2027-2046 FML 2 Forest Management Plan

PART 3 – IMPLEMENTATION AND MONITORING

Forest Management Licence No. 2 20-Year Forest Management Plan

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16.1 PLANNING

Part 2 of the forest management plan focuses on the strategic planning undertaken to develop the direction and goals that the plan will strive to meet. Strategic planning is what occurs when forest managers consider the "big picture" of the forest system over an extended period of time. It emphasizes broad-scale components of forest management, such as forest age class and composition, and how these components may influence key forest values such as the amount and arrangement of habitat types. Strategic planning provides the framework of operating areas where forest management activities may occur to achieve the goals of the plan over the long-term, but it does not detail how these activities will be operationalized in the real world. This operationalization of strategic planning is what is referred to as implementation.

Operational planning is what occurs during the 20-year implementation of the plan and focuses on the finer-scale components of forest management that need to be taken into consideration in order to apply the strategic framework on-the-ground (i.e., the actual harvest and forest renewal activities). Operational planning takes the strategic-level direction identified in a forest management plan and divides it into approachable, feasible, and focused 2-year forest management operating plans (FMOPs). If strategic planning (the forest management plan) provides the framework of operating areas, operational planning (the forest management operating plan) provides the step-by-step instructions on how to make that framework reality in the short-term.

> *A forest management plan is a specific statement of the objectives you have for your forest, followed by a series of activities that will take place in order to meet those objectives. The forest management plan* ***is a "road map" to guide you from where you are to where you want to be in the future****.*

Part 3 focuses on the activities that will take place over the duration of the plan during implementation.

16.1.1 Forest Management Operating Plans

Operational planning is developed and implemented through forest management operating plans (FMOPs). FMOPs are developed every 2 years (i.e., ten FMOPs will be developed and implemented throughout the duration of this 20-year FMP). 2-year FMOPs are a requirement of the FML Agreement and the Manitoba *Forest Act* and require provincial review and approval prior to being implemented. The contents of the FMOP conform to *Manitoba's Submission Guidelines for Forest Management Operating Plans* (Manitoba Conservation and Water Stewardship, 2015).

An FMOP outlines the proposed forest management activities to be undertaken during the duration of the two-year operating period. This includes detailed information about operating areas, wood supply, planned access development, proposed harvest, and subsequent forest renewal activities. Operating areas for third-party operators are outlined, and contingency operating areas are included should the planned progression of harvest be interrupted due to weather conditions and/or other unforeseen circumstances. The plan also includes three years of projected access development and operating areas for harvesting activities beyond the 2-year period.

Recall from section 6 Forest Administration in Part 1 – operating areas are planning units that are smaller than forest management units and are based on contiguous geography and natural boundaries such as rivers, lakes, or wetlands, have groups of forest stands with similar conditions, and/or may be accessed via the same road(s).

FMOPs take the 20-year spatial harvest schedule (for more information see section 13 Preferred Forest Management Scenario of Part 2 – Analysis and Modelling) and refine a selection of the identified polygons into individual harvest blocks that will be harvested during the 2-year FMOP period. Multiple harvest blocks exist within an operating area, but each harvest block will be considered and planned for independently. Harvest blocks selected for each FMOP are selected only from the proposed 20-year spatial harvest schedule.

Following selection, harvest blocks become operationalized. This is done through mitigation, and each harvest block will include as much mitigation as is available at the time of FMOP development. Mitigation refers to strategies and actions that can be taken to minimize and/or offset potential negative impacts to the environment that may be caused by the proposed forest management activities. NFMC works closely with provincial regional staff to develop strategies for all harvest blocks that incorporate wildlife and other resource values. These strategies are developed on a case-by-case basis. Mitigation process is explained in section 6.1.1.3 Harvest Block Mitigation Procedure.

Any identified mitigation and broad-scale information about other resource values and/or users is provided on block specific harvest information sheets with the FMOP and are accompanied by imagery of the block's location. Forest-Section-level maps are also included to show gross block boundaries.

Community information sessions are a part of the development of each FMOP. During these sessions, rightsholders, stakeholders, and the public are encouraged to provide feedback on planned operations that may impact resources of interest. community information sessions provide an opportunity for individuals and communities to provide additional values and concerns and allows NFMC to more directly address values and concerns that could not be captured at the strategic level. For instance, during engagement throughout forest management plan development, a number of values and concerns were gathered from communities on the FML in relation to moose; however, moose are a species that are most effectively managed for at the operational level during implementation. Gathering information about fine-filter management values during forest management operating plan development is an opportunity to integrate operational-level concerns consistently throughout forest management plan implementation. Input from these sessions can be considered and accommodated, if possible and reasonable, at any point during plan implementation. Information provided on a confidential basis is used only internally within NFMC to develop appropriate mitigative strategies with respect to its planned forest management activities. Sensitive information, if provided, is not shown on any publicly available maps or planning documents.

16.1.1.1 Block Selection Criteria and Design

A combination of varying landscape, geographic conditions, local climate, and a predominant wildfire regime have resulted in a wide variety of vegetation types and patterns across FML 2. To a large degree, this natural mosaic dictates the pattern and size of harvest blocks, reflecting concepts of Ecosystem-Based Management where harvest block design, pattern, and size mimic natural landscape patterns and processes.

Selection criteria for harvest blocks can include:

- Forest species composition;
- Winter versus summer access;
- Proximity to existing road infrastructure;
- Distance from the mill;
- Operating area volume;
- Stand density, age, and tree size;
- Non-timber resource values;
- Natural topographical features;
- Insect, disease, or windthrow damage;
- Community concerns; and,
- Wildlife concerns.

The shape of harvest blocks are always irregular as they are determined by natural features and forest type. The size of harvest blocks is variable and is determined by the natural size of the forest stand and operational practicality.

Where large contiguous forest stands are present with little topographical relief or natural breaks, the shape may be influenced by wildlife habitat considerations. Other factors such as insect and disease damage, production capacity, season of harvest, and access constraints can also influence the size and configuration of the harvest block.

Harvesting activities occur continuously throughout most of the year with some downtime typically being taken in the spring. This provides a steady supply of wood to the Canadian Kraft Paper Industries Ltd mill and consistent

work for the contractor workforce. With operations occurring year-round, blocks are split into two seasonal categories: winter blocks and summer blocks.

Due to the large component of wetlands on FML 2, many areas can only be accessed economically and with low environmental impact during winter conditions when the terrain is frozen. These are considered winter blocks. The provincial *Forestry Road Management* guidebook (Manitoba Conservation and Water Stewardship, 2012) and *Boreal Wetlands Conservation Codes of Practice* (Manitoba Agriculture and Resource Development, 2020) provide additional direction for reducing impacts in these areas. Other areas with more feasible access, such as over drier uplands, can be harvested in the frost-free period. These are considered summer blocks. A good balance of seasonal harvest blocks ensures a consistent supply of timber and helps distribute the harvest across the landscape.

16.1.1.2 Pre-Harvest Forest Investigation

Pre-harvest forest investigation (PHFI) surveys are an important component of sustainable forest management and the operational planning process. The data collected through these surveys is used to develop site-specific harvest design and forest renewal regimes for the proposed harvest blocks. NFMC uses the provincial *Pre-Harvest Survey Guidelines* (Manitoba Conservation and Water Stewardship, 2014) to develop PHFI survey methodology.

The data collected from PHFI surveys are summarized into PHFI reports that are shared with the Province. Related spatial data is stored and maintained within NFMC's Geographic Information System (GIS) database. Forest management operating plans will include information from the PHFI report for each proposed harvest block. PHFI data can further enhance existing resource information and can be used to analyze pre- and post-harvest forest conditions.

Examples of information collected during PHFI surveys include tree species composition, tree size, estimated tree age and volume, understory vegetation type, forest health and condition, soil types, wildlife activity, species at risk occurrence, other industry or public activity, and/or any other notable features.

NFMC staff during a pre-harvest forest investigation survey.

16.1.1.3 Operating Area and Harvest Block Mitigation Procedure

Mitigation refers to strategies and actions that can be taken to minimize and/or offset potential negative impacts to the environment that may be caused by the proposed forest management activities. Part of the mitigation procedure is to develop strategies for new operating areas that incorporate wildlife and other resource values. The harvest block mitigation procedure has been refined over the years to meet the needs of NFMC, the Province, wildlife, and the environment.

Several mitigation meetings occur annually depending on workload and need. Core members of the mitigation group include Company staff and provincial staff from the regional wildlife and forestry branches. Provincial regional staff in attendance can differ depending on the jurisdiction in which the proposed harvest blocks are located.

NFMC maintains a concise list of operating areas and harvest blocks requiring mitigation, each with an assigned priority level and the status of mitigation discussions. NFMC provides mitigation packages for proposed harvest blocks to the Province, which includes aerial photo maps, spatial data, and pre-harvest forest investigation reports. Proposed harvest block design is further refined based on desired management objectives such as for wildlife, the public, and/or resource use considerations.

Once the mitigation group reaches an agreement and operations are approved, the mitigation is valid for three years. If new information becomes available that impacts the approved mitigation during this timeframe, then an update to mitigation is required. Harvest blocks that are not resolved due to conflicts or concerns are deferred for further review or until a resolution is reached.

16.1.1.4 Non-Timber Resource Values

Planning considerations for non-timber resource values can be integrated into harvest block design anytime during the forest management operating plan development process. While a number of the values detailed in the following sections have already been considered at the strategic level through the development of the spatial harvest schedule (for more information see section 13 Preferred Forest Management Scenario of Part 2 – Analysis and Modelling), there is additional opportunity for consideration at the operational level. This cumulative approach for sensitive areas ensures that management is as all-encompassing as possible. NFMC works with the Province and a range of interested parties to ensure non-timber resource values are considered and integrated into operational planning and field operations. The below subsections highlight some of the core non-timber resources that are considered throughout the planning process.

16.1.1.4.1 Riparian Areas

Riparian areas are the transitional zones adjacent to aquatic features such as lakes and rivers. These areas can vary in composition (e.g., vegetated, rocky, sloped, etc.) and ecology, and hold many important values. The provincial *Forest Management Guidelines for Riparian Management Areas* (Manitoba Conservation and Water Stewardship, 2008) outlines the management strategies for the protection of these areas. Placement and width of riparian buffers, although defined in the guidelines, are also reviewed with provincial regional specialists on a case-by-case basis during the mitigation process.

Note that riparian areas were not considered eligible for harvest at the strategic level during the development of the spatial harvest schedule and therefore would not be identified as part of any proposed harvest block. However, confirmation of these areas occurs regardless, with additional operational sensitivities being taken into consideration for their sustainable management should operations occur near a riparian zone.

16.1.1.4.2 Wildlife Habitat and Habitat Elements

Forest management activities can influence wildlife in a variety of ways. Species oriented to forest openings, forest edges, and young forests will benefit from timber harvesting, while other species that are adapted to the forest interior and favour large, contiguous forest stands may be displaced, similar to the impacts of a forest fire.

The following general wildlife habitat principles are applied during harvest block planning and mitigation:

- Maintenance of irregular harvest block shapes as influenced by natural features and forest types;
- Variation of harvest block sizes as influenced by existing forest stand sizes and mimicking historical natural disturbance patterns;
- Application of wildlife-specific habitat- and habitat-element-related objectives;
- Retention of residual vegetation within harvest blocks to provide structural diversity and line-of-sight break up according to *Selecting Leave Trees and Coarse Woody Debris* guideline maintained through NFMC's International Organization for Standardization (ISO) Environment Management Systems (EMS) standard certification;
- Retention of wildlife trees in the form of both live trees and snags (i.e., standing dead trees) to provide habitat for cavity nesting species;
- Retention of riparian buffers as described in the provincial *Forest Management Guidelines for Riparian Management Areas* guideline (Manitoba Conservation and Water Stewardship, 2008);
- Retention of wildlife feature buffers as described in the provincial *Forest Management Guidelines for Terrestrial Buffers* (Manitoba Sustainable Development, 2017); and,

- Retention of wildlife corridors as advised by the Province during mitigation discussions.

16.1.1.4.2.1 Boreal Woodland Caribou Habitat and Habitat Elements

Boreal woodland caribou are identified as a Federal and Provincial Species at Risk. In areas where boreal woodland caribou are identified as the primary wildlife species being managed, the creation of larger harvest blocks are planned for, where possible, to encourage the creation of future tracts of contiguous forest habitat for caribou. In an area where the management of boreal woodland caribou may be identified as a concern and/or where the Province has identified that caribou are the primary wildlife species to be managed for, additional planning criteria may include:

- Modifications to access development, such as road locations, based on known habitat use and habitat elements such as calving grounds;
- Narrower sections of road right-of-way's to provide more appealing road crossing sections for animals that tend to avoid linear disturbances;
- Additional buffering of critical habitat areas and/or restricted activity near these areas during certain seasons, such as the calving season;
- Ground lichen retention strategies to conserve sources of browse;
- Post-harvest vegetation management to maintain pre-harvest softwood composition of habitat areas preferred by boreal woodland caribou and other softwood dependent wildlife;
- Emphasis of prompt and effective decommissioning of in-block access roads;
- Identification and retention of potential boreal woodland caribou habitat adjacent to proposed harvest blocks to which existing caribou populations may transition; and,
- Retention of vegetation in key movement areas to maintain connectivity between habitat patches retained, to function as movement corridors.

Cladonia lichen species that may be identified to be retained as a food source for boreal woodland caribou.

16.1.1.4.2.2 Moose Habitat and Habitat Elements

Moose are a valuable species both ecologically and culturally on FML 2. Effective management for moose typically occurs at the operational level where in-block features can be more accurately identified and mitigated. In an area where the management of moose may be identified as a concern and/or where the Province has identified that moose are the primary wildlife species to be managed for, additional planning criteria may include:

- Emphasis on irregular boundaries and in-block retention of vegetation, trees, and/or buffers to maximize edge, reduce line of sight, and reduce distance to standing tree cover;
- Consideration of retaining thermal (winter) cover within and adjacent to a harvest block;
- Reduction of vehicle access by the public with berms or gates during periods of operational inactivity;
- Temporary road buffers while the road is open and available;
- Emphasis on prompt and effective decommissioning of in-block roads;
- Development of a mitigation plan to protect areas where special habitat elements and use have been identified, such as critical wintering area or mineral licks; and,
- Minimizing vegetation management efforts on competing hardwood species as directed by the Province to allow more browse material to remain within the harvest block and to provide more effective early cover.

Figure 16.1 provides an example of how a strategic-level proposed harvest block has translated to real-life operational implementation with finer-scale management of in-block features based on some of the planning criteria identified above.

Some additional local-level aspects that that are considered during operational planning are outlined in Table 16.1.

16.1.1.4.2.3 Other Terrestrial Wildlife Habitat and Habitat Elements

Protection of wildlife habitats such as bear dens, raptor nests, heron colonies, and snake and bat hibernacula are managed according to the Province's *Forest Management Guidelines for Terrestrial Buffers* (Manitoba Sustainable Development, 2017). Buffer placement and width for important habitat features are reviewed with the Province on a case-by-case basis through the mitigation process and/or when encountered during harvest operations.

16.1.1.4.2.4 Aquatic Habitat and Habitat Elements

Protecting aquatic habitat, including erosion prevention and stream bed protection is guided by the Province and NFMC's standard operating procedures *Working Near Water Bodies* (SOP-050) and *Water Crossing* (SOP-051) developed under their International Organization for Standardization (ISO) Environmental Management System (EMS) standard certification, and is accomplished through the following:

- Proper planning and construction of access and stream crossings as per the Manitoba *Stream Crossing Guidelines for the Protection of Fish and Fish Habitat* (Manitoba Natural Resources, 1996) and the provincial *Forestry Road Management* guidebook (Manitoba Conservation and Water Stewardship, 2012);
- Proper planning and construction of in-block roads, landings, and maintaining proper logging practices during operations;
- Establishment of treed buffers adjacent to water bodies as per the provincial *Forest Management Guidelines for Riparian Management Areas* (Manitoba Conservation and Water Stewardship, 2008);
- Implementation of the federal Department of Fisheries and Oceans Canada (DFO) standards and codes of practice for managing risks to fish and fish habitat; and,
- Collaboration with the Province to consult on site-specific management practices on a case-by-case basis.

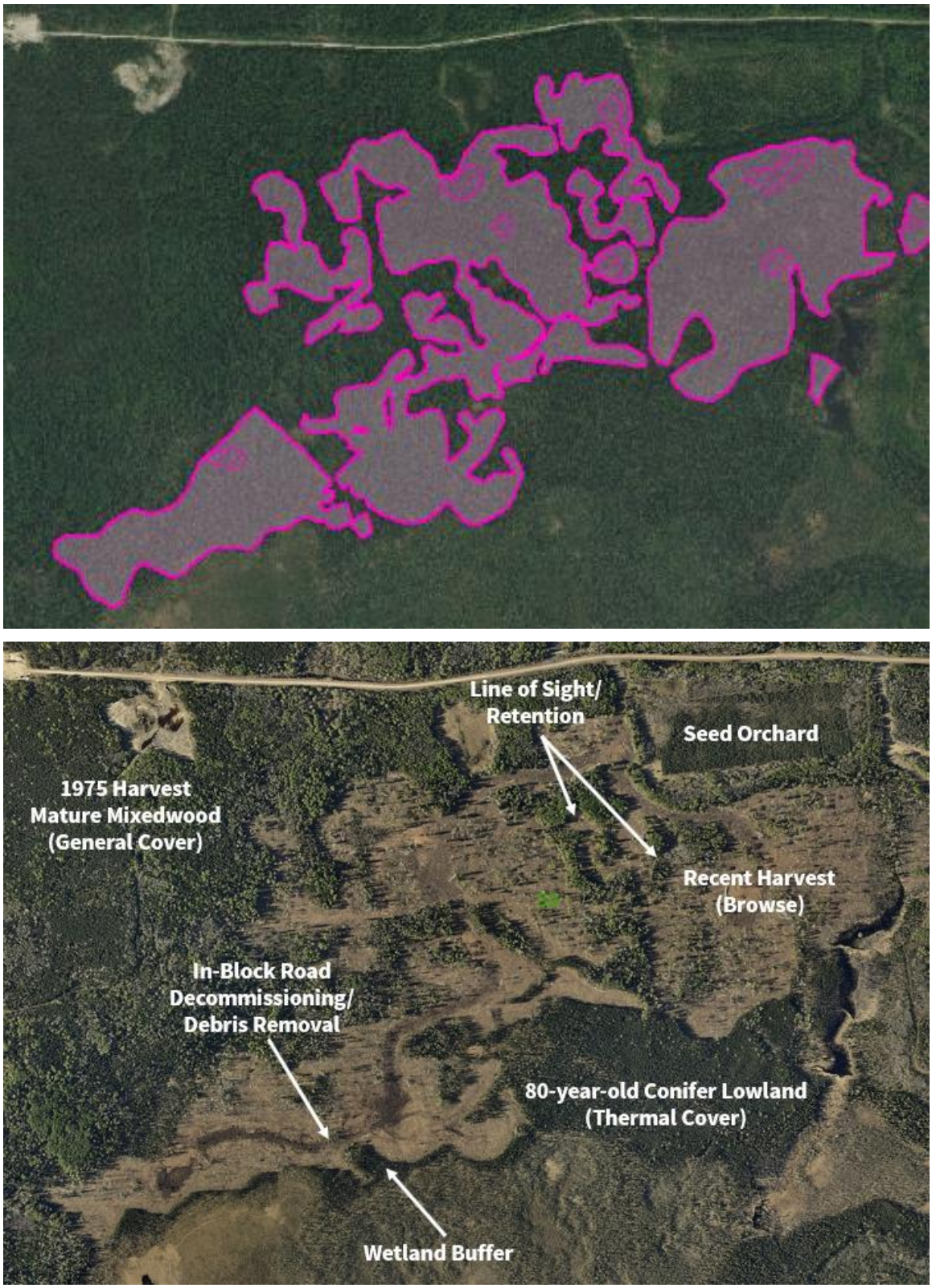

Figure 16.1. An example of strategic-level proposed harvest block selection (above) versus actual operational implementation of the harvest block (below) with finer-scale management of in-block features.

Table 16.1. Information provided by the Province of Manitoba as examples of mitigation guidelines considered for moose during the mitigation process. These examples are not an exhaustive list, and their applicability for each block is dependent on site-specific factors. In Manitoba, there are currently guidelines in place to help determine appropriate mitigation, which have been included as reference in the Document column.

Factors to Consider	Condition	Reason for Consideration	Document
Providing thermal cover. (Winter and summer)	Minimum 20% cover should be maintained within an operating area. Maximum 200 metre distance to thermal cover within blocks.	Thermal cover is important in the summer to reduce heat stress potential, and in the winter for cover from cold winter and deep snow.	Manitoba Government- *Forest Management Guidelines for Wildlife in Manitoba* and *Consolidated Buffer Management Guidelines*
Reducing line of sight within the block.	No more than 400 metre line of sight within blocks	Line of sight breaks are important to minimize hunting pressure in areas previously not open, and to also minimize the likelihood of alter predator-prey dynamics in a newly cut block.	Manitoba Government- *Forest Management Guidelines for Wildlife in Manitoba* and *Consolidated Buffer Management Guidelines*
Riparian buffer to protect habitat areas around water sources. Note that buffers sizes may vary depending on the size/ classification of the waterbody and/or species use.	Maintain proper windfirm buffers around all waterbodies. Retain buffers of at least 100 metres on large waterbodies, 60-100 metres and medium waterbodies, and 30-60 meters on smaller waterbodies to provide habitat for some interior forest species.	Riparian buffers are important for sediment and erosion control, as an aesthetic buffer, and can also help with providing cover for moose adjacent to aquatic environments they may forage within in the summer. Moose feed on aquatic vegetation, and the buffers allow cover from weather as well as predators and harvesters.	*Forest Management Guidelines for Riparian Management Areas* https://www.gov.mb.ca/nrnd/forest/pubs/practices/riparian_mgmt_re_sept2009.pdf
Ensure all access is closed as operation is completed in each area.	Materials dragged across all in-block roads to ensure they are closed. Excess materials can be left in piles as per biomass guidelines.	Access management is very important as road networks can become pathways for disease introduction through facilitating ungulate movement, such as deer accessing areas mostly inhabited by moose, as well as pathways to allow predators and harvesters to access areas previously with limited access. Decommissioning plans are included as part of forestry road management, and biomass guidelines can be used to help determine access management, such as using excess materials to cover in block roads.	*Forestry Road Management* forestry_road_mgmt_2012.pdf (gov.mb.ca) *Biomass Management* Microsoft Word - Biomass Management_ Jan_2015_Ver13-fnl.doc (gov.mb.ca)
Mineral licks.	50 to 200 metre setback buffer from the outer perimeter of the feature	Provides protection of the wildlife feature, plus cover for the animals that may be using the feature. Mineral licks are important for supporting ungulate health.	*Forest Management Guidelines for Terrestrial Buffers* https://www.gov.mb.ca/nrnd/forest/pubs/practices/terrestrial_final_jan2017.pdf

16.1.1.4.3 Resource Users

During forest management operating plan community information sessions, rightsholders, stakeholders and the general public are encouraged to provide feedback on planned operations that may impact specific resources of interest. Confidentiality agreements can be applied to protect sensitive information.

Examples of groups and individuals that NFMC works with are the Nekoté Community Liaison, Resource Management Boards, Trappers' Associations, Fishermen's Associations, Snowmobile Clubs, Cottage Owners' Associations, Lodges and Outfitters, and political bodies such as Chief and Council, Mayor and Council, and Manitoba Métis Federation.

16.1.1.4.4 Trapping

NFMC works with local trappers to mitigate the impacts forest management activities may have within their traplines. Trapline holder information is maintained as confidential by the Province, and if a point of contact for a trapline is not known, NFMC may notify the Trapping Association to relay the information to its members. forest management operating plan community information sessions are an additionally useful tool and opportunity to convey information and receive feedback about trapline areas.

16.1.1.4.5 Other Commercial Resource Users

Several commercial resource users are active within FML 2. These include mineral exploration, mining, commercial fishing, wild rice production, outfitting, and the extraction of non-timber forest products. Stakeholders are encouraged to provide feedback on planned operations that may affect resources of interest during the forest management operating plan development process either directly, through community information sessions, or may contact NFMC at any time.

16.1.1.4.6 Heritage Resources

The Provincial Historic Resources Branch (HRB) is provided the opportunity to review forest management operating plans and identify heritage resource concerns, including specific sites and locations.

When the HRB identifies sites with potential for heritage resources, appropriate mitigative measures can be applied. These measures are site-specific and may include applying buffers, operating equipment specifications, activity timing restrictions, and/or pre- and post-impact assessments carried out by a qualified archaeologist.

NFMC has developed a Heritage Resource Action Plan which addresses heritage resource issues or concerns that may arise during routine forest management operations. Staff and contractors are trained in the identification of heritage resources and procedures to be followed.

16.1.2 Planning Summary Overview

The process described below provides a general overview of how the strategic forest management direction set in the spatial harvest schedule will be implemented as operational forest management activities under this Forest Management Plan (for more information on spatial harvest schedule, see section 13 Preferred Forest Management Scenario of Part 2 – Analysis and Modelling). Note that while the process described below has generalized "steps" listed in the order that they commonly occur, many of these steps often occur concurrently (i.e., at the same) during forest management operating plan development.

- Review areas identified in the spatial harvest schedule and select areas aligned with the goals of the next 2-year forest management operating plan.
- Confirm forested stands within the selected areas are not otherwise allocated as Indigenous Reserve Land, Indigenous selection area (Treaty Land Entitlement, Grand Rapids Forebay Agreement, Northern Flood Agreement), provincial park area, protected area, or any other area chosen to be excluded from forest management activity and have not recently burned or been harvested.
- *Note that these areas were not considered eligible to be harvested during the development of the spatial harvest schedule, however, confirmation of these areas occur regardless. Confirmation will also allow NFMC to capture any potential changes to area status that may occur throughout the 20-year duration of the plan.
- Confirm timber suitability (species composition, age, volume per hectare).
- Identify access location and type (for more information, see section 16.2 Road Development, Access Management, and Other Infrastructure).
- Refine operating areas into harvest blocks of appropriate operational size based on natural stand boundaries and features such as topography, waterways, and lowlands, timber product, and infrastructure such as roads and transmission lines.
- Review operating areas and associated harvest blocks with the provincial representatives of the mitigation group for input.
- Integrate operating areas and associated harvest blocks into the ensuing 2-year forest management operating plan and collect feedback from rightsholders, stakeholders, and the general public through community information sessions.
- Develop a forestry road development plan for operating area(s). For more information, see subsection 16.2.1 Forest Road Development Planning.
- Stratify harvest blocks by forest types and conduct pre-harvest forest investigation surveys to collect data on timber value, forest features, and other related information (for more information, see the following subsection Pre-Harvest Forest Investigation).
- Confirm that riparian buffers are appropriately in place, if necessary, according to provincial guidelines. Refine harvest block boundaries as needed.
- Confirm harvest block boundaries with pre-harvest forest investigation results and refine as needed, including non-productive forest area and features that were noted during the survey that may require additional buffering.
- Apply rightsholders, stakeholders, and general public feedback heard from engagement during community information sessions.
- Engage in further discussions with and finalize detailed mitigation with the mitigation group.
- NFMC requests Work Permits from the Province once all requirements such as forest management operating plan approval, forestry road development plan approval, and Operating Permits and mitigation are in place.

Forest Management operating plan and forestry road development plan submissions and Work Permit applications are reviewed by various provincial branches for feedback and to highlight any concerns. This includes but is not limited to the Wildlife, Fisheries, Crown Lands, Forestry and Peatlands, Mining, and Historic Resources branches.

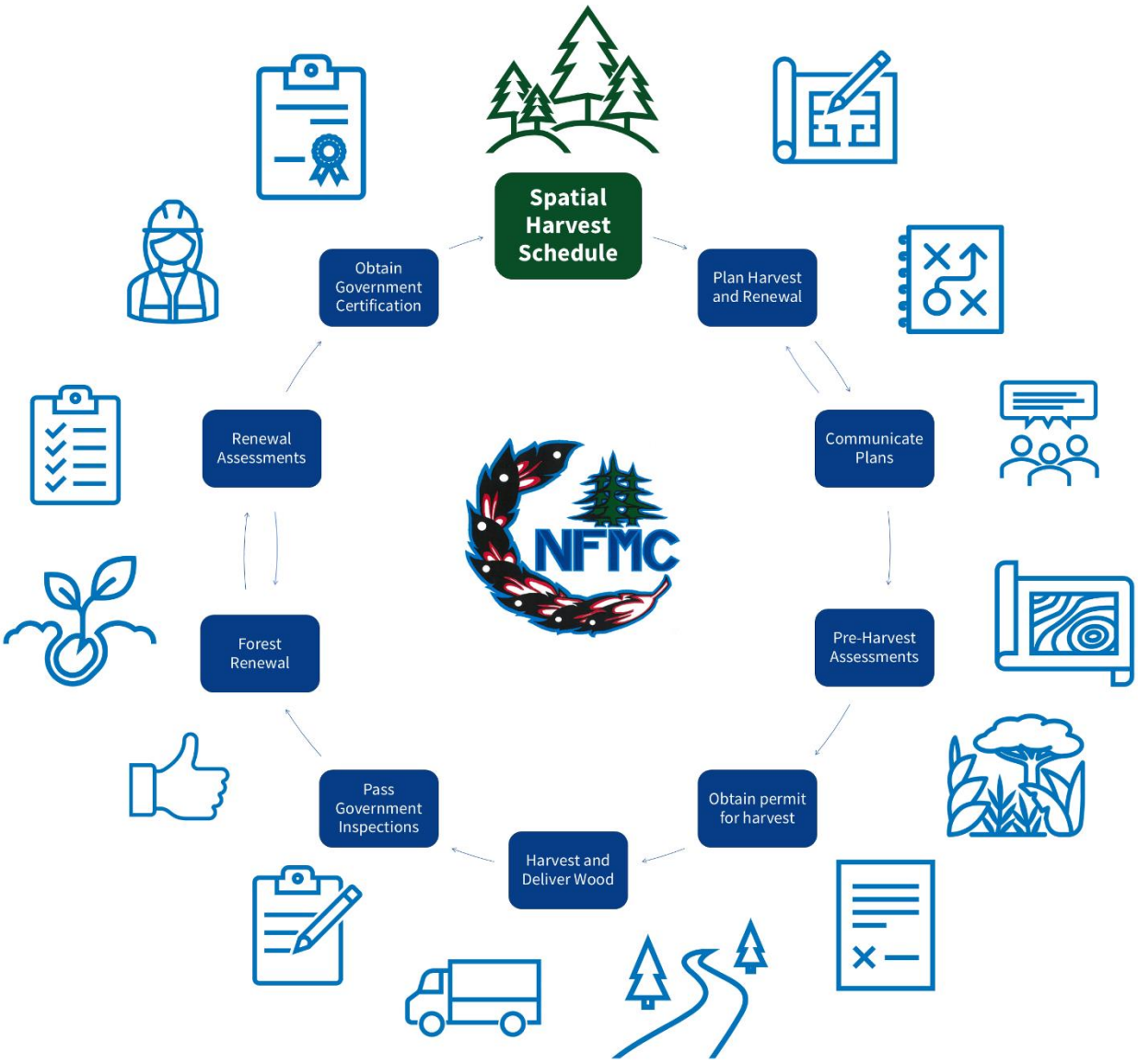

Figure 16.2. A flowchart that provides a general overview of the sustainable forest management process that occurs at the operational level.

16.2 ROAD DEVELOPMENT, ACCESS MANAGEMENT, AND OTHER INFRASTRUCTURE

In the context of this forest management plan, access refers to the network of roads and corridors managed by NFMC to reach operating areas of interest. Forestry access facilitates the transportation of:

- Forestry personnel and operations equipment to harvest blocks;
- Harvested wood products from harvest blocks to the mill; and,
- Forestry personnel and equipment for renewal (silviculture) operations.

During strategic planning, a rough, strategic-level approximation of access for harvest proposed in the spatial harvest schedule is identified through forest modelling. When a proposed operating area is selected for harvest during operational planning, the most appropriate means and location of access is identified, and fine-scale refinement occurs at the operational level through forest road development plan and forest management operating plan development. Planning for access at the operational level is done through collaboration with infrastructure development professionals. All approximations of access proposed by the Preferred Forest Management Scenario will vary on a case-by-case basis based on expert knowledge.

The goal of road development is to traverse as close as possible to operating areas and the harvest blocks within them while considering local conditions and topographical features. Special considerations are also given to the protection of streams, rivers, lakes, wetlands, known wildlife habitat areas and habitat elements, and any other sensitive sites.

16.2.1 Forest Road Development Planning

Initially, roads for all-weather and winter access are identified as approximate 1-kilometre-wide corridors based on minimizing water crossings, maximizing proportional distance on high (upland, dry) ground, and preferably traversing through target operating areas and harvest blocks.

During forest road development plan (FRDP) development, definitive locations for these roads are identified through thorough investigation. The approximated locations are refined based on aerial imagery, aerial survey, LiDAR data, and/or digital elevation model (DEM) data. This refinement is supplemented with field investigations. community information sessions also provide a valuable opportunity to discuss plans for future access development and road decommissioning with rightsholders, stakeholders, and the public to gather feedback.

The provincial *Boreal Wetlands Conservation Codes of Practice* (Manitoba Agriculture and Resource Development, 2020) and *Forestry Road Management* guidebook (Manitoba Conservation and Water Stewardship, 2012) are used throughout the planning process. NFMC also maintains their own standard operating procedures regarding road development in the *Road Management Planning* (SOP-032).

Five road categories have been developed for forest management planning within FML 2 and are outlined below.

Category 1: All-Weather Road – Primary

- All-weather road constructed to access major long-term wood supply areas on a forest management unit (FMU) scale.
- Includes built up road subgrade and gravel running surface.
- Approximate life expectancy of twenty years or more.

Category 2: All-Weather Road – Secondary

- All-weather road constructed to access individual operating areas.
- Includes built up road subgrade and gravel running surface.
- Approximate life expectancy of three years to twenty years.

Category 3: Seasonal Road - Summer Access

- Seasonal road or trail that provides access within and between harvest blocks from primary and secondary roads. May also provide access to smaller operations or isolated harvest blocks. Accessibility may be limited during wet seasons (spring and fall) or periods but can normally be accessed during summer and winter.
- Consist of stumped (i.e., where trees and stumps have been cleared) trails with little to no gravel or subgrade.
- Established on mostly high (upland, dry) ground, some subgrade construction may occur in low areas, allows for vehicle access more or less year-round.
- Life expectancy is usually one to two years but may be longer in certain circumstances.

Category 4: Seasonal Road – Winter (Frost) Access

- Winter road or trail that provides access within and between harvest blocks areas from primary, secondary and winter ice roads. May also provide access to smaller operations or isolated harvest blocks.
- Consist of stumped trails with no gravel or grade.
- Category 4 seasonal roads are roads that at some point on the route utilize swamps and/or wet ground to such an extent that vehicle access requires winter (frost) conditions for travel.
- Life expectancy is usually one to two years but may be longer in certain circumstances.

Category 5: Seasonal Road – Winter (Ice) Access

- Winter-only ice roads built to access and deliver wood from operating areas.
- Establishment will require some combination of tramping swamps and low drainage areas to drive frost in and ice crossings of lakes, rivers, streams. Crossing over periodic areas of higher ground may require some stumping.
- Category 5 winter roads are distinguished from Category 4 seasonal winter (frost) roads by including major crossings of large swamps and/or lakes and accessing larger areas with higher volumes of timber (operating area scale).
- A given route may be utilized for a single winter season or over several years.

Forestry road development plans (FRDPs) are required for all new access into operating areas and to recommission previously decommissioned roads into historic operating areas. The Provincial *Forestry Road Management* guidebook (Manitoba Conservation and Water Stewardship, 2012) describes FRDPs as an effective tool for communicating various aspects of road development plans and mitigating impacts on resource values in a given operating area. FRDPs cover the active period of timber harvesting and renewal activities up until temporary road closure or road decommissioning.

FRDPs address in detail road locations, specifications, necessary water crossings, estimated project duration, and estimated volume of timber being accessed, as well as the associate harvest strategy, renewal strategy, and access management measures as described in the following subsections. These plans take into consideration the network of existing and proposed roads, any feedback received through community engagement and will outline decommissioning timeframes and criteria. Once all concerns are addressed and road impacts are sufficiently mitigated, FRDPs are approved and signed by representatives of NFMC and the Province.

Before a road can be constructed, a right-of-way (ROW) needs to be cleared, and an access trail created to provide light vehicle access for harvesting and road-building equipment. Road development includes potential development outside of the ROW by as much as 500 metres in either direction to access borrow material. Borrow material refers to natural soil, rock, gravel, or any other material that may be required in the construction process.

Roads are constructed to requirements determined by the road category identified and other factors such as planned haul intensity, planned road duration, and topography. Prior to road construction activities commencing, a work permit application is submitted to the Province for review, approval and site-specific

operating criteria. Further details and best operating practices are outlined in the *Road Construction* standard operating procedure (SOP-033) that outlines best management practices.

16.2.2 In-Block Roads and Landings

In-block roads are used primarily to provide access for trucks that will transport harvested material from the roadside to the mill. In-block roads are generally developed based on optimizing skidding distances from the location of harvest to roadside where processing and pick-up takes place, minimizing the amount of road development needed within a harvest block. Existing trails are prioritized to navigate harvest blocks, where possible. Harvest block terrain and ground conditions are the main limiting factors when creating in-block roads. It is preferred that in-block roads occur on high, dry, well-drained, and solid ground to maximize the haul opportunity, minimize the cost of establishing the in-block road network, and reduce environmental disturbance.

When planning for the creation of in-block roads prior to operations taking place, the following is taken into consideration:

- Road distribution being dependent on volume of merchantable timber to be transported;
- Preference for loop roads and one-way traffic, and requiring vehicle turn-outs if loop roads are not possible;
- Landings for mobile chippers are developed as small as possible to minimize impact;
- Roads and landings are not located closer than 100 metres from major water features such as lakes, rivers, and streams.
- Roads and landings are not located on slopes adjacent to watercourses;
- Roads and landings avoid known sensitive sites such as cabin locations, mineral licks, karst features, large stick nests, etc.; and,
- Debris management during road clearing is specified in work permit conditions.

16.2.3 Long-Term Storage and Processing Areas

Long-term storage and processing typically take place on stockpile sites. Stockpile sites are developed when wood is harvested from areas with a limited accessibility window. The most common scenario is wood harvested from a winter harvest block (i.e., can only be accessed under frost/frozen conditions) that is then proactively relocated to a stockpile site that can be accessed year-round for processing (if necessary, e.g. chipping) and to be reloaded onto trucks for delivery to the mill. Stockpile sites may be short-term (e.g., less than six months) or used on an annual basis. Where possible, stockpile sites are located in existing cleared areas with existing reliable access. Ideally, stockpile sites are located in flat, well-drained areas well away from permanent waterbodies. Stockpiles sites require site-specific permits issued by the Province. In some instances, rail spurs and sidings will be used as stockpile areas as they are efficient uses of both space and means of transporting harvested wood to the mill.

16.2.4 Watercourse Crossings

Major watercourse crossings are identified during the forest management operating plan development process and constitute any infrastructure development required to traverse over major water features such as permanent streams and rivers to access an operating area. For each crossing, a Watercourse Crossing Data Form is completed and submitted with the forest management operating plan. Further details are developed in the forestry road development plan and during the work permit application process. Guidance for water crossing development during implementation is taken from the provincial *Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat* (Manitoba Natural Resources, 1996) and *Boreal Wetlands Conservation Codes of Practice* (Manitoba Agriculture and Resource Development, 2020), and NFMC's standard operating procedures *Working Near Water Bodies* (SOP-050) and *Water Crossing* (SOP-051) developed under their International Organization for Standardization (ISO) Environmental Management System (EMS) standard certification. Additional processes for water crossing use and establishment identified under the Federal *Canadian Navigable Waters Act* (1985) and

Fisheries Act (1985) are also reviewed and applied as required. For additional information regarding the relevancy of these Acts and others, see Appendix I – Legislation and Policies Relevant to Forest Management.

In-block roads and landings where harvested logs are being processed and stored.

16.2.4.1 In-Block Watercourse Crossings

Major water features are excluded from harvest blocks in the early stages of the planning process. Therefore, any watercourses found within harvest blocks are typically intermittent or ephemeral streams. The following criteria are implemented during harvest operations when minor watercourse crossings are required:

- The number of watercourse crossings within a harvest block is kept to a minimum;
- Water crossings are placed where the lowest slope is located to minimize altering or eroding the bank of the feature;
- All temporary stream crossings and associated debris are removed upon completion of the operation to ensure there is no disruption to water flow;
- Where crossings are required for follow-up forest renewal activities, they are removed upon completion of these activities and rehabilitated as required to prevent erosion; and,
- Winter stream crossings are made of clean snow and ice to minimize the deposition of soil and other materials into the feature. When the use of snow and ice is not possible, temporary bridging using timber corduroy, culvert, culvert bundle, or a portable bridge is used to maintain water flow and minimize erosion. Winter stream crossings must be removed before spring melt.

16.2.5 Access Management

As stated in the Forest Management Licence Agreement (FMLA), roads constructed and maintained by Canadian Kraft Paper Industries Ltd (CKP) are available for public use. However, CKP roads are maintained to a standard required for travel of vehicles and equipment involved in the operation during times when the operation is active. CKP may restrict public use of a road when conditions such as fire hazards, soft road surface, or operational circumstances pose a risk. Similarly, where the protection of non-timber values has been identified, public access on CKP roads may be limited through direction from the Province.

Under the circumstance that access to a CKP road needs to be restricted, several means of access control can be considered. For example, the use of locked gates when operations are occurring or the removal of access at the point of entry when use of the road is no longer required. NFMC, in cooperation with the Province, determines the appropriate means of access control during development of the forestry road development plan.

An example of locked road gate that may be used to restrict access to a Canadian Kraft Paper Industries Ltd road.

16.2.5.1 Road Maintenance

Canadian Kraft Paper Industries Ltd maintains roads to a standard required to facilitate operations while those operations are ongoing. Regular maintenance (e.g., grading, graveling, culvert repair and replacement, etc.) can be performed without the authority of a work permit. Major maintenance (e.g., bridge replacement) would require the authority of a Work Permit and project-specific approvals and/or processes.

16.2.5.2 Road Decommissioning

Historically, the focus of all-weather road construction has been to minimize the length of time that a road remains open in an effort to reduce the impacts of linear disturbance features on wildlife habitat from predation and human recreation. All new Canadian Kraft Paper Industries Ltd roads are constructed and managed under the guidance of an approved forestry road development plan. Without exception, all forestry road development plans include general decommissioning conditions.

As operations in an access area are approaching a conclusion, roads scheduled for decommissioning are included in the next forest management operating plan and are reviewed at community information sessions.

Once operations that required road development are complete, NFMC submits a detailed plan that identifies the location and extent of proposed decommissioning efforts. Decommissioning locations are selected based on effective elimination of vehicular traffic and prevention of potential issues that could cause environmental impacts and/or a public safety hazard. The Province issues a work permit once conditions have been agreed to. The decommissioning is monitored for a two-year period after completion. Provided the decommissioning remains effective, the Province issues NFMC a letter stating that it has met its obligations and successfully decommissioned the road.

16.2.6 Non-Timber Resource Values

16.2.6.1 Wildlife Habitat and Habitat Elements

Concerns related to wildlife, habitat, and habitat elements are mitigated during the forestry road development plan development process with the Province. During development, emphasis is given to wetland avoidance, critical habitat avoidance, and access management. Additional conditions and management practices may be implemented in the work permit mitigation process should concerns be identified. NFMC relies on the Province to provide guidance on wildlife management and additional areas of avoidance during these planning periods.

16.2.6.2 Heritage Resources

Road and water crossing development plans are shared with the Provincial Historic Resources Branch during the forest management operating plan development process. All proposed all-weather roads are reviewed for historic resources potential prior to development. Where concerns are identified, areas may be reviewed by archaeological consultants to determine potential impacts to historic resources and suggest mitigation measures. In the event of discovering any historic resources during operations, NFMC has a Heritage Resource Action Plan in place supplemented by the operational guideline *Human Remains and Heritage Resources* (GUIDE-982) developed under their International Organization for Standardization (ISO) Environmental Management System (EMS) standard certification. All staff and contractors review this guide annually.

16.3 HARVEST OPERATIONS

16.3.1 Annual Wood Requirements

Average annual wood requirements at the Canadian Kraft Paper Industries Ltd mill are detailed in Table 16.2. The values reported in this table are based on the 2021 to 2023 Forest Management Operating Plan period as reported in NFMC's *Forest Management Report 2021-23*, published in 2024. This was the last report published for reference at the time this forest management plan was developed. Average annual wood requirements include products harvested from the FML and delivered to the mill as well as products that were delivered to the mill from third-party operations/operators outside of FML 2.

Table 16.2. Average annual wood requirements for the Canadian Kraft Paper Industries Ltd mill based on the 2021 to 2023 Forest Management Operating Plan period and as reported in the Forest Management Report 2021-23 for FML 2. Requirements are based on net delivery volumes, not Crown Due volumes.

FMU	Softwood (m^3/yr)		Hardwood (m^3/yr)*	Biomass (t)	Total by Source
	Roundwood	Chips	Roundwood	Hog Fuel	
Company Contracted Operations					
53	71,349	-	-	-	71,349
58	25,189	52,311	-	-	77,501
59	-	87,852	-	-	87,852
67	14,982	-	-	-	14,982
Third Party Operations					
59	7,328	-	4,838	-	12,166
Non-FML	110,122	392,974	90	77,427	592,780
Total	*228,970*	*533,137*	*4,928*	*77,427*	

**Note that while the FML 2 Forest Management Licence Agreement does not permit Canadian Kraft Paper Industries Ltd to harvest hardwood on the FML, there are operators in the region that are permitted.*

16.3.2 Projected Harvest Volume and Area

The annual softwood harvest volumes projected by the strategic Preferred Forest Management Scenario are detailed by forest management unit (FMU) in Table 16.3 for the 20 years of the forest management plan. Note that this table reports only strategic projections for softwood. Under the Forest Management Licence Agreement (FMLA), NFMC is permitted to harvest only softwood products on the FML.

Note that the harvest volumes in the following tables are projected at the strategic level. Strategic-level forest modelling allows for forest managers to identify the capacity and potential of the forest, however, NFMC does not anticipate operating at strategic levels throughout the 20-year duration of this plan. Actual softwood harvest volumes are expected to be more consistent with current average softwood harvest volumes, with some opportunities for growth anticipated across FMUs throughout plan implementation and to assist in meeting the annual wood requirements detailed in Table 16.2.

Recent average annual wood requirements are detailed alongside the projected softwood harvest volumes for comparison. Should average annual softwood requirements be higher than the projected softwood volume, the projected volume will be adhered to.

The annual harvest area projected by the strategic Preferred Forest Management Scenario are detailed by strata in Table 16.4.

Table 16.3. Projected softwood harvest volume by forest management unit (FMU) for the 20-year planning period. Average annual softwood requirements are based on the 2021 to 2023 Forest Management Operating Plan period and as reported in the Forest Management Report 2021-23 for FML 2. All reported volumes are in cubic metres per year (m^3/yr).

FMU	Projected Annual Softwood Harvest Volume (m^3/yr)		Average Annual Softwood Harvest Volume (m^3/yr; 2021-2023)
	First 10 Years	Second 10 Years	
50	23,639	23,702	-
53	94,975	95,013	71,349
58	96,470	96,343	77,501
59	88,014	87,923	95,180
67	308,392	308,258	14,982
68	52,199	52,217	-
69	77,851	78,012	-
800	12,882	12,889	-
801	399,157*	399,157*	-
802	58,287	54,247	-
Total	*1,211,866*	*1,207,761*	*259,012*

**Should NFMC approach reaching strategic-level utilization in FMU 801 during plan implementation, NFMC will not harvest above the provincially-determined AAC (389,422 m^3/yr as of April 1, 2025 – See Appendix V – Provincial Annual Allowable Cut Letter for more information).*

Table 16.4. Projected annual area harvested by cover type and strata for the 20-year planning period. Average annual actual harvest area are based on the 2021 to 2023 Forest Management Operating Plan period and as reported in the Forest Management Report 2021-23 for FML 2. Cover types reported are softwood (S) and softwood-leading mixedwood (M).

Cover Type	Strata		Projected Annual Harvest Area (ha/yr)		Average Annual Actual Harvest Area (ha/yr)
			First 10 Years	Second 10 Years	
S	JP	Jack pine	18,873	21,301	715
	LBS	Lowland black spruce	828	1,719	73
	OSFWD	Other softwood mix	97	89	-
	SFWD	Pure softwood mix	39,723	34,964	766
	STL	Black spruce and tamarack	765	581	4
	UBS	Upland black spruce	45,152	59,121	98
M	MSPF	Softwood-leading mixedwood	11,994	9,339	104
		Total	*117,432*	*127,114*	*1,760*

16.3.3 Proposed Operating Areas and Projected Harvest Schedule

Part of the output of the modelled Preferred Forest Management Scenario is a spatial harvest schedule. A spatial harvest schedule outlines the proposed operating areas and the projected harvest schedule resulting from the Preferred Forest Management Scenario. The selected operating areas are identified by 10-year periods, outlining where forest operations should occur within the first 10 years of the plan (period 1), the second 10 years of the plan (period 2), plus two additional 10-year periods (periods 3 and 4) to achieve the strategic goals of the forest management plan.

These additional 20 years of spatial harvest schedule identified outside of the duration of the forest management plan are considered contingency. Contingency areas are identified as potential harvest areas in the event that an area in the initial 20-year spatial harvest schedule cannot be harvested or accessed as expected. Contingency areas may be explored if unforeseen circumstances, such as natural disturbances (e.g., wildfires, pest outbreaks), regulatory changes, or operational challenges make the planned harvest areas unavailable or less viable to help ensure that timber supply and forest management objectives can still be met.

Maps of the spatial harvest schedule can be found in Appendix M.

16.3.4 Harvesting Methods

The primary harvest method used on the FML is variable retention harvesting. Variable retention harvesting involves keeping certain standing trees or groups of trees within harvest blocks to maintain ecological function and/or meet specific management objectives, such as line of sight breaks and various buffers. Retained vegetation can include areas of advanced tree regeneration, individual or patches of hardwood trees, and individual or patches of non-merchantable softwood trees. In some instances, there is incidental removal of advanced tree regeneration, hardwood and non-merchantable trees to access merchantable species but to the extent possible islands of standing timber are retained for line-of-sight breaks and various types of buffers. Site-specific modifications are regularly employed and are influenced by factors such as insect and disease damage or the integration of non-timber values.

Merchantable softwood tree species for NFMC include white spruce, black spruce, jack pine, and balsam fir. Balsam fir can only constitute a maximum of 10% of the total volume due to its high sap and pitch content.

All timber is harvested through mechanical operations using two primary systems: roadside processing and roadside chipping. Other harvesting systems may be employed in the future based on management objectives, silviculture prescriptions, contractor preference and/or technological advancements.

These primary systems rely on heavy machinery equipment such as:

- Feller Bunchers – Used to cut, or fell, standing trees and then gather the logs into piles, or bunches;
- Grapple Skidders – Used to transport piles of felled trees to processing areas, such as roadsides or nearby landings;
- Stroke Delimbers – Used to remove the branches, or limbs, of a felled tree, often referred to as delimbing;
- Slasher Saw – Used to cut a log to a specific length or lengths;
- Processor Head – An excavator attachment used to handle various stages of processing such as delimbing, cutting to a specific length or lengths, and debarking; and,
- Mobile Chipper – Used to process a felled tree into wood chips. These chippers are able to delimb and debark felled trees all at once during the chipping process and can be transported from site-to-site.

During roadside processing, trees are harvested using a feller buncher and moved full-tree to roadside with a grapple skidder. At roadside, the felled trees have their branches removed using a stroke delimber and are then cut into a suitable length or lengths using a slasher or processor head. At this point, the logs are ready to be loaded onto log trucks and hauled to the mill for chipping and conversion into paper.

During roadside chipping, trees are similarly harvested using a feller buncher and moved full-tree to roadside with a grapple skidder. Full, felled trees are then fed into a mobile chipper where they are delimbed, debarked, chipped, and blown into chip vans to be hauled to the mill.

A feller buncher.

A skidder.

A mobile chipper.

In a summer-harvest jack pine stand, where the forest renewal objective is to scarify the harvest block to promote natural regeneration, efforts are made to ensure that much of the cones and seeds are left at the stump site. This can be done through raking, manually cutting, or driving over the tops of the trees at the stump site prior to skidding, or redistributing the branch debris across the cutover after delimbing at roadside. The intention is to retain the majority of cones and evenly distributed across the harvest block.

In the instance of roadside chipping, the delimbing debris gets mixed in with higher volumes of bark as the mobile chipper delimbs and debarks the felled tree at the same time. As the bark component of the debris actually inhibits seed regeneration, redistributing the debris across the cutover is not an effective approach to jack pine stand renewal. In these instances, debris is often scattered across landings and roads as a means to assist decommissioning when operations have completed. In spruce a stand where the forest renewal is to plant seedlings following harvest operations, cones and seeds do not need to be left at the stump site. In this case, trees are delimbed at roadside and the branch debris is collected into piles and burnt in the winter.

All softwood is delivered to the mill in two forms to produce unbleached Kraft paper:

- Roundwood – Softwood logs between 2.54 and 5.08 metre (8.5 and 16.7 feet) lengths; and,
- Wood chips – Quality softwood chips less than 2% bark content.

16.3.4.1 Harvest Block Navigation

NFMC provides navigational (GPS/GIS) files, data, and information for each harvest block. This includes digital spatial information related to harvest block boundaries, roads, and landings. Harvest block boundaries provided are those approved through the Work Permit. These files are able to be uploaded directly to the navigational systems of harvesting equipment for operator use and reference. The following sources are reviewed for inclusion in navigational files, and if the information cannot be conveyed spatially, it is included in the executive summary documentation of the harvest block maintained and provided by NFMC:

- Work Permit conditions and imagery;
- Approved mitigation;
- Harvest block information sheet;
- Forestry road development plans;
- Pre-harvest forest investigation report and data;
- Any recorded resource use or concern; and,
- Protection of known or potential Heritage Resources.

16.3.4.2 Harvesting Near Water Features

Harvesting near a water feature occurs when riparian buffers have not been prescribed and is restricted to minor water features such as ponds and intermittent or ephemeral streams. Harvesting adjacent to major water features such as lakes and permanent rivers and streams is controlled by the provincial *Forest Management Guidelines for Riparian Management Areas* (Manitoba Conservation and Water Stewardship, 2008). When harvest adjacent or near to a minor water feature occurs, the following general operational practices apply:

- Minimizing disturbance to understory vegetation, and residual vegetation is retained to the extent practical;
- Site-specific operating procedures are developed with equipment operators to ensure minimal impact; and,
- Any additional best management practices are described in NFMC's standard operating procedure *Working Near Water Bodies* (SOP-050).

16.3.4.3 Ground Disturbance

Ground disturbance can alter ecosystem function, reduce site productivity, disrupt surface drainage, and contribute to erosion. It includes excessive removal of the organic forest ecosystem layer (i.e., ground vegetation, leaf litter, surface soil), soil compaction, and rutting. The risk of ground disturbance is influenced by factors such as season of activity, topography, soil type, road and landing densities, equipment type, and weather conditions. The provincial *Reduce Rutted or Puddled Soil by Proper Operating Practices* guidebook (Manitoba Sustainable Development, 2016) provides direction for harvest and forest renewal operations to reduce ground disturbance.

16.3.4.4 Woody Debris Management

Woody debris, or biomass, is managed according to the provincial *Biomass Management* guidebook (Manitoba Conservation and Water Stewardship, 2015). Variations in the preexisting environmental conditions of a harvest block can guide the degree to which woody debris is managed post-harvest. Maintaining soil fertility and site productivity, enhancing forest renewal, reducing pest, insect, and disease concerns, protecting understory vegetation, advanced regeneration, and other retained vegetation, reducing fire hazard, considering wildlife habitat and habitat elements, and enhancing the economic viability of a harvest operation are all possible objectives of managing woody debris that may vary on a site-by-site basis. Travelling over woody debris generated from the limbs (branches) and tops of felled trees can also provide an effective means to minimize ground disturbance.

16.3.4.5 Retention of Residual Vegetation

Retention of residual vegetation is managed according to the provincial *Protection of Softwood Understory* guidebook (Manitoba Sustainable Development, 2017). The retention of residual vegetation within a harvest block provides structural diversity, habitat for wildlife, and line-of-sight breakup. Retained vegetation can include areas of advanced tree regeneration, individual or patches of hardwood trees, and individual or patches of non-merchantable softwood trees. The amount of residual vegetation retained on the harvest block will vary from site to site depending on a variety of factors, including forest stand composition and age, forest renewal objectives, and the type of harvesting equipment used. Vegetation may be retained as individual trees or as patches of trees.

Beyond provincial guidance, NFMC additionally mandates to maintain a minimum of five standing trees per hectare within harvest blocks, with exceptions being made to meet specific management objectives related to the control of pest, insect, or disease infestations, wildlife habitat elements, or other mitigation requirements.

The retention of residual vegetation is implemented operationally through NFMC's "leave-tree" program. To ensure that the program results in a full range of species and sizes of trees being left that were present in before

harvest and that operators can identify and retain high value wildlife trees, NFMC developed the *Selecting Leave Trees and Coarse Woody Debris* operational guideline (GUIDE-970).

16.4 FOREST RENEWAL

Forest renewal is the practice of managing forests to cultivate the regeneration and reforestation of a disturbed area to meet specific objectives. In the case of this forest management plan, forest renewal pertains to renewal of blocks post-harvest.

16.4.1 Forest Renewal Methods

Forest renewal methods include leave for natural, scarifying, planting, and applying vegetation management strategies. These forest renewal methods are often more simply referred to as silviculture. A silvicultural prescription is a framework that describes the link between current forest condition, forest renewal methods, and the future forest condition.

NFMC is responsible for the renewal of all harvest blocks within FML 2 where the harvest volume is subsequently delivered to the Canadian Kraft Paper Industries Ltd mill. As such, all planned forest renewal activities are included in 2-year forest management operating plans (see section 16.1.1 Forest Management Operating Plans) and require approved provincial work permits prior to beginning operations.

Depending on site conditions, renewal may be accomplished naturally through the seed source that remains on-site (leave for natural or scarification), through tree planting, or through a combination of both methods. Vegetation management may also be required to ensure the original species composition is maintained. Forest renewal success is evaluated through the provincial Forest Renewal Assessment (FRA) survey as guided by the *Forest Renewal Assessment Manual* (Manitoba Agriculture and Resource Development, 2020). Any areas requiring additional follow-up treatment from the FRA survey are treated and re-surveyed.

16.4.1.1 Leave For Natural

Harvest blocks that fall under the leave for natural silvicultural prescription are expected to have sufficient seed source or remaining young regenerating trees to allow for natural regeneration rather than requiring an additional seed source or artificial planting. Natural regeneration may or may not be aided with the use of mechanical equipment.

16.4.1.1.1 Scarification

Jack pine trees have *serotinous* cones. Serotinous cones are cones that only open and release seeds when exposed to heat. This is an adaptation that allows stands of tree species such as jack pine to regenerate naturally following a forest fire. Jack pine cones can persist on trees year after year and remain closed, retaining viable seed, until they are opened up by the heat of a forest fire. When cones become scattered post-harvest, the heat generated by the sun at ground level is sufficient to cause the serotinous cones to open and release their seed.

In some cases, mechanical treatment through scarification is prescribed to assist in dispersing cones and to expose the mineral soil seedbed to encourage the germination and growth of jack pine seedlings. Scarification consists of pulling shark-fin barrels and/or spiked anchor chains across harvest blocks to expose the mineral soil and scatter the cones and seeds. By dragging spiked anchor chains, this seed is distributed, and mineral soil is exposed to allow for successful germination and establishment of jack pine seedlings.

Generally, scarification is used on easily accessible sites where the pre-harvest stand structure was composed of predominantly jack pine. For scarification to be effective, it is essential that care is taken during harvest to leave as many cones evenly distributed on site as possible.

Black spruce cones are semi-serotinous. If a black spruce component was present in the stand pre-harvest, then some black spruce natural regeneration can also be expected, however, scarification is not a dependable means to solely renew black spruce.

Spiked anchor chains used for scarification.

16.4.1.1.2 No Mechanical Treatment

On some jack pine sites where the duff layer is very light, natural regeneration without any mechanical treatment may be accomplished. For this renewal method to be successful, cone-bearing slash must be spread evenly across the harvest area.

In harvested areas that have a sufficient understory of young regenerating spruce and jack pine, the use of mechanical treatment is avoided to ensure minimal disturbance to this understory vegetation.

16.4.1.2 Planting

The majority of seedlings planted are black spruce and white spruce. Jack pine is generally only planted within winter-access-only harvest blocks where scarification equipment cannot access during the summer, or if a harvest block that has been left for natural regeneration did not renew as anticipated and requires supplemental planting.

NFMC plants seedlings that are custom grown in a commercial tree nursery, and seedlings are grown only from seed collected from within designated provincial seed zones. In recognition of differing ecological conditions, the Province established unique seed zones to ensure the maintenance of genetic diversity within seeding and planting programs. It is a requirement to plant seedlings originating from the same or an otherwise approved seed zone. Transferring seedlings outside of their original seed zone is only permitted as authorized by the

Provincial Silvicultural Forester. There are three seed zones that overlap FML 2. Two federal seed zone boundaries exist for jack pine seeds collected from orchards on the FML, and seeds from these orchards are managed in accordance with the federal boundaries and regulations. Spruce seed and general collection pine seed are managed and planted within the appropriate provincial seed zone.

Seedlings are typically planted at a density of around 1,800 stems per hectare, but this may vary depending on seedling plug size, species composition management objectives, and the number of natural seedlings found within the harvest block. Seedling plugs can come in a variety of sizes and are ordered specifically to fit the soil profile of the harvest blocks that need renewing. Some areas may require smaller plugs if the soil profile is very thin, while others may require much larger plug sizes if they are being managed as a mixedwood stand. The use of larger plugs can provide a competitive advantage in mixedwood stands where hardwoods may easily outcompete softwood seedlings.

Seedlings grown for NFMC and planted in a block post-harvest for forest renewal.

16.4.1.2.1 Snow Cache

Some harvest blocks where tree planting is required are accessible only in the winter when ice roads can be constructed across frozen swamps and lakes. Depending on the number of trees required, it can be more economic to deliver the seedlings by winter road and store them for planting in the spring as opposed to delivering them by helicopter. Seedlings delivered in the winter are kept frozen in snow caches.

Snow cache construction involves stacking boxes of frozen, over-wintered seedlings on wooden pallets, wrapping them in plastic, burying them first with snow to keep the seedlings from thawing, and then with sawdust to prevent the snow from melting too quickly. In the spring before planting commences, work crews fly in by helicopter to excavate the seedlings from the caches for thawing. Once seedlings are sufficiently thawed, planters arrive by helicopter for planting.

16.4.1.3 Vegetation Management

Vegetation management refers to the intentional control of competitive plant species within a forested area to achieve specific forest management objectives. It is the intent that the control of competitive vegetation will allow for additional sunlight and resources to reach the desired renewal species. Competitive plant species typically include pioneer hardwoods such as poplar and balsam poplar.

Current provincial renewal standards state that harvest blocks are to be renewed to their pre-harvest forest cover type, or a cover type above or below the pre-harvest cover type (i.e., softwood may be renewed as softwood or softwood-leading mixedwood, but not as hardwood-leading mixedwood or hardwood). These standards are reflected in the forest management plan through the objective to maintain a forest with an age class structure and composition (i.e., cover type) that resembles that of a fire-driven boreal forest ecosystem that can support a broad range of species. A core indicator of this objective is the amount of softwood forest area that is maintained as softwood, avoiding conversion to hardwood-leading cover types as a result of forest management activities. One of the key operational approaches used to achieve this is vegetation management.

After a softwood block has been harvested, regenerating pioneer hardwood species such as trembling aspen and balsam poplar can rapidly repopulate the area and at a much greater abundance than what was present before harvest. In some cases, if renewal activities such as scarification or planting have occurred within a block post-harvest, vegetation management may be necessary to ensure that:

- Softwood seedlings have the opportunity to survive, establish, and reach an appropriate height without being outcompeted to the point of mortality by pioneer hardwood species; and,
- Forest cover type returns to (or near-to) its pre-harvest composition and does not get converted into a hardwood-leading mixedwood or pure hardwood cover type.

Vegetation management can be achieved through a variety of techniques, including but not limited to:

- Mechanical Removal – Using equipment such as brush saws, chainsaws, mowers, or mulchers to cut down and/or shred competing vegetation;
- Thinning – Selectively removing young or immature stems of competing vegetation;
- Prescribed Burn – Using intentional, controlled, and low-intensity fires to reduce competing vegetation; and,
- Herbicide – Applying chemical plant suppressants to selectively reduce competing vegetation.

Renewal through vegetation management is currently being done by NFMC exclusively through aerial application of the herbicide glyphosate. Glyphosate is applied to suppress competitive hardwood vegetation to allow softwood saplings such as pine and spruce to grow more vigorously with reduced competition for sunlight, water, and nutrients. This is also commonly referred to as "releasing" the softwood saplings trees from competition, or a release treatment.

Herbicide is currently the most effective vegetation management strategy (National Council for Air and Stream Improvement Inc, 2024), however, it does have challenges with being socially acceptable. During forest management operating plan community information sessions, planned herbicide treatments on harvest block areas are reviewed with participants. Feedback received from these meetings and any follow-up correspondence may lead to implementing some mitigation measures such as buffering berry-picking sites or remote trapper cabins. The planned harvest block areas are also reviewed with the Province during mitigation in order to consider other management objectives on the FML. Similar to harvest mitigation blocks, when vegetation management mitigation for a harvest block is finalized with the Province, it is valid for three years.

Operationally, harvest blocks requiring vegetation management are identified from heliocular surveys (i.e., surveys executed from a helicopter using the human eye). During these surveys, portions of harvest blocks that require treatment are mapped out, along with any sensitive areas such as lakes, waterways, sensitive habitat, and anthropogenic features that require buffering. Further buffering of sensitive areas is done through the use of the best available satellite or aerial imagery.

Beyond forest management operating plan approval and provincial work permit, NFMC is also required to apply for a Pesticide Use Permit. The terms and conditions of the pesticide use permit require NFMC to give written public notifications of the vegetation management program at least 15 days prior to application in one or more issues of a newspaper or news bulletin that has general circulation in the local communities describing the locations and timelines in which the vegetation management will be occurring. Prior to application, the pesticide use permit also requires NFMC to hang signs that inform the public of the pesticides being used, purpose of use, and timelines of use along roads to which the public has legal access for recreation, berry picking, etc. An annual report of pesticide use is submitted to the Province in accordance with the permit.

Vegetation management is undertaken during the end of August and beginning of September. During this period, the new spring growth of the conifer trees have set bud and entered a dormant period during which they are not susceptible to glyphosate. At the same time, hardwood trees and shrubs are still active making this an ideal widow for treatment.

16.4.2 Silvicultural Prescriptions

A silvicultural prescription is a framework that describes the link between current forest condition, forest renewal methods, and the future forest condition. The resulting future forest condition of a harvest block to the prescribed silviculture is referred to as a response (i.e., how the forest responded to forest renewal methods).

Predicted responses to leave for natural silvicultural prescriptions are in Table 16.5.

Predicted responses to planting silvicultural prescriptions are in Table 16.6.

These tables describe the current forest condition by pre-harvest stratum and the predicted future forest condition by broad forest cover type (softwood, S; softwood-leading mixedwood, M; hardwood-leading mixedwood, N; and hardwood, H).

The proportion of harvested area that expected to require vegetation management to supplement leave for natural or planting renewal methods is 47% within each forest section. For more information, see Preferred Forest Management Scenario section 13.2.4 Forest Renewal of Part 2 – Analysis and Modelling.

Table 16.5. Leave for natural projected silvicultural prescriptions and predicted responses for the 20-year planning period. Note that for jack pine (JP), leave for natural includes scarification. Dashed responses indicate no leave for natural silvicultural prescriptions were projected for that stratum. Initial cover types reported are softwood (S) and softwood-leading mixedwood (M).

Initial Cover Types	Pre-Harvest Strata		Post-Harvest Cover Types (Responses)			
			S Softwood	M Softwood-leading Mixedwood	N Hardwood-leading Mixedwood	H Hardwood
S	JP	Jack pine	86%	11%	3%	0%
	LBS	Lowland black spruce	-	-	-	-
	OSFWD	Other softwood mix	-	-	-	-
	SFWD	Pure softwood mix	100%	0%	0%	0%
	STL	Black spruce and tamarack	100%	0%	0%	0%
	UBS	Upland black spruce	12%*	88%*	0%	0%
M	MSPF	Softwood-leading mixedwood	42%	45%	13%	0%

**Note that less than 1% of UBS harvest blocks were projected as leave for natural post-harvest, providing a very limited sample size to calculate response proportion from.*

Table 16.6. Planting projected silvicultural prescriptions and predicted responses for the 20-year planning period. Initial cover types reported are softwood (S) and softwood-leading mixedwood (M).

Initial Cover Types	Pre-Harvest Strata		Post-Harvest Cover Types (Responses)			
			S	M	N	H
S	JP	Jack pine	94%	5%	1%	0%
	LBS	Lowland black spruce	100%	0%	0%	0%
	OSFWD	Other softwood mix	100%	0%	0%	0%
	SFWD	Pure softwood mix	94%	5%	1%	0%
	STL	Black spruce and tamarack	97%	3%	0%	0%
	UBS	Upland black spruce	94%	6%	1%	0%
M	MSPF	Softwood-leading mixedwood	42%	45%	13%	0%

16.5 FOREST HEALTH

According to the FML 2 Forest Management Licence Agreement (FMLA), the Province is responsible for monitoring and/or control of pests, recommending management strategies, and implementing control programs.

NFMC reports to the Province on the extent of pest and disease damage in high priority forest stands through field data collection, such as pre-harvest forest investigation and regeneration surveys. This provides an opportunity to further investigate any potential insect and disease concerns and can improve the ability of the Province to respond to forest health issues with potential treatments.

Identifying infections within operating areas and taking measures to prevent re-infection of regenerating stands reduces the effects of disease and protects the investment made in the regenerating stand. NFMC attempts to minimize the effects of pests and diseases through its harvesting and forest management activities. This may be accomplished by planning and executing prompt and strategic harvest of insect infested or disease-ridden stands to potentially control spread of the problem or salvage the timber before it has deteriorated too much to be of use to the mill.

NFMC has developed several guides under the International Organization for Standardization (ISO) Environmental Management System (EMS) standard certification that are available to forest managers and operators that provide direction in the case of pest and disease infestation. These include but are not limited to guides for jack pine budworm salvage operations and for the prevention of mistletoe infestation.

16.6 OPERATIONAL BEST MANAGEMENT PRACTICES

For a full list of the best management practices developed and maintained by NFMC through emergency preparedness procedures, standard operating procedures, and operational guidelines, see Appendix O – Operational Best Management Practices.

17 Monitoring and Assessment

This forest management plan will be monitored and assessed at a range of levels and time intervals. Reporting for a number of values, objectives, indicators, and targets (VOITs) occur at the annual, 2-year, and 5-year scales.

Complying with Canadian Standards Association (CSA) Sustainable Forest Management (SFM) standard certification requires that a number of CSA-specific indicators that overlap forest management plan VOITs be assessed yearly through an annual report. Provincial regulations require that NFMC report at two timescales – two-year Forest Management Reports to coincide with two-year forest management operating plans, and five-year Forest Reports to provide a status update on the FML and forest management plan objectives and targets. For the duration of plan implementation, twenty CSA annual reports, ten Forest Management Reports, and four Forest Reports will be completed.

17.1 REPORTING

17.1.1 Forest Report (5-year)

The Forest Report is a five-year status report of the FML area. The forest report summarizes five years of forestry activity on the FML and compares it to the FMP. This includes tracking and monitoring of forest management plan values, objectives, indicators, and targets (VOITs), a comparison of the planned targets for the measurable objectives, and a discussion on how the management objectives, targets, and strategies are being applied and achieved during the five-year term.

The Forest Report summarizes:

- A selection of Forest Management Report tables up to the five-year term;
- The previous ten years of harvest and five years of forest renewal;
- A comparison of planned targets with actual implementation results, with rationalization for variances, if necessary; and;
- Adaptive management approaches to be implemented if monitoring identifies that the forest management objectives are not being met.

17.1.2 Forest Management Report (2-year)

The Forest Management Report is prepared in accordance with *Manitoba's Submission Guidelines for Forest Management Annual Reports* (Manitoba Conservation and Water Stewardship, 2010). Forest Management Reports are submitted by NFMC to the Province every two years (rather than annually) to coincide with the two-year forest management operating plan period. The Forest Management Report summarizes:

- Harvest and natural depletion areas over the term of the forest management operating plan;
- FML 2 timber production, including quota holders' activity;
- Mill fibre supply from all sources, including all wood product;
- Volumes harvested compared to annual allowable cut (AAC);
- Access development and decommissioning, including new forest road development plans; and,
- Forest renewal activities and silvicultural surveys.

17.1.3 Forest Renewal Assessment Surveys

The *Forest Renewal Assessment Manual* (Manitoba Agriculture and Resource Development, 2020) outlines the provincial renewal standard that each harvest block needs to meet in order to be considered officially renewed (i.e., reforested). The assessment of whether this standard is reached is done through Forest Renewal Assessment (FRA) surveys. FRA surveys are completed for all harvest blocks. When a harvest block meets the renewal standards, the province will provide a Certificate of Reforestation that indicates adequate reforestation. Any

harvest block that does not meet renewal standards is assessed for follow-up renewal methods and a future FRA survey is planned.

Forest regeneration as a result of forest renewal methods.

17.2 INTERNAL MONITORING AND ASSESSMENT

17.2.1 Forest Management Activity Data Management System

In keeping with the terms of the Forest Licence Management Agreement (FMLA), NFMC maintains a digital data management system which holds spatial and non-spatial records of all planned and completed forest management activities. As per the FMLA, these records are in accordance with the *Forest Act*, are provided to the Province in a format deemed acceptable, and are a generally accepted Canadian accounting principles for such operations.

NFMC uses the data management system Land Resource Manager (LRM). This database contains all past, present, and planned harvest blocks organized in a series of tables. Each harvest block record can store a variety of information and details important for planning, operations, and renewal activities, such as species composition, estimated and actual wood volume, public concerns, survey results, start and end dates of each operation that took place. Pre-harvest forest investigation survey data collected in the field is also integrated in the database to support volume calculations for the forest management operating plan and to incorporate important features found during field work. LRM has integrated geographic information system (GIS) a mapping software allowing to link each block record with its spatial location within the GIS. LRM can summarize data and generate reports,

send notifications to users for upcoming events such as permit expiry, store documents, and link them to appropriate harvest blocks.

An integral part of executing everyday forest management activities is the use of Geographic Information Systems (GIS). NFMC uses specialized mapping software for creating array of map products for field work and navigation, planning and reporting, harvesting and renewal operations, maps to accompany harvest block mitigation, work permit application. GIS allows NFMC to utilize the latest technology in aerial surveys, combine multiple data sources, and seamless information sharing with the Province.

An additional feature of the use of a forest management activity data management system is its ability to be leveraged to track and maintain records of feedback heard through public engagement that can then be linked to on-the-ground spatial features for integration during operational planning.

17.2.2 Forestry Road Ledger

A road ledger of roads constructed, managed, and decommissioned by Canadian Kraft Paper Industries Ltd is maintained and updated regularly. The ledger contains road information such location, name, length, category (see 16.2.1 Forest Road Development Planning for a description of road categories), status, and construction and decommissioning information. The data and information maintained within the road ledger is used to satisfy the reporting required for 2-year Forest Management Reports and Canadian Standards Association (CSA) Sustainable Forest Management (SFM) standard certification annual reports.

17.3 STANDARD CERTIFICATION MONITORING AND ASSESSMENT

All standard certifications require third-party auditing to comply with and maintain certification.

17.3.1 Canadian Standards Association Sustainable Forest Management Standard Certification

Since 2004, Canadian Kraft Paper Industries Ltd and NFMC have held a Canadian Standards Association (CSA) Sustainable Forest Management (SFM) standard certification. NFMC monitors and annually reports on different forest management activities within FML 2 through this certification. The Sustainable Forest Management Plan required for certification contains CSA-specific values, objectives, indicators, and targets (VOITs) that align with the Canadian Council of Forest Minister's (CCFM) *Framework Criteria and Indicators of Sustainable Forest Management in Canada* (2005). These VOITs are required to be reported on annually to maintain certification. These annual reports are publicly available on NFMC's website, www.niso.ca.

For more information, see Part 1 – Planning Context, Forest Administration subsection 6.4 Forest Certification Systems and Part 2 – Modelling and Analysis section 9 Values, Objectives, Indicators, and Targets.

17.3.2 International Organization for Standardization Environmental Management System Standard Certification

NFMC also developed an International Organization for Standardization (ISO) Environmental Management System (EMS) to improve environmental performance. Through this system, NFMC has developed and maintains a series of emergency preparedness procedures, standard operating procedures, and operational guidelines that describe best management practices to follow under a range of circumstances and situations. Maintenance, training of staff and contractors, and compliance with these best management practices occurs through the ISO EMS standard certification. For a full list of the best management practices developed and maintained by NFMC, see Appendix O – Operational Best Management Practices.

Information within these documents is presented in a context readily applied in an operator's day-to-day activities. Some of these best management practices were developed to comply with government regulations,

while others are designed to achieve various environmental commitments that are part of NFMC's Canadian Standards Association (CSA) Sustainable Forest Management (SFM) standard certification.

A key component of maintaining ISO EMS standard certification is ensuring that contractors are operating consistently with NFMC's commitments. To do this, a number of monitoring and reporting processes are in place:

- Contractor Orientation Record – An annual review of the ISO EMS and CSA SFM certification requirements, obligations, and procedures appropriate to the contracted activities. Requires contractor sign-off.
- Executive Summary – An overview of all documentation relating to a harvest block to ensure that all commitments and mitigations have been considered. Executive summaries are compiled by NFMC for all harvest blocks prior to harvest operations beginning.
- Tailgate Meeting – A facilitated review of the executive summary, provincially-approved work permit, map, and any other harvest or forest renewal activity conditions. Requires Company and contractor sign-off.
- Operations Inspection – An inspection regularly conducted by NFMC to assess contractor compliance with harvest or forest renewal activity conditions, and advise the contractor of any issues that require correction. Requires Company and contractor sign-off.
- Final Inspection – An inspection conducted by NFMC at the end of harvest or forest renewal activities to assess contractor compliance with all conditions. Requires Company and contractor sign-off.

For more information, see Part 1 – Planning Context, Forest Administration subsection 6.4 Forest Certification Systems.

18 Research

18.1 BOREAL SONGBIRD HABITAT MONITORING

While engaging with rightsholders and stakeholders during the development of this forest management plan, it was noted that some of the specific habitat models that existed for use in Manitoba were out of date, lacked regional validation, or might not apply to the northern boreal regions of FML 2. Based on this feedback and additional research, NFMC explored alternatives such as updated wildlife habitat models that may be valid for use within the plan, as well as the possibility to enhance future habitat modelling with data collection and research initiatives on the FML during the 20-year implementation period of plan.

NFMC implemented a new approach using boreal songbird habitat models to assess relative habitat measures in the forest management plan and for alternative management strategies (see Part 2 – Analysis and Modelling, Modelling Wildlife Habitat and Habitat Elements subsection 11.4 Boreal Songbird Habitat Elements). The approach utilized data driven songbird models using local Manitoba observation data to develop and validate model performance for use in this area. Developing this forest management plan and engaging with rightsholders and stakeholders has identified a need to collect additional data to continually improve the preliminary models that represent habitat needs and conditions within the FML.

Songbirds are excellent indicators of forest ecosystem health and biodiversity. They have been well researched and widely used in conservation biology and landscape ecology in many regions. Their response to known environmental changes is well documented, which makes it easier to compare findings or apply research from other regions or ecosystems. A lot of research has been focused on songbirds over the years due to their wide distribution in many forest ecosystems.

Existing data used for the preliminary development of new Manitoba songbird models was available from the *Atlas of the Breeding Birds of Manitoba* (birdatlas.mb.ca). This location data was a starting point for model development and validation but also identified a gap in the available observation data for the region. A research plan has been drafted for field data collection during implementation of the forest management plan to continually refine, validate and develop unique habitat models for the area, which will assist in monitoring changes and supporting management decisions.

18.1.1 Boreal Songbird Field Studies on FML 2

Field studies will be designed to be implemented over the first five years of the forest management plan. This monitoring proposal will provide additional data collection within the FML to further evaluate the local models used in the development of the 20-year plan. It is NFMC's hope to partner with Nekoté communities to acquire the required equipment and employ community members to deploy and the retrieve equipment, as well as to record site description survey data. Following forest management plan approval, a detailed project plan for field studies will be developed in partnership with those Nekoté communities that are interested in participating in the program.

Below is a general description of what the field study components would look like.

Equipment

The primary equipment required for this field study would be autonomous recording units (ARUs). ARUs are audio recording devices that can be reliably deployed and left to collect acoustic recordings from a variety of natural environments, including the ability to record birdsongs from within forested environments. An estimate of the cost to acquire the required equipment is approximately $10,000, however, additional work would need to be done to determine funding and ability to deploy and retrieve the equipment within the appropriate seasons to finalize this field study.

- ARUs would be deployed and relocated five times during the breeding season (last week of May to first week of July) over a three to five year period.
- Each ARU would be left in place for a minimum of three days.
- It is recommended that at least twenty ARUs be deployed.

  For example, ARU equipment available at the time of forest management plan development include:

  Wildlife Acoustic's Song Meter Mini 2 AA– approximately $500 (wildlifeacoustics.com); and,

  Wildlife Acoustic's Song Meter SM4 – approximately $900 (wildlifeacoustics.com). The SM4 provides stereo recording to better estimate the number of individuals present for a species.
- This would be expected to yield approximately 300 observation points.

Interpretation of Recordings

An interpretation of the recordings could be done remotely as digital downloads are sent directly from the recording device for interpretation. Recording interpretation would leverage the use of WildTrax, an online platform that simplifies the processing, organization, storage, and sharing of environmental sensor data (wildtrax.ca). A more specific cost estimate can be generated for the service once the monitoring plan has been approved to determine the available resources.

Examples of interpretation plans and services include:

- The Alberta Biodiversity Monitoring Institute (ABMI) can use WildTrax to interpret recordings.
- WildTrax can provide a direct quote for the cost per minute to interpret recordings.

18.1.2 Continued Analysis and Model Refinement

For the implementation of the monitoring program, a survey and protocol would be developed. An example of the work that would be undertaken to design the field data collection is below. Data collected during the implementation of the plan would be integrated into the models developed using the currently available observation data for FML 2 (see Part 2 – Analysis and Modelling, Modelling Wildlife Habitat and Habitat Elements subsection 11.4 Boreal Songbird Habitat Elements) to further refine the relationships, as well as provide additional validation datasets to test and improve model performance.

Field survey design and autonomous recording unit (ARU) deployment protocols:

- Use R program to develop a randomly stratified, spatially dispersed survey design (i.e., ARU deployment locations).
- Program ARU recording schedule. ARUs will record in the morning to capture the dawn chorus (30 minutes before sunrise until 9:30 AM) and in the evening. Evening recordings will also capture amphibian recordings.
- Develop data sheet and site description standards with Nekoté and NFMC.

Data preparation of processed recordings:

- Assemble data in proper format, check for errors.
- From data for each recording, determine the maximum number of individuals of a species heard in a recording.
- Calculate and link QPAD (Quantitative Population Assessment Design) estimates for correction of observation errors to account for factors that might make it harder to detect or count birds correctly during field data collection surveys.

Data analysis and modelling:

- Link Patchworks habitat model variables to new bird observations.
- Check data for best distribution (e.g., Poisson, negative-binomial).
- Develop bird density models using appropriate regression (e.g., Poisson).

- Develop/refine resource selection models using logistic regression (described in Part 2 – Analysis and Modelling, Modelling Wildlife Habitat and Habitat Elements subsection 11.4 Boreal Songbird Habitat Elements).
- Produce model testing and performance statistics.

The implementation of boreal songbird habitat monitoring represents a significant step forward in refining and validating habitat models for the northern boreal forests of Manitoba. By integrating local observation data and leveraging advanced modelling approaches, NFMC has laid the groundwork for improving habitat assessments and supporting adaptive forest management strategies during plan implementation.

The planned field studies and collaborative partnerships with Nekoté communities will provide critical new data to address existing gaps, enhance model accuracy, and ensure continued alignment with the dynamic needs of forest ecosystems. These efforts will not only strengthen the science underpinning forest management decisions, but NFMC hopes to foster meaningful community involvement and capacity building.

Through this ongoing commitment to research, monitoring, and stakeholder engagement, NFMC will be well-positioned to adapt and respond to the evolving challenges of forest management while maintaining a balance with ecological sustainability and biodiversity conservation.

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