Forest Management Manual for New Brunswick Crown Land

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FOREST MANAGEMENT MANUAL

FOR NEW BRUNSWICK

CROWN LAND

JUNE 2004

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Table of Contents

1 INTRODUCTION **1**

2 GOALS AND OBJECTIVES FOR CROWN LAND MANAGEMENT **2**

2.1 THE NEW BRUNSWICK APPROACH TO FOREST MANAGEMENT 2

3 MANAGEMENT PLANNING **4**

3.1 BACKGROUND 4
3.2 FOREST MANAGEMENT PLANNING PROCEDURES 4
3.3 FOREST MANAGEMENT PLAN FORMAT 4
3.4 FOREST MANAGEMENT PLAN SCHEDULE 5
3.5 ROLES AND RESPONSIBILITIES 5

4 OPERATIONAL PLANNING AND IMPLEMENTATION **6**

4.1 GENERAL 6
4.1.1 Silviculture *8*
4.1.2 Harvesting *8*
4.1.3 Roads and Watercourse Crossings *9*
4.1.4 Fish and Wildlife Habitat *9*
4.1.5 Scaling and Utilisation *9*
4.2 SILVICULTURE 10
4.2.1 General *10*
4.2.2 Silviculture Planning *10*
4.2.2.1 Objectives 10
4.2.2.2 Roles and Responsibilities 10
4.2.2.3 Requirements and Standards 10
4.2.3 Silviculture Treatment Standards *13*
4.2.3.1 Objectives 13
4.2.3.2 Roles and Responsibilities 13
4.2.3.3 Natural Regeneration Standards 13
4.2.3.4 Softwood Plantation Standards 14
4.2.3.5 Herbicide Standards 15
4.2.3.6 Pre-commercial Thinning Standards 17
4.2.3.7 Plantation Cleaning Standards 18
4.2.3.8 Commercial Thinning Standards 19
4.2.4 Silviculture Monitoring and Reimbursement *19*
4.2.4.1 Objectives 19
4.2.4.2 Roles and Responsibilities 19
4.2.4.3 Pre-treatment Sampling 20
4.2.4.4 Post-treatment Sampling 22
4.2.4.5 Long-term Sampling 24
4.2.4.6 Invoicing 25
4.2.4.7 Year-end Reconciliation 26
4.2.4.8 Silviculture Rate Determination 26
4.3 HARVESTING 27
4.3.1 General *27*
4.3.2 Harvest Planning *27*
4.3.2.1 Objectives 27
4.3.2.2 Roles and Responsibilities 27
4.3.2.3 Requirements and Standards 28
4.3.3 Harvest Implementation and Monitoring *29*
4.3.3.1 Objectives 29

4.3.3.2 Roles and Responsibilities 29
4.3.3.3 Requirements and Standards 30
4.3.4 Harvest Amendment Process 32
4.3.4.1 Objectives 32
4.3.4.2 Roles and Responsibilities 32
4.3.4.3 Requirements and Standards 32
4.4 ROADS AND WATERCOURSE CROSSINGS 34
4.4.1 General 34
4.4.2 Planning and Permitting 34
4.4.2.1 Background 34
4.4.2.2 Road Definitions 35
4.4.2.3 Forest Road Specifications 35
4.4.2.4 Logging, Temporary, and Winter Road Specifications 36
4.4.2.5 Roads in Sensitive Areas 37
4.4.2.6 Road Planning 37
4.4.2.7 Permits and Approvals 37
4.4.2.8 Road Layout and Other Criteria 38
4.4.2.9 Utilisation of Wood and Other Material from Rights-of-Way 38
4.4.2.10 Bullpens 39
4.4.2.11 Equipment Use Outside of the Right of Way 39
4.4.2.12 Soil Disturbance 39
4.4.2.13 Gravel Pits and Borrow Pits 39
4.4.2.14 Signage 40
4.4.2.15 Maintenance 40
4.4.2.16 Abandoning and Closing of Roads 40
4.4.3 Watercourse Crossings 40
4.4.3.1 Width of the No-Grub Zone 40
4.4.3.2 Design Loading 41
4.4.3.3 Culvert Sizing Criteria 41
4.4.3.4 Single Culvert Installation 42
4.4.3.5 Multiple Culvert Installation 42
4.4.3.6 Culvert Material 42
4.4.3.7 Backfill and Compaction 43
4.4.3.8 Bridge Installation 43
4.4.3.9 Temporary Crossings 43
4.4.3.10 Stabilisation of Watercourse Crossings 43
4.4.3.11 Fording 43
4.4.3.12 Cross Drainage Culverts 44
4.4.3.13 Off -Take Ditching 44
4.5 FISH AND WILDLIFE HABITAT 45
4.5.1 General 45
4.5.2 Heron and Raptor Nest Tree Retention 45
4.5.2.1 Background 45
4.5.2.2 Objective 46
4.5.2.3 Roles and Responsibilities 46
4.5.2.4 Requirements and Standards 46
4.5.2.5 Nest Descriptions and Identification 48
4.5.2.6 Reporting Nests 48
4.5.3 Watercourse Buffer Zone Standards 48
4.5.3.1 Background 48
4.5.3.2 Watercourse Buffer Zone Objectives and Functions 48
4.5.3.3 Roles and Responsibilities 49
4.5.3.4 Standards and Requirements 50
***4.5.4** Forestry Operations in Old Spruce-Fir Habitat Blocks 53*
4.5.4.1 Roles and Responsibilities 53
4.5.4.2 Standards and Requirements 54
4.5.5 Deer Wintering Area Management 55
4.5.5.1 General 55

4.5.5.2 DWA Management Objectives 56
4.5.5.3 Roles and Responsibilities 57
4.5.5.4 DWA Management Plans 58
4.5.5.5 Review and Approval of DWA Management Plans 59
4.5.5.6 Operating Plan 60
4.5.5.7 Assessment of Plan Implementation 60
4.5.5.8 Follow-up DWA Management Plans 61
4.6 SCALING AND UTILISATION 62
4.6.1 General *62*
4.6.2 Objectives *62*
4.6.3 Roles and Responsibilities *62*
4.6.4 Standards and Requirements *63*
4.6.4.1 Scaling Arrangements 63
4.6.4.2 General Scale Requirements 64
4.6.4.3 Wood Tracking and Identification 65
4.6.4.4 Scale Submission 66
4.6.4.5 Merchantable Waste and Utilisation 66
5 ANNUAL REPORT 67
5.1 BACKGROUND 67
5.2 OBJECTIVES 67
5.3 ROLES AND RESPONSIBILITIES 67
5.4 FORMAT, SUBMISSION, AND APPROVAL STANDARDS 68
5.5 SECTION STANDARDS 68
5.5.1 Roads and Watercourses *68*
5.5.2 Harvest *68*
5.5.3 Silviculture *69*
5.5.4 Fish and Wildlife *69*
5.5.5 Public Values *69*
5.5.6 DNR Activities *70*
6 FOREST INVENTORY 71
6.1 BACKGROUND 71
6.2 OBJECTIVES 72
6.3 ROLES AND RESPONSIBILITIES 72
6.4 STANDARDS AND REQUIREMENTS 72
7 LICENSEE PERFORMANCE EVALUATION 74
8 APPENDICES 75
8.1 GENERAL 75
9 APPENDIX - SILVICULTURE 76
9.1 NURSERY CONTAINER STOCK SPECIFICATIONS 77
9.2 COMMERCIAL THINNING GUIDELINES FOR POST-TREATMENT STAND BASAL AREA 78
9.3 SILVICULTURE STOCKING SURVEY 79
9.4 SILVICULTURE DENSITY SURVEY 80
9.5 QUALITY ASSESSMENT PROCEDURES FOR PRE-COMMERCIAL THINNING AND PLANTATION CLEANING. 81
9.6 10TH-YEAR PLANTATION SURVEY PROCEDURES 82

10 APPENDIX - HARVESTING 87

10.1 DESCRIPTION OF PLANNED HARVEST OPERATIONS 88
10.2 PROPOSED HARVEST VOLUMES BY SPECIES, PRODUCT, AND ALLOCATION 90
10.3 MINIMUM REQUIRED INFORMATION FOR WEEKLY STATUS REPORT 91
10.4 FINAL HARVEST AND FINAL TRUCKING INSPECTION REPORT 92
10.5 STEEP SLOPE HARVESTING STANDARDS 94
10.5.1 General 94
10.5.2 Objectives 94
10.5.3 Criteria 94
10.6 BEST MANAGEMENT PRACTICES FOR CROWN LAND TOLERANT HARDWOOD AND TOLERANT HARDWOOD/SOFTWOOD STANDS 95
10.6.1 Objective 95
***10.6.2** Standards: 95*
10.6.3 Roles and Responsibilities: 96
10.7 PROTECTION OF ADVANCED QUALITY NATURAL SOFTWOOD REGENERATION 99
10.7.1 Objective 99
10.7.2 Roles and Responsibilities 99
10.7.3 Requirements and Standards 99
10.7.3.1 Pre-Harvest Eligibility Criteria 99
10.7.3.2 Post-Harvest Standard 100
10.7.3.3 Post-Harvest Block Evaluation 100

11 APPENDIX - FISH AND WILDLIFE HABITAT 101

11.1 OSFH BLOCK MANAGEMENT 102
11.1.1 OSFH Block Management Plan Format 102
11.1.2 Old Spruce-Fir Habitat (OSFH) Definition 103
11.1.2.1 OSFH Stand Structure Criteria 103
11.1.2.2 OSFH Spatial Criteria 103
11.1.2.3 Definition of OSFH Habitat Windows 104
11.2 DETERMINING BANK SLOPE FOR WATERCOURSE BUFFER ZONE WIDTH 105
11.2.1 Slope and Ground Distance Equivalents for Buffer Width 106
11.3 DEER WINTERING AREA MANAGEMENT 107
11.3.1 DWA Management Plan Content 107
11.3.1.1 Full DWA Management Plan 107
11.3.1.2 Follow-up DWA Management Plan 109
11.3.1.3 Management Planning Option for Small DWA 113
11.3.2 Deer Winter Habitat Definitions 115
11.3.2.1 Severe Winter Deer Habitat (SWDH) Stand Structure 115
11.3.2.2 Severe Winter Deer Habitat (SWDH) Spatial Criteria 116
11.3.2.3 Moderate Winter Deer Habitat (MWDH) Stand Structure 116
11.3.2.4 Moderate Winter Deer Habitat (MWDH) Spatial Criteria 116
11.3.2.5 Definition of DWA Habitat Windows 116
11.3.3 Harvest and Silviculture Guidelines for DWA 118
11.3.3.1 General 118
11.3.3.2 Reproduction Methods & Harvest Guidelines 118
11.3.3.3 Plantations and Competition Control 119

12 APPENDIX - SCALING AND UTILISATION 121

12.1 MERCHANTABLE WASTE VOLUME DETERMINATION 122
12.2 PRODUCT UTILISATION STANDARDS 123

13 APPENDIX - ANNUAL REPORT 124

13.1 SUMMARY OF STRUCTURES INSTALLED IN WATERCOURSES 125
13.2 SUMMARY OF HARVEST BY DESTINATION WITHIN AND OUTSIDE NEW BRUNSWICK 126
13.3 SUMMARY OF HARVEST BY FOREST ZONE AND VOLUME CATEGORY 127
13.4 SUMMARY OF NON-CLEAR CUT HARVEST IN THE GENERAL FOREST 128
13.5 SUMMARY OF GENERAL FOREST COMMERCIAL THINNING AREA 129
13.6 LIST OF HARVEST BLOCKS OPERATED DURING PAST YEAR 130
13.7 SUMMARY OF GENERAL FOREST SILVICULTURE TREATMENTS COMPARED TO SILVICULTURE TARGETS 131
13.8 SILVICULTURE AREA SUMMARY BY TREATMENT TYPE AND FOREST ZONE. 132
13.9 LIST OF SILVICULTURE BLOCKS OPERATED DURING PAST YEAR 133
13.10 5TH-YEAR STATUS OF PLANTATIONS AND NATURALLY REGENERATING AREAS 134
13.11 10TH-YEAR STATUS OF PLANTATIONS 135
13.12 SUMMARY OF APPROVED DWA MANAGEMENT PLANS 136
13.13 DWA MANAGEMENT PLANS APPROVED DURING THE PAST YEAR 137

List of Tables

Table 1. Schedule of annual Operating Plan activities. 7
Table 2. Raptor and heron nest retention standards. 47
Table 3. Watercourse buffer zone standards. 51
Table 4. New Brunswick nursery container stock specifications. 77
Table 5. Commercial thinning guidelines for post-treatment stand basal area for various species and site combinations. 78
Table 6. The percent deductions for various quality factors used in the post-treatment assessment of pre-commercial thinning and plantation cleaning areas. 81
Table 7. Criteria for assessing individual tree damage occurring as a result of harvesting. 96
Table 8. Stand characteristics that provide habitat for OSFH species. Characteristics and related minimum values are tree cavities (CV dbh), woody debris (WD), dead or dying trees (DD dbh), live tree boles (TB dbh), conifer cones (CO), crown closure (CC percent), and shrub layer (SL). Values in bold are those that contribute directly to the structural definitions. 104
Table 9. *Water Quality & Aquatic Habitat* buffer zone widths (horizontal distances) as a function of bank slope (percent and degree) and ground distance equivalents 106
Table 10. DWA Treatment Status Report. 111
Table 11. Summary of DWA treatments proposed for the current period: Year A to Year B 111
Table 12. General softwood species utilisation standards. 123
Table 13. General hardwood species utilisation standards. 123

List of Figures

Figure 1. Typical road cross-section (Adapted from: FERIC, 1999). 36
Figure 2. General features of a well constructed bridge crossing, including the 30 m no-grub zone. 41
Figure 3. Severe (northern) and moderate (southern) winter deer habitat management zones. 57
Figure 4. Tolerant hardwood management considerations for prescription development. 98
Figure 5. Conventional situation where slope changes gradually as one moves away from the watercourse. 105
Figure 6. Slope determination when there is a steep bank adjacent to the watercourse and the terrain levels off there after. 105
Figure 7. Situation where the adjacent land begins to slope away from the watercourse. 105
Figure 8. General forest condition windows for Severe Winter Deer Habitat (SWDH) and Moderate Winter Deer Habitat (MWDH). 117

1 Introduction

In 1982, with the proclamation of the *Crown Lands and Forests Act* (CLFA), a comprehensive forest management system was introduced for Crown land. The Act made provision for the establishment of Crown Timber Licences (Licences) and the assignment of management responsibility for those Licences to the forest industry (Licensees). The role of government in this management system is to set forest management goals, objectives, and standards, monitor the activities of the Licensees, and to periodically assess Licensee performance. The role of Licensees is to implement the goals and objectives set by government. The standards, criteria, and procedures established for Crown land direct Licensees in the implementation of government's goals and objectives. The standards, criteria, and procedures are contained in the Forest Management Manual (FMM), which is amended by mutual consent of the Minister of Natural Resources and Licensees. The FMM forms part of the Forest Management Agreement (FMA) which outlines the specific responsibilities of Licensees and the Minister in the management and use of Crown land. The FMM represents "Schedule E" of the FMA.

The forest management system devised for Crown land operates on a five-year cycle. The Minister and Licensee review the FMA at the end of each five-year period of the agreement. The FMM is also reviewed at five-year intervals. Each review establishes the standards, criteria, and procedures for operating Crown land during the next five-year period.

Two of the essential components of the Crown land forest management system are the requirements for management planning and the evaluation of management performance. Licensees develop long-term Forest Management Plans that describe how the goals and objectives of government are to be achieved over the next five-year period. Forest Management Plans are implemented through operating plans that are prepared annually by Licensees. The Department of Natural Resources (DNR) is responsible for reviewing and approving management and operating plans and monitoring their implementation. At the end of each period, using defined indicators, DNR evaluates how well Licensees performed in achieving the stated goals and objectives of government. The results of that evaluation are a prime consideration in the Minister's decision on whether to extend the term of a Licence for an additional five-year period.

2 Goals and Objectives for Crown Land Management

National discussion on the management of Canada's forests led to the signing of the National Forest Accord in 1992 to which New Brunswick is a signatory. The Accord unites the Canadian forest community in working co-operatively toward the goal of sustainable forests. A revised national forest strategy, *Sustainable Forests: A Canadian Commitment 1998 – 2003* guides Canada's efforts in sustainable forest management. Recognising the changing attitudes of Canadian society towards its forests the strategy seeks to achieve consensus on managing forests on a sustainable basis considering forest ecosystems, economic, social and cultural values.

The national forest strategy yields the following broad principles.

Healthy forest ecosystems are essential to maintain the quality of life and forests must be managed to maintain their essential ecological processes, biological diversity, productivity, resiliency and capacity for renewal.

- Sustainable forest management requires an adaptive management approach that recognises a forest's potential to sustain a range of values to users and strives to find the best balance of uses based on relative benefit and impact. Forest managers must practice forestry based on ethical conduct and a sound understanding of ecological principles.
- Effective public participation in forest policy and planning processes is essential.
- Canadian wood and paper companies must remain globally competitive and this will depend on the ability of industry and government to respond to competitive pressures.

2.1 The New Brunswick Approach to Forest Management

The Minister of Natural Resources is responsible for the management of resources on Crown lands and the mission of the Department is "*To manage the natural resources of the Province in the best interest of its citizens*". To do this the Minister has established the following goals to direct the management of these lands:

- Account for public values on Crown lands.
- Maintain the diversity of forest ecosystems and their associated ecological values.
- Provide habitat necessary to support populations of native wildlife species at desired levels across their natural ranges.
- Maximise the long-term economic benefits from the sustainable timber supply while meeting identified non-timber objectives.
- Protect water quality and maintain adequate habitat for fish and wildlife species.
- Provide for recreational opportunities on Crown land.

The strategies and specific objectives set for Licensees to achieve these goals are defined in detail in *A Vision for New Brunswick Forests: Goals and Objectives for Crown Land Management.* This document builds upon national commitments made by provincial governments to manage

sustainably and defines the objectives for the 2002 Forest Management Plans on New Brunswick Crown lands and can be summarised as follows:

- Public Value and Uses

Licensees are required to involve the public in the Forest Management Planning process by soliciting the public's view and providing the opportunity for all stakeholders to participate. Licensees are required to maintain the integrity of existing recreational sites.

- Forest Ecosystems

Licensees are required to manage forest ecosystems to ensure that all naturally occurring vegetative communities and successional stages are represented on the landscape and unique sites of ecological, historical, cultural or scenic value are protected.

- Wildlife Habitat

Licensees are required to manage wildlife habitat to maintain viable populations of all species. Five distinct upland habitat types have been identified and defined in terms of vegetation communities, successional stage and peak volume: Hardwood, Tolerant Hardwood, Spruce Fir, Pine and Mixed Wood

Licensees are required to develop and implement management plans for the deer wintering area (DWA) land base that maximises the long-term sustainable supply of deer winter habitat.

- Timber

Licensees are required to manage the timber resource to maximise the sustainable supply of timber after meeting identified non-timber objectives. This is accomplished by harvest scheduling and employing a full range of harvest prescriptions and silviculture treatments.

- Water

Licensees are required to maintain watercourse buffer zones along all watercourses with a discernible channel. Buffer zones are applied according to the objectives and guidelines detailed in *"Watercourse Buffer Zone Guidelines for Crown Land Forestry Activities"*. Timber harvesting is permitted within buffer zones so long as it does not compromise the function of the buffer.

- Recreation and Aesthetics

Licensees are required to maintain aesthetic buffer zones along all numbered provincial highways that abut Crown land and along watercourses with high recreational use.

- Forest Management Plan Format

Licensees are required to prepare Forest Management Plans that meet prescribed standards. Licensees are evaluated on the preparation of these plans as part of the Licensee Performance Evaluation.

3 Management Planning

3.1 Background

A Forest Management Plan is required by the CLFA and is found as Schedule C in the FMA. The plan defines how the Licence will be managed. Management objectives addressed in the plan are defined by government and are revised and published in *A Vision for New Brunswick Forests: Goals and Objectives for Crown Land Management* every 5 years in advance of the next planning cycle. The plan forecasts timber and habitat supplies for 80 years and requires mapping of harvest blocks and specific habitat areas for a minimum of 25 years. Forest Management Plans are revised on a 5-year cycle that began in 1982.

The Forest Management Plan provides direction for the preparation of various site specific wildlife habitat management plans. These plans must be prepared separately for each DWA and Old Spruce Fir Habitat (OSFH) area for which harvesting is planned. Specifics about the objectives and standards for these Habitat Management Plans can be found in section 4.5.

3.2 Forest Management Planning Procedures

Planning requires the incorporation of multiple-use objectives in land management. This involves the use of a forest inventory - growing it into the future, while at the same time balancing trade-offs between objectives.

Computer-based modelling software (e.g. WOODSTOCK) has been developed to use forest inventory data, generate management scenarios, and provide information for decision making. The model uses forest inventory data that describe individual stands on the Licence. Stands with similar growth and development patterns are grouped into strata, or classes. Each stratum describes a number of values such as timber, wildlife habitat and biodiversity, as well as, operational considerations that describe how each value responds to forest management interventions.

Using the modelling software, Licensees initially prepare a non-spatial Forest Management Plan proposal that describes how they plan to address management objectives as well as describe resultant sustainable harvest levels and required silviculture. After this proposal is reviewed and approved by DNR, Licensees proceed with defining operational harvest blocking and habitat areas for the first 25 years of the Forest Management Plan. The model is then re-run using the operationally defined harvest blocking and a spatial-based sustainable harvest level is determined. It is this sustainable harvest level that is then allocated by the Minister to Licensees and Sub-Licensees.

The Forest Management Plan guides all forest-related activities on the Licence. This is accomplished through the annual Operating Plans that define where harvesting, silviculture and road construction is to occur on the Licence.

3.3 Forest Management Plan Format

The document, *A Vision for New Brunswick Forests: Goals and Objectives for Crown Land Management,* describes the standards for the Forest Management Plan format. The document

defines management scenarios that must be analysed and presented along with tables, graphs and charts that explain the analysed scenarios.

3.4 Forest Management Plan Schedule

A schedule of activity for the creation of these Forest Management Plans is developed by mutual agreement between Licensees and DNR through the *Forest Management Planning Committee*. This Committee is composed of representatives from each Licensee and DNR. It has the mandate to set procedures, standards, roles and responsibilities, and milestones for activities leading to the creation of Forest Management Plans. These activities include ensuring that all necessary databases such as deer wintering areas, old spruce-fir habitat blocks, buffers, operationally inaccessible areas, Forest Development Survey cruise data, forest inventory and yield curves are ready to be used in the upcoming management plan cycle.

The schedule created by the Forest Management Planning Committee defines milestones that both Licensees and DNR must respect in order to complete Forest Management Plans prior to the beginning of the 5-year management plan period.

3.5 Roles and Responsibilities

To ensure the efficient execution of the Forest Management Plan schedule, the roles and responsibilities of both DNR and Licensees need to be clearly defined.

DNR is responsible for setting forest management goals, objectives and standards that reflect public values. It is also responsible for the identification and development of forest management policies, objectives and standards and the review and approval of the Forest Management Plan.

Licensees are responsible for developing and implementing Forest Management Plans that meet government goals, objectives, and standards. They prepare spatial Forest Management Plans using the DNR format and submit them in accordance with the established schedule. They also conduct public consultation related to the Forest Management Plan.

4 Operational Planning and Implementation

4.1 General

This section of the FMM contains the five major activity areas associated with the management of the New Brunswick Crown land forest resource. Specifically, these areas are:

- Silviculture
- Harvesting
- Roads and Watercourse Crossings
- Fish and Wildlife Habitat
- Scaling and Utilisation

Each activity area, represented as an individual section in the FMM, describes the objectives, roles and responsibilities of DNR and Licensees, and the requirements and standards to which Crown land is to be managed. It is recognised that due to extenuating circumstances the standards contained in this manual may not be appropriate in all cases. As such, DNR may approve modifications to a standard where deemed appropriate.

Some operations on Crown land have the potential to cause environmental damage. As such, it is the responsibility of the Licensee to develop and include in their Operating Plan a *Hazardous Materials Spill Response Plan* that defines the measures to be taken in the event of a spill. Operations associated with road construction and watercourse crossings have the most potential to pollute water and adversely affect aquatic habitat. Where environmental problems occur, they are to be corrected and DNR immediately notified of the mitigative actions taken. Adherence to the following standards and precautions will help minimise environmental damage.

- Chemicals such as lime, cement, creosote, and de-icing agents, shall be restricted to their prescribed use.
- No garbage shall be left on Crown Lands.
- For equipment spills of oil, fuels, coolant and hazardous waste resulting from hose ruptures or other accidents, use preventative measures to ensure the spill is contained away from surface water flow.
- All spills of oil, fuels, coolant and hazardous waste shall be collected or absorbed and the waste disposed of at a recognised disposal site. A list of disposal sites may be obtained from the Department Environment and Local Government.
- In the event of a spill greater than 20 litres, the operator is to notify the Department of Environment and Local Government (DELG) and DNR.

This major section of the FMM describes the planning process and required content of Operating Plans that are prepared annually by Licensees and reviewed and approved by DNR. Through the Operating Plan, approval is provided for implementation of the major activities associated with the management of Crown land.

The Operating Plan is to be developed, submitted, reviewed and approved according to the schedule in Table 1. Detailed information about actual Operating Plan content and standards can

be found in each activity section of the Operational Planning and Implementation section of the FMM.

The Department reviews and approves the Operating Plan subject to the FMM and Departmental policies. The Operating Plan will be used as part of the performance evaluation of the Licensee. One copy of the approved Operating Plan is to be submitted by the Licensee and will reside in the DNR Regional office.

Table 1. Schedule of annual Operating Plan activities.

Responsibility	Activity	Completion Date	FMM Section
Licensee	Operating Plan first submission: - at least 70 % of planned annual harvest volume - approved herbicide plan	November 30	4.3.2
DNR	Response to first Operating Plan submission	February 15	4.3.2
Licensee	Operating Plan second submission: - 100 % of planned annual harvest volume - proposed and existing road network	March 15	4.3.2 and 4.4.2.6
Licensee	Status report for all blocks with no final harvest inspection report submitted	March 31	4.3.3
DNR	Response to second Operating Plan submission	April 15	4.3.2
Licensee	Outstanding Operating Plan issues submitted to DNR	April 30	4.3.2
Licensee	Remaining components of the Operating Plan - scaling arrangements - letters of agreement for Sub-Licensee operations - fibre requirement information - product utilisation standards - road maintenance - Hazardous Materials Spill Response Plan	Prior to harvest commencement	
Licensee	Submit Silviculture Work Plan	One month prior to silviculture commencement	4.2.2
Licensee	Submit at least 25 % of total proposed area for each silviculture treatment type	Two weeks prior to treatment commencement	4.2.2
DNR	Response to outstanding Operating Plan issues	June 15	4.3.2
Licensee	Following year's herbicide plan submission	August 15	4.2.2
Licensee	All allocated forest products harvested during the previous operating season shall have been trucked to an approved destination	September 30	4.3.3
DNR	Response to following year's herbicide submission	October 15	4.2.2

The Operating Plan, when approved, authorises Licensees to carry out the activities they propose to undertake on their Licences. Management of Crown land activities at the operational level is

described in the five major activity sections. Each section describes the framework for the implementation of the activity and associated components including objectives, roles, responsibilities, and standards to which the activity is to be implemented. A brief summary and introduction of each section follows.

4.1.1 Silviculture

The silviculture section and related appendices of the FMM (sections 4.2 and 9) describe the system used to implement, monitor and reimburse Licensees for silviculture activities done on Crown land. Licensees have the responsibility to plan and implement silviculture on Crown land following the standards and procedures detailed in the FMM. The Licensees are reimbursed for the completed silviculture as described in the Silviculture Monitoring and Reimbursement part of the silviculture section. As part of long-term sampling aimed at ensuring areas perform as predicted in the Licence Forest Management Plans, Licensees conduct visual assessments in five year-old plantations and naturally regenerating cuts, and formal surveys in ten year-old plantations.

The role of DNR in the silviculture delivery system is to monitor Licensee compliance with pre- and post-treatment standards, establish reimbursement rates, approve Licence silviculture budgets and reimburse Licensees for successfully completed treatments.

For a complete description of procedures, standards, requirements, roles, and responsibilities please refer to section 4.2 of the FMM.

4.1.2 Harvesting

The harvesting section of the manual identifies information and time frames for development and submission of the annual Operating Plan by the Licensees and its review by DNR.

In planning the annual harvest, Licensees will be expected to schedule the harvest of approved blocks to minimise volume loss. Volume loss may also be minimised by substituting period 1 blocks with later period blocks that are declining more rapidly in volume. The Licensee must provide justification acceptable to DNR for rescheduling blocks into the first five-year period. Harvest blocks may also be adjusted for site-specific wildlife habitat reasons.

All operations on Crown land must comply with the standards and criteria identified in the Harvesting section. As such, it is essential that both the Licensee and Sub-Licensees monitor their operations to ensure that all standards and conditions are being followed. As custodian of the forest resource, DNR holds final responsibility for monitoring all harvest operations, assessing infractions and communicating them to Licensees.

Throughout the operating season changes to the approved Operating Plan are made possible through the amendment process. Major amendments require DNR approval prior to implementation while minor amendments may be implemented immediately with subsequent notification to DNR.

In order to allow proper harvest monitoring, the Licensee must provide the appropriate DNR office(s) with weekly status reports for all Licensee and Sub-Licensee operations. The Licensee must also provide a final harvest inspection report to DNR for each harvest block. Section 4.3 contains a complete description of procedures, standards, requirements, roles, and responsibilities.

4.1.3 Roads and Watercourse Crossings

The Roads and Watercourse Crossings section of the FMM (section 4.4) describes the requirements relating to the planning, construction, and maintenance of roads and the installation of watercourse crossings. A primary objective associated with the development and maintenance of the Crown road system is the protection of fish and wildlife habitat. As such, Licensees, Sub-Licensees and Permittees are required to correct all environmental problems associated with roads and watercourse crossings.

The Licensee's Operating Plan identifies proposed road and watercourse crossing activities on an annual basis. Section 4.4 contains a complete description of procedures, standards, requirements, roles, and responsibilities.

4.1.4 Fish and Wildlife Habitat

Forestry activities affect the abundance and distribution of fish and wildlife habitats on the landscape through time. Strategic-level objectives and standards for the provision of wildlife habitats over the long-term are described in the Forest Management Planning section and in the document *A Vision for New Brunswick Forests: Goals and Objectives for Crown Land Management*. The Fish and Wildlife Habitat section of the FMM (section 4.5) describe the objectives, roles, responsibilities, standards, and requirements of the Licensees and DNR for the management and protection of fish and wildlife habitats at the operational level on Crown land.

In general, Licensees have the responsibility to plan and implement forestry activities on Crown land that follow these standards considering actual ground conditions. DNR, in turn, is responsible for monitoring compliance with these standards and assessing Licensee performance.

4.1.5 Scaling and Utilisation

The Scaling and Utilisation section and associated appendices of the FMM (sections 4.6 and 12) describe the standards and associated requirements for accurately measuring and efficiently utilising the Crown Timber resource. Scaling arrangements, which are submitted as part of the Operating Plan and approved by DNR, define the methods and procedures to be used on each Licence for scaling and monitoring the movement of primary forest products. The Licensee is responsible for the accurate measurement and timely submission to DNR of scale related information for all timber harvested by the Licence and Sub-Licensees. DNR monitors scaling and utilisation on all Crown land operations to ensure that Crown timber is accurately measured and reported in a timely fashion. A wood tracking system to monitor the movement and accounting of Crown timber is also described. Licensees are responsible for collecting and remitting royalties to DNR for timber harvested by themselves and Sub-Licensees.

Efficient use of Crown timber requires full utilisation of the tree and directing timber of a specific size and quality to the appropriate mills. Product utilisation standards exist so that material of a defined size and quality is directed to the best end use thereby helping to fulfil the various species and product allocations on a Licence. For a complete description of procedures, standards, requirements, roles, and responsibilities refer to section 4.6 of the FMM.

4.2 Silviculture

4.2.1 General

The Forest Management Plan approved for each Crown Timber Licence identifies a range of silviculture treatments and associated hectares that are to be implemented annually on each Licence over the five-year management period. Silviculture treatments are to be implemented on hardwood and softwood sites to support maximum increases in both present and future sustainable wood supplies and the provision of non-timber objectives.

The Silviculture section of the FMM describes the system that is in place for the management of New Brunswick's Crown land silviculture program. The silviculture system is managed through the following three components: Silviculture Planning, Silviculture Treatment Standards, and Silviculture Monitoring and Reimbursement. Each component addresses the objectives, roles, and responsibilities of Licensees and DNR, and defines the requirements and standards for the successful implementation of each treatment.

4.2.2 Silviculture Planning

4.2.2.1 Objectives

The Silviculture section of the Operating Plan is intended to outline the level of silviculture effort by treatment type that the Licensee proposes to implement during any operating year. The silviculture planning component describes the system used to plan and implement silviculture treatments and identifies the minimum information that must be submitted to DNR by Licensees.

4.2.2.2 Roles and Responsibilities

The Licensee is responsible for:

- Planning and submitting a Silviculture Work Plan and schedule of treatments to be implemented on the Licence.

DNR is responsible for:

- Reviewing and approving the silviculture budget for each Licence.
- Reviewing Silviculture Work Plans and schedules to validate proposed treatments.
- Conducting pre- and post-treatment assessment on a sample of submitted blocks (sections 4.2.4.3 and 4.2.4.4).

4.2.2.3 Requirements and Standards

Budgeting

The Licensee is responsible for:

- Submitting proposed area by treatment type for the upcoming operating year for use in determining the silviculture budget.

DNR is responsible for:

- Reviewing Licensee summaries of proposed area by treatment type for

the current operating year to be used in setting the silviculture budget.

Silviculture Work Plan

The Licensee is responsible for:

- Submitting to DNR, no later than one month prior to treatment commencement, a Silviculture Work Plan as part of the Operating Plan. The Work Plan is comprised of a list of treatment types and associated areas for all treatments proposed on the Licence. Licensees are not required to submit block data supporting proposed treatments as part of the Work Plan. When a Licence overlaps Regional boundaries, the Work Plan will identify the treatment types and areas proposed for each Region.
- Submitting with the Silviculture Work Plan a 1:125 000 scale map indicating treatment location, block number and treatment type.
- Submitting amendments to DNR so that the small-scale Silviculture Work Plan map remains current.

Silviculture Treatment Details

During the operating season the Licensee is responsible for submitting to DNR additional information concerning silviculture treatments considering the following:

- These submissions are to include only full planting, pre-commercial thinning, intermediate thinning and plantation cleaning.
- The first submission and each subsequent one must contain at least 25 % of the total proposed treatment type area. This will be sufficient to permit DNR to select a 20-30 % pre-treatment sample.
- Each submission represents a fixed population and as such the same block number cannot appear on two different lists.
- Each submission must be submitted at least two (2) weeks prior to commencing treatment of any blocks contained in the submission.
- The format for individual treatment block maps included in each submission must be 1:12 500 GIS forest cover type maps indicating map number, block number, block section, area, and treatment type.
- Each submission must contain individual treatment block maps for all full planting blocks submitted. Individual treatment block maps for thinning and cleaning are only required for blocks picked by DNR for pre-treatment sampling (section 4.2.4.3).
- Blocks will not be categorised by density, composition, or height class.

DNR is responsible for:

- Carrying out assessments (section 4.2.4.3) in a proportion of the proposed silviculture areas.

Herbicide

The Licensee is responsible for:

- Developing a proposed herbicide schedule from visual assessments (except for herbiciding of naturally regenerated cuts, where softwood stocking is to be derived from plot data).
- Submitting to DNR, before August 15th, a schedule of areas to be herbicided the following operating year. The herbicide schedule will contain:
  - 1:12 500 map and photo numbers (treatment area to be clearly outlined).
  - Name of geographic location.
  - Plantation number (12 characters).
  - Block number for natural areas (10 characters).
  - Softwood stocking for naturally regenerated cuts.
  - Species to be treated, area to be treated (ha).
  - Priority for treatment (high, medium, low).
  - Comments (e.g. site preparation block, 2nd treatment).
- Forwarding a revised herbicide plan, after taking into account DNR comments on the initial submission, by November 30th with the Operating Plan submission.
- Submitting any small additions (i.e. no more then 100 ha per Licence) to the herbicide program no later than one month prior to the start of the herbicide program.

DNR is responsible for:

- Evaluating the herbicide proposals and forwarding comments to Licensees by October 15th.
- Approving any small additions (i.e. no more then 100 ha per Licence) to the herbicide program.
- Obtaining all necessary permits and certificates.
- Advising the public of where, when, and how operations will be carried out.

4.2.3 Silviculture Treatment Standards

4.2.3.1 Objectives

Areas that are selected for treatment on Crown land must meet standards that have been established by industry and DNR. Treatment sites are to be selected on the basis of best site quality.

The purpose of this section is to identify the eligibility criteria and post-treatment standards for those silviculture treatments that are acceptable on Crown land. Nursery stock specifications for trees shipped from the Provincial tree nursery can be found in section 9.1. Sampling standards used for the measurement of pre- and post-treatment conditions can be found in sections 4.2.4.3 and 4.2.4.4.

4.2.3.2 Roles and Responsibilities

The Licensee is responsible for:

- Ensuring that all areas considered for silviculture treatment meet pre-treatment criteria and once treated meet the post-treatment criteria.
- Submitting commercial thinning prescriptions and conducting operations consistent with Forest Management Plan objectives.

DNR is responsible for:

- Monitoring the performance of Licensees in conforming to pre and post-treatment criteria.
- Approving prescriptions for commercial thinning operations as submitted in the Operating Plan and ensuring that they are in compliance with the Forest Management Plan objectives.

The Licensee and DNR are jointly responsible for:

- Developing pre-treatment eligibility criteria and post-treatment standards for silviculture treatments.

4.2.3.3 Natural Regeneration Standards

Natural Regeneration Target

The regeneration target for naturally regenerating areas 5 years after clear cut is as follows:

- Minimum stocking of 60 % commercial species.
- Minimum height of 0.50 m.

Areas not meeting the natural regeneration stocking target should be considered for silvicultural treatment. If significant amounts of area do not meet the stocking target then both the regeneration projections made in the Forest Management Plan and the prioritisation of area for planting should be re-examined.

4.2.3.4 Softwood Plantation Standards

Pre-treatment Criteria

The pre-treatment criteria for softwood plantations are:

- In most cases, areas to be planted should originate from one of the following cover types:
  - Softwood (S) (75 % or more softwood).
  - Softwood/hardwood (SH) (softwoods greater than or equal to 50 % and less than 75 %),
  - Intolerant (HS) hardwood/softwood (softwoods greater than or equal to 25% and less than 50 %, with more intolerant than tolerant hardwood),
  - Intolerant (H) hardwood (less than 25 % softwood, with more intolerant than tolerant hardwood) on ecosites 1, 2, 3, 4 or 6.
  - Exceptions may be approved by DNR where relatively small parts (e.g. < 5 ha) of the cut block originated from cover types other than indicated in the above four bullets.
- Where intolerant H type stands on ecosites 5, 7, 8, and 9, or tolerant H or HS stand types are not regenerating as expected, the decision to full plant will be determined by a joint DNR and Licensee assessment.
- The stocking of acceptable softwood regeneration (section 9.3) must be less than 45 % for full planting or less than 75 % for fill planting.
- Unless otherwise approved by DNR the timing of regeneration evaluation is as follows:
  - Areas harvested during September to April can be evaluated no earlier than the August following harvest.
  - Areas harvested during May to August can be evaluated no earlier than July of the following season.

Immediate Post-treatment Criteria

The post-treatment criteria for softwood plantations immediately after treatment are:

- Density:
  - 1 650 to 2 500 stems/ha for full plantations.
  - 2 500 to 4 000 stems/ha for full plantations composed of white pine or white pine and spruce or red pine mixtures. In mixtures, white pine must be greater than 50 % of trees planted.
  - Not applicable in fill plantations.
- Minimum stocking:
  - 90 % stocking of planted trees in full plantations.

- 90 % stocking of planted and naturals in fill plantations.
- 50 % stocking of planted trees in full tree roadside plantations.

5th-year Full Plantation Post-treatment Criteria

The post-treatment criteria for softwood full plantations five years after treatment are:

- Target Density:
  - 1 500 to 3 000 softwood stems/ha.
  - 2 500 to 4 000 stems/ha for full plantations composed of white pine or white pine and spruce or red pine mixtures. In mixtures, white pine must be greater than 50 % of trees planted.
- Stocking:
  - Minimum 75 % stocking of softwood (planted and natural) trees.
  - Minimum 50 % stocking of softwood (planted and natural) trees in full tree roadside plantations.
  - Minimum 65 % of area stocked to softwood at target density (see above).
- Overtopping:
  - Maximum 25 % of area stocked to softwood with hardwood or shrub species taller than the crop softwood tree.

4.2.3.5 Herbicide Standards

Pre-treatment Criteria

Unless otherwise approved by DNR, the following criteria shall apply to areas to be treated with herbicides. Reasonable effort should be made to stratify according to established criteria using the sampling procedures outlined below.

- Softwood Plantations - First Application:
  - Softwood stocking (planted and natural) must be greater than 75 %.
  - Plantations must be established for at least 1 growing season.
  - Hardwood, woody brush and/or herbaceous weeds must occupy 80 % of the site.
  - 60 % of the planted softwood crop trees must show growth interference.
- Softwood Plantations - Second Application:
  - More than 25 % of the softwood is showing growth interference with hardwood, woody brush and/or herbaceous weeds. Growth interference refers to reduced leader height growth, abundance of shade foliage, damage to leader from “whipping” or other physical

damage from adjacent vegetation. Shade foliage is characterized by fine, short needles and branches and perhaps light discolouration. Both reduced leader length and shade tolerant foliage are readily apparent by observation and comparison of a few "competition free" seedlings in the plantation or cutover.

- Plantation is less than 8 years old.

- Site Preparation
  - Where the following is specified or occurs: larch planting, hardwood planting, fill planting, scarified areas where planting was unavoidably delayed, dense aspen regeneration, wild fire, etc.
- Naturally Regenerated Cuts
  - No significant volume of residual commercial hardwoods.
  - No application if the original map stand typing was greater than 60 % tolerant hardwood.
  - Softwood stocking (based on stocked plots) must be greater than or equal to 75 %.
  - Hardwood, woody brush and/or herbaceous weeds must overtop more than 75 % of the stocked softwood.
  - Where significant amounts of larch and/or cedar occur, the stocking of each should be recorded and considered in the approval of the area.
- Experimental
  - Relatively small areas as per design.

Sampling Procedures

- Plantation (First and Second application):
  - Visual assessment of competition levels using existing criteria is acceptable.
- Natural Stand:
  - Assessment is to be done using the silviculture stocking survey (section 9.3) with an intensity of 1 plot per hectare. Stocking should be recorded by commercial softwood and hardwood species groups. Where significant amounts of larch and cedar occur they must be tallied separately from the commercial softwood group.

Herbicide Setbacks

Helicopter spray crews carry out operations in about a 40-day period in August and September. Each area treated is closed to public access during application but reopened when treatment is completed and area posted. Signs remain in place until mid October.

- Setbacks are defined as follows:
  - No application is conducted within 155 m of occupied habitation.
  - No application is conducted within 50 m of adjacent private property boundaries.
  - No application is conducted within 65 m of surface water.
  - No application is conducted within 3 km upstream from the extraction point of a designated watershed.
  - No application is conducted in wind speeds above 10 miles (16 km) per hour.

4.2.3.6 Pre-commercial Thinning Standards

Pre-treatment Criteria

The pre-treatment criteria for pre-commercial thinning are:

- Where softwood crop trees are greater than or equal to 50 %:
  - Residual tree basal area must not exceed 25 % crown closure (normally equates to a residual basal area of 5 m^2/ha).
  - Density must be greater than 3 000 stems/ha.
  - Stocking of crop trees must be greater than 60 %.
  - Crop trees are defined as jack pine, spruce, fir, white pine, cedar, hemlock, red pine, larch, commercial hardwood, or any combination of these. In deer wintering areas precommercial thinning should favour the leaving of cedar, hemlock, spruce, or fir over other commercial species.
  - The average height of crop trees will normally be 2.0 m to 7.0 m. Where mountain maple is a significant competitor (greater than 25 % stocking) the average crop tree height will be 3.0 m to 7.0 m.
- Where hardwood crop trees are greater than 50 %:
  - Residual tree basal area must not exceed 25 % crown closure (normally equates to a residual basal area of 5 m^2/ha).
  - Density must be greater than 3 000 stems/ha.
  - Stocking of crop trees must be greater than 60 %.
  - Crop trees are defined as sugar maple, red maple, yellow birch, oak, ash, white birch, aspen, commercial softwood or any combination of these. In deer wintering areas precommercial thinning should favour the leaving of cedar, hemlock, spruce, or fir over other commercial species.
  - The average height of crop trees will normally be 4.0 m to 9.0 m.

Post-treatment Criteria

The post-treatment criteria for pre-commercial thinning are:

- Crop tree density:
  - S and SH stands are 1 500 to 3 000 stems/ha (3 000 to 4 000 stems/ha will be allowed in white pine provided that white pine are more than 50 % of the crop trees).
  - HS and H stands are 2 000 to 3 500 stems/ha.
- Crop tree stocking of 60 % minimum.
- Quality of 85 % minimum (section 9.5).
- Average crop tree heights will normally be between 2 and 7 m for softwood and 4 and 9 m for hardwood.

4.2.3.7 Plantation Cleaning Standards

Pre-treatment Criteria

The pre-treatment criteria for plantation cleaning are:

- Full plantations that meet the 5th-year post-treatment criteria (section 4.2.3.4) will be eligible for plantation cleaning. Full plantations that do not meet the 5th-year post-treatment criteria should be considered as failed plantations and may be eligible for pre-commercial thinning (section 4.2.3.6).
- Density must be greater than 3 000 stems/ha.
- Stocking of softwood crop trees must be greater than 75 %.
- Crop trees are defined as jack pine, spruce, fir, white pine, cedar, hemlock, red pine, larch, commercial hardwood, or any combination of these. In deer wintering areas plantation cleaning areas should favour the leaving of cedar, hemlock, spruce, or fir over other commercial species.
- The average height of crop trees will normally be 2.0 m to 7.0 m. Where mountain maple is a significant competitor (greater than 25 % stocking) the average crop tree height will be 3.0 m to 7.0 m.

Post-treatment Criteria

The post-treatment criteria for plantation cleaning are:

- Crop tree densities:
  - 1500 to 3000 stems/ha (3000 to 4000 stems/ha will be allowed in white pine provided that white pine are more than 50 % of the crop trees).
- Softwood crop tree stocking of 75 % minimum.
- Quality of 85 % minimum (section 9.5).
- Average crop tree height should normally be in between 2.0 to 7.0 m.

4.2.3.8 Commercial Thinning Standards

Pre-treatment Criteria

The pre-treatment criteria for commercial thinning are:

- Should originate from softwood or mixed wood plantation or pre-commercial thinning. Other stand types may be considered for commercial thinning as approved by DNR.
- Minimum post-treatment total basal area of 14 m^2/ha.
- Crop tree selection must conform to the Forest Management Plan objectives and be described in the treatment prescription.

Post-treatment Criteria

The post-treatment criteria for commercial thinning are:

- No more than 40 % of total stand basal area (including trails) may have been removed.
- To ensure that harvesting occurs uniformly across the block, thresholds have been set for stand basal area variation. These thresholds are:
  - +/- 3 m^2/ha 80 % of the time for plantations, and
  - +/- 4 m^2/ha 80 % of the time for pre-commercial thinning stands.
- Post-treatment conditions for the block should be as approved in the Operating Plan prescription including a target basal area (m^2/ha).
- Minimum post-treatment total basal area of 14 m^2/ha. See section 9.2 for guidelines on post-treatment stand basal area by species and site.
- Crop tree damage must not exceed 10 % (cambium exposure greater than 15 cm^2 to stem and roots is considered to be damage).
- The average basal area removal across all blocks must be consistent with the Forest Management Plan objectives.

4.2.4 Silviculture Monitoring and Reimbursement

4.2.4.1 Objectives

The system of silviculture delivery on Crown land provides for the monitoring of silviculture and the annual updating of reimbursement rates. The purpose of this section is to describe the process, roles and responsibilities associated with monitoring, reimbursement rate establishment, invoicing and year-end reconciliation.

4.2.4.2 Roles and Responsibilities

The Licensee is responsible for:

- Planning and implementing silviculture on Crown land

- Ensuring that the information required for DNR treatment monitoring and reimbursement rate establishment is submitted in a timely fashion.
- Ensuring that post-treatment silviculture information submitted is complete, accurate and submitted in a timely fashion.
- Ensuring that invoices are submitted to DNR on a monthly basis.
- Conducting and reporting on the results of the 5th and 10th-year surveys to DNR.

DNR is responsible for:

- Conducting pre and post-treatment silviculture sampling assessments.
- Monitoring to ensure Licensee submission of post-treatment silviculture information complies with all standards.
- Sampling silviculture treatments to collect the necessary information for updating silviculture reimbursement rates.
- Establishing silviculture reimbursement rates.
- Processing Licensee silviculture invoices for payment.
- Conducting year-end reconciliation for each silviculture treatment type.

4.2.4.3 Pre-treatment Sampling

Full planting is assessed by DNR to ensure compliance with establishment criteria. Thinning and cleaning are assessed prior to treatment only to collect density information used in calculating the following year's reimbursement rates.

Plantations

- Pre-treatment assessment of proposed full plant areas is required prior to site preparation. There is no requirement to assess proposed fill plantation areas prior to treatment.
- Regions will assess regeneration in proportion to the total area proposed for full planting in order to document the extent to which Licensees comply with established criteria (section 4.2.3.4).
- Upon receipt of maps in the Silviculture Work Plan detail submissions (section 4.2.2.3), DNR will, within a two day working period, randomly select the full plant blocks to assess (10-20 % of submitted area) and notify the Licensee which blocks or block sections are to be assessed for regeneration. With two full days notice, the Licensee has the option of accompanying DNR during the assessment of the selected blocks.
- Blocks or block sections will be assessed for stocking using the silviculture stocking survey (section 9.3) at an intensity of either two (2) or four (4) plots per hectare. However, if a block fails the stocking standard a survey done at four (4) plots per hectare is required.

- All survey results, determined alone by DNR or jointly with Licensee, will be final. Stocking values of surveyed blocks will be presented to the Licensee as the block assessments are completed.
- A block or block section will be deemed unacceptable for full planting when the stocking of acceptable softwood regeneration as determined by the survey exceeds 45 %. Where the stocking level exceeds 45 %, the Licensee has the option of fill planting the block or stratifying it to determine unstocked parts acceptable for full planting. Where full planting is the chosen option, the block number and stocking value of each stratified section is to be submitted to DNR one week prior to the commencement of scarification.

Roadside Plantations on Full Tree Operations

- Roadside strips must be visually assessed for stocking of commercial species (section 4.2.3.3) within 3 years of harvest and if planting is required, it must be completed within 6 years of harvest.

Pre-Commercial Thinning, and Plantation Cleaning

- Upon receipt of block lists, DNR will within two working days select the blocks to be sampled (random basis) and notify the Licensee. Upon notification, Licensees are required to have all blocks mapped and ready for DNR sampling. Sampling will cover the entire block within the perimeter mapped by the Licensee.
- The Licensee, given two full days notice, has the option of assessing the blocks with the DNR as per the DNR time schedule.
- All survey results either alone by DNR or jointly with Licensee will be final.
- Blocks will be assessed by species for density, residual stem basal area, stocking and height at an intensity of 1 plot per hectare. The same plot centre will be used for both the silviculture stocking survey (section 9.3) and silviculture density survey (section 9.4). In order to determine the average block height, the height of the tallest crop tree in each stocking survey plot will be measured to the nearest one-third of a metre.
- The proportion of softwood relative to hardwood density will determine the composition of each block. A block will be considered softwood when softwood crop trees are greater than or equal to 50 % of the total crop tree density.
- Portions of blocks less than 0.04 ha in size which do not meet criteria, will be included in the sampled area for recording height and density information.
- Blocks that do not meet criteria for density, basal area of residuals, stocking, or average height will not be included in data to determine

reimbursement rates.

4.2.4.4 Post-treatment Sampling

An assessment of area is carried out in a portion of each funded silviculture treatment type completed on Crown land. The intent of this procedure is to verify the accuracy of treated area reported by Licensees. A quality assessment is also conducted in pre-commercial thinning and plantation cleaning at the time of area verification.

DNR is responsible to ensure that commercial thinning operations comply with the objectives as stated in Licensee Forest Management Plans and the post-treatment standards approved with this treatment in the Operating Plans. As such, post-treatment assessments will be carried out in at least 10 % of the commercially treated area on each Licence with a minimum of two treatment blocks.

In order to allow proper DNR post-treatment monitoring, Licensees will within one month of treatment completion (planting, pre-commercial thinning or plantation cleaning), submit the treatment data form, map, or digitised map of each treated block to the appropriate DNR office. The thirty day requirement also applies to sections of blocks. For commercial thinning a final harvest inspection report should be submitted as per the standards found in section 4.3.3.

Area Measurement

The following procedure will apply to all area verification:

- Where Licensees submit a block using GIS area, DNR will ensure that the treated area conforms to the mapped block boundaries and subtract void area (measured using GPS if desired) from the GIS area.
- Where Licensees do not use the GIS area, DNR can use GPS to verify the block area.
- DNR areas will be final, unless there is a discrepancy (+/-5 %). When there is a large discrepancy, DNR and the Licensee must determine what is causing the difference. If necessary, a joint field visit may be done.
- All untreated areas larger than 0.04 ha are considered voids and will be deducted to calculate net treated area. All voids 0.5 ha and larger are to be mapped. When measuring a void a growing space of 1 m is allowed on crop trees.

Plantations

Since Licensees are required to assess plantation quality (both fill and full) at year five and ten, and take proper remedial action, immediate post treatment quality assessment of plantations is not conducted by DNR. Therefore, only post-treatment area assessment will be carried out by DNR.

The full plantation post-treatment assessment procedure will be done as follows:

- A minimum of 10 % of full planting treatment area is monitored by

DNR. Post treatment area assessment will apply to the entire block or block section.

The fill plantation post-treatment assessment procedure will be done as follows:

- A minimum of 20 % of post-treatment fill planting area is monitored by DNR for natural stocking determination and area verification. Post-treatment area assessment will apply to the entire block or block section. DNR will (following Licensee notification of block completion), randomly select the fill plant blocks to assess and notify the Licensee. With two full days notice, the Licensee has the option of assessing the selected blocks with DNR as per the DNR time schedule.
- The assessment will be conducted at an intensity of two plots per hectare using the silviculture stocking survey (section 9.3).
- The area within 50 m of a road on full tree operations is to be surveyed separately (see roadside strip planting assessment below).

The roadside strip planting on full tree operations will be assessed post-treatment as follows:

- Area must be visually assessed for stocking (section 4.2.3.3) of commercial species within 3 years of harvest and if planting is required, must be completed within 6 years of harvest. After the planting, DNR may conduct an area audit and will estimate whether or not the roadside portion meets the 50 % softwood stocking standard. If the roadside strip fails the DNR assessment, the Licensee may request a formal joint survey. Where the roadside strip does not meet the post-treatment standard, the Licensee must bring the area up to standard during the subsequent operating season.

Pre-Commercial Thinning and Plantation Cleaning

The pre-commercial thinning and plantation cleaning post-treatment assessment procedure will be done as follows:

- A minimum of 10 % of the treatment type area is monitored with a minimum of two blocks. All post treatment assessments will apply to the entire block or block section.
- The quality of the thinning treatment will be assessed using the silviculture quality survey (section 9.5).
- In the event that the treated area does not meet quality, stocking, or area standards (section 4.2.3.6 or 4.2.3.7) as determined from DNR assessment, the Licensee has the option of accepting DNR results or requesting a joint assessment. Where a joint survey is to be done and the area has failed to meet stocking standards, an intensity of 5 stocking plots/ha should be used to be confident in the final stocking estimate. The results of all joint assessments are final.

- The total area that fails to meet post-treatment criteria will be considered as unacceptable area and utilised as such in the year-end area reconciliation process (section 4.2.4.7).

Commercial Thinning

The commercial thinning post-treatment assessment procedure will be done as follows:

- Post-treatment assessments will be carried out in at least 10 % of the total annual treated area on a Licence.
- 1 plot per hectare (minimum of 10 plots) evenly distributed over the block and generally perpendicular to the direction of the trails.
- At each plot the following is assessed:
  - Basal area (m^2/ha) by species.
  - Percent of crop trees with damage (cambium exposure greater than 15 cm^2 to stem and roots is considered to be damage).
  - Tree selection to meet the overall prescription objective.
- A Licensee and DNR joint survey (2 plots/ha) will be done if the block fails to meet post-treatment standards (section 4.2.3.8). The results of this survey will be considered final.

4.2.4.5 Long-term Sampling

5^{th}-year Plantation and Natural Regeneration Area Survey

- Licensees, based on visual assessments, will report on the stocking and hardwood competition status of all 5-year-old plantations, indicating any remedial action required (section 5.5.3).
- Following the same time frame and based on visual assessments, Licensees will report on the status of untreated cuts with respect to the total commercial crop tree stocking, average dominant tree height and species mix (section 5.5.3).

10^{th}-year Plantation Survey

- The 10^{th}-year plantation survey (section 9.6) has been designed to provide data which will confirm the current condition of the plantation and indicate what, if any, treatments is necessary to improve stand growth in order to meet the specified growth objectives in the Forest Management Plan.
- Only those plantations that have not already been cleaned, or are not scheduled to be cleaned (based upon a Licensee and DNR agreement), need to be surveyed by Licensees as part of the 10^{th}-year program.

4.2.4.6 Invoicing

Invoice Content

Licensees must submit to DNR, on a monthly basis, original signed invoices that are based on area treated at the time of invoicing.

Licensees will provide the following detail on each monthly invoice:

- Area (ha) for each treatment type.
- Reimbursement rate/ha or wage rate/hour.
- Total amounts for each treatment type.
- Applicable HST.

Invoice Verification

- Invoices exhibiting errors will be returned immediately (with explanation) to the Licensee for correction.
- Original invoices will be processed by DNR for payment before block assessment occurs.

Monthly Status Report

- Licensees will submit to DNR a monthly status report summarising all Crown land silviculture completed and projected to be completed at year-end by the Licensee.
- This report must be submitted no later than the 10th day of each following month
- Each report will include the following:
  - Licence name.
  - Month of treatment.
  - Hectares treated during that month for each treatment type.
  - Dollars expended during that month on each treatment type.
  - Projected hectares to be treated by each treatment type for the entire treatment season.
  - Projected total dollars to be expended on each treatment type for the entire treatment season.
  - Total number of silviculture workers employed on the Licence during that month.

Treatment Certification

- Licensees will, within 30 days of treatment completion, submit the treatment certification data form and map (1:12 500) of each treated block to DNR. Electronic equivalent submission will be acceptable.
- Certification forms or maps exhibiting errors will be returned to the Licensee for correction.

- DNR will use the certification information to verify silviculture updates, compile year-end results and verify budget expenditures by treatment type to complete the year-end reconciliation process.

4.2.4.7 Year-end Reconciliation

Year-end area reconciliation is carried out annually to resolve differences between DNR and Licensees with respect to the measurement of treatment areas and compliance with quality standards established for Crown land silviculture. The area of thinning, cleaning and plantation not meeting existing criteria are to be included in the year-end reconciliation calculation. DNR will, upon receipt of notification of treatment completion, carry out post treatment assessments (section 4.2.4.4) on randomly selected blocks in each treatment type.

Reconciliation calculations are carried out for each treatment type. The year-end difference between the Licensee and DNR net area in a treatment type may vary by a maximum of +/-2 %. Where the difference is greater than the maximum allowable +/-2 %, an adjustment will be made to the total invoiced amount for that treatment.

4.2.4.8 Silviculture Rate Determination

DNR pre-treatment assessments for thinning and cleaning (section 4.2.4.3) and post-treatment assessments for fill planting (section 4.2.4.4) will be used to determine reimbursement rates for each Licence. The area sampled by DNR must be at least 20-30 % of the total treated area submitted by the Licensee for treatment.

The data used to determine the reimbursement rate comes from the current year and the two previous year's sampling. If a submitted block is found upon sampling to not meet the criteria for treatment then that sampled block is neither used in the reimbursement rate determination nor treated by the Licensee. The three-year average area-weighted stocking, in the case of fill planting, or density, in the case of thinning and cleaning, will be used to determine the reimbursement rate for a treatment.

4.3 Harvesting

4.3.1 General

The harvest section of the Forest Management Manual covers the objectives, roles, responsibilities, standards, and requirements of Licensees, Sub-Licensees, and DNR for the following aspects of harvest operations on Crown land:

- Harvest Planning
- Harvest Implementation and monitoring
- Amendment Process

4.3.2 Harvest Planning

4.3.2.1 Objectives

The Harvest section of the Operating Plan is intended to provide the geographical locations and operational details for all Licence harvest treatments for the operating year. This information is used to plan, review, approve, implement, and monitor the progress of harvest treatments on the Licence.

Periodic reporting throughout the operating year on the status and progress of harvest operations on Crown land is intended to facilitate a reasonable level of monitoring and control of harvest operations conducted by Licensees, Sub-Licensees, DNR, and other permittees.

4.3.2.2 Roles and Responsibilities

The Licensee is responsible for:

- Submitting an operating plan that is consistent with objectives identified in the Forest Management Plan and meets FMM requirements.
- Preparing and submitting the annual Operating Plan information to DNR for all planned harvest operations on the Licence.
- Negotiating wood supply agreements with the appropriate Crown Sub-Licensees and incorporating these into the harvest section of the Operating Plan.
- Providing DNR with commencement notification through weekly status reports for all Licensee and Sub-Licensee harvest operations carried out under the Operating Plan.
- For Licensee harvest operations: obtaining all regulatory permits associated with conducting harvest operations on Crown land.
- For Sub-Licensee harvest operations: ensuring all regulatory permits associated with conducting harvest operations on Crown land have been obtained.
- For Licensee and Sub-Licensee operations: submitting all required timber scale information to DNR from harvest operations conducted under the Operating Plan (section 4.6).
- Submitting proposed harvest amendments to DNR and keeping the Operating Plan up-to-date with approved amendments.

- For Licensee and Sub-Licensee operations: submitting the *Hazardous Materials Spill Response Plan*.

DNR is responsible for:

- Reviewing and approving proposed harvest treatments in the Operating Plan consistent with the objectives in the Forest Management Plan.
- Reporting to the Licensee information on harvest operations under DNR supervision (e.g. First Nations, tendered or untendered permits). Information shall be submitted in the same format, as that required for the Operating Plan.

4.3.2.3 Requirements and Standards

The Licensee shall ensure that the Harvest section of the Operating Plan contains:

- Mapped locations of harvest blocks and treatments (1:12 500 scale or a digital format mutually agreeable to DNR and Licensee).
- Descriptions of scheduled treatments (section 10.1).
- Planned annual harvest volumes by species, product and allocation (section 10.2).
- Maps shall show forest classification information, GIS map numbers, harvest block numbers, photographic centres & numbers, Crown boundary lines, existing and proposed roads, proposed watercourse crossing locations and opening sizes, harvest treatment boundaries, watercourses, and watercourse buffer zone objective(s). They shall also contain OSFH, DWA, and other environmental or recreational information maintained by DNR in the forest inventory (GIS) (e.g. PSP, trails, Protected Areas, leases, or unique sites).
- Block-specific prescriptions that indicate silvicultural objectives. For blocks in DWA and OSFH, prescriptions shall identify pre- and post-treatment habitat status (sections 4.5.4 and 4.5.5). Non-clear cut prescriptions shall describe the treatment objective criteria and post-treatment objectives.
- The Licensee shall adhere to the following schedule for the submission of Operating Plan harvest information to DNR (Table 1):
    - November 30th – geographical and harvest treatment information for at least 70 % of the planned harvest volume for softwood and hardwood.
    - March 15th – submission of geographical and harvest information (sections 10.1 and 10.2) for 100 % of the planned harvest volume for all species and products.
    - Any outstanding Operating Plan issues will be formally submitted to DNR on or before April 30th.
- Unless otherwise agreed with DNR, one signed copy of the approved Operating Plan shall be provided to DNR Regional office responsible for that portion of a given licence.

DNR is responsible for:

- Submitting operating plan information (to the same standards and content) to Licensees pertaining to public fuel wood harvesting or other operations under DNR supervision.

- Issuing work permits for industrial operations prior to commencement of operations. The Operating Plan approval letter will be the work permit for Licensee/Sub-Licensee Crown land operations.
- Adhering to the following schedule in reviewing the harvest section of Operating Plan (Table 1):
    - February 15th – response to Licensees on their November 30th submission indicating approved blocks, details for any required modifications, or further information required.
    - April 15th – response to Licensees on their submission of March 15th with a status report of submitted blocks indicating approval and an explanation of any modifications required.
    - Any outstanding Operating Plan issues after the formal response to the Licensee's submission of April 30th shall be resolved by DNR on or before June 15th.

4.3.3 Harvest Implementation and Monitoring

4.3.3.1 Objectives

Harvest operations must be effectively implemented in compliance with the Operating Plan and consistent with the objectives and strategies of the Forest Management Plan.

A communication process must be established between Licensees and DNR that provides DNR with sufficient information to be able to efficiently and effectively monitor harvest operations.

4.3.3.2 Roles and Responsibilities

The Licensee is responsible for:

- Monitoring of Licensee and Sub-Licensee harvest operations to ensure compliance with the Operating Plan, the FMM, and federal and provincial acts and regulations.
- Providing DNR with a weekly status report for all active harvest blocks (section 10.3).
- Providing DNR with amendments for Licensee and Sub-Licensee operations (section 4.3.4).
- Providing DNR with final harvest inspection information for each harvest block (section 10.4).
- Notifying DNR where “No Hunting” signs are required around harvest operations during hunting season.
- Requesting approval from DNR for temporary road closure when this action is deemed necessary to prevent unnecessary damage (4.4.2.16).

DNR is responsible for:

- Monitoring of all harvest operations on the Licence to ensure compliance with the Operating Plan, the FMM and federal and provincial acts and regulations. This also includes harvest operations conducted outside of the Operating Plan (e.g. mine sites, tendered and untendered, quarry sites, industrial campsites, and utility corridors).

- Supplying and posting "No Hunting" signs on operations during hunting season as requested by the Licensee or other permittees.
- Supplying Licensee with signed copy of Final Inspection form (section 10.4).

4.3.3.3 Requirements and Standards

The Licensee is responsible for:

- Complying with federal and provincial acts and regulations.
- Ensuring that Licensee and Sub-Licensee harvest operations are carried out in compliance with the Operating Plan and all standards found in the FMM. They will also monitor these harvest operations for compliance with the following requirements that are the responsibility of the Licensee or Sub-Licensee who operated the harvest block:
    - Block boundaries are located (i.e. flagged) as in the Operating Plan and are consistent with opening size objectives as indicated in the Forest Management Plan and as developed by the *Forest Management Planning Committee* (section 3.4).
    - A legible sign indicating the harvest block number shall be posted when harvesting activity commences on a block and shall remain intact until all primary forest products have been trucked.
    - Maximum opening size is limited to 100 ha. DNR may authorise larger openings.
    - Crown boundary lines, mining claim posts, and survey monuments must remain intact. Boundary lines should be kept free of slash from harvest operations.
    - Provincial highway rights-of-way shall not be used as landing areas.
    - The surface of roads should not normally be used as landing areas. If road rights-of-way are used as landing areas, the operator shall restore them to standard (section 4.4) following completion of the operation.
    - Operations adjacent to a numbered provincial highway require a 30 m standing timber buffer along the right-of-way edge.
    - Harvesting of steep slopes shall be conducted in accordance with the Steep Slope Harvesting Standards (section 10.5).
    - Harvesting of tolerant hardwood and tolerant hardwood/softwood stands shall be conducted in accordance with the Best Management Practices for Crown Land Tolerant Hardwood and Tolerant Hardwood/Softwood Stands (section 10.6).
    - Harvest slash and chipper debris shall be distributed so it does not pose a significant fire hazard or inhibit the achievement of regeneration standards (section 4.2.3.3). In cases where regeneration standards have not been met because of harvest slash, site restoration or remedial silviculture (sections 4.2.3.4 and 4.2.4.4) will be the responsibility of the Licensee or Sub-Licensee who operated the block.
    - No garbage, oil, or other refuse associated with the harvest operations shall be left on the harvest block. Spills of hazardous materials shall be remedied according to the *Hazardous Material Spill Response Plan* found in the Operating Plan.

- Reasonable efforts have been made to minimise rutting.
- Damage to roads shall be minimised. The Licensee or Sub-Licensee causing the damage shall be responsible to bring the road back up to standard as soon as possible.
- All allocated primary forest products harvested in one operating year shall be trucked to an approved destination (as per the Operating Plan) by no later September 30th of the following year unless otherwise approved by DNR.
- Buffering of permanent sample plots to established standards.

- Providing amendments for Licensee and Sub-Licensee harvest treatments according to the amendment process (section 4.3.4).
- Providing appropriate DNR office(s) with weekly status reports for all Licensee and Sub-Licensee harvest operations such that:
  - Information is provided in a format mutually agreeable to Licensee and DNR.
  - All information required (section 10.3) be supplied on status report.
  - Status reports shall be provided to DNR at least one workday prior to commencement of the week covered in the report.
- Providing DNR with final harvest inspection information (section 10.4) for Licensee and Sub-Licensee harvest blocks within 2 weeks of completion of the harvest operation. Where winter operations prevent the completion of a final inspection within 2 weeks, an alternative submission date will be worked out between Licensees and DNR.
- Providing DNR with a status report by March 31st of all blocks for which a final harvest inspection report has not been submitted. This report will indicate the status of the block harvest operation and a date for the submission of a final harvest inspection report.
- Providing a list of blocks for which hauling is not complete and wood remains on the block by a date in April to be set annually by DNR.

DNR is responsible for:

- Monitoring all harvest operations conducted on the Licence for compliance with the Operating Plan, Federal and Provincial acts and regulations.
- Approving final harvest information submitted by Licensees within 4 weeks of submission. When winter conditions prevent the completion of a final inspection within 4 weeks, an alternative submission date will be worked out between Licensees and DNR.
- To ensure all merchantable primary forest products are removed from harvest operations conducted outside of the Operating Plan (e.g. mine sites, tendered and untendered permits, quarry sites, industrial campsites, and utility corridors).
- For other permitted uses of the forest DNR is responsible to ensure that arrangements have been made with the Permittee to cover repair costs for significant damage they cause to roads (e.g. sugar leases, camp leases, and quarry access).

4.3.4 Harvest Amendment Process

4.3.4.1 Objectives

The amendment process is in place to efficiently update the Operating Plan for changes made in response to:

- New or more accurate information about forest stands or operating conditions.
- Economic changes (e.g. markets, mill closures, and product specifications).
- Environmental changes (e.g. wet weather, wind damage, snow depth).
- Site specific wildlife habitat concerns.

The amendment process provides information about major changes (***major amendments***) in advance, so that DNR has a reasonable amount of time to fulfil their responsibility of reviewing and responding to the Licensee.

The process provides Licensees with some operational flexibility and the responsibility to make independent changes (***minor amendments***) that are consistent with Forest Management Plan objectives and FMM standards.

4.3.4.2 Roles and Responsibilities

The Licensee is responsible for:

- Developing and proposing amendments that are consistent with the Forest Management Plan objectives and FMM requirements.
- Providing DNR with Operating Plan information to support ***major amendments*** for Licensee and Sub-Licensee harvest blocks or other Operating Plan contents.
- For amendments involving Sub-Licensees: promptly notifying them of the results of the DNR decision regarding the proposed amendment.

DNR is responsible for:

- Reviewing and responding to all proposed ***major amendments*** to the Operating Plan.

4.3.4.3 Requirements and Standards

The following changes shall be considered ***major amendments*** to the Operating Plan:

- Changing scaling arrangements.
- Changing product utilisation standards.
- Adding a new harvest block.
- Exporting, trading or exchanging wood.
- Increasing the size of an approved harvest block by more than 5 ha or 10 % of the block area, whichever is less.

- Changing the location of a proposed road outside of the block by more than 100 m, ensuring that the change in location does not impact on DWA, OSFH, non-clear cut high quality stands or silviculturally treated areas.
- Changing the watercourse buffer zone objective.
- Reducing a buffer zone width if prescribed in the Operating Plan.
- Changing by greater than 100 m the proposed crossing location on a watercourse with a defined channel width > 0.5 m.
- Changing the type of watercourse crossing to be installed or reducing the size of the opening (flow capacity).
- Changing the pre-treatment criteria or post-treatment objectives for a non-clear cut prescription or the pre/post-treatment habitat status in OSFH or DWA areas.
- For changes to the Operating Plan that do not qualify as ***major amendments***, the Licensee does not require approval of DNR. These ***minor amendments*** should however be communicated to the appropriate DNR field staff within 2 working days, in order to allow the harvest inspection process to be conducted efficiently and effectively.

The Licensee is responsible for:

- Ensuring that ***major amendments*** are not implemented prior to approval by DNR. The Licensee or Sub-Licensee may immediately implement ***minor amendments***.
- Ensuring that objectives for making ***major amendments*** are to be consistent with the Forest Management Plan objectives and FMM requirements (e.g. salvaging dying wood and maintaining high quality residual stands).
- Providing DNR with information to support proposed ***major amendments*** in the same format and to the same standard as the original Operating Plan submission.
- The Licensee must apply to DNR to approve all watercourse crossings after September 30th.

DNR is responsible for:

- Providing the Licensee with a decision regarding approval for the proposed ***major amendment*** within 10 working days. DNR must provide an explanation if the amendment is not approved.

4.4 Roads and Watercourse Crossings

4.4.1 General

The primary purpose of a road system is for forest management activities, mineral resources and recreational use. During the development and maintenance of the road system, protection of fish and wildlife habitats will be a primary objective.

This section provides minimum specifications applicable to each category of road and required procedures for planning, locating, constructing, maintaining, and closing, abandoning and signing of roads. Forest operations must comply with all federal and provincial acts and regulations.

A guideline document entitled "*Roads and Watercourse Crossings Guidelines*" has been developed in support of the New Brunswick *Crown Lands and Forest Act* and the Forest Management Manual. In general, the guideline describes procedures, practices and results that are consistent with the legislative requirements of the Manual.

4.4.2 Planning and Permitting

4.4.2.1 Background

An efficient road network is necessary to support the various management objectives assigned under the *Crown Lands and Forests Act*. This network provides multi-purpose access to the forest resource and is used by a variety of stakeholders including, Licensees and Sub-Licensees, DNR, and the general public. It is critical that this road network provide safe and adequate access. Government's responsibility in this area lies in the establishment of appropriate road construction specifications, maintenance standards and monitoring to ensure that those specifications and standards are met. The Licensee's responsibility is to plan, construct and maintain the required road network.

Through annual operating plan submissions, Licensees plan the location of new roads and stream crossings, and also identify those roads requiring maintenance during the year. An essential component of this exercise is the designation of those roads that are to be constructed as forest roads, and those that are to be constructed as logging roads. Forest roads are roads that form the main road network as set out in the yearly Licensee operating plans. All other roads are considered to be logging roads and include all roads built within a harvest block and those offshoot roads from the main road network that are necessary to obtain access to a particular harvest block. It is critical that the intended use and appropriate classification of all roads are accurately identified so that the cost of road construction can be properly assigned.

Forest and logging roads must be constructed to standards specified in the Roads and Watercourse Crossings Section of the FMM. The CLFA and FMA assign responsibility to Licensees for the construction and maintenance of forest roads. Individual Licensees and Sub-Licensees are responsible for the construction of the logging roads to and within the harvest blocks that they operate unless Sub-Licensees make arrangements to have Licensees construct these roads on their behalf. Once harvest operations have been completed and all the timber products removed, the responsibility for required maintenance of all logging roads rests with the Licensee.

Through an independent study co-ordinated by the DNR, the costs (overhead charges) associated with the management of the Crown timber resource are established periodically. The overhead charges determined through the study include a component for the road construction and maintenance costs that are appropriate for Licensees to recoup from Sub-Licensees. In this calculation, a consistent accounting approach is applied to determine an average per cubic meter charge for road construction and maintenance costs across all Licences. This charge is adjusted by Licence, where applicable, through a forest road surcharge that reflects the extra costs of road construction attributable to general site conditions. This overhead cost system provides the mechanism for ensuring that Sub-Licensees bear appropriate forest road construction and maintenance costs, proportional to their allocation.

Sub-Licensees may either construct their own operating roads or reimburse Licensees for their construction. Where the Licensee constructs the roads, the construction costs and the reimbursement arrangements are negotiated between the Sub-Licensee and Licensee as operating road construction costs are not included in overhead charges.

The forest road network is intended to provide adequate and safe access to the Crown resource. In order to ensure that the forest road network is satisfactorily addressing these requirements, Licensees are required to review the forest road network with the DNR at the end of each five-year period. This review serves to assess whether roads need to be deleted, upgraded or constructed to provide access to each Crown Licence. This review defines the forest road network for the next management period.

4.4.2.2 Road Definitions

- Forest Road – The permanent main road system of a Licence designed to provide access for forest management activity, mineral resource development and recreational use. The Licensee lists all forest roads on the Licence in their Forest Management Plan.
- Logging Road – All permanent roads on a Licence not designated as forest roads. They include roads leading directly to and within harvest blocks.
- Winter Road – Seasonal road, only used after ground is frozen. Limited only to areas where logging roads cannot be constructed.
- Temporary Road – Limited to 400 m in length, to access wood where no further road development beyond this point is planned. Within one year after harvest completion the area of the road must be reclaimed and reforested at the expense of the operator.

4.4.2.3 Forest Road Specifications

- Some forest roads constructed prior to the issuance of Crown Timber Licences in 1982 exist at a standard below the minimum accepted, however, any subsequent construction or upgrading of forest roads shall be carried out to meet minimum standards.

- The design of a forest road is dependent upon design loadings, vehicle dimensions, travel speeds, sight distances, and traffic densities that are required during the life of the road (Figure 1).
- Forest road specifications:
  - Maximum cleared right-of-way: 30 m
  - Minimum shoulder to shoulder: 5.5 m
  - Minimum gravelled surface: 5.5 m
  - Minimum sight distance: 60 m
  - Minimum ditch depth: 0.3 m
  - Brush disposal: Burying, bull penning, windrowing
  - Traffic control devices: Regulatory signs
  - Minimum structure life: 15 years

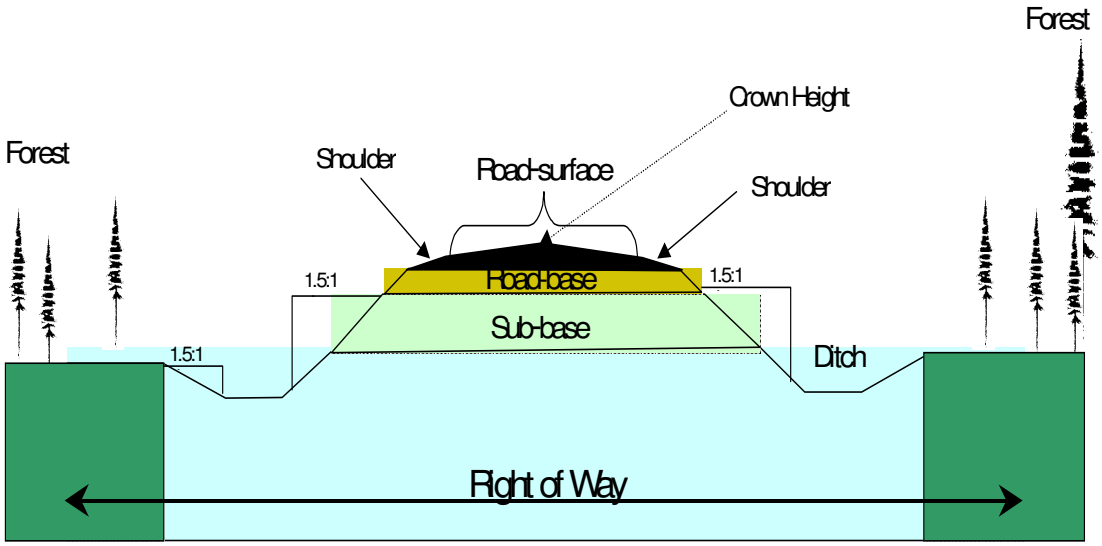


Figure 1. Typical road cross-section (Adapted from: FERIC, 1999).

4.4.2.4 Logging, Temporary, and Winter Road Specifications

- Temporary, logging and winter roads shall be built for the primary purpose of timber extraction and silviculture. Layout and design are dependent on the type of harvesting system used by the Licensee, Sub-Licensee and Permittee.
- Specifications:
  - Maximum cleared right-of-way: 20 m
  - Minimum shoulder to shoulder: 3.7 m

- Logging road surface must be elevated or ditched where required such that it provides for surface water drainage.

4.4.2.5 Roads in Sensitive Areas

- Where roads are in or adjacent to site specific wildlife habitat, refer to the specific wildlife habitat guidelines (section 4.5).

4.4.2.6 Road Planning

- Before commencing road construction or right-of-way clearing, the Licensee must have an approved Operating Plan for the current operating period and all necessary permits.
- Road planning and designation should be consistent with long-term requirements for future forest management activities.
- The Licensee's Operating Plan will contain:
    - 1:125 000 maps showing the location and classification of all existing and proposed forest roads, and
    - 1:12 500 maps showing location and classification of all proposed roads and maintenance projects (not to include road grading activities) unless already covered by maps in the harvest section (section 4.3.2.3).
- Road locations should be designed to minimise the number of watercourse crossings.
- Watercourse crossings will be installed between June 1st and September 30th.
- In fish bearing streams, installation of new watercourse crossings outside of the June 1st to September 30th window will only be approved utilising bridges or open-bottom structures where no in stream work, diversions or pumping-around is required.
- Planning for road layout will consider the known location of all sensitive environmental areas such as Deer Wintering Areas, sites of endangered species as identified by the New Brunswick *Endangered Species Act*, critical fish habitats, wetlands, etc.

4.4.2.7 Permits and Approvals

- For a watercourse draining an area greater than 600 ha, a Watercourse Alteration Permit is required from DELG.
- The Licensee will submit with the Operating Plan a list of all proposed watercourse crossings and a list of all Watercourse Alteration applications required in accordance with the *Clean Water Act*.

- Watercourse crossing structures in natural watercourses shall be installed in the dry. See "*Roads and Watercourse Crossings Guidelines*" for in-the-dry techniques.

4.4.2.8 Road Layout and Other Criteria

- The Licensee, Sub-Licensee or Permittee shall construct roads to the classification specified in the approved Operating Plan.
- The location of a road shall be defined on the ground by means of a clearly marked centre line or sidelines prior to clearing of the right-of-way.
- Roads shall not be located in watercourse buffer zones except at approved watercourse crossings.
- Watercourses (channel width ≥ 0.5 m) with a road right-of-way built parallel to it must have a treed buffer of at least 30 m.
- A Licensee shall reclassify an inactive logging road into a forest road at the request of DNR. If road reclassification is primarily for non-forestry use, any physical improvements will be done at the expense of DNR.
- Where a road not exceeding 1.5 km in length crosses lands owned or controlled by a Licensee, the Licensee shall grant a free right-of-way to the Crown. The Licensee shall construct and maintain this portion of road to the same standard as a forest road on Crown Land.

4.4.2.9 Utilisation of Wood and Other Material from Rights-of-Way

- Wood harvested from forest and logging road rights-of-way should be landed within the width of the right-of-way. Provisions can be made for landings of appropriate size including removal of wood outside the right-of-way. Grubbing is not permitted within the landing area. See "*Roads and Watercourse Crossings Guidelines*".
- Individual leaning and damaged merchantable trees along the right-of-way edge shall be appropriately utilised.
- Merchantable trees shall not be buried in roads.
- All roots, stumps, unmerchantable trees, and overburden material must be disposed of by bull penning, burying, or windrowing within the right-of-way width.
- Debris shall not be pushed into standing timber.
- On steep side slopes or on wet and unstable areas requiring brush mats, right-of-way debris may be buried in the road subgrade.
- Wood shall not be piled down within 30 m of a natural watercourse greater than 0.5 m in width or 15 m of a natural watercourse less than 0.5 m in width.

4.4.2.10 Bullpens

- Bullpens shall be a minimum of 30 m apart if on one side of the right-of-way or a minimum of 60 m apart if on both sides of the right-of-way.
- Bullpens shall be flattened, covered with soil and sloped.
- Bullpens and windrows shall not be located within 30 m of a watercourse.

4.4.2.11 Equipment Use Outside of the Right of Way

- Road building equipment associated with the removal of ground vegetation or soil disturbance shall not be permitted outside the road right-of-way width. This applies particularly to the channelization of natural watercourses and trenching for additional fill.
- Equipment work will only be permitted outside the road right-of-way width if required for surface water management such as off-take ditching or other water control devices.

4.4.2.12 Soil Disturbance

- In a harvest block, the area bared to mineral soil and/or covered with windrow material shall not exceed five percent of the harvested area.
- Vegetation will be maintained where possible to prevent unnecessary erosion and sedimentation problems. In areas where vegetation has been disturbed, proper stabilisation techniques will be employed.

4.4.2.13 Gravel Pits and Borrow Pits

- No material is to be removed from within 60 m of any watercourse or from below the water table.
- For safety purposes, faces of gravel and borrow pits must be stabilised. The Licensee, Sub-Licensee or Permittee will comply with all conditions for stabilisation and reclamation identified in the Quarry permit. See also the "*Roads and Watercourse Crossings Guidelines*".
- If the gravel or borrow pit has been temporarily or permanently abandoned, the Licensee, Sub-Licensee or Permittee will immediately correct all existing or potential safety or environmental problems. DNR will be notified of any environmental problems, including mitigative actions taken. A time frame for additional mitigative measures will be identified by DNR.
- A quarry permit is required if a quarriable substance is to be loaded and transported by truck or other material hauling equipment, or removed from outside of the road right-of-way.

4.4.2.14 Signage

- The Licensee shall be responsible for erection and maintenance of regulatory signs on roads where warranted.
- All regulatory traffic signs used on roads shall meet the requirements of applicable provincial Acts and Regulations and shall indicate actions that the operator of a motor vehicle must take for the proper and safe operation of that vehicle.

4.4.2.15 Maintenance

- The Licensee is responsible for the maintenance of all forest roads to design standards and specifications as stated in the Forest Management Manual and/or approved Operating Plan.
- Maintenance of forest roads shall include bridge/culvert repair and/or installations, gravelling, ditching, surface water management, brush removal, grading and sign installations.
- When a forest road is not being maintained to the satisfaction of DNR, DNR may undertake the work and the Licensee will be responsible for all related costs.
- The Licensee, Sub-Licensee or Permittee shall be required to rectify environmental problems on all roads in accordance with DNR regulations and standards.

4.4.2.16 Abandoning and Closing of Roads

- Forest and logging roads on Crown Lands will only be closed or abandoned through the authority of DNR.
- If a road is closed at the request of the Licensee, the Licensee shall be responsible for the proper placement of barricades, approach, and road closed signs.
- The Licensee shall give prior warning to Sub-Licensees and other industrial users of any road closure. This responsibility shall belong to DNR if the road is closed at the request of DNR.
- A Licensee may restrict access to the public on active logging or forest roads, by gating or signing, with the approval of DNR.

4.4.3 Watercourse Crossings

4.4.3.1 Width of the No-Grub Zone

- The width of the no-grub zone is dependent on the following:
    - For natural watercourses whose channel is 0.5 m or wider, a 30 m no-grub zone shall be maintained except immediately underlying the roadbed (Figure 2).

- For natural watercourses whose channel is less than 0.5 m in width, a 10 m no-grub zone shall be maintained except immediately underlying the roadbed.
- Regardless of the watercourse width no harvesting of non-merchantable wood shall be undertaken in the right-of-way area within 10 m of the watercourse excluding the roadbed.

- Grubbing and excavation of diversion channels within the no-grub zone is permitted for "in-the-dry" watercourse crossings (see "*Roads and Watercourse Crossings Guidelines*" for acceptable techniques).

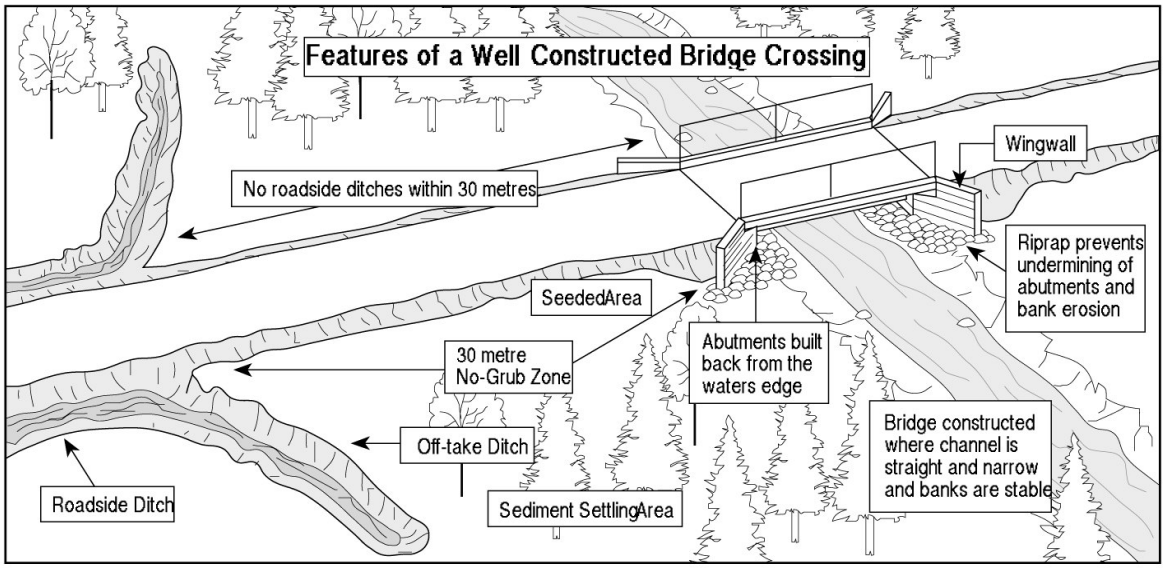


Figure 2. General features of a well constructed bridge crossing, including the 30 m no-grub zone.

4.4.3.2 Design Loading

- Watercourse crossing structures shall be designed, installed and maintained to support design loadings.
- Watercourse crossing structures that do not support design loadings shall be clearly posted stating the maximum allowable gross vehicle weight.

4.4.3.3 Culvert Sizing Criteria

- The size of drainage structures shall be determined according to the area of opening required at peak water flow. The required structure size is based on the ability to meet a 1-in-100 year (Q100) peak flow event. See "*Roads and Watercourse Crossings Guidelines*".

- Minimum culvert sizing is dependent on channel width as follows:
  - Natural Watercourses:
    - For watercourses 0.5 m and wider, the minimum acceptable culvert shall be a circular pipe 760 mm in diameter or equivalent.
    - For watercourses with a channel less than 0.5 m, the minimum acceptable culvert shall be a circular pipe 450 mm in diameter or equivalent.
  - Artificial Channel:
    - In an artificial channel constructed for surface drainage, the minimum acceptable culvert shall be a circular pipe 300 mm in diameter.
- Channel measurements shall be taken in a representative undisturbed area directly upstream of the proposed installation site for the watercourse crossing. See *Roads and Watercourse Crossings Guidelines* for details on the channel measurement procedure.

4.4.3.4 Single Culvert Installation

- Culvert pipe in natural watercourses shall be installed on a uniform slope such that the inlet and outlet are set at least 15 cm into the streambed.
- The maximum slope of culverts in fish bearing watercourses is 0.5 %. Where the stream gradient does not allow for this requirement, other acceptable methods must be employed to ensure fish passage. See "*Roads and Watercourse Crossings Guidelines*".

4.4.3.5 Multiple Culvert Installation

- Multiple culvert installations shall be restricted to two culverts in a natural watercourse channel.
- The minimum culvert diameter permitted in multiple culvert installations is the same as those diameters permitted in single culvert installations.
- Multiple culverts shall be placed a distance of one half the diameter or structure span apart, or 1 m, whichever is greater.
- The bottom of one culvert shall be set 15 cm into the streambed, with the second culvert set at an elevation equal to the original streambed.
- The area between culverts shall be stabilised.

4.4.3.6 Culvert Material

- Galvanised steel, aluminium, concrete and plastic pipes or squared timber shall be used in culvert installations on forest and logging roads.

4.4.3.7 Backfill and Compaction

- The minimum depth of fill over the culvert must be one-half the diameter of the culvert.
- Stable backfill material is required (gravel or coarse sands).
- Culverts 760 mm or larger must have the backfill material compacted by mechanical and/or manual devices.

4.4.3.8 Bridge Installation

- Excavation of the piers, footings and abutments shall be conducted in such a manner as to keep the work area separated from the watercourse. Cofferdams used shall be made of clean non-erodible material to separate work areas from watercourse.
- During the removal of a cofferdam, care will be taken to minimise siltation of the watercourse. The streambed shall be returned to its original condition.
- Excavated material shall be placed in an area where it cannot enter the watercourse.

4.4.3.9 Temporary Crossings

- Temporary crossing structures shall be removed by March 31st.
- Temporary structures can only be placed in areas with approach slopes which are less than 25 % (approximately 11°).

4.4.3.10 Stabilisation of Watercourse Crossings

- Structures installed in natural watercourses require stabilisation of inlet and outlet fill slopes from the base to the road surface at the time of installation. Acceptable methods for stabilisation are described in the *Roads and Watercourse Crossings Guidelines*.
- To prevent erosion and undermining, culverts must be of adequate length to ensure proper stabilisation of the inlet and outlet fill slopes (see *Roads and Watercourse Crossings Guidelines*).
- Where a culvert has been stabilised by cribbing or shear wall, the 2:1 slope requirement shall apply to the area from the top of the cribbing or shear wall to the road surface.
- Stabilisation methods that include vegetation must be completed by September 15th.

4.4.3.11 Fording

- Fording will only occur at recognised fording locations or where approval has been granted in the Operating Plan. Where permission has been granted to construct the road, such approval authorises limited fording for right-of-way clearing and installation of the watercourse crossing and shall be restricted to the area underneath the future road surface.

- Nothing may be skidded or dragged across a ford.
- Fording sites will be chosen based on the high degree of stability of the stream banks, streambed substrate material and upland approaches.
- Fording of a watercourse by equipment should be limited and confined to a single tract within a confined, narrow stable area where the streambed and stream bank are firm.
- Fording will cease immediately upon streambed or bank damage and stabilisation will be completed before activities continue.
- Restoration of the streambed and/or stream bank shall be undertaken as required to prevent sedimentation of the watercourse.

4.4.3.12 Cross Drainage Culverts

- On steep grades, where the soil type is susceptible to erosion, culverts shall be skewed across the road so that water will flow through at a uniform rate. Spacing for cross drainage culverts or water diversions shall be determined as follows:

$$Spacing = \frac{500\,metres}{percent\ road\ \ grade}$$

- In the event that the terrain is not suitable for cross drainage culvert placement as a result of ledge substrate underlay, the nearest acceptable location should be utilised and spacing resumed.

4.4.3.13 Off -Take Ditching

- No off-take or diversion ditches will be constructed within 30 m of a watercourse. No ditching is permitted within 30 m and 10 m of watercourses $\geq$ 0.5 m in width and $<$ 0.5 m respectively (Figure 2).
- On steep grades, groins and diversion ditches shall be used to restrict surface drainage flow down ditches and to dissipate this flow away from the road and stream into vegetation or standing timber Spacing shall be determined as follows:

$$Spacing = \frac{500\,metres}{percent\ road\ \ grade}$$

- In areas where a ledge substrate or topography does not permit the construction of an off-take ditch, the nearest acceptable location should be utilised and spacing resumed.

4.5 Fish and Wildlife Habitat

4.5.1 General

The Fish and Wildlife Habitat section of the Forest Management Manual covers the objectives, roles, responsibilities, standards, and requirements of the Licensees and DNR for the management and protection of fish and wildlife habitats at the operational level on Crown lands. Strategic-level objectives and standards are described in the Forest Management Planning section and in *A Vision for New Brunswick Forests: Goals and Objectives for Crown Land Management*.

Operational standards are defined for:

- Heron and Raptor Nest Tree Retention
- Watercourse Buffer Zones
- Forestry Operations in Old Spruce-Fir Habitat Areas
- Deer Wintering Area Management

Operational standards for the five old-forest wildlife habitat types, other than Old Spruce-Fir, for which there are objectives on Crown land *(A Vision for New Brunswick Forests: Goals and Objectives for Crown Land Management*) have not been defined. The need for operational standards and mechanisms to implement and monitor them for these habitat types will be evaluated for 2007. However, definitions of these habitats are described in *Habitat Definitions for Vertebrate Forest Wildlife in New Brunswick*, DNR 2001 in prep.

The standards for DWA and OSFH blocks include standards for the site-specific management planning aspects that direct the forestry activities within individual DWA and OSFH blocks.

Though comprehensive with respect to their topic area, these standards do not stand-alone when it comes to planning and implementing forestry activities on Crown land. As such, they should not be used in isolation of other standards described in the FMM.

4.5.2 Heron and Raptor Nest Tree Retention

4.5.2.1 Background

The bald eagle, peregrine falcon, osprey and nine other common species of raptors (hawks and owls), along with three species of heron, nest in trees on forestlands in New Brunswick. All exhibit a strong affinity for previously used nest trees and territories. Timber harvesting and associated activities (e.g., road construction and location) can influence the availability and viability of nesting sites for these species through: 1) removal of nest trees, 2) disturbance of nesting birds, and 3) alterations to forest structure within a species home range. Buffering nest trees from disturbance during the nesting season will maintain the viability of the nest site.

This section of the Forest Management Manual provides the objectives, roles, responsibilities, and standards for raptor and heron nest site retention on Crown lands. Nest descriptions and nest reporting are also discussed.

4.5.2.2 Objective

The objective for all forestry operations is to minimise the disturbance to nesting raptors and herons while maintaining the integrity of known nest sites.

4.5.2.3 Roles and Responsibilities

The Licensee is responsible for:

- Recognising raptor and heron nests encountered during forestry operations and adjusting operations considering the standards found in this section.
- Indicating on the final harvest inspection report (section 10.4) when a buffer zone has been left for raptor or heron nests.

DNR is responsible for:

- Notifying Licensee of any known nest locations.
- Monitoring Licensee and Sub-Licensee compliance to these standards.

4.5.2.4 Requirements and Standards

Three types of buffers shall be maintained around raptor and heron nest sites. The width of the buffers considers the species tolerance to disturbance during nesting and the species status in New Brunswick as identified by DNR (*Status of Wildlife in New Brunswick Report*, DNR 2001).

All operators on Crown land are responsible for ensuring that:

Nest Buffer

- Trees supporting a raptor or heron nest are not harvested.
- Treed buffer zones of the specified radius (Table 2) are maintained around raptor and heron nests.
- Timber harvesting within the nest buffer leaves the nest tree stable and that no more than 30 % of the basal area of the buffer is harvested.

Nesting Season No-Activity Zone

- Felling trees and road construction activities do not occur within the specified distance (Table 2) of an active raptor or heron nest during the nesting season (March until mid-August).

No-Roads Zone

- New roads are not located within the specified distance (Table 2) of a raptor or heron nest.

Table 2. Raptor and heron nest retention standards.

Species	Conservation Status Rank	Nest Type	Buffer Type							
			Nest Buffer (m)			Nesting Season No-Activity Zone (m)		No-Roads Zone (m)		
			15	50	100	≥100	≥200	≥50	≥100	≥400
Bald Eagle	At Risk	Stick			√		√			√
Peregrine Falcon	At Risk	Cliff			√		√			√
Black Crowned Night Heron	Sensitive	Stick			√		√			√
Green Heron	Sensitive	Stick			√		√			√
Cooper's Hawk	May Be At Risk	Stick			√		√		√	
Red Shouldered Hawk	May Be At Risk	Stick			√		√		√	
Long-eared Owl	Undetermined	Stick			√		√		√	
Boreal Owl	Undetermined	Cavity			√		√		√	
Hawk Owl	Undetermined	Stick			√		√		√	
Great Blue Heron	Sensitive	Stick		√			√			√
Sharp-shinned Hawk	Secure	Stick		√		√			√	
Northern Goshawk	Secure	Stick		√		√			√	
Red-tailed Hawk	Sensitive	Stick		√		√			√	
Broad-winged Hawk	Secure	Stick		√		√			√	
Barred Owl	Secure	Cavity		√		√			√	
Northern Saw-whet Owl	Secure	Cavity	√			√			√	
Osprey	Secure	Stick	√			√		√		
American Kestrel	Secure	Cavity	√			√		√		
Merlin	Secure	Stick	√			√		√		
Great Horned Owl	Secure	Stick	√			√		√		

4.5.2.5 Nest Descriptions and Identification

Bald Eagle and Osprey

- Nests of bald eagles and ospreys are located in trees (live or dead) or on hydro poles/towers and are made of sticks and limbs. Their nests are large, generally ≥ 90 cm in diameter.

Peregrine Falcon

- Peregrine falcon nests are located on cliff faces.

Herons

- The three species of heron that nest on forestlands in New Brunswick are the Great Blue Heron, Black-crowned Night Heron and Green Heron. Heron nests are made of sticks, located in trees and generally ≥ 25 cm in diameter. Herons may nest individually or in colonies.

Other Raptors

- American kestrel, northern saw-whet owl, barred owl and boreal owl nest in cavities in trees.
- The remaining raptor's nests are made of sticks and located in trees. The nests are generally ≥ 25 cm in diameter.

4.5.2.6 Reporting Nests

Persons encountering the nests of any species listed here should report their location to the nearest DNR office so that appropriate measures are taken during harvest operations and road construction.

4.5.3 Watercourse Buffer Zone Standards

4.5.3.1 Background

A natural watercourse is the full width and length, including the bed, banks, sides and shoreline, or any part, of a river, creek, stream, brook, lake, pond, wetland or other natural channel, the primary function of which is the conveyance or containment of water whether the flow be continuous or not. Forestry activities have the potential to affect watercourse functions and processes by changing water flow and quality, and the habitats of associated animals. A means to moderate some of these affects is to leave areas of undisturbed vegetation (watercourse buffer zone) between a timber harvest operation and an adjacent natural watercourse. On Crown land, watercourse buffer zones are left adjacent to all natural watercourses. Timber harvesting may occur within watercourse buffers as long as the buffer's ability to fulfill its objective is not compromised.

4.5.3.2 Watercourse Buffer Zone Objectives and Functions

The width and desired structural features of a watercourse buffer zone differ somewhat depending on the function (objective) the buffer zone is intended to serve and the influence of modifiers like watercourse size, bank slope and the condition of the adjacent forest (Table 3). On Crown land all watercourse buffer zones are intended to protect water quality and aquatic habitat, while some

may also be required for recreation and aesthetic reasons or to provide wildlife travel corridors in heavily harvested areas.

Water Quality & Aquatic Habitat

Buffer zones are left along natural watercourses to protect water quality and aquatic habitat (water chemistry and temperature, food and cover). Considered under water quality & aquatic habitat are site-specific concerns that may require wider buffer zones. These include critical fish spawning areas, waterfowl production wetlands, provincially significant wetlands and designated watersheds.

The buffer zone protects water quality and aquatic habitat in a number of ways. The trees and shrubs in the buffer zone help maintain the microclimate around the watercourse by providing shade and acting as an insulator against the extremes of temperature and humidity found in open areas. They also provide organic material (leaves and woody debris) to the watercourse that is a source of nutrients and habitat structures for aquatic animals. Larger trees with cavities may provide nesting sites for cavity nesting waterfowl and other species not considered being aquatic.

The forest floor within the buffer functions as a deposition zone where sediment, originating from areas with exposed soil and transported via overland flow, may be deposited before reaching the watercourse.

Guidelines for determining bank slope and the ground distance equivalents for buffer width can be found in section 11.2.

Wildlife Travel Corridor

In areas where harvest block size and adjacency standards have been waived, buffer zones may be expanded beyond what is required for water quality and aquatic habitat to provide wildlife with access to hiding cover and opportunities for concealed movement through the forest landscape. In and adjacent to deer wintering areas or in moose winter concentration areas, buffer zones may be expanded to provide winter travel corridors and cover. Vegetation that is greater than or equal to two metres tall offers hiding cover for most of our terrestrial wildlife species in summer. During winter taller conifer trees are needed to intercept snow to provide travel corridors for deer and moose.

Aquatic Recreation & Aesthetics

On watercourses providing an important recreational resource (e.g. high-use boating or angling) buffers may also be used to limit the visual perception of human disturbances (e.g. timber harvesting) immediately adjacent to the watercourse. These buffers may be wider than needed for water quality and aquatic habitat protection. Trees provide an effective visual barrier.

4.5.3.3 Roles and Responsibilities

With respect to preparation and implementation of the Operating Plan, the Licensee is responsible for:

- Soliciting DNR input on the watercourse buffer zone objective(s) to be considered on individual harvest blocks and watercourses.

- Leaving buffer zones adjacent to all natural watercourses encountered during harvesting operations, considering the buffer zone objective(s) in the Operating Plan, the standards in this document, the characteristics of the land and forest adjacent to the watercourse, the requirements of the *Clean Water Act*, its regulations, terms and conditions.
- Recognising the following situations during implementation of the Operating Plan and adjusting buffer zones and/or forestry prescriptions as necessary to meet identified objectives:
    - Landform and forest conditions that could compromise the ability of the approved buffer zone to achieve the management objective(s) (e.g. stand condition, slope, erosion hazard), and/or
    - Situations where implementing approved forestry activities in the buffer zone will compromise the management objective(s) (e.g. the prescribed removal rate of trees will reduce the stand below the minimum crown closure or basal area levels).
- Obtaining DNR approval for adjustments to buffer zones that deviate from these standards (e.g. change from selection harvest to salvage harvest).

DNR is responsible for:

- Reviewing the Operating Plan and approving watercourse buffer zones and forestry activities that meet standards and are capable of achieving the defined objective(s).
- Monitoring forestry activities within buffer zones.

4.5.3.4 Standards and Requirements

Trees may be selectively harvested and salvaged from buffer zones, as approved in the Operating Plan, so long the buffer's ability to fulfil its objective is not compromised. Harvesting must also comply with the standards in this section, the New Brunswick *Clean Water Act*, and its Regulations, terms and conditions.

Extra care must be taken during forestry operations in watercourse buffer zones so as not to significantly increase the potential for blow down or siltation of the watercourse. The following standards should ensure that the functionality and stability of the buffer are maintained.

Exposed Mineral Soil & Siltation

- Rutting of the ground and exposure of mineral soil within the buffer zone shall be minimal.
- Mineral soil exposed through forestry operations, including road building and maintenance, which can enter a natural watercourse, shall be stabilised immediately.

Table 3. Watercourse buffer zone standards.

Buffer Zone Objective	Buffer Width Modifiers		No Travel Zone Width[1] (m)	Buffer Zone Width[2] (m)	Vegetative Structure Description	
Water Quality and Aquatic Habitat Code = WQ Applies to all natural watercourses	**Channel Width < 0.5 m**		3	3	Leave non-merchantable trees and shrubs.	
	Fish Habitat[3]		3	15	Same as for Channel Width ≥ 0.5 m	
	Channel Width ≥ 0.5 m					
	Bank Slope	0 to 5 %	15	15[4] to 30	**Vegetation Type:**	Conifer or deciduous shrubs or trees
		6 to 24 %	15	30		
		≥ 25 %	30	60	**Development Stage:**	≥ Mature
	High wind-throw potential[5]		15	30 to 60 ST[7]	**CC/Ht/BA:**	CC ≥ 50 %, Ht ≥ 10 m, BA ≥ 18 m^2/ha
	Critical Fish Habitat[6]		30	30 to 60 ST	**Special Features:**	Manage to maintain a supply of trees ≥ 40 cm DBH, cavity trees and snag trees.
	Waterfowl Production Wetland[8]		15	30 ST		
	Provincially Significant Wetland[9]		30	30 to 60 ST		
	NBDELG Designated Watershed[10]		15	75		
Wildlife Travel Corridor Code = TS or TW	Summer Travel Corridor		see WQ	60 to 90	**Vegetation Type:**	Conifer or deciduous shrubs or trees
					Development Stage:	≥ Sapling
					Ht/Stocking:	Ht ≥ 2 m; Stocking ≥ 80 %
	Winter Travel Corridor		see WQ	60 to 90 ST	**Vegetation Type:**	Conifer trees
					Development Stage:	≥ Immature
					CC/Ht/BA	CC ≥ 50 %, Ht ≥ 10 m, BA ≥ 18 m^2/ha
	Travel corridors along brooks and streams should be ≤ 60 m wide. Travel corridors along rivers and lakes should be ≤ 90 m wide.					
Aquatic Recreation and Aesthetics Code = AR	High-use Recreational Waters (Regional Designation)		see WQ	30 to 60 ST	Same as for WQ Channel Width ≥ 0.5 m	
	Listed Recreational Waters (Provincial Designation)		see WQ	30 to 90 ST		

1 **No travel zone** applies to wheeled or tracked vehicles and extends inland the specified distance from the waterside edge of alders or willows.
2 **Buffer zone width** extends inland the specified distance starting from the waterside edge of woody shrub vegetation ≥ 2 m in height and provides ≥ 50 % crown closure (i.e. sparse shrub cover does not count).
3 **Fish habitat** is a watercourse with continuous flow and a streambed of mineral soil and with fish present or inhabiting a connected stream in close proximity.
4 **15 m** wide buffer zones can only be applied to watercourses that drain < 600 ha.
5 **Wind throw potential** is a qualitative rating of the likelihood of trees being blown down by wind events common for the area. The following factors contribute to "high" wind throw potential: buffer dominated by shallow rooted species (e.g. balsam fir, black spruce, red spruce, larch, white birch, and black ash), moderate to poorly drained soils, clayey soils, buffer edge perpendicular to winds.
6 **Critical fish habitat** consists of significant spawning or nursery area designated by DNR.
7 **ST** designates a buffer zone that shall extend inland for the specified distance stating from the boundary of a wetland or waterside edge of trees.
8 **Waterfowl production wetland** is a wetland that supports cavity-nesting waterfowl and shall have a 30 m standing timber buffer to provide a source of cavity trees.
9 **Provincially significant wetland** is a wetland formally listed by DNR and shall have 30 to 60 m standing timber buffer (based upon protection needs) with a 30 m no intervention and no travel zone.
10 **Designated watersheds** supply drinking water and are protected by regulations of the DELG.

Timber Harvesting

- Forestry activities in buffer zones shall not compromise the function of the buffer zone (Table 3).
- Wood shall not be piled down within 30 m of a natural watercourse greater than 0.5 m in width or 15 m of a natural watercourse less than 0.5 m in width.

Buffer Zone Stability

- A Licensee shall not be held accountable for a partially harvested buffer zone that blows down so long as harvesting adhered to the standards in this buffer zone stability section.
- Unless otherwise specified in the Operating Plan, partial harvesting within watercourse buffer zones shall not be undertaken in the following stand types:
  - Over mature balsam fir stands.
  - Mature balsam fir stands where the buffer width is ≤ 30 m.
  - Over mature spruce stands where the buffer width is ≤ 30 m.
  - Mature and over mature conifer stands on poorly drained sites where the buffer width is ≤ 30 m.
- Some salvage operations may be approved in specific circumstances within the above stand types.
- No more than 30 % of the merchantable stems and basal area shall be removed in any 10-year period while maintaining basal area ≥ 18 m^2/ha.
- In general timber harvesting should remove merchantable trees from across the range of species, stem sizes (dbh), and tree conditions present in the buffer zone. However, favouring of longer lived and deep-rooted species such as tolerant hardwoods, eastern hemlock, eastern cedar and white pine is preferred.
- Damage to residual trees, advanced regeneration, shrub and ground layer vegetation caused by forestry activities shall be minimal within the buffer zone.
- Openings resulting from timber harvesting (e.g. cut strips/patches, trails) shall not exceed 10 m in width.

Water Temperature

- Timber harvesting shall not reduce crown closure below 50 %.

Fish Passage

- No trees, tops, slash, debris or primary forest product from a harvesting operation shall be felled into, or allowed to enter, a natural watercourse.

Woody Debris, Snags and Cavities

- To maintain a natural source of woody debris falling into the watercourse and snags in the remainder of the buffer zone, no more than 30 % of the dead and dying trees, standing or on the ground, shall be harvested in any 10 year period. This also applies to salvage harvest operations within buffer zones.
- Trees with cavities shall not be harvested.

Machinery Tracking

- No vehicle shall travel through or in a natural watercourse except for approved road building purposes.
- Vehicles shall not travel within 15 m of the bank of a natural watercourse with a channel width ≥ 0.5 m, or within 3 m of a natural watercourse with a channel width < 0.5 m.

Roads

- Forest and logging roads shall not be located in watercourse buffer zones except at approved watercourse crossings.
- Road rights-of-way built parallel to a natural watercourse (channel width ≥ 0.5 m) shall have a treed buffer zone ≥ 30 m in width.

4.5.4 Forestry Operations in Old Spruce-Fir Habitat Blocks

Implementation of the New Brunswick government's objectives for management of Crown Land (*A Vision for New Brunswick Forests: Goals and Objectives for Crown Land Management*) is carried out at the strategic level under a Forest Management Plan that is revised every 5 years. Objectives include the production of specified levels of eight wildlife habitats needed to support viable populations of the associated wildlife species. Habitats are defined in terms of timber yield curve development and spatial patterns in Forest Management Plans, as well as detailed forest stand structure definitions needed to plan and implement forestry activities on the ground. The definitions are described in *Habitat Definitions for Vertebrate Forest Wildlife in New Brunswick* (DNR 2001).

Old spruce –fir habitat (OSFH) is the only habitat type that is identified spatially (blocked) in Forest Management Plans and that comes with specific planning and implementation standards related to timber harvesting. OSFH is described in general and detailed stand structure terms in section 11.1.2.

This section of the FMM describes the roles, responsibilities and standards for forestry activities in OSFH blocks.

4.5.4.1 Roles and Responsibilities

The Licensee is responsible for:

- Ensuring that timber harvesting does not compromise OSFH objectives at the Licence, ecoregion and OSFH block level.

- Preparing and submitting an OSFH Block Management Plan showing the affects on habitat supply of timber harvest operations. The management plan is required before harvest operations in OSFH will be approved in the Operating Plan.

DNR is responsible for:

- Reviewing and approving forestry activities in the Operating Plan considering the OSFH objectives at the Licence, ecoregion and OSFH block level, and the OSFH Block Management Plan.
- Monitoring forestry activities in OSFH blocks.

4.5.4.2 Standards and Requirements

The OSFH Block Management Plan shall provide the context for individual timber harvest operations that are described in the Operating Plan. The management plan is comprised of a non-spatial management scenario and a spatial harvest block list. The non-spatial component normally shall be submitted in the Forest Management Plan for the Licence.

Non-spatial

- The non-spatial management scenario shall report OSFH supply under a no-harvest scenario and under the timber-harvesting scenario for those periods in which the OSFH block contributes to the Licence objective. It shall include information described in the non-spatial part of section 11.1 and be presented in a similar format.
- No more than 40 % of the hectares providing OSFH within an OSFH block can be harvested (partially or wholly) in a single management period.

Spatial

- The harvest block list shall normally be provided with the Operating Plan and shall include all blocks harvested to date within the management period and those to be harvested in the current year. It shall include the information in the spatial part of section 11.1 and be presented in a similar format.

Stand Stability

Trees may be selectively harvested and salvaged from OSFH stands, as approved in the Operating Plan, so long as the stand's ability to provide OSFH is not compromised. Extra care must be taken during forestry operations in OSFH stands so as not to significantly increase the potential for blow down. These standards should ensure that the functionality and stability of the habitat stands are maintained.

- A Licensee shall not be held accountable for a partially harvested stand that blows down so long as harvesting adhered to the standards in this stand stability section.
- Unless otherwise specified in the Operating Plan, partial harvesting

shall not be undertaken in the following stand types in OSFH blocks:

- Over mature balsam fir dominated stands on any site.
- Mature and over mature spruce and fir dominated stands on poorly drained sites.

- To limit the risk of stand blow down, no more than 30 % of the basal area shall be harvested while maintaining a residual basal area of ≥ 18 m^2/ha and crown closure 50 %.

Woody Debris & Cavities

- To ensure a supply of coarse woody debris, no more than 30 % of the dead trees standing or on the ground shall be harvested.
- To maintain the supply of large cavities, no tree ≥ 45 cm dbh having a cavity shall be harvested.

Road Construction

- Road construction in OSFH blocks shall be kept to the minimum needed to access harvest blocks.
- In OSFH blocks with percent habitat values ≤ 75 %, the area of OSFH that can be harvested for road rights-of-way shall not exceed 2 %.
- Forest and logging roads constructed in OSFH blocks normally shall be ≥ 50 m from watercourses and rights-of-way shall be ≤ 15 m in width.

4.5.5 Deer Wintering Area Management

4.5.5.1 General

Implementation of the New Brunswick government's objectives for management of Crown Land (*A Vision for New Brunswick Forests: Goals and Objectives for Crown Land Management*) is carried out at the strategic level under a Forest Management Plan that is revised every 5 years. With respect to ensuring suitable habitats are available to support white-tailed deer populations, the strategy identified in the Forest Management Plan is implemented through individual Deer Wintering Area (DWA) Management Plans prepared during the 5-year management period. The DWA Management Plan provides the context for management and directs the stand level forestry treatments in the Operating Plan. In general, Licensees are responsible for preparing and implementing DWA Management Plans while DNR sets management objectives and standards, approves plans, monitors implementation and assesses Licensee performance.

To survive the winter season, deer seek habitats with a combination of cover and food that minimises net energy loss. As winter conditions change from mild to moderate and then severe, the relative importance of cover versus food, and consequently the range and optimal combination of suitable habitats, also change. Therefore, two winter periods and corresponding habitats have been defined for managing winter habitat requirements: *Severe Winter* to define harsh periods and *Moderate Winter* to capture moderate and mild periods. Corresponding habitats are *Severe Winter Deer Habitat* (SWDH) and *Moderate Winter Deer Habitat* (MWDH). These habitats are described in general and detailed stand structure terms in section 11.3.2.

During the snow-free portion of the year (i.e. spring, summer and fall), deer range over most of the landscape and use a wide range of forest and non-forest vegetation communities. However, as snow accumulates and temperatures drop, deer spend more time in older conifer-dominated forest stands associated with watercourses and valleys. The area deer occupy during winter (winter range) generally represents only 10 to 20 percent of summer range. In addition, deer often return to winter in the same locations from one year to the next. These traditionally used areas are called deer wintering areas (DWA) and are the focus of forest management activities to provide winter habitat on Crown land. A DWA Management Plan is required before harvesting activities are undertaken in a DWA.

This section describes the objectives, roles, responsibilities and standards for management of individual DWA on Crown land. Additional supporting information and guidelines are provided in section 11.3.

4.5.5.2 DWA Management Objectives

The definition of two winter habitats allows for management objectives to reflect variation in winter severity in different parts of the province by balancing the supplies of severe and moderate habitats. New Brunswick has been divided into two winter severity regions for the purpose of assigning habitat management priority (Figure 3). In the severe winter region SWDH is the primary habitat managed for, whereas, MWDH is the focus of management in the moderate winter region.

DWA shall be managed to maximise the sustainable supply of the primary habitat within a DWA over the 80-year planning horizon through harvesting and silviculture, while meeting these conditions:

- Short-term reductions in SWDH resulting from the harvest of habitat stands shall not, in combination with reductions due to natural stand break-up, exceed 15 % in any 5-year management period.
- The sustainable supply of the secondary habitat type shall be maximised over the 80-year planning horizon after that of the primary habitat.
- Connectivity of the SWDH components of the DWA shall be maximised.

Exceptions to these objectives may be approved under these conditions:

- A DWA cannot maintain a reasonable sustained supply of habitat over the long-term. This is generally restricted to small DWA less than 100 ha in size.
- In areas of the province where deer numbers are low, the need to minimise risks to deer in an active DWA may justify limiting or excluding forestry activities in the short term.

Under these exceptions the short-term (5 to 20 years) management scenario will often involve no harvesting or only light intervention levels even in non-habitat stands.

Figure 3. Severe (northern) and moderate (southern) winter deer habitat management zones.

4.5.5.3 Roles and Responsibilities

The Licensee is responsible for:

- Identifying in the Forest Management Plan the total hectares of DWA for which the Licensee intends to develop 1st-Time and Follow-up DWA Management Plans during management period 1.
- Obtaining DNR approval on the habitat objectives to be managed for in a DWA prior to commencing management planning, as well as incorporating any special management considerations identified by DNR.
- Preparing and implementing DWA Management Plans considering the objectives, standards and guidelines for DWA management.
- Ensuring forestry activities in DWA comply with the objectives and the pre/post treatment habitat status as described in the DWA Management Plan and Operating Plan.
- Reporting on the status of period 1 treatments (section 11.3.1, Table 10). The information will be used in the assessment of plan implementation and approval of follow-up management plans.

DNR is responsible for:

- Approving the objective(s) for which individual DWA will be managed.

- Identifying and informing Licensees of any special management considerations for an individual DWA.
- Reviewing and approving DWA Management Plans.
- Monitoring forestry operations within a DWA.
- Assessing implementation of period 1 management activities prior to approving follow-up management plans.

4.5.5.4 DWA Management Plans

The DWA Management Plan describes the management strategy for a DWA for 80 years into the future. The plan includes:

- A statement of objectives.
- A forecast of SWDH and MWDH under a no-intervention scenario and the management scenario.
- The types and levels of harvest and silviculture for the entire planning horizon.
- The location of harvest blocks for the first 25 years.
- The location of the stands that will provide habitat during the low point in habitat supply.

After the first period a Follow-up DWA Management Plan shall be required in every period that harvesting activities are scheduled.

Characterising Stands

DWA Management Plans shall be developed based on accurate descriptions of the following stand-level parameters:

- Habitat suitability through time (SWDH, MWDH and old spruce-fir habitat (OSFH) suitability where OSFH/DWA overlap occurs).
- Suitability for forestry treatments.
- Pre- and post-treatment SWDH and MWDH status category.
- Natural stand succession.

Forest characterisation accuracy at the DWA Management Plan level shall be considered acceptable if not more than 10 percent of the stands assessed have differences that significantly affect winter habitat supply forecasts or forestry treatment suitability.
Forest characterisation accuracy at the Operating Plan level within DWA shall be considered acceptable if the area of harvest blocks rejected due to stand-level characterisation concerns does not exceed 20 % of the area approved for harvest in period 1 or 10 % of the total DWA.

Content and Format

DWA Management Plans and follow-up management plans shall contain the information described in DWA Management Plan Content (section 11.3.1).

Plan Scheduling

Period 1 of the DWA Management Plan shall end on the same date as the Forest Management Plan.

General Forestry Practices

When developing DWA Management Plans the following will be considered:

- To maximise the sustainable supply of SWDH it is critical that conifer stands regenerate back to conifers. To minimise the need for planting conifers, reproduction methods that promote natural conifer regeneration shall be investigated and given priority where opportunities exist.
- Harvesting of cedar and hemlock trees in DWA shall be restricted to where it is a necessary component of a harvest prescription to regenerate these species.
- Tolerant hardwood stands that meet the eligibility criteria defined in Best Management Practices for Tolerant Hardwood (section 10.6) shall be managed according to those standards. In other hardwood stands management should favour increasing the conifer component of the stand.
- In consideration of browse production over the long-term, treatment of deciduous stands should be scheduled throughout the management plan time horizon (i.e. avoid treating all candidates in one period).

4.5.5.5 Review and Approval of DWA Management Plans

Number of Plans per Month

DNR shall review up to two DWA Management Plans per Licence per month. A Licensee may submit more than two plans per month but DNR cannot guarantee completing the review within the standard time frame.

Time Frame

- Within **10 working days** of submission of a DWA Management Plan, DNR shall report to the Licensee any gross inconsistencies, errors or omissions in the plan with respect to objectives, management scenario or content.
- Within **20 working days** of submission of the DWA Management Plan, DNR shall have completed its review of all components of the plan and will have responded to the Licensee in writing, indicating approval or non-approval with rationale and recommendations.
- Response times normally will be less for plans submitted with summarised stand-level field data (e.g. species composition, softwood crown closure, basal area, age).

4.5.5.6 Operating Plan

The DWA Management Plan is implemented through the Operating Plan, which describes the details for all forestry activities to be undertaken on the Licence in a given year. The Operating Plan is prepared annually by the Licensee and approved by DNR.

Stand Stability

- As certain forest conditions are generally considered to be susceptible to blow down, partial harvesting shall not be undertaken in the following types of SWDH and MWDH stands where the intent is to leave them in a habitat condition after harvest, unless otherwise specified in the Operating Plan:
  - Over mature balsam fir dominated stands on any site.
  - Mature and over mature spruce and fir dominated stands on poorly drained sites.
- To limit the risk of stand blow down, no more than 30 % of the basal area shall be harvested while maintaining a residual basal area of ≥ 20 m^2/ha and crown closure of ≥ 50 %.
- A Licensee shall not be held accountable for a partially harvested SWDH of MWDH stand that blows down so long as harvesting adhered to these standards.

Road Standards

- Road construction in a DWA shall be kept to the minimum needed to access harvest blocks.
- Forest and logging roads constructed in a DWA shall be ≥ 50 m from watercourses and rights-of-way shall be ≤ 15 m in width.
- Roads shall not be located through SWDH.

4.5.5.7 Assessment of Plan Implementation

DNR shall review the status of period 1 treatments (i.e. Treatment Status Report) after period 1 and prior to implementation of period 2. The results of the review will be considered in the approval of the follow-up management plan and assist in planning silviculture.

Treatment Status Report

- The Treatment Status Report shall describe the present condition of all areas harvested and silviculturally treated within a DWA in the previous period relative to the projected condition in the DWA Management Plan. Refer to Table 10 in section 11.3.1 for required information and suggested format. Data collected as part of the 5th-year survey (section 5.5.3) is one source of this information.
- The Treatment Status Report shall be completed by the Licensee and submitted to DNR prior to development of a Follow-up DWA Management Plan.

Assessment Threshold

- Implementation of period 1 shall be considered successful if the area of harvest blocks not achieving their intended pre- and post-treatment habitat status total less than 10 % of the area approved for harvest in period 1 or 10 % of the total DWA, whichever is less.

4.5.5.8 Follow-up DWA Management Plans

After the initial plan for a DWA, all others are considered Follow-up DWA Management Plans. Two formats exist for Follow-up DWA Management Plans. These consist of a Continuance-of-Approval Plan and a Full Revision Plan.

Continuance-of-Approval Plan

The conditions for consideration and approval under a Continuance-of-Approval Plan are:

- Successful implementation of Period 1 treatments. Differences between the management plan and actual operations such as, fine-tuning of harvest block boundaries, or changes to treatment prescriptions not affecting the pre- and post-treatment habitat status shall not be considered as significant.
- The operations being proposed for this period match those outlined for period 2 in the DWA Management Plan.
- Forest characterisation is considered to be accurate by DNR and Licensee.
- DWA management planning requirements have not changed so as to make the plan obsolete.

Where the above conditions are met, the Continuance-of-Approval Plan shall consist of amending the Treatment Status Report and the required details for period 2 treatments to the initial plan.

Full Revision Plan

In the event one or more of the conditions for a Continuance-of-Approval Plan are not met, the Follow-up plan will involve a ***full revision*** (section 4.5.5.4).

4.6 Scaling and Utilisation

4.6.1 General

Scaling and utilisation are key elements in monitoring, measuring and evaluating the timber strategies outlined in *A Vision for New Brunswick Forests: Goals and Objectives for Crown Land Management*. The accurate and consistent measurement of primary forest products from Crown land is fundamental to all volume-related references in this document, and to all volume-related transactions on Crown land. Product utilisation standards are defined so that timber of a specific size and quality is produced and directed to the appropriate mills.

This section describes the scaling and utilisation standards to be used on New Brunswick Crown land. These standards are derived from the *Crown Lands and Forests Act* & Regulations, the *Scalers Act* and Regulations, the NBDNR Scaling Manual, and from DNR directives and policies.

4.6.2 Objectives

Scaling and utilisation standards will:

- Ensure that appropriate methods are used to measure primary forest products.
- Ensure that product and volume information is accurately reported for wood harvested from Crown Lands.
- Accurately describe the movement of primary forest products from the woods to the final mill destination such that all wood harvested from Crown Lands is accounted for.
- Minimise the amount of waste wood fibre in harvesting and processing operations.
- Ensure appropriate fibre recovery from Crown Land harvest operations by providing guidelines on classification and assessment.

4.6.3 Roles and Responsibilities

The Licensee is responsible for the following on all Licensee and Sub-Licensee Crown land operations:

- Submitting scaling arrangements prior to the start of operations each year as part of the annual Operating Plan.
- Ensuring that scaling arrangements properly address all aspects of scaling primary forest products.
- Amending scaling arrangements as required throughout the operating year.
- Scaling wood using procedures outlined in the scaling arrangements, *Scalers Act* and DNR Scaling Manual.
- Using an approved tracking system to identify and follow the movement of all primary forest products from Crown land (section 4.6.4.3).
- Submitting scale related information in an approved format on a regular and timely basis (section 4.6.4.4).

- Ensuring that utilisation standards are met on all operations.
- Carrying out waste analysis surveys, when requested by DNR.
- Distributing appropriately suitable primary forest products to the allocated users of their Licence.
- Applying for permits to distribute primary forest products to destinations outside the province of New Brunswick.
- Applying for the distribution of any non-allocated primary forest products produced from harvest operations.
- Applying for approval on any exchanges involving Crown timber.

DNR is responsible for the following on all operations on Crown land:

- Reviewing and approving scaling arrangements and amendments submitted by Licensees.
- Monitoring the movement of primary forest products.
- Monitoring the reporting of scale information.
- Monitoring and performing regular checks of scale information, scale accuracy, and scale procedures for all primary forest products.
- Monitoring and checking of weigh scale systems used to measure primary forest products.
- Monitoring the utilisation of all timber.
- Monitoring the distribution of primary forest products.
- Reviewing and processing requests for permits to distribute primary forest products to destinations outside the province of New Brunswick.
- Reviewing and approving the distribution of all non-allocated primary forest products.
- Reviewing and approving all exchanges involving Crown timber.

4.6.4 Standards and Requirements

4.6.4.1 Scaling Arrangements

The Licensee is responsible to ensure that scaling arrangements are submitted as part of the Operating Plan prior to the start of operations (Table 1). Scale arrangements will be divided into two sections, "General" and "Mill Specific", which will include at least the following:

- The "General" section is applied on a Licence basis:
    - Details the transportation certificate system to be used.
    - Identifies wood transportation and identification requirements.
    - Describes pile numbering and marking requirements.
    - Includes a truck listing with owner's names and licence plate numbers.
    - Describes scale submission procedures.

- Details mass scaling procedures.

- The "Mill Specific" section applies to all mills that will be receiving wood from the Licence and describes mill specific information:
    - Each species and product to be scaled.
    - Mill and Bush scale methods.
    - Units of measure and conversion procedures.
    - Sampling methods and intensities.
    - Volume tables that will be used.
    - Scaler names and ID numbers.
    - Marking paint colour codes.
    - Weigh scale maintenance and testing procedures (where applicable).

4.6.4.2 General Scale Requirements

With respect to scale requirements in general:

- The Licensee is responsible for ensuring that bush scaled wood, mill scaled wood and sampled wood remains intact for 48 hours (72 hours on the weekend) unless released by DNR.
- All facilities with weigh scales used to measure Crown wood are responsible for making available the results of their maintenance and testing for DNR inspection.

With respect to **stack** or **piece scale** the Licensee will be responsible for:

- Communicating to DNR the information that will be marked on each pile of wood to be scaled. This must include pile number, scaler initials, date, and block number. The total number of pieces must also be included for log scale, and pile length and height for stacked scale.
- Ensuring that pile number series are unique for a block and different from transportation certificate numbers.
- Ensuring that there are no more than 1000 pieces in a pile of logs or tree length.
- Ensuring that hardwood logs are spread out in single tiers for scaling, and product-species classification.
- Ensuring that partial scale procedures approved by DNR are used where less than 100 % of the pieces are measured.
- Ensuring that when logs are delivered to a mill for piece scale and a scaler is not available:
    - The load must be kept separate in the yard and left until scaled.
    - The load must be identified by the transportation certificate number.

- The log count must be entered on the transportation certificate.

With respect to **mass scale** the Licensee will be responsible for:

- Identifying, and having approved by DNR, the methods for determining sample loads, the intensity of the sample and how the results of the sample will be applied to the conversion of mass to volume.
- Submitting summarised sample results to the Regional Inspector on a regular pay period basis.
- Ensuring that when standard conversion factors are used in mass scaling, the primary forest product must be delivered and scaled within 4 weeks of felling. Any adjustments made to the factors must be approved by DNR.
- Ensuring that the list of weigh scales used by the Licensee is provided to, and approved by, DNR before being used to measure Crown wood.

4.6.4.3 Wood Tracking and Identification

The procedures outlined for tracking wood are intended to:

- Provide an audit trail for all Crown wood.
- Reduce unauthorised removal of wood from Crown land.
- Clearly identify the measurement status of the wood.

The Licensee, for Licensee and Sub-Licensee operations, and DNR, for all tendered and untendered permittee operations, are responsible for the following standards on Crown land:

- Ensuring that a DNR approved transportation certificate accompanies every load of Crown wood in transit, and that it must be distinguishable from slips used by Licensees and Sub-Licensees for other sources of wood.
- Ensuring that transportation certificate numbers assigned for the operating year are unique.
- Ensuring that a copy of the completed transportation certificate is contained exterior to the cab of the truck in a secure and approved fashion or deposited in a transportation certificate box while the wood is in transit.
- Ensuring that every load of Crown round wood in transit is identified by at least a 0.5 m square orange “X” painted directly on the product, on the driver’s side near the bottom front of the load.
- Reporting missing and voided transportation certificates on a monthly basis to the Regional Inspector and providing all the necessary documentation for verification.
- Accounting for all assigned transportation certificates by April 15th.
- Ensuring that bush scale wood is differentiated from mill scale wood by the use of a specific colour of paint and marking method as approved by DNR.

4.6.4.4 Scale Submission

Scaled volume and other related scale information must be reported to DNR on a monthly basis. The formats for electronic submission of scale to DNR are detailed in the ***Transfer File Definition*** document maintained by DNR.

4.6.4.5 Merchantable Waste and Utilisation

- The definitions for merchantable waste are described in the timber regulations of the *Crown Lands and Forests Act*.
- The amount of waste produced on any operation must be minimised.
- All merchantable material on roads and landings must be utilised. Where it is evident that merchantable waste is being created roadside as a result of poor slashing or processing practices, DNR may ask that all merchantable material be picked up or conduct a merchantable waste volume determination. Waste volume determination on roads and landings will be assessed following the timber and scaling regulations.
- Where waste within a harvest block is a concern, DNR may request that the Licensee submit a waste analysis report for the harvest block or for a portion of the block. The procedures for determining and reporting merchantable waste within a harvest block, or portion of, are set out in section 12.1. A penalty may be assessed if the total merchantable waste exceeds an average of 3.0 m^3/ha or 3 % of the volume harvested by the operator.
- The tree bole will be utilised out to an 8 cm top inside bark. Special allowance may be granted by DNR where this standard cannot reasonably be met.
- General product utilisation guidelines are described in section 12.2.

5 Annual Report

5.1 Background

Implementation of New Brunswick government's objectives for management of Crown land (*A Vision for New Brunswick Forests: Goals and Objectives for Crown Land Management*) is carried out at the strategic level under a Forest Management Plan that is reviewed every five years. The Forest Management Plan is in turn applied at the stand level through an annual Operating Plan. In order to compare actual forestry activities carried out during any year against the Operating and Forest Management Plans, an annual review process is required. The Licensee's activities are reviewed partially through their submission to DNR of an Annual Report.

The Annual Report provides various summaries of activities that were carried out on the Licence during the previous year. It also serves as a status report on implementation of the Forest Management Plan.

This section of the FMM describes objectives, roles and responsibilities, and performance requirements for preparation and submission of the Annual Report.

5.2 Objectives

The Annual Report will:

- provide a summary of previous year's activities on a Licence,
- be used by DNR as part of the evaluation of the performance of Licensees in complying with the Forest Management and Operating Plans, and
- provide historical documentation of the previous year's activities on Crown land managed by the Licensee, and provide a status report of actual activities occurring on the Licence in terms of 5-year levels set in the Forest Management Plan.

5.3 Roles and Responsibilities

The Licensee is responsible for:

- compilation and submission of the Annual Report for forestry activities on Crown Land, and
- submission of an Annual Report for forest management activities on lands owned or controlled by the Licensee (upon request by DNR) in a format mutually agreeable to DNR and the Licensees.

DNR is responsible for:

- verifying that the Annual Report is an accurate reflection of the past year's activities,
- verifying that those activities comply with Forest Management and Operating Plans,
- supplying Licensee with information for certain DNR activities on the Licence, and
- summarising information for Provincial policy decision making and National reporting requirements.

5.4 Format, Submission, and Approval Standards

The Annual Report, covering activities that occur each year between April 1 and March 31 inclusively, must be submitted by July 31 of each year. The Annual Report will be submitted in a format mutually agreed to by DNR and Licensees.

The Annual Report will contain the following sections:

- Roads and Watercourse Crossings,
- Harvest,
- Silviculture,
- Fish and Wildlife,
- Public Values, and
- DNR Activities.

DNR will review the annual report to ensure that all information is correct and complete (section 5.5). The Annual Report review and approval schedule is as follows:

- DNR will review and provide the Licensee with a list of corrections within 2 months of the receipt of the Annual Report,
- the Licensee will provide all necessary corrections within 1 month of receipt of the DNR review, and
- DNR will have provided the Licensee with a letter of approval within 1 month of the receipt of the corrected Annual Report.

5.5 Section Standards

5.5.1 Roads and Watercourses

The Roads and Watercourse crossings section will contain at least the following:

- a summary of forest and logging road construction,
- a summary of significant forest road maintenance activities, and
- a list, by harvest block, road identifier or location, of all structures (culverts, bridges, etc.) installed in natural watercourses by Licensee or Sub-Licensee (section 13.1).

5.5.2 Harvest

The Harvest section will contain summaries of annual harvest levels as well as a period-to-date status comparison to the Forest Management Plan. The Harvest section will contain at least the following:

- a summary of actual species and product volume harvested by destination (section 13.2),

- a summary of volume harvested by forest zone and volume category as defined in the Licensee Performance Review (section 13.3),
- a summary of general forest area harvested by non-clear cut harvest methods (section 13.4),
- a summary of general forest area commercially thinned (section 13.5), and
- a list of blocks harvested (section 13.6).

5.5.3 Silviculture

The Silviculture section will contain summaries of annual silviculture levels as well as a period-to-date status comparison to the Forest Management Plan levels. The Silviculture section will contain at least the following:

- a summary of treatment type area as compared with silviculture targets (section 13.7),
- a summary of silviculture area by treatment type and forest zone (section 13.8),
- a list of actual silviculture activities carried out on the Licence (section 13.9),
- a list of all 5-year-old plantations and naturally regenerating areas indicating their current status and, for plantations, any necessary remedial action (section 13.10),
- a list of all 10-year-old plantations indicating their current status and any necessary remedial action (section 13.11).

5.5.4 Fish and Wildlife

The Fish and Wildlife section will contain at least the following:

- a summary of area for which DWA specific management plans have been approved during the past year, as well as a comparison to the Forest Management Plan levels (section 13.12), and
- a list of DWA areas for which management plans have been approved during the past year (section 13.13).

5.5.5 Public Values

The public section will contain at least the following:

- a description of consultation held with stakeholders on Crown Land management, and
- a description of Licensee recreational development activities carried out in the past year with maps where appropriate.

5.5.6 DNR Activities

DNR will provide to the Licensee, no later than June 15 of each year, appropriate information on all DNR administered activities on the Licence. The DNR Activities section may contain but is not limited to:

- a summary of the species and product volume actually harvested on tendered and untendered permit areas, and
- a summary of all DNR activities affecting the forest inventory undertaken on the Licence and reported to the same standards as specified for the Licensee.

6 Forest Inventory

6.1 Background

In the context of this section Forest Inventory includes the following:

- The geographically-referenced forest and non-forest stands on Crown Land, described in terms of species mix, stage of development and other stand parameters as specified in "New Brunswick's Integrated Land Classification System", as well as mapped linear features such as roads and streams. This will be referred to as the forest layer.
- The ground-based measurement data of forest stands, collected through the Forest Development Survey (FDS), to acquire quantitative stand data such as volume, density and age by individual species.

The forest layer defines the composition and distribution of forest stands. The FDS is implemented to account for photo-interpretation error and to design yield curves for each stand type in terms of species and volume over time. Both these data sources must be kept sufficiently up-to-date and accurate to enable the preparation of realistic and achievable forest-level management plans.

Updating is the process of refreshing the forest layer with changes that have occurred in, either the attributes or physical shape of forest stands, or geographic features. These changes occur along different time lines and have different impacts on the inventory. The extent and timing of updating the forest layer are associated with the type of forest change. Forest change may be categorised into three types:

- Natural change – Changes in forest stands over time due to natural processes such as ageing, succession, and moderate levels of insect damage, blow down and disease. These dynamic changes are best re-inventoried after a certain growth period (e.g. 10 years) in order to reclassify stand attributes and associated stand yields.
- Licensee-managed change – Changes in forest stands due to planned activities conducted by Licensees and Sub-Licensees. These forest management changes primarily involve road construction, harvesting and silviculture. Such changes shall be updated annually to facilitate operational planning and to track the implementation of the long-term Forest Management Plan.
- DNR-monitored change – Changes in forest stands due to activities managed and/or monitored by DNR. These changes include public fuel wood harvesting, DNR silviculture treatments, Crown Land leases and major construction projects, such as new highways and utility corridors. Other changes monitored include trespass activities as well as large-scale natural disturbances such as wildfire and blow down. As much as possible, this kind of change is incorporated into the annual update process

6.2 Objectives

The Forest Inventory and Updating process will:

- provide a description of the composition and distribution of the forest resource at the stand level,
- be used by Licensees and DNR in the preparation and approval of Forest Management and Operating Plans, and
- be used as the basis for determining forest management objectives to ensure the long-term sustainable supply of forest products and other timber and non-timber resources.

6.3 Roles and Responsibilities

The Licensee is responsible for:

- providing DNR with spatial and attribute data for all Licensee-managed change on their Licence, and
- collection and submission of FDS data.

DNR is responsible for:

- updating the forest layer with natural, Licensee-managed and DNR-monitored forest change,
- providing Licensees with an up-to-date forest inventory suitable for the development and implementation of a Forest Management Plan, and
- compiling and linking the FDS data to the forest layer.

DNR and Licensees are jointly responsible for:

- continually improving the forest inventory system and update process,
- co-ordinating the forest development survey through the *Forest Management Planning Committee* (section 3.4), and
- continually improving methods of data collection and transfer between Licensees and DNR in order to be more efficient and reduce any redundancies.

6.4 Standards and Requirements

The Licensee is responsible for:

- A Geographic Information System (GIS) coverage containing spatial and attribute data for all Licensee-managed forest change conducted on the Licence for the previous year (April 1st to March 31st) shall be provided to DNR on or before September 30th.
- The attributes are to be assigned according to the specifications described in “New Brunswick’s Integrated Land Classification System”.
- Spatial updates have to be compared to the current forest layer in order to determine how to accurately incorporate the update into the existing forest layer. In cases where the forest layer

spatial and/or attribute data need to be adjusted, Licensees will provide details describing how this adjustment should be done.

- If a Licensee does not provide updates to the specifications above, then they must submit a remotely sensed image showing the block and outlining the treatment(s) applied, as well as the information required to assign appropriate post-treatment attributes.
- Collection of FDS data should be done so as to maintain a good association between ground and interpretation.
- Completed and checked FDS data are to be forwarded to DNR in an appropriate format and on a timely basis, as determined by the *Forest Management Planning Committee*.

DNR is responsible for:

- The natural forest change will be captured periodically, normally every ten years, by a re-inventory process involving the acquisition and interpretation of remote sensing imagery which meets the level of accuracy required for "New Brunswick's Integrated Land Classification System". The scheduling of this re-inventory should be designed to minimise variation of the age (or vintage) of the inventory within a Licence and should consider forest management planning processes.
- Licensee-managed change data shall be verified, using the remotely sensed image provided by the Licensee or where no image is provided, by a system of sampling agreed to by DNR and Licensees, to determine the accuracy and reliability of Licensee updates. The updates will then be incorporated into the inventory and the updated forest layer forwarded to Licensees on or before July 31st of the year following receipt of the updates. As much as possible, this updated forest layer shall also include any DNR-monitored changes from the previous year.
- The FDS data collected by Licensees will be compiled and spatially linked to the forest layer. This information will be provided to Licensees in the format and time frame as determined by the *Forest Management Planning Committee*.

DNR and Licensees are jointly responsible for:

- DNR and Licensees will mutually agree on principles and practices to be used by Licensees in preparation and submission of the spatial and attribute data describing annual Licensee-managed forest change.
- DNR and Licensee shall co-ordinate their efforts to capture the information required to update trespass activities. These updates should be to the same standard, and whenever feasible, be included with Licensee updates.
- Suitable geo-referenced ground information from surveys (e.g. regeneration surveys, permanent sample plots, and FDS plots) should be provided to interpreters to assist in maintaining the desired accuracy during the re-inventory process.
- The FDS is to be carried out according to the procedures described in the "New Brunswick Forest Development Survey Field Manual". These procedures are set by the *Forest Management Planning Committee* so as to efficiently and effectively collect the information required for yield curve development to be used in forest management planning.

7 Licensee Performance Evaluation

Under the CLFA the Minister of Natural Resources evaluates Licensee forest management performance at five-year intervals. The Licensee Performance Criteria document outlines a procedure to evaluate the forest management performance of each Licensee. The evaluation results are used in the Minister of Natural Resources' decision to extend the length of the FMA.

The evaluation is based on a predetermined set of criteria, indicators and thresholds revised every five years. A consultative process between industry and DNR is utilised to develop a set of fair evaluating criteria. The completed document entitled "Licence Performance Criteria" forms Schedule 'G' of the FMA.

The Licensee Performance Criteria document addresses the key elements of the evaluation methodology:

- Who is being evaluated?
- Who is making the evaluation?
- What is the timing of the evaluation?
- What are the evaluating criteria?
- Two major areas:
  - Implementation of the current Forest Management Plan
  - Development of the upcoming period Forest Management Plan.
- What are the performance thresholds?

The first performance evaluation was conducted in 1987, the end of the first management period under the direction of the CLFA. The act requires that the Minister of Natural Resources carry out an evaluation within six months of the expiration of each five-year management period. If the Minister is satisfied with the performance of the Licensee, the term of the Licence may be extended by five years beyond the existing term. The results are then made public.

8 Appendices

8.1 General

All forms provided in the appendices of the FMM are guides, unless otherwise noted, to show the minimum information required. Licensees may develop their own version of these forms for submission to DNR. The content and format of these new versions must be agreeable to both DNR and the Licensee.

9 Appendix - Silviculture

9.1 Nursery Container Stock Specifications

The parameters in Table 4 define the range of acceptable seedlings that could be found throughout the shipping year in meeting varying planting schedules. Upon mutual agreement between the nursery and Licensee, healthy seedlings may be shipped that fall outside of the stated specifications.

Table 4. New Brunswick nursery container stock specifications.

Parameter	All Species		
	Minimum	Average	Maximum
Shoot Height (cm)	(10)	15	(30)
Root Collar Diameter (mm)	(1.25)	1.5	(3.0)
Total Dry Weight (mg)	500	1000	2750

DNR will develop a shipping plan in conjunction with the Licensee's requested planting needs. The objective will be to have available to ship as much as possible seedlings meeting the average stated specifications.

As much as possible DNR will attempt to balance availability of seedlings to individual Licensees and ensure that seedlings are shipped in their prime (not held too long).

A Licensee representative will be encouraged to visit the nursery to see that the seedlings in the crop are of an acceptable quality and standard, prior to shipping commencement.

Individual loads should be ordered no later than 2h00 p.m. on the previous day for which the seedlings are requested. At the time of ordering, the nursery should be given the complete silviculture treatment number (Block #). Licensee representatives will have to accept delivery outside of normal working hours. Upon delivery, the Licensee representative will sign a receiving slip indicating that the stock is acceptable. It is expected that the Licensee representative will provide help in unloading the truck. If a load or any part is rejected, reasons must be stated with all of the rejected seedlings returned.

In order to facilitate deliveries and recording of block numbers, Licensees will provide a map at a scale of 1:125 000 and a list of planned planting blocks prior to the shipping season, if needed.

Licensees are responsible for stockpiling empty seedling trays and ensuring that the nursery is aware of the location of the stockpiles during the planting season.

9.2 Commercial Thinning Guidelines for Post-Treatment Stand Basal Area

Table 5. Commercial thinning guidelines for post-treatment stand basal area for various species and site combinations.

N.B. Site Indexes		Factored minimum BA (m^2/ha) at height of dominants (including trails)			
		10 m	12 m	14 m	16 m
A	SP & Fir – 18 m/50 years	17	18	20	22
	Jack Pine 21 m/50 years	17	18	19	20
B	SP & Fir – 15 m/50 years	15	17	19	21
	Jack Pine 18 m/50 years	15	16	18	19
C	SP & Fir – 12 m/50 years	15	17	18	20
	Jack Pine 15 m/50 years	13	14	16	18

9.3 Silviculture Stocking Survey

The silviculture stocking survey consists of the following:

- Minimum plot intensity is one (1) plot per hectare unless otherwise stated.
- Stocking plot size is 5.0 m^2 (circle, 1.26m in radius).
- Minimum number of plots is 20.
- Plots must be established using a uniform grid.
- Plots will not be placed in non-productive areas (i.e. roads, swamps and rock outcrops).
- Natural regeneration is to be tallied separately from planted trees in plantations.
- A plot is considered stocked when it contains a minimum of one (1) acceptable seedling or two germinants.
- The following (excluding healthy live germinants) will not be counted in a survey:
    - layerings,
    - seedlings with over 25 % of circumference of stem girdled (i.e. bark removed),
    - seedlings with a live crown ratio of less than 20 %, and
    - advanced, stunted fir regeneration. This is advanced regeneration present following harvest. Generally, this refers to trees over one metre in height with short "umbrella" shaped crowns exhibiting very poor annual growth (i.e. in excess of 10 years of age) as a result of overtopping suppression.

9.4 Silviculture Density Survey

The silviculture density survey consists of the following:

- Minimum plot intensity is one (1) plot per hectare, unless otherwise stated.
- Plot size of 6.67 m^2 (circle, 1.46 m in radius).
- A minimum of 20 plots per block.
- Plots must be established using a uniform grid.
- Tallying will be done by species and will include all woody stems one (1) metre or taller in height. Dead stems are to be tallied from those areas that have been herbicided at least three years prior to thinning. Non-commercial species such as wild raisin, elderberry, dogwood, and hobble bush should not be tallied.
- If residual stem basal area is to be tallied, then a BAF 2 prism is to be used.

9.5 Quality Assessment Procedures for Pre-commercial Thinning and Plantation Cleaning.

The silviculture quality assessment survey for thinned areas consists of the following:

- Circular plots 40 m² (3.57 m radius) established at uniform intervals and evenly spaced over the entire treatment area.
- Sampling intensity will be a minimum of one (1) plot per hectare.
- Plots to determine stocking (section 9.3) will be established using the same centre point as the 40 m² plot.
- Data to be collected on each 40 m^2 plot include:
  - Number of crop trees and average height by species
  - Occurrence of unacceptable quality factors (Table 6).

Table 6. The percent deductions for various quality factors used in the post-treatment assessment of pre-commercial thinning and plantation cleaning areas.

Quality Factor	Deduction (%)
a) Crop tree selection	5
b) Excessive cutting of potential crop trees[1]	5
c) Crop tree damage	3
d) Crop tree spacing	3
e) Uncut competition[2]	3
f) Live branches on cut stumps[2]	3
g) Incomplete cuts	1

NOTE: For a) to e) count each occurrence.
For f) and g) count each occurrence only once.

[1] Undamaged crop trees should be at acceptable stocking levels over the treated area. The minimum acceptable spacing between crop trees is one (1) metre (to accommodate any natural openings).
[2] Count only if considered to be potential future competition.

9.6 10th-Year Plantation Survey Procedures

The 10th-year survey sampling procedure is as follows:

1. Stands should be measured after most of the current leader growth is completed. Therefore, it is recommended that sampling begin after August 1st. In the event sampling is performed earlier, all heights should be referenced to the last complete leader.
2. The minimum sampling intensity for all plantations greater than 20 ha will be 1 plot per ha. For plantation less than 20 ha, 20 samples will be taken.
3. Sample plots will be 6.67 m^2 in size (1.46 m radius). To provide uniform and representative coverage of the area sampled, plots will be uniformly distributed across the block.
4. The sampling grid can be oriented in any direction but lines should not be parallel to any existing site preparation rows
5. Some plantations are divided into sections based on species or stock type differences. In such cases, the sampled pattern and intensity will be laid out for the whole plantation, irrespective of sections. However, to allow reporting by section, the proper section number will be assigned to each sampled plot.
6. Once a plot is established a 1.46 m radius is swung 360 degrees around the plot center by the cruiser.
7. If the block has been herbicided within the last 3 years both live and dead stems greater than 1 m in height must be tallied, otherwise only live stems greater than 1 m in height are to be measured. Since the results of this survey can be used for the determination of pre-spacing densities all stems will be counted rather than placing an upper limit on the number of trees counted.
8. The cruiser tallies the density of all non-residual softwood trees (natural and planted) in the 1.46 m radius circle of trees greater than 1m in height.
9. The height (nearest 10 cm) of the tallest live non-residual softwood and its species code are recorded in the softwood HGT and SP columns respectively.
10. The cruiser tallies the density of all non-residual hardwood trees similar to that for softwood. Stump sprouts must be tallied separately from single tree stems. Each stump sprout counts as one stem.
11. The height (nearest 10 cm) of the tallest live non-residual hardwood individual and its species code are recorded in the hardwood HGT and hardwood SP columns respectively.

10th-year Silviculture Survey Tally Sheet

Crew		Date		Region	Licence	Block	Year	Type
1	2	Month	Year					

SECT	Plot No.	Softwood			Single Tree Hardwood			Hardwood Stump Sprouts			Dead wood
		D	SP	HGT	D	SP	HGT	D	SP	HGT	D

Remarks:

Map Number	Photo Number

10th-year Silviculture Survey Tally Sheet, continued

Species Codes

Softwood		Hardwood	
01	black spruce	12	red maple
02	white spruce	13	sugar maple
03	red spruce	14	yellow birch
04	Norway spruce	15	beech
05	balsam fir	16	ironwood
06	white pine	17	oak
07	jack pine	18	ash
08	red pine	19	white birch
09	cedar	20	poplar
10	hemlock	21	grey birch
11	tamarack	34	striped maple
		35	mountain maple
		36	pin cherry
		37	mountain ash
		38	alder
		39	willow
		40	hazel

Remarks Code Description

01	Need cleaning
02	Needs spacing
03	Insect and/or disease problems
04	Browsing problems
05	Stocking problems
06	Free-to-grow
07	Needs herbicide
08	No major problems
09	Other:

_____

Comments:

Tally Sheet Explanation:

1. Crew: Initials of survey members,
2. Date: The month and year of survey,
3. Region, Licence, Block: Region, Licence, block number
4. Year, Type: Year and silviculture type for the sample area
5. SECT: Plantation section number
6. Plot No.: Sequential number from 1 to the total number of plots in the sampled area.
7. Softwood D: Total count of all live non-residual planted and natural softwood greater than 1 m in height.
8. Softwood SP: Species code of the tallest live non-residual softwood.
9. Softwood HGT: Total height of tallest live non-residual softwood (nearest 10 cm).
10. Single Tree Hardwood D: Total count of all live non-residual hardwood greater than 1 m in height.
11. Single Tree Hardwood SP: Species code of the tallest live non-residual hardwood.
12. Single Tree Hardwood HGT: Total height of tallest live non-residual hardwood (nearest 10 cm).
13. Hardwood Stump Sprouts D: Total count of all live non-residual hardwood stump sprouts greater than 1 m in height.
14. Hardwood Stump Sprouts SP: Species code of the tallest live non-residual hardwood stump sprout.
15. Hardwood Stump Sprouts HGT: Total height of tallest live non-residual hardwood stump sprout (nearest 10cm).
16. Deadwood D: If the block has been herbicided within the last three years, then dead stems must be tallied. Total count of all dead stems greater than 1 m in height.

10 Appendix - Harvesting

10.1 Description of Planned Harvest Operations

Licence		Block #									
Amendment Date (dd/mm/yyyy)									Map #		
DWA #							OSFH #				

Prescription				Section		Area (ha)			Season

Product		Species Code			Proposed Harvest (m^3)							

Comments / Operational Details

Licence – Licence name.

Block # – 9 digit harvest block number.

Amendment Date – 8 digit date (dd/mm/yyyy).

Map # – 1:12 500 GIS map number.

DWA # – 6 character DWA number.

OSFH # – 6 character OSFH number.

Section – 2 characters depicting section of harvest block (as per eScale). Sections must also be identified on the map. A buffer with planned intervention for example, would be a section.

Prescription – Total of 4 characters, first 2 characters will be alphanumeric as per current coded format for harvest method. The last 2 characters will be a numeric code to represent prescriptions. The prescription will be developed by each Licensee to describe the activities on the Licence. Prescriptions developed for DWA or areas must have provision for describing the pre- and post-treatment habitat status. The codes and prescriptions must be included in the Operating Plan.

Area – Hectares (3 digits).

Season – 1 character. 'W' indicates a winter harvest.

Product – 2 characters as per Product Codes from the *Timber Scale Reporting Code Tables.*

Species Code – 3 characters as per Species Codes from the *Timber Scale Reporting Code Tables*.

Proposed Harvest – Harvest volumes expressed in m^3.

10.2 Proposed Harvest Volumes by Species, Product, and Allocation

Licence _____ Year _____

Product and Species Code[1]	Volume (m^3) by Licensee or Sub-Licensee Name										Total Volume (m^3)
Total											

[1] Species and products shall be listed as in *Timber Scale Code Reporting Tables*.

10.3 Minimum Required Information for Weekly Status Report

Headings

Licensee

Week Commencing

Columns

Block Number (7 digit)

Section (as per e-Scale, 2 characters)

DNR Region/District (3 digit)

Operator ID (4 character code as per current *Timber Scale Reporting Code Tables*)

Harvest Start (day/month/year)

Harvest End (day/month/year)

Trucking End (day/month/year)

Harvest (X)

Slashing (X)

Chipping (X)

Trucking (X)

Silviculture code (two digit code, i.e. BP, BT, FP)

Harvest treatment code

Road (two digit code i.e. construction, culvert installation)

Comments

10.4 Final Harvest and Final Trucking Inspection Report

Licensee _____ Harvest Block _____ Date Received _____
Sub-Licensee _____ Harvest Report _____ Date _____
DNR District _____ Trucking Report _____ Date _____

SECTION 1: FINAL HARVEST INSPECTION

	If any of the questions below are answered NO please comment:	Licensee Yes	Licensee No	DNR Yes	DNR No
1	Harvest prescription followed?	❑	❑	❑	❑
2	Utilisation standards were followed?	❑	❑	❑	❑
3	Harvest was conducted within flagged block as in Operating Plan?	❑	❑	❑	❑
4	Requirements for forest and logging roads in accordance with the Roads and Watercourse Crossings section of the FMM were followed?	❑	❑	❑	❑
5	Requirements for harvesting in accordance with the Harvesting section of FMM were followed?	❑	❑	❑	❑

6 Total number of watercourse crossings (culverts, bridges). <0 .5 m _____ >0.5 m _____ **Total** _____

7 Are there residual species remaining on the block to be harvested?

Species	Product	Volume Estimate (m^3)

8 Reasons for uncut areas:

1) _____ Unmapped water / stream buffers
2) _____ Added wildlife buffers or site specific wildlife habitat
3) _____ Wet Areas SEASONAL Wet Area ❑ PERMANENT Wet Area ❑
4) _____ Steep Areas _____ % slope
5) _____ Rocky Areas
6) _____ Immature wood
7) _____ Low volume stand (< 50 m^3/ha)
8) _____ Tolerant Hardwood (TH) Potential
9) _____ Other, please specify (e.g. PSP, silviculture potential) _____
10) _____ Area is to be re-submitted.

LICENSEE COMMENTS:	DNR COMMENTS:

I certify that the information contained in this report is complete and accurate.
Licensee _____ Date _____
Forest Ranger _____ Date _____

NOTE: Attached map (1:12 500 scale) must indicate any changes made to the block. There must be sufficient information on the map to cross reference with the Annual Report (e.g. culvert locations, buffers).

SECTION 2: FINAL TRUCKING INSPECTION

	If the question below is answered NO please comment:	Licensee Yes	Licensee No	DNR Yes	DNR No
9	All merchantable wood has been removed from roadside?	❑	❑	❑	❑

LICENSEE COMMENTS:	DNR COMMENTS:

I certify that the information contained in this report is complete and accurate.

Licensee _____ Date _____

Forest Ranger _____ Date _____

10.5 Steep Slope Harvesting Standards

10.5.1 General

The standards in this section will be applied when harvesting occurs on steep slopes within the inoperable land base as identified in the Forest Management Plan. These standards usually relate to cable yarding activities but are not restricted to this method of harvest. The requirements of the *Clean Water Act*, Watercourse Buffer Zone Guidelines (section 4.5.3) and Forest Management Manual must be respected in the application of these standards.

10.5.2 Objectives

The objective of the steep slope harvesting standards is to define criteria for the harvest of the inoperable land base that will both prevent soil erosion and minimise any negative aesthetic impact.

10.5.3 Criteria

Harvest on steep slopes will be done as follows:

- Salvage of blow down areas is to be considered before non-blow down areas.
- Areas with greater advanced softwood stocking are to be higher priority than those of lesser advanced softwood stocking.
- Harvest systems must ensure protection of advanced regeneration.
- Soil disturbance must be kept to an absolute minimum.
- A regeneration survey is to be conducted immediately following harvest so that fill planting can proceed where necessary without delay.
- Within one year of harvest the minimum total stocking of all species (natural or planted) must be 90 %.
- Eligible stands must meet the following criteria:
    - Minimum stocking of 40 % advanced softwood regeneration (30 cm minimum height and 1 m maximum height)
    - Maximum opening size is 20 hectares.
    - Maximum width (perpendicular to the slope) is 200 m.
    - Uncut areas of at least 10 hectares in size are to be left between harvested areas.
- Exceptions to the above standards may be approved by DNR where more than 50 % of the stand has blown down.

10.6 Best Management Practices for Crown Land Tolerant Hardwood and Tolerant Hardwood/Softwood Stands

10.6.1 Objective

Crown land tolerant hardwood and tolerant hardwood-softwood stands[1] will be managed to maximise the sustainable supply of hardwood logs while respecting other identified non-timber values. This will be accomplished by promoting high value tolerant hardwood in the overstory, where present and high value tolerant hardwood regeneration through even-aged and uneven-aged silviculture treatments (Figure 4).

10.6.2 Standards:

- Candidate stands for uneven-aged management strategy are greater than 5 ha in size and are considered to contain:
    - a minimum density of 200 quality stems/ha in H stands and a density of 150 quality stems/ha in HS stands,

      or

    - a pre-treatment stand basal area greater than 20 m^2/ha in which the basal area of quality potential stems is greater than 40 % of the pre-treatment stand basal area.
- A quality stem is considered to contain or have the potential to contain a log 2.6 m or greater in length and have a dbh greater or equal to 10 cm.
- Stands will receive a prescription unique to their development and condition when they exceed 5 ha in size. Stands less then 5 ha should be considered for management when adjacent to similar TH stand types.
- No uneven-aged management treatments are to occur before August 15 (biological date whereby bark is firmly attached to the tree).
- Operations should be in compliance with all aspects of the Forest Management Manual for Crown Lands in New Brunswick, related to harvesting, including but not limited to wildlife considerations, forest road construction, and adjacency guidelines.
- Licensees must implement harvest systems conducive to minimising logging damage to residual trees. No more than 10 % of the residual trees may be damaged (Table 7).

[1] Tolerant hardwood > 50 % of stand volume. Red maple is considered tolerant hardwood when found on good sites. Actual stand species composition should direct proper tolerant hardwood management, not solely harvest block boundaries or photo-interpreted stand attributes.

Table 7. Criteria for assessing individual tree damage occurring as a result of harvesting.

Injury Type	Degree of Damage
Bark Abrasion	Bark scuffed off, exposing 580 cm^2 or more of wood surface for yellow birch, or 968 cm^2 or more of wood surface for other species.
Broken Branches	Branches larger than 7.6 cm in diameter broken from the tree.
Root Damage	Root area within the drip line of the tree crown where 25 % or more of the surface area is exposed.
Stem Breakage	Main stem broken, destroying the tree and most or the entire crown.
Bending	Tree partly or entirely uprooted, noticeably tipped out of its normal growing position.

10.6.3 Roles and Responsibilities:

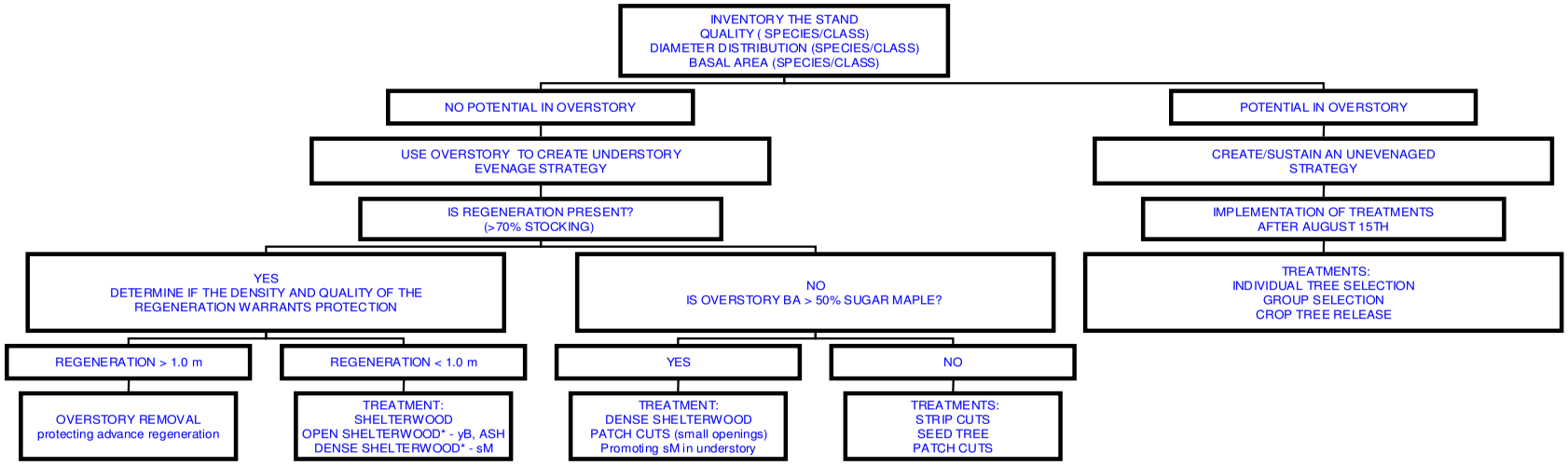
The Licensee shall be responsible for:

- Acquiring stand information. Unless otherwise approved, all tolerant hardwood and tolerant hardwood softwood stands require a cruise. The cruise must have sample points distributed uniformly over the area to be treated with a sample intensity of 1 plot/ha. Trees greater than 9.1 cm will be tallied in 2 cm classes and regeneration evaluated at each point.
- Formulating prescriptions (Figure 4) that properly stratify the treatment area and are consistent with DNR tolerant hardwood management objectives.
- Submitting prescriptions as part of the Operating Plan including the expected end results of implementing the prescription. DNR requires the following summaries in order to evaluate treatment prescriptions. These summaries will support the Licensees rationale for choosing selected treatments. Individual cruise point data by stand is not required. The following information should be summarised for each proposed treatment in the Operating plan:
    - Treatment basal area (m^2/ha) by species and class[1].
    - Total treatment basal area (m^2/ha) by species.
    - For even-aged treatments the number of quality stems/ha or % BA of quality stems
    - Abundance of quality TH advance regeneration (stocking %) and height (m)
- Monitoring harvest operations to ensure prescriptions adequately address stand conditions and are implemented properly.
- Completing and submit the final harvest inspection report.
- Submitting treatment results as required in the Annual Report.

[1] **Large log:** > 40 cm dbh, **log**: 28 cm to 38 cm dbh, **small log**: 10 cm to 26 cm dbh, **pulp**: healthy non-quality producing stem, **cull**: unhealthy non-quality producing stem that will be considered unmerchantable in five years.

DNR shall be responsible for:

- Evaluating and approving all formulated prescriptions prior to being implemented.
- Verifying that prescriptions were properly implemented.
- Verifying accurate reporting of completed treatments in the Annual Report.



EVEN-AGED TREATMENTS (NON-QUALITY POTENTIAL PRODUCING STANDS):

- **OVERSTORY REMOVAL** - SYSTEMATIC REMOVAL OF ALL MERCHANABLE STEMS, ENSURING PROTECTION OF QUALITY ADVANCE REGENERATION.
- **SHELTERWOOD** - UNIFORM REDUCTION IN STAND BASAL AREA AND CROWN CLOSURE IN ORDER TO PRODUCE OR GRADUALLY RELEASE DESIRED REGENERATION.

  (**OPEN SHELTERWOOD**: Basal Area at 10 -12 m^2/ha and Crown Closure Between 50 - 60%; **DENSE SHELTERWOOD**: Basal Area at 14 -16 m^2/ha Crown Closure between 60 - 70%.)
- **SEED TREE** - CLEARCUT OVERSTORY AND ENCOURAGE MINERAL SOIL DISTURBANCE, ENSURING THAT 8 -10 MATURE YELLOW BIRCH SEED TREES/HA REMAIN.
- **STRIP CUT** - HARVEST UNIFORMLY SPACED STRIP CLEARCUTS, GENERALLY 25 m WIDE, ENSURING MINERAL SOIL IN EACH STRIP IS WELL DISTURBED.
- **PATCH CUTS** - HARVEST OF PATCH CLEARCUTS REMOVING UP TO 30 - 40% OF TOTAL AREA .

UNEVEN-AGED TREATMENTS (QUALITY POTENTIAL PRODUCING STANDS):

- **INDIVIDUAL TREE SELECTION** - MAXIMUM 30% UNIFORM REDUCTION IN BASAL AREA ACROSS ALL DIAMETER CLASSES, ENSURING THAT THE QUALITY OF THE STAND IS IMPROVED FROM IT'S ORIGINAL PRE-HARVEST CONDITION. POST HARVEST BASAL AREA SHOULD NOT BE LOWER THAN 16-18 m^2/ha
- **GROUP SELECTION** - HARVEST OF PATCH CLEARCUTS IN A STAND ENSURING THAT A MAXIMUM OF 10% OF THE AREA IS TREATED AT A TIME. PATCH SIZES < 0.04 ha PROMOTE TOLERANT HARDWOOD REGENERATION AND PATCH SIZES > 0.04 ha PROMOTE INTERMEDIATE TOLERANT HARDWOODS.
- **CROP TREE RELEASE** - RELEASE OF CROWNS FOR SELECTED QUAILTY CROP TREES ON TWO OR THREE SIDES.

This figure identifies proven treatments in managing tolerant hardwood stands. Other treatments, or variations of the present list, may be acceptable as long as they meet DNR tolerant hardwood management objectives.

Figure 4. Tolerant hardwood management considerations for prescription development.

10.7 Protection of Advanced Quality Natural Softwood Regeneration

10.7.1 Objective

One of the goals for New Brunswick Crown land, as stated in *A Vision for New Brunswick Forests: Goals and Objectives for Crown Land Management*, is "to maintain the diversity of forest ecosystems and their associated ecological values". As part of the strategy for achieving this goal, quality natural regeneration will be protected on Crown land.

This section describes the roles, responsibilities, requirements, and standards necessary for the identification and protection of advanced quality natural softwood regeneration.

10.7.2 Roles and Responsibilities

The Licensees are responsible for:

- Identifying harvest blocks that require protection of advanced quality natural softwood regeneration in the Operating Plan.
- Providing documentation when requested by DNR, to support not protecting advanced quality natural softwood regeneration in a harvest block.
- Ensuring that Licensee and Sub-Licensee harvest operations protect advanced quality natural softwood regeneration where prescribed.
- Reporting on the success of prescribed advanced quality natural softwood regeneration protection using the Final Harvest Inspection Report (section 10.4).

DNR is responsible for:

- Reviewing and approving proposed harvest prescriptions in the Operating plan ensuring that the protection of advanced quality natural softwood regeneration has been considered.
- Monitoring harvest operations to ensure that harvest operations protect advanced quality natural softwood regeneration where prescribed.
- Evaluating the success of prescribed advanced quality natural softwood regeneration protection during the Final Harvest Inspection.

10.7.3 Requirements and Standards

In order to allow proper pre and post-harvest evaluation, Licensees will identify in their Operating Plan harvest blocks or portions of harvest blocks that warrant the protection of advanced quality natural softwood regeneration. Where this applies to portions of a harvest block, the area to be protected must be clearly identified on the 1:12 500 harvest block map.

10.7.3.1 Pre-Harvest Eligibility Criteria

Natural regeneration warranting protection must be evaluated in terms of the following criteria:

- Tree Quality:
    - Stems should have 50 % live crown.

- Stems have exhibited good past leader growth.
- Stems should exhibit a healthy green appearance.
- Stems should exhibit the formation of a good healthy leader.
- Stem age varies with geographical location but should normally not exceed 20 years of age for balsam fir or 30 years of age for spruce.

- Stocking Levels:
  - Regeneration is less than 2 m in height then stocking must be greater than 60 %.
  - Regeneration is greater than 2 m in height then stocking must be greater than 70 %.
- Height:
  - Maximum 5 m.
- Area:
  - Normally size of area to protect should be based upon producing a reasonably sized area to silviculturally treat (5 ha is the suggested minimum).
- Site Potential:
  - Suitability of natural species to the site.
  - Balsam fir should normally not be protected on a poorly drained site.

10.7.3.2 Post-Harvest Standard

An area approved for regeneration protection will fail when more than 40 % of that area has been both disturbed and does not contain quality natural softwood regeneration.

10.7.3.3 Post-Harvest Block Evaluation

A post harvest evaluation is to be carried out during Final Harvest Inspection. A visual inspection may be all that is required to verify that the standard has been met. If the visual inspection is questionable the following sampling procedures should be used to do a final joint assessment.

- Assessments will be conducted at an intensity of two (2) plots per hectare (plot size 5 m^2) with a minimum of 20 plots per block. Blocks will be assessed using a systematic pattern.
- Plots are not to be established within 50 m of a road on a full tree operation.
- Area within individual 5 m^2 plots will be assessed for regeneration disturbance.
- A plot will fail when disturbance has occurred and there is no quality softwood regeneration remaining within the plot.
- The assessment will be calculated as a percentage of plots that failed compared to the total number of plots in the assessment.
- The harvested area fails to meet the standard for regeneration protection when more than 40 % of the plots fail to pass the assessment.

11 Appendix - Fish and Wildlife Habitat

11.1 OSFH Block Management

11.1.1 OSFH Block Management Plan Format

Date:
OSFH Block Number: OS 880101
OSFH Block Periods: P 1 to 5
OSFH Block Total Area (including non forest): 1,000 ha
DWA/OSFH Overlap %: 15 %

OSFH Block Non-Spatial Management Scenario	Management Period						
	1	2	3	4	5		
No Harvest OSFH Supply (ha)	850	850	850	800	800		
No Harvest OSFH (%)	85	85	85	80	80		
Harvest Area: H:H (ha)	100						
Harvest Area: H:N (ha)	50						
Harvest Area: N:N (ha)	70						
Post Harvest OSFH Supply (ha)	800	800	800	800	800		
Post Harvest OSFH (%)	80	80	80	80	80		

Spatial Period 1 Harvest Block Summary			
Harvest Block Number	Area (ha)	Pre/Post Habitat Status Category*	Comments
ABCD	20	H:H	
EFGH	40	H:H	
IJKL	30	H:H	
MNOP	10	H:H	
QRST	20	H:N	
UVWX	30	H:N	
YZAB	35	N:N	
CDEF	35	N:N	

*Pre/Post Treatment OSFH Status Category	Habitat Status Pre-Treatment		Post-Treatment
NN	Non-Habitat	⇒	Non-Habitat
HN	Habitat	⇒	Non-Habitat
HH	Habitat	⇒	Habitat

11.1.2 Old Spruce-Fir Habitat (OSFH) Definition

Old Spruce-fir Habitat (OSFH) provides habitat for 56 vertebrate species. Thirty-four of those are habitat-generalists whose requirements are met in a broad range of habitat conditions. The remainder utilise spruce-fir forest only, and 17 of those require OSFH: American marten (AM), white-tailed deer (WD), black-backed woodpecker (BWP), red-breasted nuthatch (RN), red crossbill, white-winged crossbill, evening grosbeak (EG), olive-sided flycatcher (OF), boreal chickadee (BC), winter wren, golden-crowned kinglet, ruby-crowned kinglet (RK), solitary vireo, Cape May warbler, Blackburnian warbler, bay-breasted warbler (BW) and pine siskin (PS). Indicator species for OSFH are AM, WD, BWP, RN, EG, OF, BC, RK, BW and PS; the structural characteristics required to maintain them relate to tree cavities, woody debris, dead or dying trees, conifer cones, overstory crown closure, and a shrub layer (Table 8). A separate strategy exists for management of white-tailed deer; hence its requirements do not contribute to the definition of OSFH.

Habitat is defined in terms of stand structure criteria for operational planning and assessment, and in terms of timber volume development patterns for strategic forest planning.

11.1.2.1 OSFH Stand Structure Criteria

Vegetative Composition: Softwood and softwood-hardwood stands with at least 35% balsam fir (BF), red spruce (RS), white spruce (WS), black spruce (BS) and eastern cedar (EC) combined.

Crown Closure: ≥ 40 % of stems ≥ 10 cm dbh.
Note: Basal Areas less than 18 m^2/ha (of stems ≥ 10 cm dbh) are unlikely to provide 40% crown closure.

Stem Densities:

Live	≥ 10 per hectare of stems ≥ 30 cm dbh.
Dead	≥ 20 per hectare of stems ≥ 10 cm dbh
	≥ 20 per hectare of stems ≥ 30 cm dbh
Cavities	≥ 20 per 200 hectare of stems ≥ 45 cm dbh with cavity openings ≥ 8 cm & ≥ 5 m above ground. Note: Cavities are only required in ecoregions having the American marten.

11.1.2.2 OSFH Spatial Criteria

Patch Size: ≥ 375 ha

Minimum area of OSFH stands: 375 ha

Proportion of patch in OSFH stands: ≥ 0.75

Block Width: normally ≥ 1000 m and always ≥ 500 m

Table 8. Stand characteristics that provide habitat for OSFH species. Characteristics and related minimum values are tree cavities (CV dbh), woody debris (WD), dead or dying trees (DD dbh), live tree boles (TB dbh), conifer cones (CO), crown closure (CC percent), and shrub layer (SL). Values in bold are those that contribute directly to the structural definitions.

Species	Habitat Requirements	
	Nesting/Denning	Foraging
American marten	**CV 45**, WD	WD
Black-backed woodpecker	**DD 30**	**DD 10**
Red-breasted nuthatch	CV 15	**TB 30, CC 40**
Evening grosbeak		**CC 40**
Olive-sided flycatcher		**CC 40**
Winter wren	WD, SL	WD, SL
Ruby-crowned kinglet		**CC 40**
Bay-breasted warbler		**CC 40**
Pine siskin		**CC 40**

11.1.2.3 Definition of OSFH Habitat Windows

Forest strata are assigned to OSFH based on relative volume of component species at the point of maximum volume yield. Habitat typically begins at age 60, 70 and 80 for strata dominated by BF, RS or WS, and BS or EC, respectively. Habitat ends when volume of BF, RS, WS, BS and EC combined has declined to 50 m3/ha.

11.2 Determining Bank Slope for Watercourse Buffer Zone Width

Where the objective is to protect Water Quality and Aquatic Habitat, the slope of land perpendicular to a watercourse is one modifier of buffer zone width.

Slope is determined over a distance of 30 m beginning, in most circumstances, from the waterside edge of eligible shrub vegetation (alders, willows or trees) (points A to B in Figure 5). Unless specified as a *standing-timber buffer*, the buffer zone is also measured from the waterside edge of eligible shrub vegetation (points A, C and A in Figure 5, Figure 6 and Figure 7 respectively).

This information sheet describes two common exceptions to the normal situation and the associated procedures for determining slope. In addition, Table 9 provides conversions for horizontal distance to ground distance equivalent and slope in percent (%) to slope in degree (^{O}).

It is not uncommon to have steep banks immediately adjacent to the watercourse (C to A in Figure 6) with the slope levelling off a little further away (point A in Figure 6). Where the slope levels off within 10 m of a watercourse draining ≤ 600 ha, or, within 20 m of a watercourse draining > 600 ha (points C to A in Figure 6), slope should be measured from the crest of the initial rise (point A in Figure 6).

Another possibility is an initial increase in slope but at some point within 10 or 20 m of the watercourse the terrain begins to slope away. In such cases buffer width should be a minimum of 15 or 30 m depending on drainage area (Figure 7).

(**Note:** The actual buffer width must consider the wind throw, soil erosion and other modifiers given in section 4.5.3).

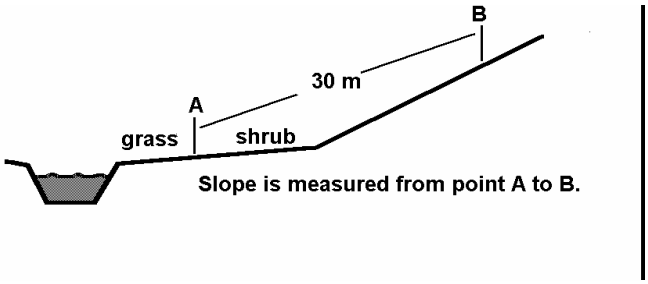


Figure 5. Conventional situation where slope changes gradually as one moves away from the watercourse.

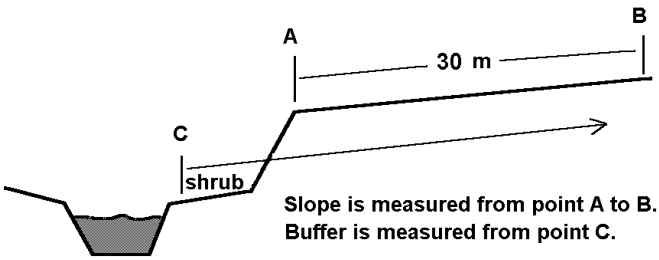


Figure 6. Slope determination when there is a steep bank adjacent to the watercourse and the terrain levels off there after.

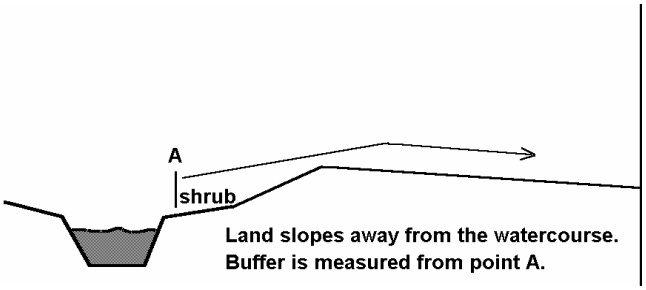


Figure 7. Situation where the adjacent land begins to slope away from the watercourse.

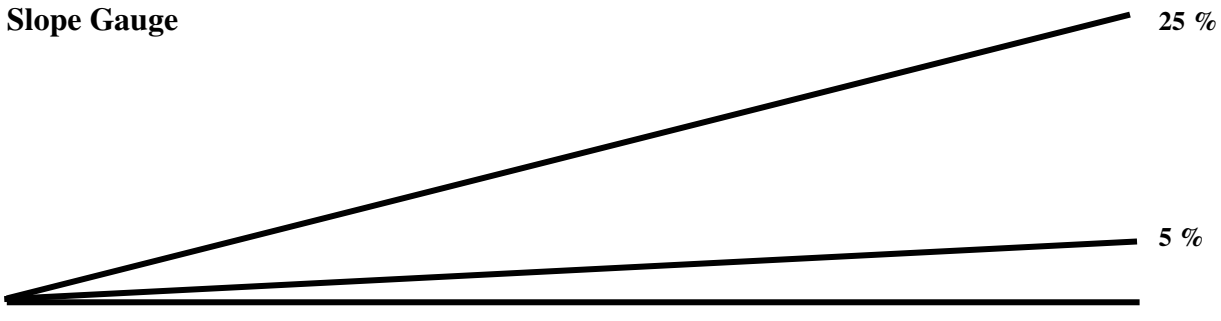
11.2.1 Slope and Ground Distance Equivalents for Buffer Width

The buffer widths given for ***Water Quality & Aquatic Habitat*** are true horizontal distances in accordance with the *Clean Water Act*. However for practical purposes, buffer widths are measured in the field as ground distance equivalents. Table 9 provides ground distance equivalents for various slopes and horizontal distances. For slopes ≤ 25 % the ground distance is essentially the same as horizontal distance. Slope can also be measured in degrees (^{o}); in fact most *Suunto* hypsometers (height gauges) have a slope (in degrees) conversion table on the back. For reference purposes degree slope equivalents are included in Table 9.

Table 9. *Water Quality & Aquatic Habitat* buffer zone widths (horizontal distances) as a function of bank slope (percent and degree) and ground distance equivalents

Slope		Water Quality & Aquatic Habitat Buffer Widths*	
Percent %	**Degrees ^{o}**	**Horizontal Distance (m)**	**Ground Distance Equivalent (m)**
≤ 5	≤ 3	15 or 30	15 or 30
6 – 24	4 - 13	30	30
25	14	60	60
30	17	60	65
50	27	60	70
70	35	60	75
90	42	60	80
100	45	60	85
110	47	60	90
120	50	60	95

*Buffer width must also consider the other modifiers included in the Watercourse Buffer Zone Guidelines (section 4.5.3).



11.3 DEER WINTERING AREA MANAGEMENT

11.3.1 DWA Management Plan Content

11.3.1.1 Full DWA Management Plan

Full DWA Management Plans shall contain the following sections and the information described in each:

Cover Page

The cover page will include:

- DWA number.
- Licence number.
- Licensee name.
- DNR Region and District number(s).
- Submission date.
- Name of the submitter.
- Space for date of DNR approval and signature of the Regional Director.

Introduction

The introduction will:

- Provide the DWA number, size (ha), location, and FDS map numbers.
- Identify whether this is a 1st-time plan for the DWA or a Follow-up Plan.
- Describe present and past deer activity in the DWA.
- State the management objective(s) for the DWA and identify any special management considerations.

Forest Description

The forest description section will:

- Describe the present state of the forest in the DWA including the species and age class structure.
- Describe how the forest was characterised for management planning, including: the vintage, type and source of forest inventory data and the methods and rules used to determine volume yield curves, stand age and habitat suitability.
- Provide a stand list detailing: map and stand number, area, species composition (e.g. FUNA), age, present timber curve number, and SWDH & MWDH window. This can be submitted in tabular or computer file format.
- Describe the forestry treatments available for use in the DWA.
- If applicable, identify and describe the computer model(s) used to

develop the management plan.

- Present and discuss the no-intervention SWDH & MWDH supply (graphical) from year 0 to 80.

Management Scenarios

The **Non-Spatial Analysis (Pre-Blocked)** section will:

- Present and discuss SWDH & MWDH supplies under various management scenarios, including:
  - A no-intervention scenario.
  - An intervention scenario without silviculture.
  - An intervention scenario with maximum planting and spacing.
- Identify the preferred scenario and discuss the rationale for its selection.
- The Spatial Analysis (Blocked) section will:
- Present and discuss SWDH & MWDH supply from the spatial scenario. Explain differences in SWDH & MWDH supply and treatment levels and types between spatial and non-spatial scenarios. **Note:** Where computer forest projection models have been used, the spatial habitat supply should be determined using a harvest sequence file detailing actual classes/stands to be treated.
- Provide a map indicating the location of SWDH & MWDH stands for the period of lowest supply in the first 40 years or for year 40 if SWDH supply is constant or increasing.
- Map the location of harvest blocks for at least the first five periods (25 years), identifying treatment type and block number.
- Treatment blocks in DWA should be ≥ 10 ha so as to avoid creating small isolated patches of SWDH in the future. Treatment blocks should encompass the total area to which a treatment is applied.

  For example:

Treatment Block #:	123...
Block Size:	40 ha
Treatment:	strip cut treatment (33 % removal; cut 30 m / leave 60 m)
Area Harvested:	13 ha (0.33 X 40 ha)

- Summarise the types and levels of management treatments by period.
- Provide a summary of period 1 interventions outlining: block number, block area, harvest treatment (code), map and stand number, strata number, age, area, pre/post treatment habitat status, expected natural regeneration status (codes: SW, MW or HW) and projected future SWDH & MWDH status (codes: Y (yes) or N (no)).
- Timber harvest treatments fall into one of three possible pre/post

treatment habitat status categories:

Pre/Post Treatment OSFH Status Category	Habitat Status		
	Pre-Treatment		Post-Treatment
NN	Non-Habitat	⇒	Non-Habitat
HN	Habitat	⇒	Non-Habitat
HH	Habitat	⇒	Habitat

Plan Amendments

The **Plan Amendments** section will:

- Identify and describe any amendments made during implementation of period 1. This section will normally be blank in the first management plan for a DWA but may contain information in the follow-up revisions required in each period that harvesting is scheduled.

Appendices

The **Appendices** section will contain:

- Map Products used during management plan development (e.g. stand basal area or crown closure maps).
- Forest Management Model input files and reports; include period 1 treatment reports, or equivalents, for proposed non-spatial and spatial scenarios.
- Cruise Information Summary (if applicable). Summaries should include: map and stand number, area, age by species, basal area by species or species group and condition, natural regeneration status, and comments.
- Treatment Status Report (Table 10) is required for stands harvested 3 or more years previous and must include:
  - Harvest block number, including year of treatment.
  - Treatment type.
  - Intended post treatment SWDH & MWDH and regeneration status as described in the associated management and/or operating plan.
  - Actual status based on a field inspection.
  - Comments regarding the expected development of the stand over the next 5 years.

11.3.1.2 Follow-up DWA Management Plan

The submission of a Follow-up DWA Management Plan under the conditions for a continuance-of-approval shall provide a summary of the previous period's management activities and details for the current period's treatments. Upon approval, it shall be appended to the original DWA Management Plan. The plan shall contain the following sections and the information described in each:

Cover Page

The **Cover Page** will contain:

- DWA number.
- Licence number.
- Licensee name.
- DNR Region and District number(s).
- Submission date.
- Name of the submitter.
- Space for date of DNR approval and signature of the Regional Director.

Treatment Status Report

The **Treatment Status Report** will:

- Describe the present condition of all areas harvested and silviculturally treated within a DWA in the previous period relative to the projected condition in the DWA Management Plan. Refer to Table 10 for content and format.

Summary of Treatments for Current Period

The **Summary of Treatments for Current Period section** will:

- This table shall provide the required details on harvest blocks for the current period. Refer to Table 11 for content and format.

Table 10. DWA Treatment Status Report.

DWA #:	Years: to

Treatment Block Number and Section		Stand / Map List	Block Area (ha)		Treatment Type		Pre/Post Treatment Habitat Status (HH, HN, NN)		Treatment Status	Expected Long-term Habitat Status	Actual Natural Regeneration	Required Follow-up Treatments to Achieve Long-term Habitat Status	
Management Plan	Operating Plan		P	A	P	A	P	A	Yes or No with Year / Period of Expected Completion	Habitat Type: status (% of block) (from Mgmt Plan)	SW, SH, HS, HW (% of block)	Treatment Type (% of block)	Year / Period

Table 11. Summary of DWA treatments proposed for the current period: Year A to Year B

DWA#:	Years: to

Treatment Block and Section	Block Area (ha)	Stand / Map	Stand Area (ha)	Treatment Type	Forest Type	DS/Age	Pre/Post Treatment Habitat Status HH, HN, NN	Expected Natural Regeneration Response SW, SH, HS, HW	Expected Long-term Habitat Status Habitat Type: status (% of block) (from Mgmt Plan)	Comments

Description of Treatment Status Report Items

DWA#: DWA# (e.g. DW462001)

Years: Years spanning period 1 of the plan (e.g. 1992 to 1997)

Treatment Block and Section:

- **Management Plan** Block identifier from DWA Management Plan.
- **Operating Plan** Block identifier from Annual Report.

Stand / Map List: Stand(s) and map number(s) associated with the block and section from DWA Management Plan.

Block Area (ha):
- **P** Treatment block area from DWA Management Plan.
- **A** Treatment block area from Annual Report.

Treatment Type:
- **P** Treatment approved for the block (stand) from DWA Management Plan (e.g. SWSELC = softwood selection)
- **A** Treatment type applied to the block (stand) from Annual Report.

Pre/Post Habitat Status:
- **P** Indicate habitat type and pre- and post-treatment habitat status of stand from DWA Management Plan.
- **A** Actual pre- and post-treatment habitat status of the stand from Annual Report.

Codes:
- **HH** Was habitat before treatment and will be after (e.g. SWDH-HH)
- **HN** Was habitat before treatment but will no longer be habitat after treatment (e.g. MWDH- HN)
- **NN** Was not habitat before treatment and is not habitat after treatment.

Treatment Status: Indicate whether treatment was completed. If not, indicate the reason why not and if and when it will be completed.

Expected Long-term Habitat Status: Indicate the habitat type (e.g. SWDH) and whether or not the block or stand is projected to be habitat in the future; from the DWA Management Plan (e.g. SWDH/P-14 = will be SWDH in period 14 (year 70)).

Actual Natural Regeneration: Actual natural regeneration response based on a visual check within 3 years after treatment (e.g. HS = hardwood dominated mixed wood).

Required Follow-up Treatment: Any follow-up silviculture treatment(s) required to ensure the block/stand achieves the target long-term habitat status and the period(s) in which they will be implemented (e.g. herbicide release in period 2).

11.3.1.3 Management Planning Option for Small DWA

This section outlines the objectives and standards of a management planning option for small deer wintering areas (DWA) subject to a restricted set of harvest treatments. This option is intended to make it easier to conduct harvest treatments in a small DWA by simplifying planning requirements when the harvesting has no negative effects on habitat suitability or DWA function.

Qualification Criteria

DWA that qualify for management under this option must be less than 100 hectares in size (forested area) and the harvest treatments must not take stands out of severe winter deer habitat (SWDH) or moderate winter deer habitat (MWDH) condition.

There are approximately 300 DWA on Crown land less than 100 hectares in size. Collectively they account for 8% of the total hectares designated as DWA.

Description

Under this option a conventional DWA management plan will not be required for harvesting to be approved in eligible DWA. Rather, a summary of non-spatial habitat supply, harvest and silviculture for a DWA, or group of DWA, shall constitute the Management Plan. The actual blocking of harvest within individual DWA will be submitted directly in the Operating Plan after the Management Plan has been approved.

The management objective is to conduct harvest operations that improve the long-term supply of winter habitat within the DWA while not compromising the function of the DWA and not reducing the amount of SWDH and MWDH in the short and medium term. Short-term benefits from browse production will often result from these treatments.

Maintaining the connectivity and functionality of deer winter habitat and protecting the stability of residual stands shall be a primary consideration of licensees and DNR in the planning and approval of harvest operations in these small DWA.

Management Plan Standards

The management plan for a DWA, or collection of DWA under this option, shall include:

- List of the DWA for which the plan applies.
- Statement of management objective
- Projected severe and moderate winter deer habitat under a no-interventions scenario and the proposed non-spatial management scenario.
- Estimated wood supply for period 1.
- Estimated area to be harvested by treatment in period 1.

- Estimated area to be planted (full and fill) and spaced in period 1.

Maximum Area Harvested

The maximum area that can be treated in a DWA is governed by two rules:

- No more than 20% of a DWA should be harvested in a period.
- No more than 33% of the DWA should be < 30 years of age.

DNR will approve higher harvest levels where the DWA has no potential to over winter deer. The 20% harvest level may not be realized due to considerations for maintaining habitat connectivity and stability.

Timing of Plan Submission

The management plan shall be submitted at least 2 weeks prior to commencing associated Operating Plan blocks.

Operating Plan Standards

The following standards apply:

- An up-to-date map for each DWA showing the location of all proposed harvest blocks for the year shall accompany the standard Operating Plan information for harvest blocks in DWA.
- Harvest blocks should not be submitted until a management plan is approved.
- Forestry operations shall comply with the standards and guidelines outlined in this document and the Forest Management Manual.
- In the approval of harvest blocks, particular attention will be given to maintaining habitat connectivity and residual stand stability.

11.3.2 Deer Winter Habitat Definitions

Two winter habitat types have been defined for deer and are managed for in DWA on Crown land. Under severe winter conditions, deer seek refuge in conifer dominated stands with mature canopies that provide lower snow depths and wind speeds, and higher temperatures (snow and thermal cover). Conifer cover is considered to contribute more to the energy balance of deer than food and dominates habitat selection, but both are required components of suitable habitat. SWDH is high value cover in combination with at least some browse. The preferred arrangement is for both components to be provided within stands. The combination of cover stands adjacent to food sources, such as cuts, may also provide some habitat value, but are not readily accessible during severe conditions, and not counted in the supply of Severe Winter Deer Habitat.

During moderate winter conditions deer take advantage of increased mobility to seek stands of high food value with at least low to moderate cover (primarily for thermal shelter). Food is considered the primary factor to which deer respond under moderate winter conditions, moderated by the lesser requirement for cover. Although preferred habitats have higher food levels than the minimum required during severe periods, a broader range of types meet requirements during moderate winter conditions.

As for SWDH, the preferred arrangement is for food and cover to be provided within stands. However, adjacent food and cover stands are more likely to produce useful habitat combinations than during severe conditions because mobility allows for access to open habitats. Therefore, in additions to stands meeting both requirements, stands providing moderate cover only or moderate food only will also be tracked and accounted for in the supply of Moderate Winter Deer Habitat (MWDH). Similarly, individual treatments that create adjacent food and cover, such as patch and strip cut, may be assessed for their suitability as MWDH on a case by case basis.

These habitat types are described in terms of vegetative composition, stand structure, patch attributes, and habitat yield relationships used for strategic forest planning, DWA management planning, developing operational harvest prescriptions and for monitoring implementation. These definitions are intended as estimates of conditions that meet cover and food requirements within stands. It should be noted that elevation, slope and aspect are also important factors affecting the habitat value of forest stands as both SWDH and MWDH. South facing slopes at lower elevations are warmer, more sheltered and preferred by deer, especially along watercourses.

11.3.2.1 Severe Winter Deer Habitat (SWDH) Stand Structure

Forest Type: Conifer and Conifer-Hardwood stands excluding larch, pine, poor-site-spruce and most pure black spruce types.

Conifer Crown Closure: ≥ 50 % (trees ≥ 10 m tall)
Note: Conifer basal area values less than 20 m^2/ha (trees ≥ 10 cm dbh) are unlikely to provide 50 % crown closure.

Mean Conifer DBH: ≥ 18 cm

Understory: ≥ 10 % ground cover of available browse species. When not present, consider interventions that will enhance browse.

11.3.2.2 Severe Winter Deer Habitat (SWDH) Spatial Criteria

Patch Size: ≥ 10 ha of SWDH stands
≥ 75 % of the area in SWDH stands
≥ 300 m minimum patch width

Connectivity: Patches should be connected by winter travel corridors: conifer crown closure ≥ 50 %; development stage ≥ immature; width ≥ 90 m.

11.3.2.3 Moderate Winter Deer Habitat (MWDH) Stand Structure

Forest Type: Conifer, Conifer-Hardwood and Hardwood-Conifer stands excluding larch, pine, poor-site-spruce and most pure black spruce.

Conifer Crown Closure: ≥ 30 % (trees ≥ 10 m tall)
Note: Conifer basal area values less than 14 m^2/ha (trees ≥ 10 cm dbh) are unlikely to provide 30 % crown closure.

Mean Conifer DBH: ≥ 18 cm

Understory: ≥ 30 % ground cover of available browse species. When not present, consider interventions that enhance browse.

11.3.2.4 Moderate Winter Deer Habitat (MWDH) Spatial Criteria

Patch Size: ≥ 5 ha of SWDH stands
≥ 75 % of the area in SWDH stands
≥ 150 m minimum patch width

11.3.2.5 Definition of DWA Habitat Windows

DWA Management Plans are normally developed with the aid of DNR approved computer forest projection model (e.g. WOODSTOCK). Regardless of the model used, it is necessary to define for each stand or strata the development of habitat through time as well as the other items listed under Characterising Stands (section 4.5.5.4). DNR will place habitat windows on timber volume yield curves submitted in the appropriate format using the same procedure as for the Forest Management Plans. Figure 8 illustrates the pattern and timing of windows for general forest conditions. Windows shown are intended to represent average windows for fully stocked stands. Cruise and site data from individual DWA may warrant adjustments to average windows.

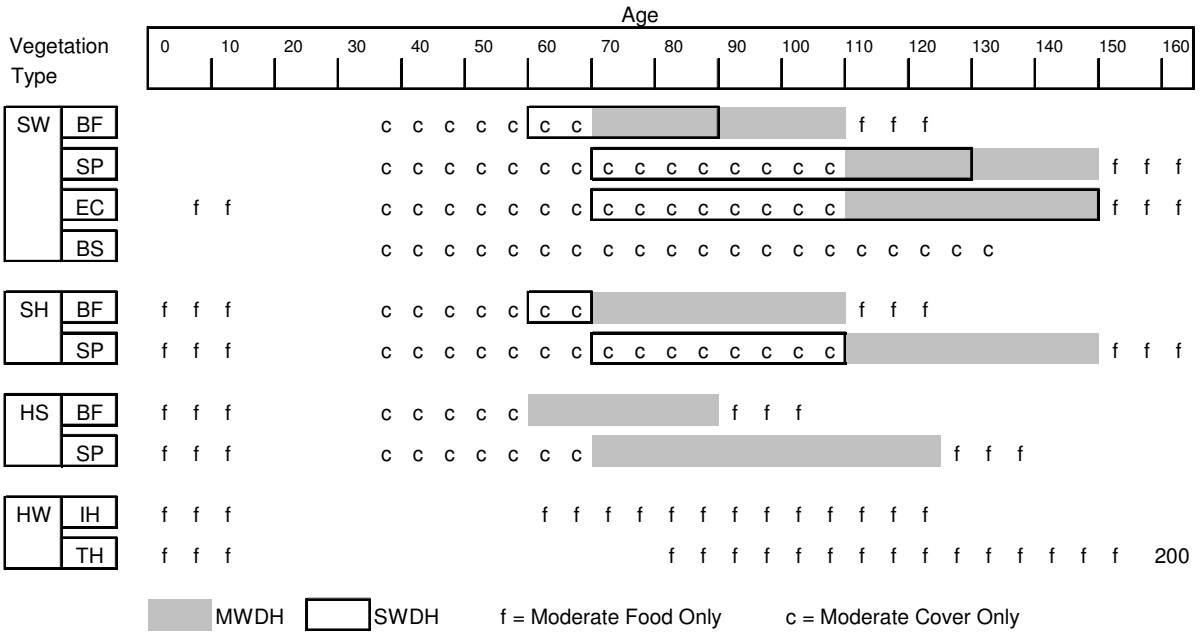


Figure 8. General forest condition windows for Severe Winter Deer Habitat (SWDH) and Moderate Winter Deer Habitat (MWDH).

11.3.3 Harvest and Silviculture Guidelines for DWA

11.3.3.1 General

Forestry activities in DWA are undertaken to produce a long-term sustainable supply of winter habitat for white-tailed deer. Here, the basic harvesting and silviculture treatments are described and discussed in-terms of their potential to maintain and create habitat for deer. These guidelines should be considered in the development and implementation of DWA Management Plans.

Conifer Forest Types

To maximise the sustainable supply of SWDH it is critical that conifer stands regenerate back to conifers. To minimise the need for planting conifers, reproduction methods that promote natural conifer regeneration must be investigated and given priority where opportunities exist.

Cedar and Hemlock

Cedar and hemlock trees are long lived, provide superior shelter, and are a preferred food of deer. Cedar and hemlock stands in DWA should not be clear cut and the occurrence of these tree species should be encouraged in all stands. To this end, the harvesting of cedar and hemlock trees in DWA is restricted to where it is necessary to propagate these species.

Deciduous Forest Types

Though deciduous and mixed forest stands in DWA do not provide SWDH they can provide food when deer movement is not restricted by snow depth and hardwood conifer mixed stands may provide MWDH. In consideration of browse production over the long-term, treatment of deciduous stands should be distributed throughout the management plan time horizon.

11.3.3.2 Reproduction Methods & Harvest Guidelines

Reproduction methods can be divided into even-aged and uneven-aged types. Stands managed using uneven-aged methods may provide SWDH or MWDH indefinitely and, therefore, uneven-aged management is preferred in suitable stand types. Even-aged shelter wood and patch or strip clear cut treatments may continue to provide deer with accessible food under severe winter conditions between the initial and final intervention.

Uneven-aged Group Selection

The group selection method should be used in uneven-aged conifer stands. To favour shade-tolerant regeneration and maintain the stand in habitat condition, openings should be 6 to 12 m and less than 20 % of the stand should be treated every 20 years. Light scarification favours cedar, hemlock and spruce regeneration; however, the potential for establishment or release of raspberry and deciduous competition must be considered. Depending on initial stand structure, group selection treatments can maintain the stand in a SWDH or MWDH condition indefinitely. Group selection treatments are preferred over uniform selection because it retains patches of high crown closure in the treatment block.

Uneven-aged Group/Strip Shelter wood

In stable, even-aged stands where suitable advanced regeneration is not adequate, a 2 or 3-pass shelter wood treatment is an appropriate regeneration method. Keeping openings to less than half the height of the overstory

favours regeneration of shade tolerant tree species. Limiting the strips and patches to less than 30 % of the stand area can maintain the stand in a habitat condition until the second intervention. As with group selection, light scarification favours cedar, hemlock and spruce regeneration: however, the potential for raspberry and deciduous competition must be considered. Group or strip shelter wood treatments are preferred over uniform shelter wood because it retains patches of high crown closure in the treatment block.

Even-Aged Multi-Pass Strip or Patch Clear Cut

In stable (wind firm), even-aged stands with suitable advanced regeneration, strip or patch clear cut treatments are useful where browse availability is limiting or there is a short-term need to maintain connectivity. Conifer regeneration and deciduous browse is released in the harvested area and the unharvested areas can provide shelter and allow deer to access browse. Where this is the intent, harvested strips should be ≤ 30 m wide and patches ≤ 100 m wide. Unharvested leave strips should be ≥ 50 m or twice the width of the harvested strip whichever is greater. Leave patches should be ≥ 100 m wide. Leave strips/patches should be harvested 10 to 15 years after the initial harvest. Treatments that harvest ≤ 20 % of the area can maintain the treatment block in a SWDH condition until the second intervention (i.e. removal of leave strips/patches). Advanced conifer regeneration must be protected.

Single-Pass Clear Cut

Conventional clear cut treatments (i.e. removal of all merchantable stems from the treatment block in a single operation) are acceptable where unstable stand conditions exist (i.e. forest stands experiencing rapid volume loss and expected to have less than 30 % conifer crown closure within 5 years) or residual habitat levels, browse accessibility and connectivity are not a concern. Advanced conifer regeneration must be protected.

11.3.3.3 Plantations and Competition Control

Planting conifers to produce future SWDH is an acceptable management tool when the cut does not have adequate conifer stocking. Pine plantations should not be established in DWA and preference should be given to red or white spruce over black spruce. Target densities should recognise the intent is to produce immature and older trees with deep and wide crowns, as they are better interceptors of snow and individually provide superior thermal cover.

Herbicide treatment(s) are also permitted to control competition on sites that have adequate conifer stocking, but the conifers are judged to be experiencing unacceptable growth interference.

Modifications to standard plantation and herbicide practices may be required in DWA where available browse is judged to be insufficient. Modifications should not affect the area greater than 30 m from the edge of shelter stands.

Pre-Commercial Thinning and Plantation Cleaning

Pre-commercial thinning and plantation cleaning treatments affect and direct species composition and density of the stand. In DWA these treatments should favour leaving the following species (in order of priority): cedar and hemlock, red and white spruce, balsam fir, and black spruce. To the extent possible cedar and hemlock stems should not be cut regardless of crop tree status. Target densities should recognise that the intent is to produce immature and older trees with deep and wide crowns, as they are better interceptors of snow, individually provide superior thermal cover and provide more favourable conditions for the movement of yarding deer.

Commercial Thinning

Commercial thinning treatments affect and direct the species composition and density of the stand. In DWA these treatments have the potential to accelerate the production of SWDH and MWDH by opening up the overstory to generate more favourable stem densities, maintain crown depth and stimulate crown response on residual trees, and increase the production of browse. Where this is the intent, small openings (< 1 tree height) should be interspersed through the stand with light thinning of trees in between. Openings should occupy no more than 30 % of the stand and conifer crown closure should be > 50 % in the thinned portions.

12 Appendix - Scaling and Utilisation

12.1 Merchantable Waste Volume Determination

1. Waste sampling shall be performed at an intensity of 1.25 %.
2. Merchantable waste shall be determined by the following procedure:

1. Define the block on a 1:12 500 scale map and determine size (ha) of the block.

    2. Indicate location of waste plots on map. Plots shall be uniformly distributed over the entire block or portion thereof.

    3. Locate plots in the block as indicated on a 1:12 500 scale map. Plots shall be either circular with a radius of 12.62 m or rectangular 10.0 m wide and 50.0 m long. The centre point or corners of all plots shall be marked to allow DNR to check waste sampling.

    4. Waste shall be considered within the plot when the sawn surface or butt end of a tree, piece, log or top is within the plot. A standing tree or stump shall be considered within the plot when more than one-half of the tree or stump diameter is within the plot.

5. Waste in tops and pieces shall be tallied by mid-diameter in cm of 2.44 m bolts.

    Waste in trees shall be tallied by diameter breast height (dbh) in 2 cm size classes.

    Waste in cut or broken pieces shall be tallied by mid-diameter in 2 cm size classes and 0.50 m length classes.

    Waste in skids and logs shall be tallied by small top diameter in 2 cm size classes and 0.20 m length classes. Skids or logs longer than 5.7 m shall be tallied as two logs.

    Waste in high stumps shall be tallied by number.

    6. Determine merchantable waste per ha by multiplying the tallied waste volume by 20.0 and dividing by the number of plots tallied.

    7. Merchantable waste volume determination will be reported on the form supplied by DNR.

12.2 Product Utilisation Standards

Table 12. General softwood species utilisation standards.

Softwood[1]			
Quality Factors	**Veneer Quality**	**Saw Quality**	**Pulp**
Diameter (cm class)(Min.)	26	12	8
Faces Clear (Min.)	4[2]	0	0
Sweep (Max.)	5% volume	1/3 volume	
Other Form Defects (Max.)[3]	0		
Rot (Max.)	0		1/2 volume

Table 13. General hardwood species utilisation standards.

Hardwood[1]				
Quality Factors	**Veneer Quality[4]**	**Saw Quality[5]**		**Pulp**
Diameter (cm class)(Min.)	26	22	18	8
Length (m)	≤ 2.60	< 3.66	≥ 3.66	
Faces Clear (Min.)	4[2]	0		0
Sweep (Max.)	5% volume	1/3 volume		
Other Form Defects (Max.)	0			
Rot (Max.)	0			1/2 volume

[1] Standards may differ for specific species as approved by DNR.
[2] Where markets exists, a few knots cut flush with the surface of the log are accepted and do not constitute a clear face defect. Mills specifications should be consulted.
[3] Includes crooks and seams.
[4] Considering market value and demands for hardwood veneer, the production of veneer quality material should be a priority. For this reason, any portion of the stem meeting veneer and mill length specification must be produced as veneer.
[5] Due to hardwood form characteristics, a lower diameter exists for long logs ≥ 3.66 m in order to ensure the maximum utilisation of saw material.

13 Appendix - Annual Report

13.1 Summary of Structures Installed in Watercourses

LICENCE: **YEAR:**

Harvest Block Number or Road Name and/or Number	GIS Map Number	Water Course Structures					Comments[1]
		Water Course Alteration Permit Number	Water Course Name or Location	Drainage Area (ha)	Size of Installed Structure	Violation (Yes/No)	

[1] Provide penalty number in comments when violation is indicated.

13.2 Summary of Harvest by Destination Within and Outside New Brunswick

LICENCE: **YEAR:**

Name of Destination[1]	Volume (m^3) by Species and Product[2]								
Licence Totals									

[1] Volume exports must include the name of the exporter and the receiving Province, US State or Country (if outside Canada and US). Volume exchanges must include the names of the parties involved and the volumes (m^3) by species and product involved.

[2] Species and products shall be listed as in *Timber Scale Code Reporting Tables*.

13.3 Summary of Harvest by Forest Zone and Volume Category

LICENCE: **YEAR:**

Forest Zone[1]	Volume Category[1]	Annual Volume Harvested (m^3)					Period-to-Date		5-year Total Allocated Volume (m^3)
		Year 1	Year 2	Year 3	Year 4	Year 5	Volume Harvested (m^3)	Percent of 5-year Total Allocated Volume	
Licence Totals									

[1] Both Forest Zone and Volume Category shall be listed as defined in current *Licensee Performance Review* document.

13.4 Summary of Non-Clear Cut Harvest in the General Forest

LICENCE: **YEAR:**

Non-Clear Cut Harvest Type[1] (Description and Code)	Annual Area Harvested (ha)					Period-to-Date		5-year Area Approved in the Forest Management Plan (ha)
	Year 1	Year 2	Year 3	Year 4	Year 5	Area Harvested (ha)	Percent of 5-year Area Approved in the Forest Management Plan	

[1] Non-clear cut harvest type shall be listed as in current Licence Forest Management Plan.

13.5 Summary of General Forest Commercial Thinning Area

LICENCE: **YEAR:**

Annual Area Commercially Thinned (ha)					Period-to-Date		5-year Forest Management Plan Commercial Thinning Area (ha)
Year 1	Year 2	Year 3	Year 4	Year 5	Total Actual Area Commercially Thinned (ha)	Percent of 5-year Forest Management Plan Commercial Thinning Area	

13.6 List of Harvest Blocks Operated During Past Year

LICENCE: **YEAR:**

Harvest Block Number	GIS map number	Forest Zone[1]	Buffer Associated with Block (Y or N)	Penalties Associated with Harvest Block (Y or N)			Volume (m^3) by Species and Product[2]					
				Unauthorised Machine Operation in or Adjacent to Watercourse	Failure to Maintain Buffer Zone Appropriate to Approved Objective	Pre/Post Treatment Habitat Status						

[1] Forest Zone shall be listed as defined in current *Licensee Performance Review* document.
[2] Species and products shall be listed as in *Timber Scale Code Reporting Tables*.

13.7 Summary of General Forest Silviculture Treatments Compared to Silviculture Targets

LICENCE: **YEAR:**

Silviculture Treatment Type	Annual General Forest Area Treated (ha)					Period-to-Date		Cumulative Annual General Forest Silviculture Target Area (ha)
	Year 1	Year 2	Year 3	Year 4	Year 5	General Forest Area Treated (ha)	Percent of Cumulative Annual General Forest Silviculture Target Area	
Reforestation								
Pre-commercial Thinning								

13.8 Silviculture Area Summary by Treatment Type and Forest Zone.

LICENCE: **YEAR:**

Forest Zone[1]	Silviculture Treatment Type	Annual Area Treated (ha)					Period-to-Date		5-year Area Approved in Forest Management Plan (ha)
		Year 1	Year 2	Year 3	Year 4	Year 5	Area Treated (ha)	Percent of 5-year Area Approved in Forest Management Plan	

[1] Forest Zone shall be listed as defined in current *Licensee Performance Review* document.

13.9 List of Silviculture Blocks Operated during Past Year

LICENCE: **YEAR:**

Silviculture Block Number	GIS map number	Area (ha)	Type & Year of Site Preparation or Type of Herbicide Treatment	Thinning or Cleaning Pre-Treatment Density (trees/ha)	Post-Treatment		
					Total Density (trees/ha)	Species Mix[1]	Total stocking (%)

[1] Post-treatment species mix shall be listed as defined in "*New Brunswick's Integrated Land Classification System*".

13.10 5th-Year Status of Plantations and Naturally Regenerating Areas

LICENCE: **YEAR:**

Block Number	GIS map number	Area (ha)	Plantations			Naturally Regenerating Areas		
			Meets Softwood Stocking Standard (Y or N)	Meets Hardwood Competition Free-to-grow Standard (Y or N)	Type and Timing of Remedial Action Required	Species Mix[1]	Average Dominant Tree Height (m)	Total Stocking (%)

[1] Species mix shall be listed as defined in "*New Brunswick's Integrated Land Classification System*".

13.11 10th-Year Status of Plantations

LICENCE: **YEAR:**

Block Number	GIS map number	Area (ha)	Reason for NOT Surveying Plantation at 10th-year			Results of 10th-year Survey		
			Previously Remedially Treated (Y or N)	Scheduled for Remedial Treatment		Meets Softwood Stocking Standard (Y or N)	Meets Density Standard (Y or N)	Type and Timing of Remedial Action Required
				Type	Year			

13.12 Summary of Approved DWA Management Plans

LICENCE: **YEAR:**

Category	Annual DWA Management Plan Area Approved (ha)					Period-to-Date		5-year Forest Management Plan DWA Management Plan Area (ha)
	Year 1	Year 2	Year 3	Year 4	Year 5	Total Area Approved (ha)	Percent of 5-year Forest Management Plan DWA Management Plan Area	
1st-time plan								
Follow-up plan								

13.13 DWA Management Plans Approved during the Past Year

LICENCE: **YEAR:**

DWA Number	Area (ha)	1st-time Plan	Follow-up Plan