash forests (NFSG #13):

- not more than 50% of the live basal area is to be removed;
- retained basal area of regrowth trees (not including live overwood) in stands of:
  - age 14-20 years is ≥ 17 m^2/ha;
  - age 21-30 years is ≥ 20 m^2/ha;
  - age 31-35 years is ≥ 23 m^2/ha;
  - age 36-40 years is ≥ 28 m^2/ha;
  - age 41 years and greater is ≥ 32 m^2/ha;
- on slopes ≤15°, average outrow width does not exceed 4.5 m (7 m for 1939 Ash) and average bay width is a minimum 14 metres (20 metres for 1939 Ash);
- on slopes >15°, outrow width does not exceed 4.5 m and bay width is a minimum 12 m;
- not more than 15% of retained crop trees have damage to boles and/or crowns;
- dominant and co-dominant trees are retained unless on defined outrows or extraction tracks;
- species composition is similar to that prior to thinning .

Coupes in mixed species forests (NFSG #14):

- not more than 50% of the live basal area is to be removed and retained basal area for regrowth crop trees (not including live overwood) in stands of:
  - age 20-24 years is ≥ 17 m^2/ha;
  - age 25-34 years is ≥ 21 m^2/ha;
  - age 35 years and greater is ≥ 25 m^2/ha;
- in natural regrowth areas, outrows are a maximum of 4.5 m and bays are a minimum width of 12 m, unless uniform thinning has been adopted;
- not more than 15% of retained crop trees have damage to boles and/or crowns;
- dominant and co-dominant trees are retained unless on defined outrows or extraction tracks; and
- species composition is similar to that prior to thinning.

Assessment of damage from thinning activities (based on NFSG #13 and #14)

During thinning operations, damage to retained trees may be caused if trees being felled or processed, hit or brush against the bark of retained trees. Damage can also be caused by machinery contacting trees. Damage inflicted by the current operation must be restricted to no more than an average of 15% of retained 'crop' trees (those that contain or are likely in the future to contain merchantable timber) as assessed for each coupe.

Damage is defined as:

- breakage or splitting of the bark-wood bond of any size anywhere on the main bole, whether bark is removed or not;
- severe impact on bole (bark-wood bond breakage not apparent), as indicated by bad bruising or rubbing of the inner bark (only 20% of any such trees on a transect counted); or
- breakage or removal of 30% or more of the original crown.

Annex 2 Random number table

45	25	35	18	73	36	61	47	53	56	61	12
68	15	61	50	44	73	71	52	35	53	20	42
54	65	50	30	12	27	21	77	33	28	10	52
67	52	68	58	19	41	61	74	59	26	68	64
72	72	41	16	61	31	47	23	70	48	18	14
36	54	61	76	54	78	12	28	54	43	55	80
80	70	40	49	66	74	79	52	75	45	73	29
40	35	78	10	54	16	62	38	27	13	61	48
17	60	58	47	72	13	27	36	55	62	41	13
40	39	38	20	65	19	71	49	38	21	27	44
15	59	80	59	60	40	24	13	33	54	27	52
33	72	78	61	26	22	56	19	74	58	31	19
43	15	23	14	53	38	33	27	72	31	64	50
57	25	22	31	38	27	60	42	64	66	22	14
58	54	19	72	43	60	29	63	35	72	31	23
48	49	69	72	69	70	56	11	58	76	76	16
71	38	73	33	48	42	36	57	11	44	21	24
75	43	38	24	43	60	57	26	51	51	26	56
49	18	26	30	53	30	31	61	29	29	49	24
66	37	76	62	61	50	32	34	20	74	26	27
65	50	17	15	45	62	55	44	10	38	18	74
40	50	22	40	34	39	74	74	44	22	62	25
67	34	44	47	44	15	54	36	61	75	12	32
74	66	71	26	61	23	49	69	79	17	18	26
33	26	59	68	63	68	57	20	34	41	64	53
21	14	29	43	60	55	54	45	39	42	57	20
76	68	74	14	45	17	29	57	28	19	19	56
52	42	26	70	39	40	53	36	45	19	17	65
22	16	41	69	10	33	56	48	66	70	44	24
44	30	31	67	73	42	74	22	60	52	30	30
55	61	74	61	10	18	57	50	20	78	15	63
48	47	52	35	52	33	50	40	20	78	31	14
44	66	21	11	70	13	25	64	50	76	62	32
46	27	19	42	11	61	37	75	50	63	30	22
61	11	24	66	34	32	21	58	77	38	35	63
40	21	15	39	12	56	33	55	66	21	76	69
76	57	25	50	26	35	68	10	69	29	44	79
20	47	69	42	79	32	60	56	28	47	48	60
49	37	70	31	24	69	54	74	24	69	21	71
69	51	75	79	19	49	35	64	30	45	66	42
64	72	37	18	73	22	76	31	36	62	12	52
38	71	18	66	78	74	50	59	65	57	48	12
18	37	11	34	59	62	71	43	11	53	19	10
78	28	63	69	52	12	23	20	30	45	54	11
55	31	42	22	34	38	70	69	68	70	26	61
39	59	54	18	77	12	17	72	62	77	48	40
56	50	52	66	71	75	75	30	57	79	10	33