MANNING DIVERSIFIED FOREST PRODUCTS LTD.

FMA Area

2007 – 2017 Forest Management Plan for FMA 0200041

May 31, 2007

Prepared by:
The Forestry Corp.

2007 – 2017 FMP FOR FMA 0200041

FMA Area forms one of 10 sections of the 2007 – 2017 Forest Management Plan for Manning Diversified Forest Products Ltd.'s Forest Management Agreement (FMA) 0200041. The Forest Management Plan (FMP) includes the following sections:

1. **Introduction and Plan Development** – Introduces the companies operating on the FMA and describes the FMP development process, including the public consultation process. Includes the FMP Standards Checklist.
2. **FMA Area** – Describes the physical environment of the FMA Area.
3. **FMA Resources** – Describes the natural resources within the FMA Area.
4. **Values, Objectives, Indicators and Targets** (VOITs) – Details the values, objectives, indicators and targets that were instrumental in selecting the Preferred Forest Management Strategy and in developing forest management strategies for the FMP.
5. **Forest Landscape Metrics** – Presents specific information regarding forest vegetation composition and natural disturbance within the FMA Area and/or northwestern Alberta to address VOIT requirements.
6. **Landbase Netdown** – Provides a detailed description of the landbase netdown process, in preparation for the Timber Supply Analysis.
7. **Yield Curves** – Documents the volume sampling and yield curve development process.
8. **Timber Supply Analysis** – Describes how the Preferred Forest Management Strategy, which was selected to meet Values and Objectives, was incorporated into the Timber Supply Analysis and provides an Annual Allowable Cut for both the coniferous and deciduous landbases.
9. **Implementation** – Describes the forest management strategies and operations that will be used to implement the FMP and help ensure that indicators and targets are met.
10. **Monitoring and Research** – Describes monitoring commitments required to ensure indicators and targets are tracked and describes Manning Diversified's approach to supporting research.

Table of Contents

List of Appendices

List of Tables

List of Figures

1. Location

Manning Diversified's FMA Area is located in northwestern Alberta, north and west of the town of Manning. The FMA Area is composed of two disjunct Forest Management Units (FMUs). These FMUs are both designated as P16 however, for clarity and brevity, they are generally referred to by their former designation, P6 and P9 within the FMP (Figure 1-1). In total, the FMA Area is approximately 595,677 hectares in size.

P6 is located to the northwest of Manning and covers approximately 295,751 ha. The southern boundary of P6 is formed by the Notikewin River and lies at roughly the same latitude as the town of Manning. FMU P07 lies to the west of P6, with P10 forming the northern boundary of the FMU. Both P7 and P10 are within Daishowa-Marubeni Ltd.'s FMA Area. Agricultural land (White Zone) is located to the east of FMU P6. Highway 35 (also known as the MacKenzie Highway), crosses through the northeast corner of FMU P6.

FMU P9 is 299,926 ha in size. The southern boundary of FMU P9 is located approximately 110 km northwest of the town of Manning. The southern boundary is formed by the Chinchaga River which divides P9 from P10. To the west of P9 lies P8, which is also part of Daishowa's FMA Area. To the north, P9 is bordered by FMU F26, which is part of Tolko High Level and Footner Forest Products Ltd. joint FMA Area. The Paddle Prairie Métis Settlement (FMU M1) lies to the east of P9.

Manning's FMA Area occurs almost exclusively within the Northern Lights Municipal District (MD 22) (Figure 1-2). The town of Manning is also located within this Municipal District. Approximately 10 townships along the western edge of P6 and the southern tip of P9 lie within the Clear Hills Municipal District (MD 21).

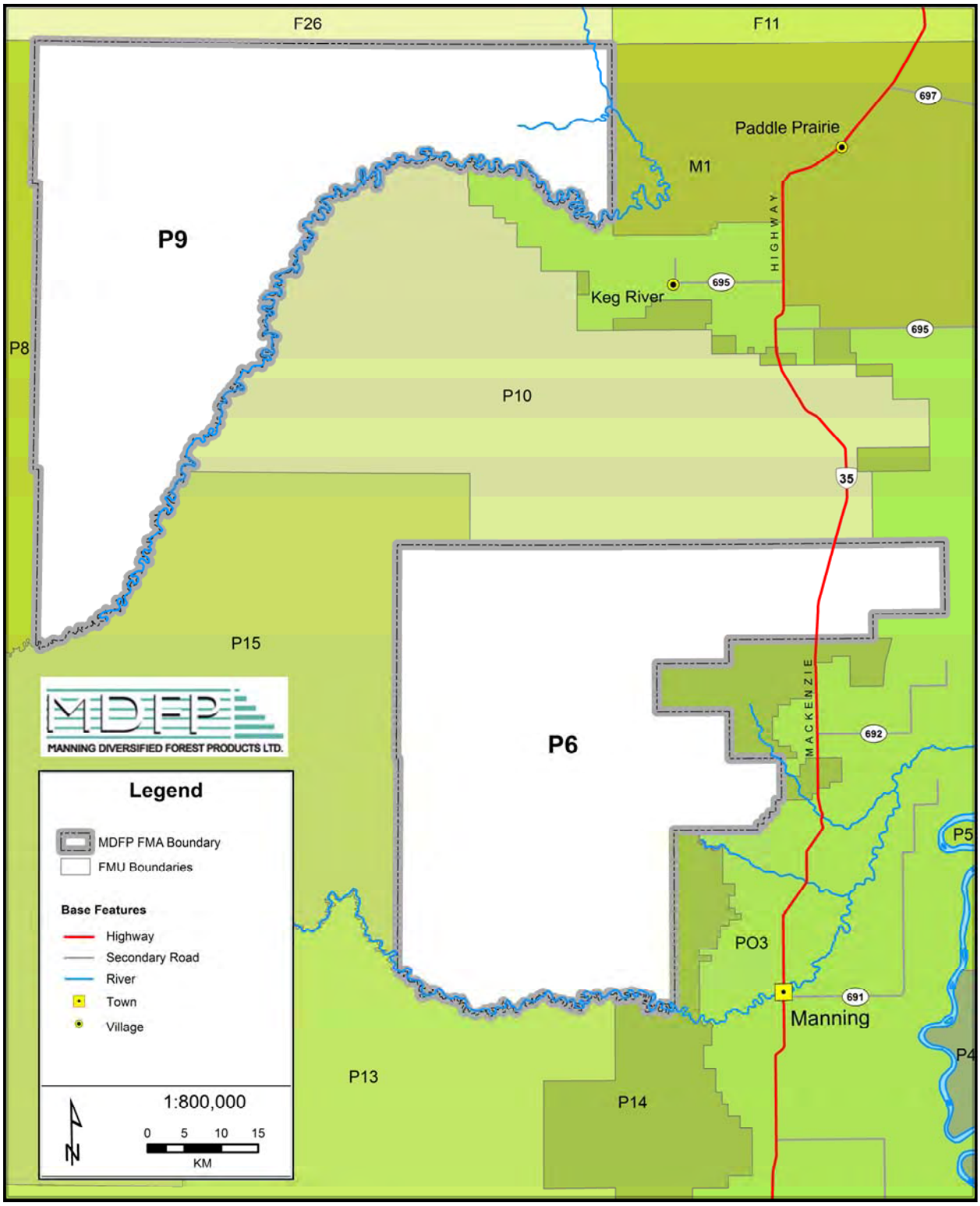

Figure 1-1. Forest management units surrounding Manning Diversified's FMA Area.

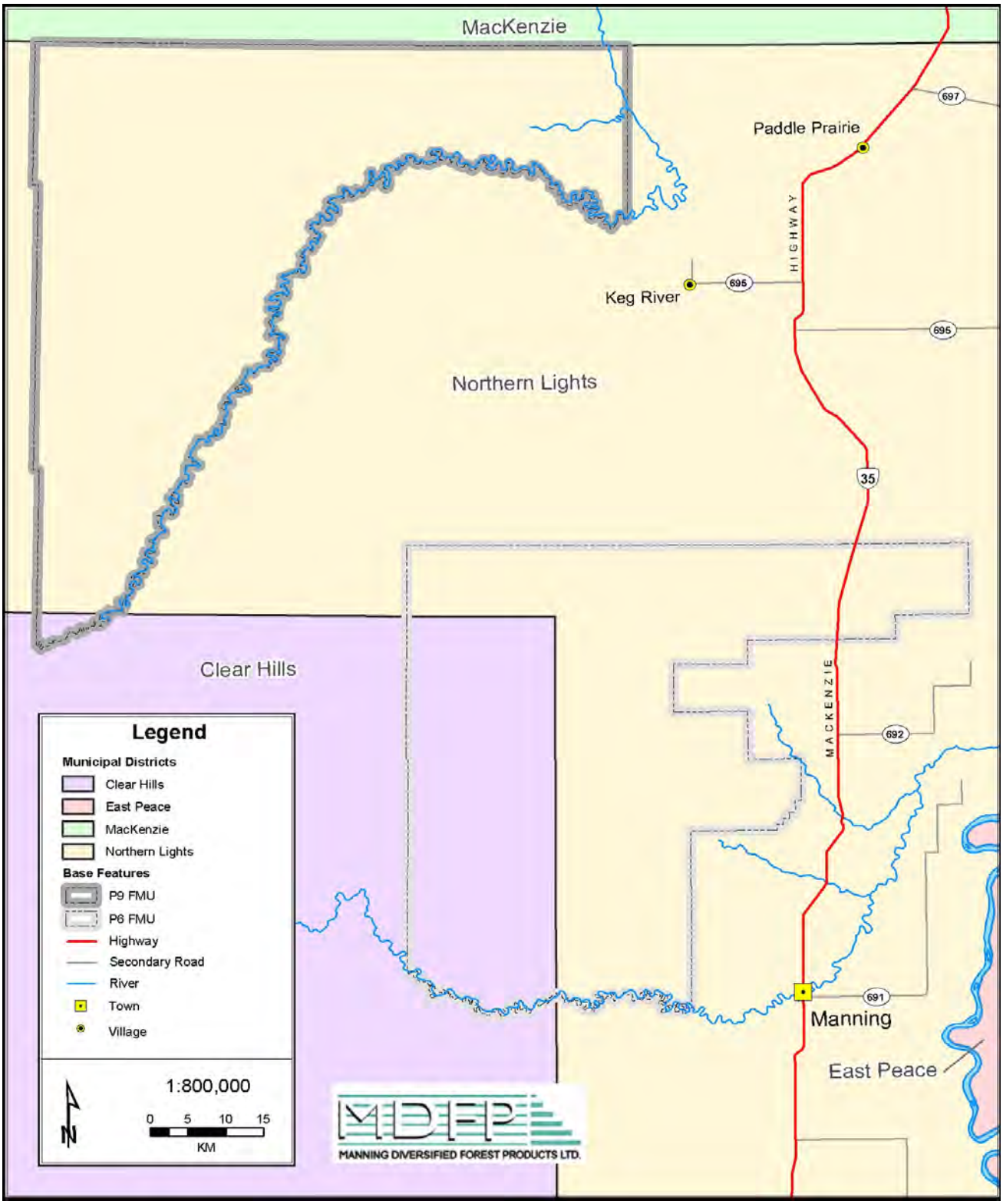

Figure 1-2. Municipal districts within Manning Diversified's FMA Area.

2. Glacial History and Parent Materials

The physical environment of Northwestern Alberta strongly reflects geologic events associated with the Quaternary Period. This Period is composed of two Epochs: the Pleistocene Epoch and the more recent Holocene Epoch.

The Pleistocene Epoch, commonly referred to as the Great Ice Age, spans the period from 1.8 million years before present to approximately 10,000 years before present. The Pleistocene was characterized by four major ice advances, each separated by a deglaciation, referred to as an interglacial period (which is the present condition).

During the last glacial advance, the Wisconsinian glaciation, the FMA Area was covered by the Laurentide (or Continental) ice sheet, which spread from its centre in the Hudson Bay region. This ice sheet reached its maximum extent approximately 20,000 year before present (Dyke and Prest 1987 and Stelfox and Wynnes 1999) and did not retreat from Northwestern Alberta until approximately 12,000 to 13,500 years ago (Bobrowsky et. al. 1993 and Stelfox and Wynnes 1999).

The advance of the Laurentide ice sheet through northern Alberta was primarily from the northeast to the southwest while the subsequent retreat was generally in the reverse direction. As the ice sheet advanced, surface material over which the ice sheets passed was incorporated into the glacial ice. This material was a mixture of bedrock, older till, soil and plant material. As the glacier retreated, this material was re-deposited as an unsorted mixture called ground moraine or till. Ground moraine deposits generally reflect the content of local materials which originated from the direction of ice advance (i.e., transport of most material is not over long distances and follows the direction of ice advance).

The retreat of the Laurentide ice sheet produced large volumes of meltwater that were trapped between the retreating ice and higher elevation lands in western Alberta. Because the trapped water was in contact with the retreating edge of the ice sheet, soil particles were continuously entering the lake as the sheet continued melting. Deposition of the soil particle continued over time, with fine textured materials taking longer to deposit than coarse textured materials.

Because of the region's glacial history, the FMA Area is characterized predominantly by relatively flat land with fine textured morainal soils which formed by deposits associated with Glacial Lake Peace. Organic soils are scattered throughout the FMA Area, while fluvial deposits are generally restricted to existing or historic river channels. Although detailed soils information is not available for the FMA Area, parent materials have been identified within P6 as part of an Ecosection mapping program (Geographic Dynamics Corp. 2000).

3. Natural Regions

In Alberta, a landscape classification system referred to as the Natural Region and Sub-regions is widely utilized for land management programs (e.g., parks and protected areas network, ecologically-based forest management tools, etc.). The system was originally developed in 1994 (AEP 1994) . A review to refine and update the classification was initiated in the fall 2000 to take advantage of GIS technology and an increased knowledge of the ecology of the province. The results of this review were made available, in draft form, to the public in 2004 and formally adopted in 2005. The following description is based on the 2005 Version[1] of the Natural Regions/Sub-regions (Figure 3-1).

Natural Regions contain similar landforms, hydrology, geology, soils, climate, plants and wildlife. They are further divided into Sub-regions, on the basis of similar landscape patterns. Six Natural Regions are recognized in Alberta. MDFP's FMA Area falls exclusively within the Boreal Forest Natural Region.

FMU P6 lies almost exclusively within the Lower Boreal Highlands Natural Sub-region. The Lower Boreal Highlands occurs throughout the central and western portions of the FMU and accounts for 91% of the FMU area. The only other Sub-region with significant representation is the Dry Mixedwood Sub-region. It accounts for approximately 27,500 ha. (9%) located along the eastern edge of the FMU. Approximately 120 ha along the western edge of P6 falls within the Upper Boreal Highlands Natural Sub-region.

P9 also lies predominantly within the Lower Boreal Highlands Natural Sub-region. Within P9 the Lower Boreal accounts for 72% of the area, occurring along the central and western portions of the FMU. The Central Mixedwood Sub-region occurs in the northeast of FMU P9. It accounts for the remaining 28% of the FMU (83,721 ha).

The following descriptions are taken from the Alberta Environment's Draft Natural Sub-region Summary Sheets (2004).

[1] The 1994 version of the Natural Sub-regions was utilized for components of the timber supply analysis. The 1994 version is provided in section 2.1.2 of **Landbase Netdown**.

3.1 Dry Mixedwood Sub-region

The Dry Mixedwood Sub-region is characterized by undulating plains and hummocky uplands. Its climate is warmer that other Mixedwood Sub-regions. It is drier than the Central Mixedwoods and moister than the Northern Mixedwoods. Mean annual temperature across the Sub-region is –1.0° C and mean annual precipitation is 459 mm. The average frost free period is 98 days and the average growing degree days (above 5° C) is 1299.

Parent material in the Sub-region is mainly glacial till, along with some lacustrine and fluvial materials. Associated soils are predominantly Orthic and Dark Gray Luvisols, along with some Brunisolic soils associated with sands. Wetlands consist of Mesisols and Gleysols.

Aspen forests with shrub understories (rose, beaked hazel, low bush cranberry) are common in the Sub-region. In the northern portion of the Dry Mixedwood Sub-region near Manning, buffaloberry becomes a prominent understorey shrub. White spruce is also common, often occurring in mixtures with aspen. Jack pine forests are common on sandy sites.

3.2 Central Mixedwood Sub-region

The Central Mixedwood Sub-region is represented by undulating plains with some hummocky uplands. Its climate is continental, with warm summers and cold winters. Mean annual temperature is 0.1° C and mean annual precipitation is 473 mm. The average frost free period is 97 days and the average growing degree days is 1237.

Parent materials in the Sub-region are a combination of glacial till, lacustrine and fluvial materials. Orthic Gray Luvisolic soils are predominant, with Brunisols occurring on sands. Wetlands are generally associated with Mesisols, although Fibrisols and Gleysols also occur.

Mixedwood forest cover is dominant in the Central Mixedwood Sub-region, with aspen predominant early on, succeeding to white spruce. Shrub understories with low bush cranberry, rose, green alder, beaked hazel and buffaloberry are common. Jack pine forests are common on sandy sites. Peatlands supporting black spruce and/or tamarack are fairly extensive.

3.3 Lower Boreal Highlands

The Lower Boreal Highlands Sub-region, which accounts for 81% of the FMA Area, is characterized by undulating and hummocky uplands with some undulating valleys. The Sub-region occurs along the lower slopes of the highlands of northern Alberta (e.g., Buffalo Head Hills, Birch Mountains, etc.). Mean annual temperature is –1.0° C and mean annual precipitation is 494 mm. The average frost free period is 96 days and the average growing degree days is 1098.

Parent material is predominantly glacial till. Soils are mainly Orthic Gray Luvisols, which are often gleyed. Wetlands are associated with Mesisols and occasionally Gleysols.

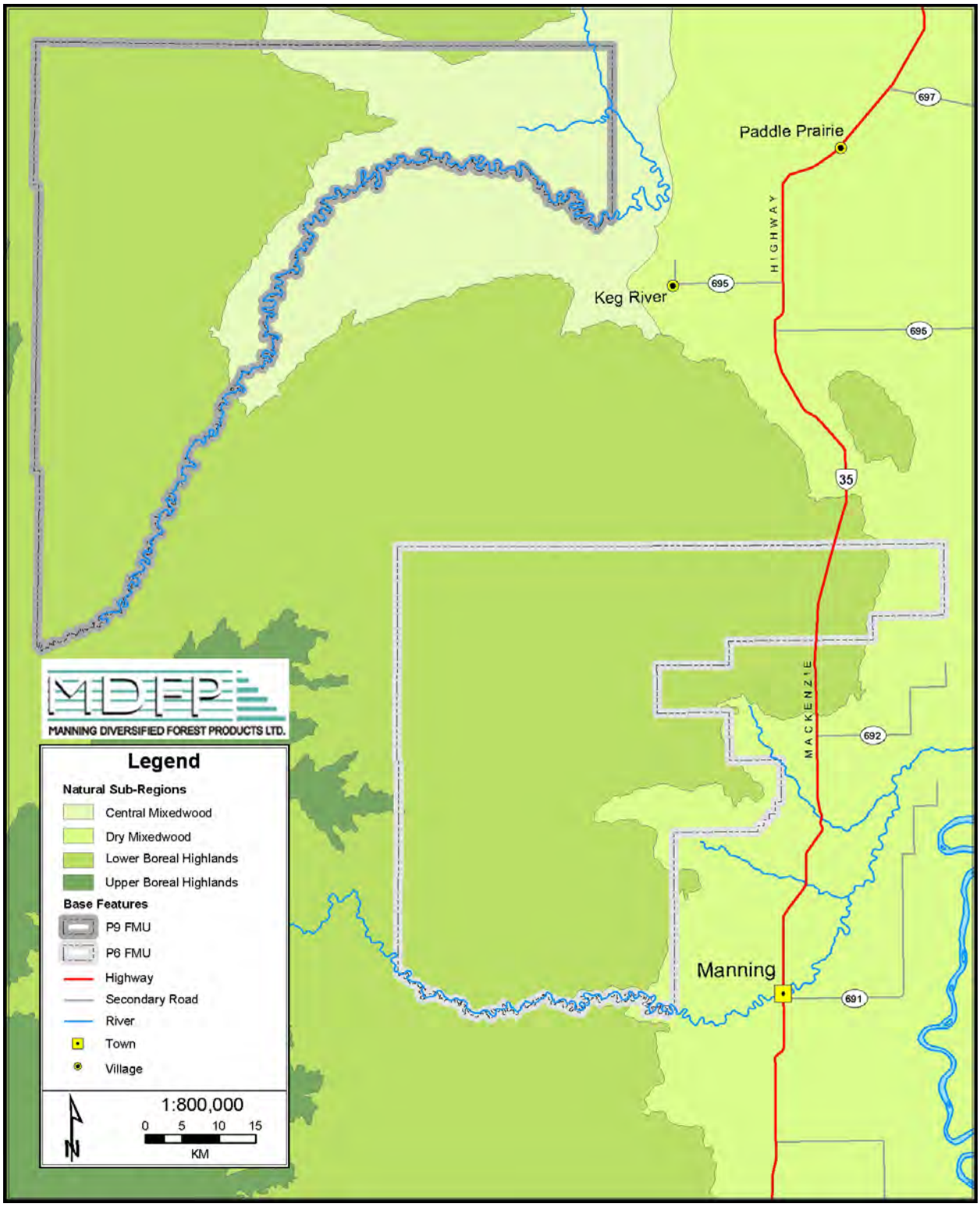

Figure 3-1. Natural Regions and Sub-regions within Manning Diversified's FMA Area (2005 version).

Mixedwood forest cover is dominant in the Lower Boreal Highlands, with combinations of aspen, poplar, white spruce, black spruce and paper birch. These often succeed to predominant white spruce (with a balsam fir component). Lodgepole-jack pine hybrids are associated with this Sub-region. Understory shrubs such as low-bush cranberry, rose and green alder occur on richer sites, with nutrient poorer sites supporting Labrador tea and *Vaccinium* species.

3.4 Upper Boreal Highlands

The Upper Boreal Highlands Sub-region occurs along the upper slopes and undulating plateau surfaces of the highlands of northern Alberta. Mean annual temperature is –1.5° C and the mean annual precipitation is 534 mm. The average frost free period is 96 days and the growing degree days is 990.

Parent material is predominantly glacial till. Soils are generally Orthic Gray Luvisols, along with Brunisolic Gray Luvisols. Both may be Gleyed. Mesisols and Organic Cryosols are associated with wetland areas, along with some Gleysols.

Conifer forest cover dominates the Upper Boreal Highland Sub-region. Lodgepole and lodgepole/jack pine hybrids form extensive stands, often mixed with black spruce. Understory shrubs include green alder and Labrador tea. White spruce stands are not common. Wetter sites are characterized by open-grown black spruce forest types.

4. Ecodistricts

In 1995 the Province of Alberta went beyond the Natural Region/Sub-region classification and developed an Ecodistrict classification for the province. The Ecodistrict classification (Figure 4-1) is nested within the Natural Region/Sub-region classification. Within each Region/Sub-region, Ecodistricts recognize areas with distinctive physiographic or geological patterns. It is important to note that the Ecodistricts are hierarchical within the 1994 version of the Natural Regions/Sub-regions, and references within this section refer to the 1994 Sub-regional classification (see section 2.1.2 in **Landbase Netdown**).

The following descriptions of the Ecodistricts within the FMA Area is based on Strong and Thompson's 1995 'Ecodistricts of Alberta: Summary of Biophysical Attributes'.

4.1 Notikewin Plain

The Notikewin Plain, within the FMA Area, was classified is a component of the Lower Foothills Natural Sub-region (1994 version).

The Notikewin Plain accounts for 72% of the land within P6 and 36% of the FMA Area. The Notikewin Plain is characterized by rolling to inclined morainal plains, with slopes ranging from 0 to 15%. Soils are characteristically well to imperfectly drained Gray Luvisols.

4.2 Clear Hills Upland

The Clear Hills Upland, within the FMA Area, was classified is a component of the Lower Foothills Natural Sub-region (1994 version).

The Clear Hills Upland is restricted to two lobes along the western edge of P6 and represents 25% of the FMU's area (12% of the FMA Area). The Clear Hill Upland is characterized by rolling morainal uplands, with slopes generally ranging from 0 to 15%. Soils are predominantly well to moderately well drained Gray Luvisols.

The Clear Hills were formed prior to the Pleistocene Epoch, between 1.8 and 65 million years before present. At the time, erosion-resistant alluvium originating from the Rocky Mountains was deposited along river channels. Over time, the river channels shifted course, leaving abandoned river channels and creating newer channel-related deposits. Subsequent river erosion has worn through adjacent softer sandstones and shales, leaving the older river channels as exposed highlands (Edwards and Scafe 1994). Elevations in the Clear Hill (and Naylor Hills) range from a minimum of 400 m above sea level (asl) to approximately 1050 m asl (Geographic Dynamics Corp., 2000).

4.3 Manning Plain

The Manning Plain, within the FMA Area, was classified is a component of the Dry Mixedwood Natural Sub-region (1994 version).

The distribution of the Manning Plain District within the FMA Area is restricted 3% of the area within P6 (2% of the FMA Area), all located along the eastern edge of FMU P6. The Manning Plain is characterized by rolling morainal and undulating lacustrine sediments, with slopes ranging from 0 to 9%. Soils are predominantly Gray Luvisols.

4.4 Chinchaga Plain

The Chinchaga Plain, within the FMA Area, was classified is a component of the Lower Foothills Natural Sub-region (1994 version).

The Chinchaga Plain accounts for approximately 61% of the area in FMU P9 or 31% of the FMA Area. It occurs along the western edge of the FMU, running its full length north to south. The Chinchaga Plain is characterized by undulating lacustrine and morainal plains with up to 60% organics. Slopes range from 0 to 5%. Soils drainage is extremely variable, ranging from moderate to imperfectly drained lacustrine and morainal deposits to poorly and very poorly drained organic sites. Soils are typically Gray Luvisols or organic.

4.5 Hay River Plain

The Hay River Plain, within the FMA Area, was classified is a component of the Wetland Mixedwood Natural Sub-region (1994 version).

The distribution of the Hay River Plain within the FMA Area is restricted to approximately 56,638 ha. along the eastern edge of FMU P9 (19 % of the FMU and 10% of the FMA Area). The Hay River Plain is characterized by a level lacustrine plain, with slopes ranging from 0 to 3%. Soils are typically moderately to poorly drained Gray Luvisols and Gleysols.

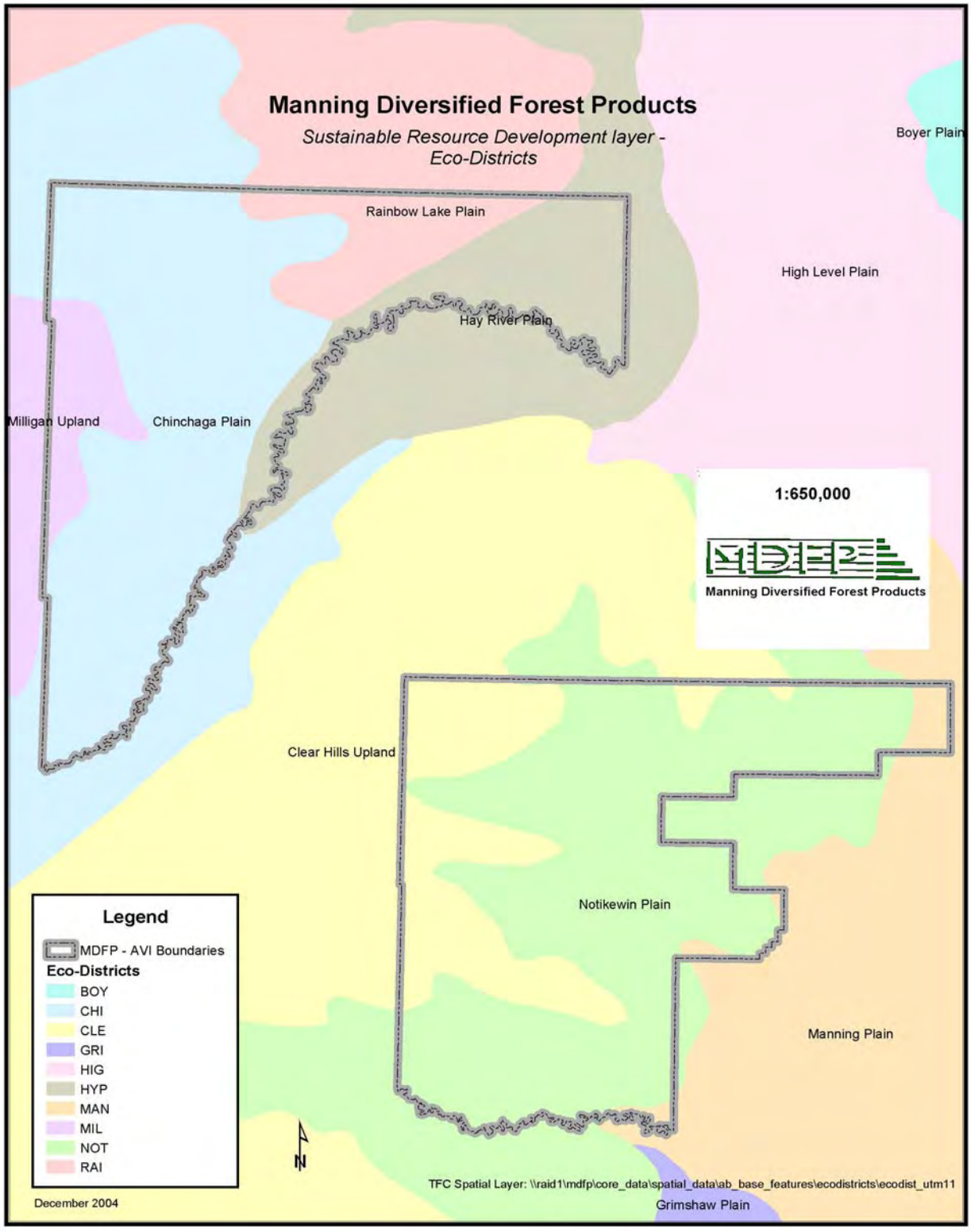

Figure 4-1. Ecodistrict classification (Ecodistricts were mapped on the basis of the 1994 Natural Region and Sub-region classification).

4.6 Rainbow Lake Plain

The Rainbow Lake Plain, within the FMA Area, was classified is a component of the Wetland Mixedwood Natural Sub-region (1994 version).

The Rainbow Lake Plain accounts for approximately 12% of the area in FMU P9 and 6% of the area within the FMA. It is located along the northern boundary of FMU P9. The Rainbow Lake Plain is characterized by undulating morainal plains with up to 30% organics. Slopes range from 0 to 5%. Soils drainage is variable, ranging from moderate to imperfectly drained morainal deposits to poorly drained organic sites. Soils are typically Gray Luvisols or organic.

4.7 Milligan Upland

The Milligan Upland, within the FMA Area, was classified is a component of the Lower Foothills Natural Sub-region (1994 version).

The Milligan Upland is restricted in distribution to the extreme western edge of FMU P9. It accounts for approximately 8% of the area within FMU P9 and 4% of the area within the FMA. The Milligan Upland is characterized by rolling morainal uplands with up to 20% organic terrain. Slopes in the uplands are generally 6 to 15%. The soils are predominantly moderately drained Gray Luvisols. Organic sites are relatively flat (0 to 3% slopes) with poor to very poor drainage.

5. Watersheds

5.1 Primary Watersheds

Manning Diversified's FMA Area is composed of two disjunct Forest Management Units, P6 and P9. FMU P6, the southernmost of the two Units, lies almost exclusively within the Notikewin River watershed (Figure 5-1). The Notikewin River watershed is considered part of the Peace/Slave River Basin. The land within P9 is almost exclusively part of the Chinchaga watershed which drains into the Hay River Basin.

The Notikewin River forms the southern boundary of FMU P6. Major tributaries of the Notikewin River which pass through the FMU include the Botha, Hotchkiss and Meikle Rivers. The Notikewin and its tributaries generally flow eastward through the FMU before draining into the Peace River.

The Notikewin River provides the town of Manning with its water supply. Monthly flow of the Notikewin River at Manning averages 14 $m^{-3}s^{-1}$ with peak flows associated with snowmelt which typically occurs in May (Scrimgeour et al., 2003). Mean monthly discharge for May reaches 149 $m^{-3}s^{-1}$ Lowest flows are recorded in February. Data from 1961 to 1999 indicates mean monthly flow is highly variable within months (coefficient of variation based on monthly means is 104%).

In P9, the Chinchaga River forms the southern boundary of the FMU. Major tributaries of the Chinchaga River which pass through the FMU include the Thordarson Creek, Waniandy Creek and Haig River. These tributaries generally flow southeastward through the FMU before draining into the Chinchaga River. The Chinchaga flows towards the northeast, eventually draining into the Hay River.

5.2 Major Watersheds

Each of the two primary watersheds within the FMA Area is divided into smaller watersheds by Laing (2004). Identification and delineation of these major watersheds is important for facilitating watershed management within the FMA Area. Laing identified 22 major watershed that fall within the boundaries

of the Area (Figure 5-2). These watersheds or portions thereof ranged in size from 16 to 173 km^2 in size. Details regarding the methodology used to delineate the major watersheds are provided in Appendix I.

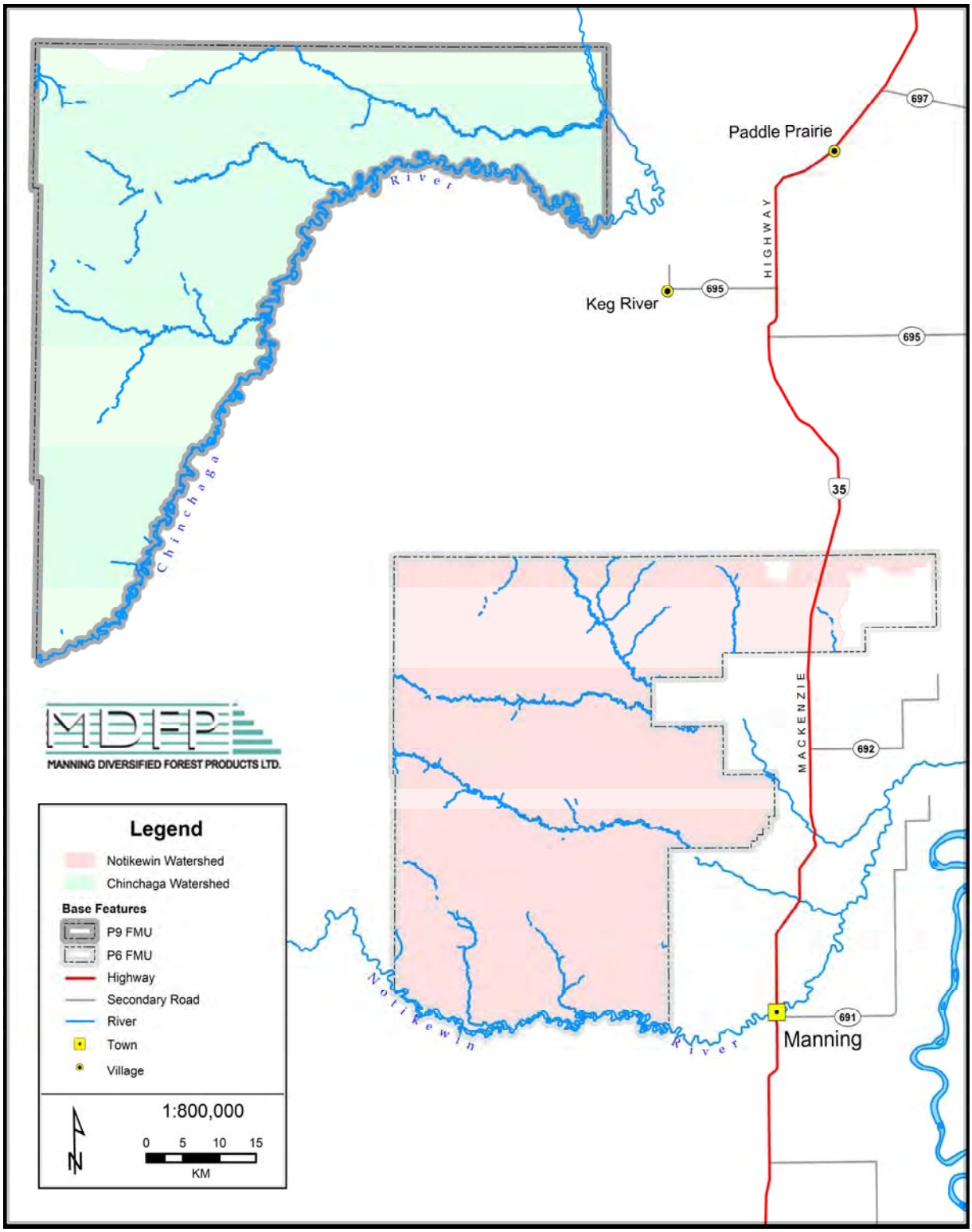

Figure 5-1. Notikewin and Chinchaga watersheds.

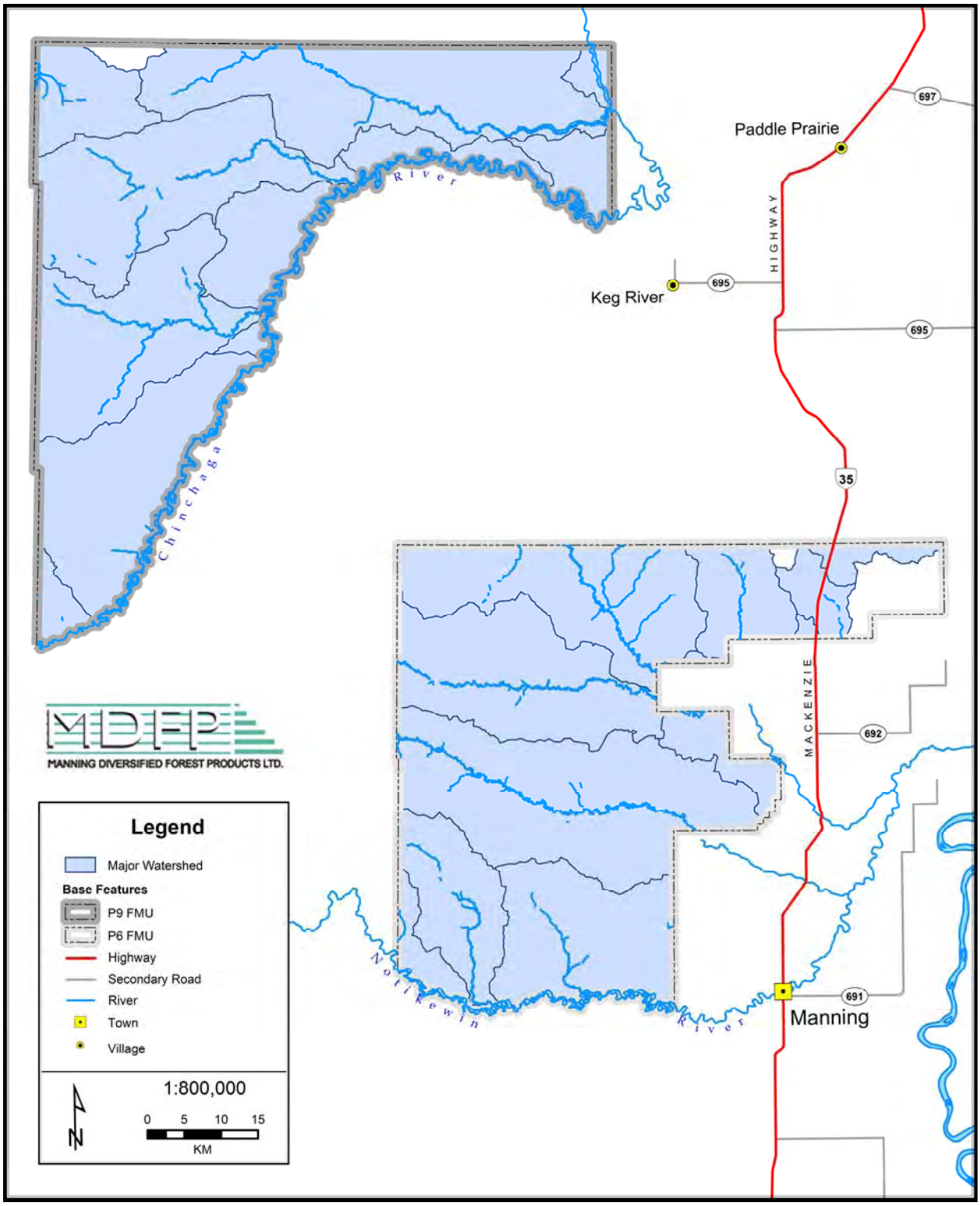

Figure 5-2. Major watersheds (from Laing 2004).

6. Climate

Approximately 81% of the FMA Area lies within the Lower Boreal Highlands Sub-region. The climate of this Sub-region is influenced by its proximity to the Rocky Mountain which lie to the west. Summer temperatures are typically cooler than in the adjacent Mixedwood Natural Regions, which are at a lower elevation. According the SRD, the mean annual temperature within this Sub-region is –1.0°C and mean annual precipitation is 494 mm. The average frost free period is 96 days and the average growing degree days is 1098 (Alberta Environment's Draft Natural Sub-region Summary Sheets, 2004).

The remaining 19%of the FMA Area is classified as Central and Dry Mixedwood Sub-region. The climate of these Sub-regions is slightly warmer than the adjacent Lower Boreal Highlands Sub-region. The mean annual temperature within this Sub-region are between 0.1°C and -1.0°C while mean annual precipitation is between 459 and 473 mm. The average frost free period is 98 days and the average growing degree days is 1237 to 1299 (Alberta Environment's Draft Natural Sub-region Summary Sheets).

To better characterize the climate within Manning Diversified's FMA Area, nine Environment Canada climate stations were identified within the vicinity of the FMA Area. The names and locations of these weather stations are identified in Table 6-1 and Figure 6-1 along with the information that was available for each.

The following detailed climate information was compiled using Environment Canada Climate Normals, available directly from Environment Canada. Descriptions of the data elements summarized were also provided by Environment Canada (http://www.climate.weatheroffice.ec.gc.ca/climateData/canada_e.html).

6.1 Climate Normals

The climate data used represents climate 'normals', a term commonly used to describe climate data elements that have been averaged over a fixed, standard period of years. The period currently in use is from 1961 to 1990. However, for some stations climate normals are not available for the 1961-1990 period. In these cases, any currently available data was used (data collection periods are identified in Table 6-1 for each weather station).

6.2 Climate Elements

Environment Canada compiles and reports on a large number of climate elements, of which only a small subset was selected. All elements are reported on a monthly basis.

The daily mean temperature is derived on a daily basis from the average of the daily minimum and daily maximum temperatures. Daily minimums and maximums are recorded over 24 hour periods which begin and end in the morning. These values are then averaged for the entire month, over the reporting period (generally 30 years, from 1961 to 1990).

Growing Degree Days (5° C) represent the number of Celsius degrees that the mean temperature is above 5° C. These values are accumulated over each month and then averaged over the reporting period.

Table 6-1. Names and locations of Environment Canada's weather stations in the vicinity of Manning Diversified's FMA Area.

Weather Station (data collection years)	Location		Elevation (m)	Data
Battle River Lookout Tower (1955-1993)	57°°-29	117-39	732	Precipitation, temperature and degree days; Summer only
Berwyn (1975-1993)	56°-9	117°-41	626	Precipitation and temperature; No degree days; Year round
Hawk Hills Lookout Tower (1962-1993)	57°-39	117°-25	610	Precipitation, temperature and degree days; Summer only
Keg River Ranger Station (1965-1993)	57°-45	117-37	405	Precipitation, temperature; Some degree days; Summer only
Manning (1985-1993)	56°-57	117-39	491	Precipitation and temperature; No degree days; Year round
Nina Lake (1980-1993)	57°-19	117-12	453	Precipitation data; No temperature/degree days; Year round
Notikewin East (1962 – 1993)	57°-1	117-34	465	Precipitation and temperature; No degree days; Year round
Notikewin Lookout Tower (1957-1993)	56°-52	118-35	762	Precipitation, temperature and degree days; Summer only
Peace River Airport (1944-1990)	56°-14	117-26	571	Precipitation, temperature and degree days; Year round

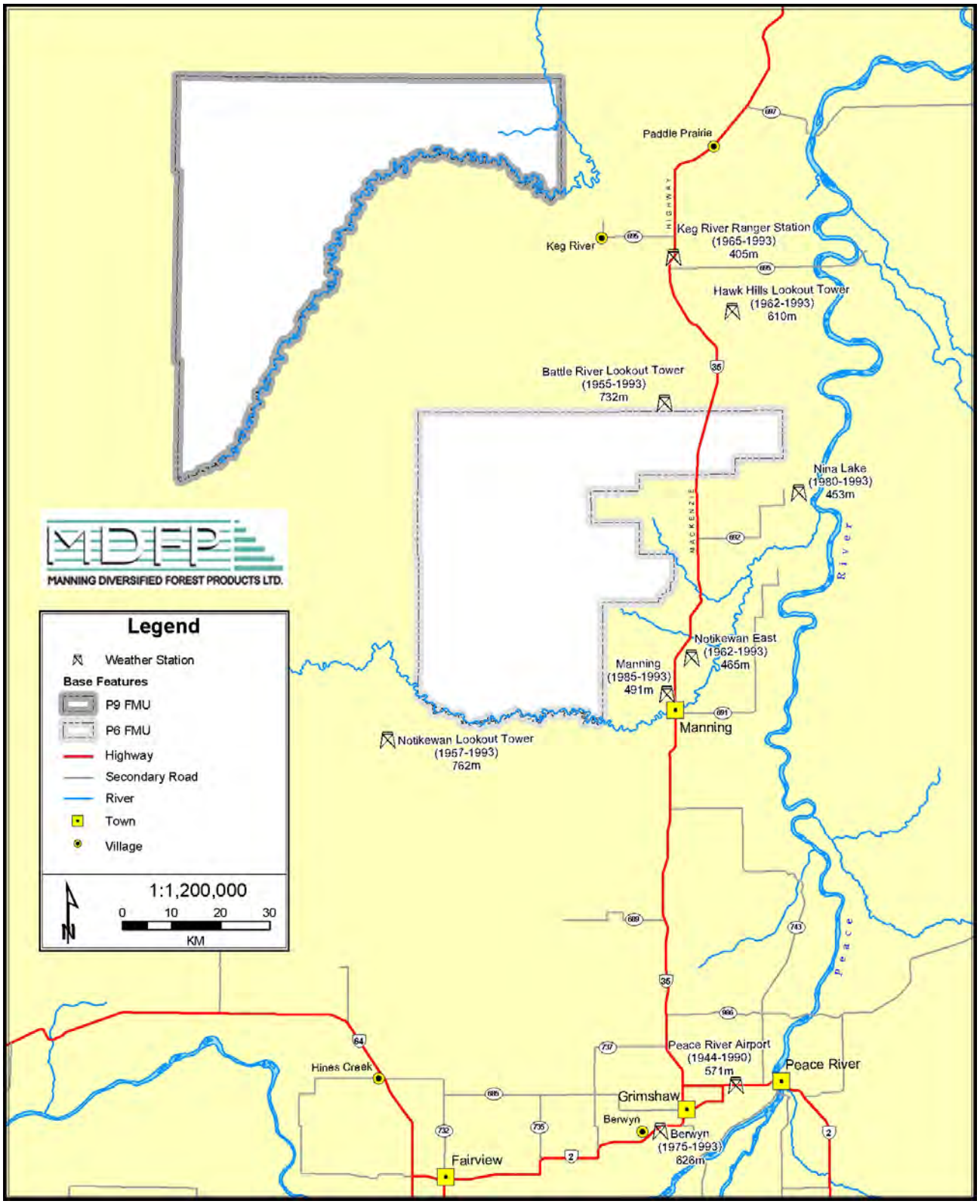

Figure 6-1. Locations of Environment Canada's weather stations in the vicinity of Manning Diversified's FMA Area.

Rainfall, Snowfall and Precipitation are also accumulated over each month and then averaged over the reporting period. Precipitation is measured using a rain gauge. Snowfall is measured at several points in the immediate vicinity of the station using a snow ruler. Precipitation represents the rainfall and the water equivalent of the snowfall. The water equivalent of snowfall is generally computed by dividing the snowfall depth by 10 (in some stations it can be measured more directly by sampling/melting the snowfall). Environment Canada warns climate data users that Precipitation figures reported are not always equal to the sum of the Rainfall plus one tenth of the Snowfall because of missing observations and other data problems.

6.3 Climate Within the FMA Area

6.3.1 Temperature

The average daily mean, minimum and maximum temperature, by month, for all weather stations sampled is shown in Figure 6-2, along with the range of daily means. Daily minimum temperatures showed the same trends as Mean Temperatures, with July being the warmest month (9.4° C) and January the coldest (-22.6° C). Daily minimum temperatures for May to September averaged above freezing. Daily mean temperatures were highest for July (15.5° C) and lowest in January (-16.8° C). April to October had average daily means above freezing, while the remaining five months average below freezing. Daily maximum temperatures showed the same trends as mean temperature in terms of warmest and coldest months and months averaging above freezing. July's daily maximum temperature was 21.6° C while January's was –11.1° C. Although five months averaged below freezing, March's daily maximum average was only slightly below freezing, at -0.7° C.

6.3.2 Precipitation

Based on the climate station data used, the average annual precipitation in the vicinity of Manning's FMA Area is 426.5 mm (Figure 6-3). Approximately 70% of the precipitation falls as rain (297.8 mm), with the remaining falling as snow. Precipitation from November to March is almost exclusively through snowfall. Snowfalls in June and August are rare, and no snowfall was recorded at any of the weather stations in July.

Precipitation is highest in the summer months of June, July and August. Almost 70% of the rainfall occurs within these 3 months. Highest monthly rates occur in July, corresponding to the warmest temperatures.

6.3.3 Growing Degree Days

Growing Degree Days (above 5° C) were only available for a limited number of weather stations, especially for non-summer months (September to April). Figure 6-4 shows the distribution of Degree Days through the year. One quarter of the Degree Days are accumulated in July, with an additional 44% accumulated in June and August. Total Degree Days averaged 1206, although this number should be considered a rough guide, since only the Peace River Airport station reported Degree Days between September and April.

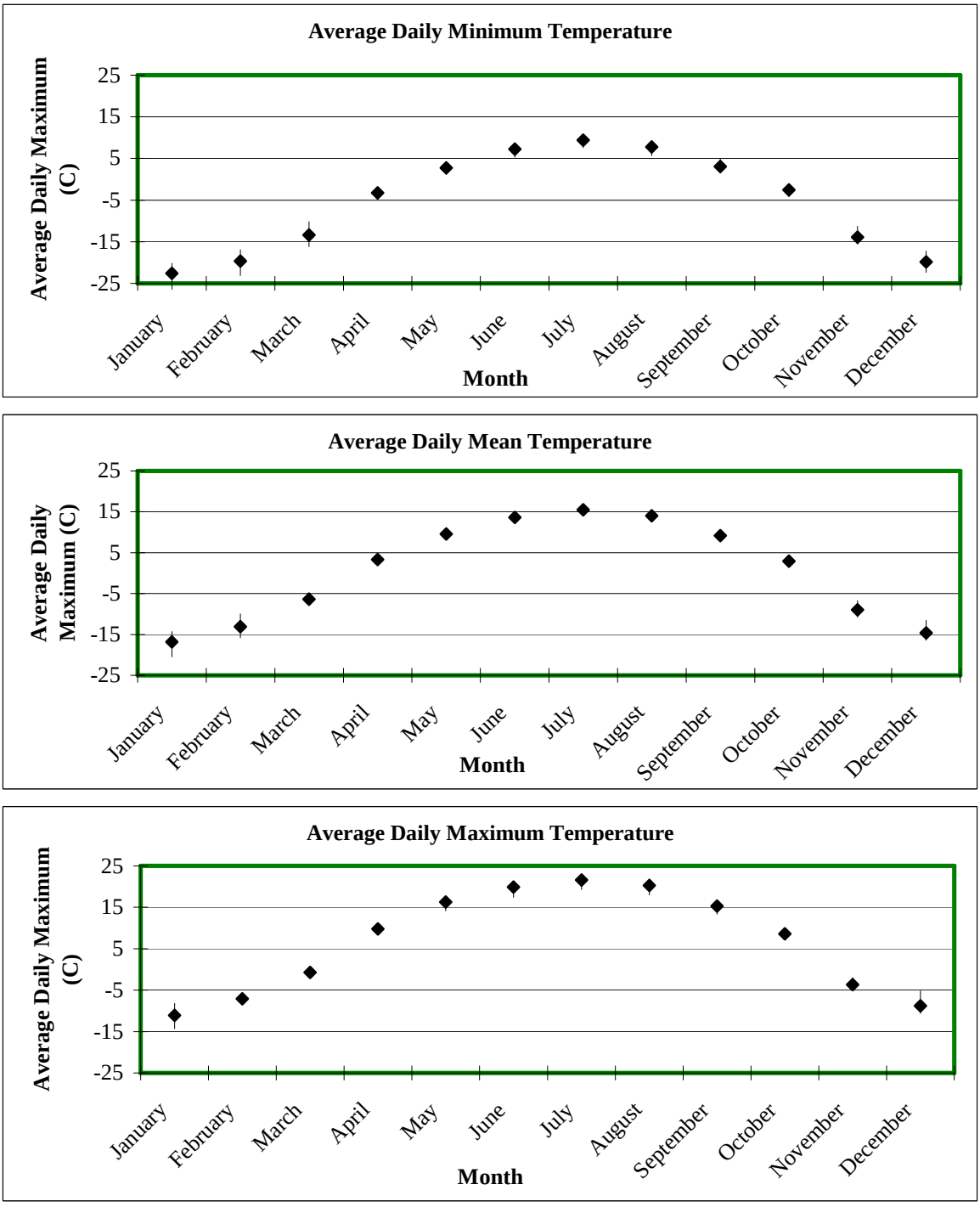

Figure 6-2. Daily minimum, mean and maximum temperatures (along with monthly range of minimum, mean and maximum temperatures) for select weather stations in the vicinity of FMA Area (based on between 4 and 8 weather stations, depending on month).

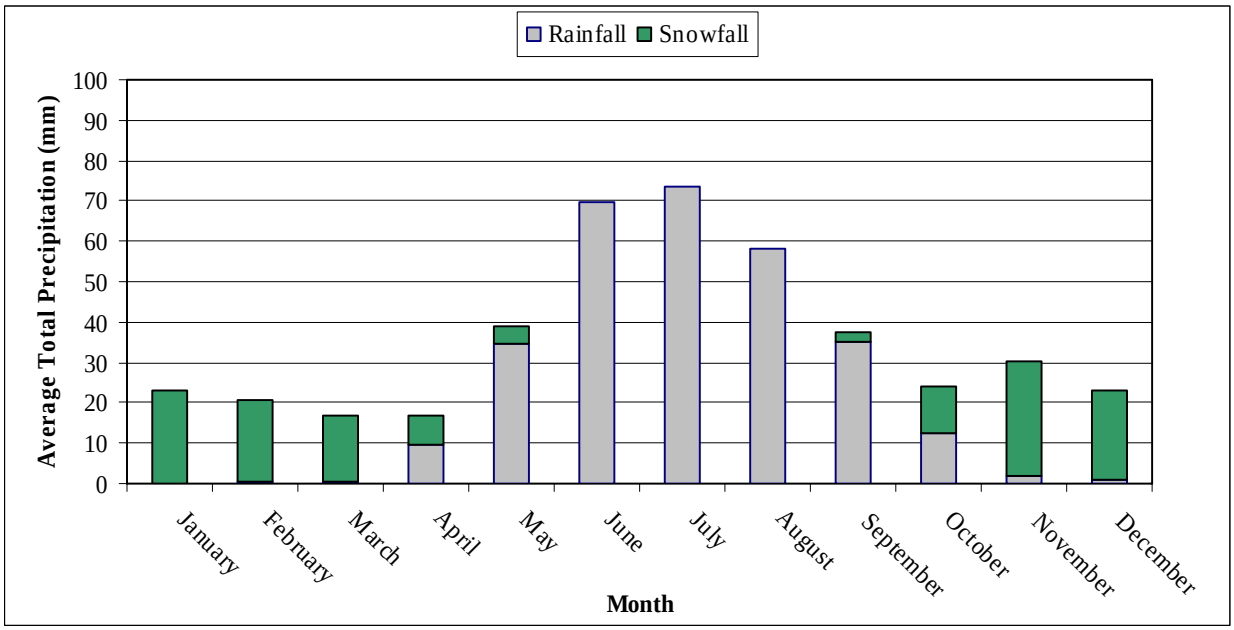

Figure 6-3. Average total precipitation, snowfall and rainfall, for select weather stations in the vicinity of FMA Area (based on between 4 and 8 weather stations, depending on month).

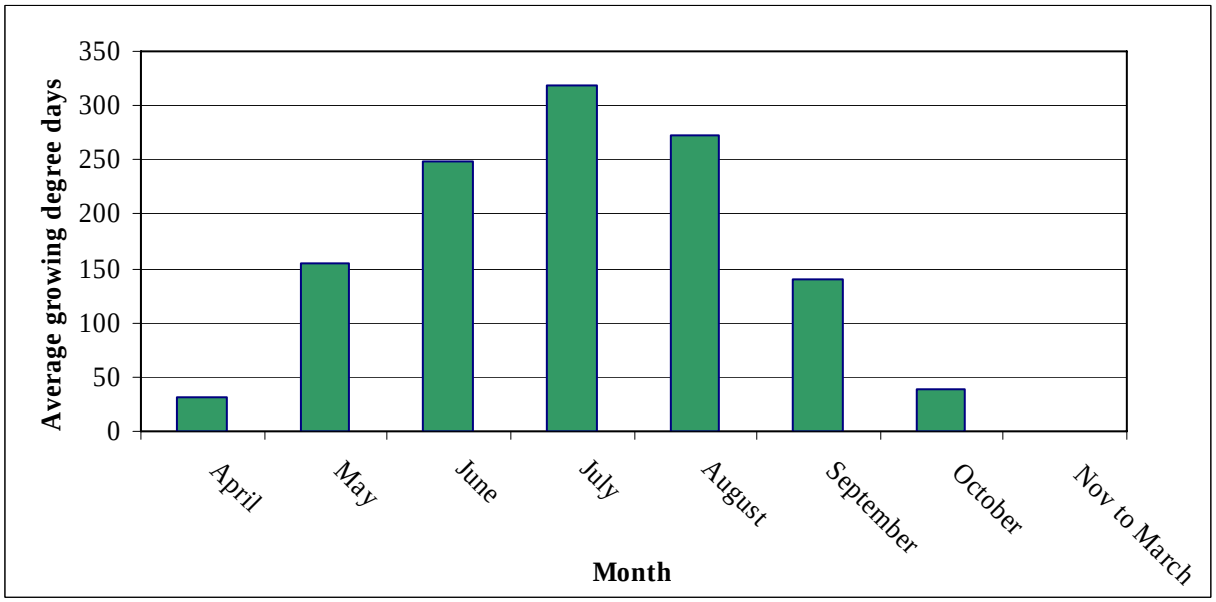

Figure 6-4. Growing degree days above 5° C for select weather stations in the vicinity of the FMA Area (only one weather station reporting from September to April).

7. Role of Fire

Wildfire plays a key role in the natural disturbance regime of boreal and cordilleran forest ecosystems. The forests of northwestern Alberta have developed in conjunction with and as a result of, this fire regime. The forests that exist in northern Alberta today, to a large extent, reflect the fire history of the region. Fire has traditionally been the mechanism by which forests have been created and subsequently destroyed. Some areas and vegetation types burn frequently, while others may survive long periods between fire events.

Prior to settlement of northwestern Alberta by humans (including Aboriginal populations), fires were lightning caused. With the arrival of Aboriginal groups and Europeans to the region, the cause, location and frequency of fire ignitions altered. Settlers increased the frequency of fires in the vicinity of settlements and initiated localized wildfire suppression efforts. With increased settlement and industrial forestry operations, the Province placed increasing emphasis on control of wildfire. As early as the 1880's, the Province first initiated attempts to control spread of wildfires and by the 1950's considerable efforts were being directed towards fire prevention and suppression programs. Today this program has expanded to incorporate changing attitudes towards wildfire by incorporating computer-based fire-risk modeling, controlled burning for risk reduction and fuel modification in high fire-risk areas (Alberta Sustainable Resource Development 2001).

Because wildfire varies spatially and temporally and can impact large areas, a regional overview of fire history was considered important to the understanding of the FMA Area. Additional information specific to Manning's FMA Area is provided in section 3 in Forest Landscape Metrics. The following discussion of fire regimes is based, to a large extent, on Chapter 5 of 'A physical, biological and land use synopsis of the boreal forest's Natural Regions of northwestern Alberta' (Stelfox and Wynnes 1999). The data source for the statistics presented by Stelfox and Wynnes is Alberta Sustainable Resource Development's (ASRD) Fire Database.

7.1 Basic Statistics

Within the northwest region identified by DMI (114-120 W longitude, 56-60° N latitude; see Figure 7-1), summary statistics presented by DMI (based ASRD Fire Database for northwestern Alberta for the period

from 1961 to 1995) indicate 6,676 fire starts within northwestern Alberta during the 35 year data period (Table 7-1). The region covers approximately 15,223,007 hectares, which means on average, over a 35 year period, one fire starts every 2,280 hectares or, annually, one fire starts every 79,809 hectares. These fires were responsible for burning 1,656,729 hectares, averaging 248.2 hectares per fire. The median fire size was 0.4 hectares, indicating there are numerous small fires. The largest fire, in the area, accounted for 223,991.3 hectares of burn.

Table 7-1. Summary statistics for fires in northwest Alberta (1961–1995) (from Stelfox and Wynnes 1999; data source: ASRD Fire Database).

Total Number Fires Recorded	6,676
Total Area Burned	1,656,729 ha
Minimum Fire Size	0.1 ha
Maximum Fire Size	223,991.3 ha
Mean Fire Size	248.2 ha
Median Fire Size	0.4 ha

7.2 Fire Origins and Causes

Wildfires are typically classified into two primary groups – lightning caused (natural origin) and human caused (referred to as incendiary). Incendiary fires are related to settlements, recreation activities, railroads, etc.

Within northwestern Alberta, lightning is the most frequent cause of fire. Man-made fires are less frequent and are primarily the result of activities of residents. Lightning caused fires occur throughout the region (Figure 7-1) while man-made starts tend to cluster in the vicinity of settlements, transportation corridors and recreational sites (Figure 7-2, Figure 7-3 and Figure 7-4).

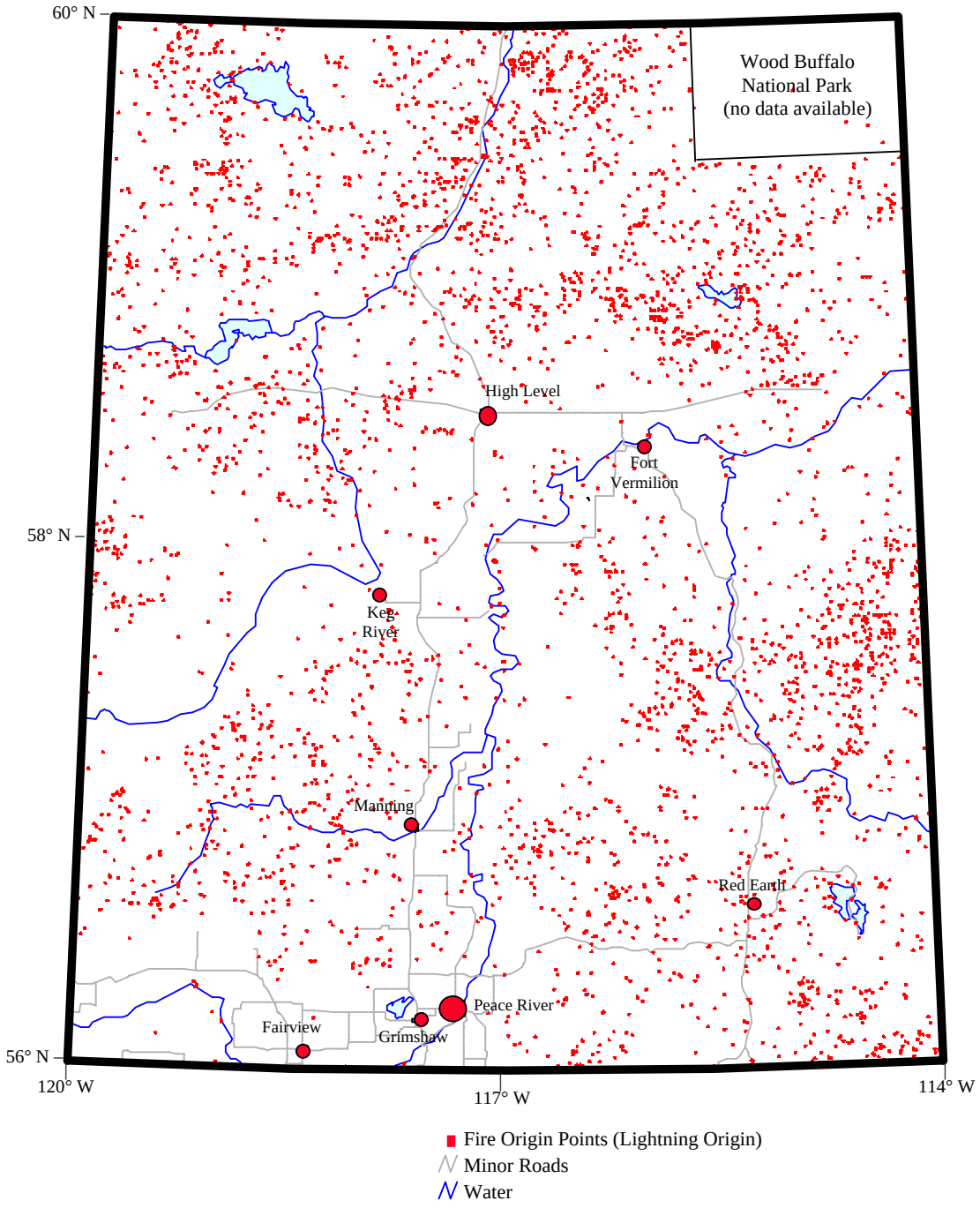

Figure 7-1. Location of fire origins (1961–1995) caused by lightning (from Stelfox and Wynnes 1999; data source: ASRD Fire Database).

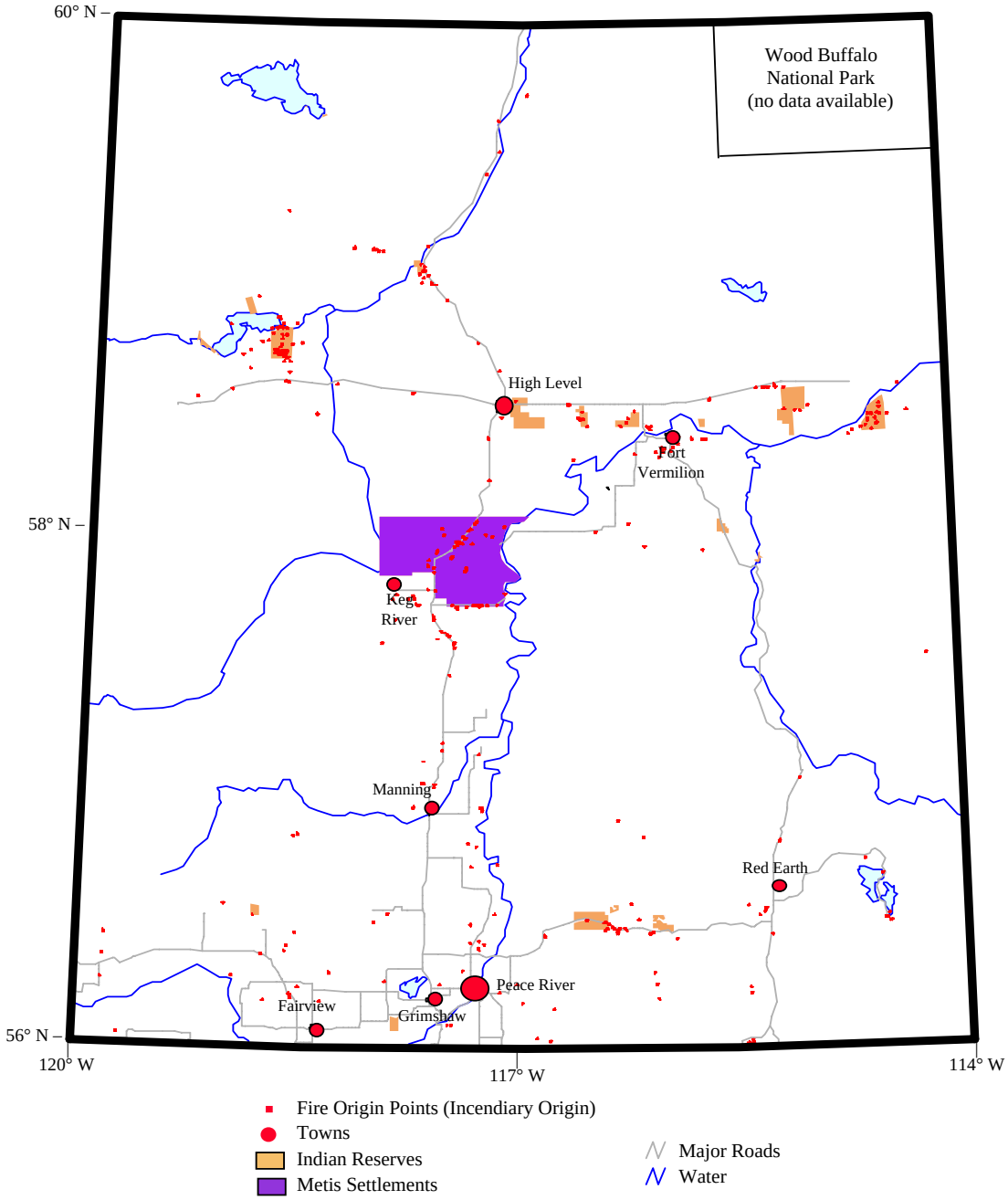

Figure 7-2. Location of fire origins (1961–1995) caused by incendiary activities (from Stelfox and Wynnes 1999; data source: ASRD Fire Database).

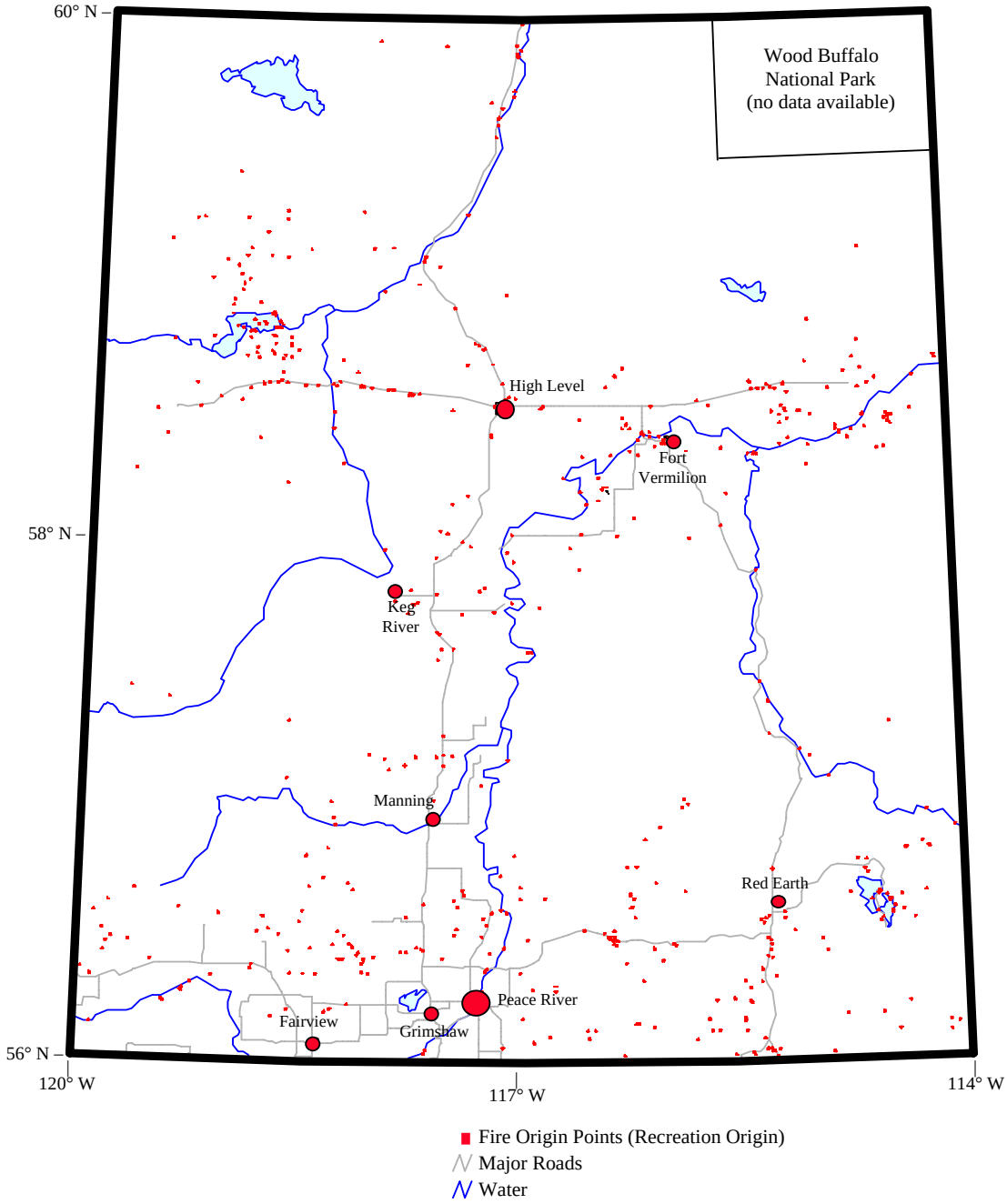

Figure 7-3. Location of fire origins (1961–1995) caused by recreational activities (from Stelfox and Wynnes 1999; data source: ASRD Fire Database).

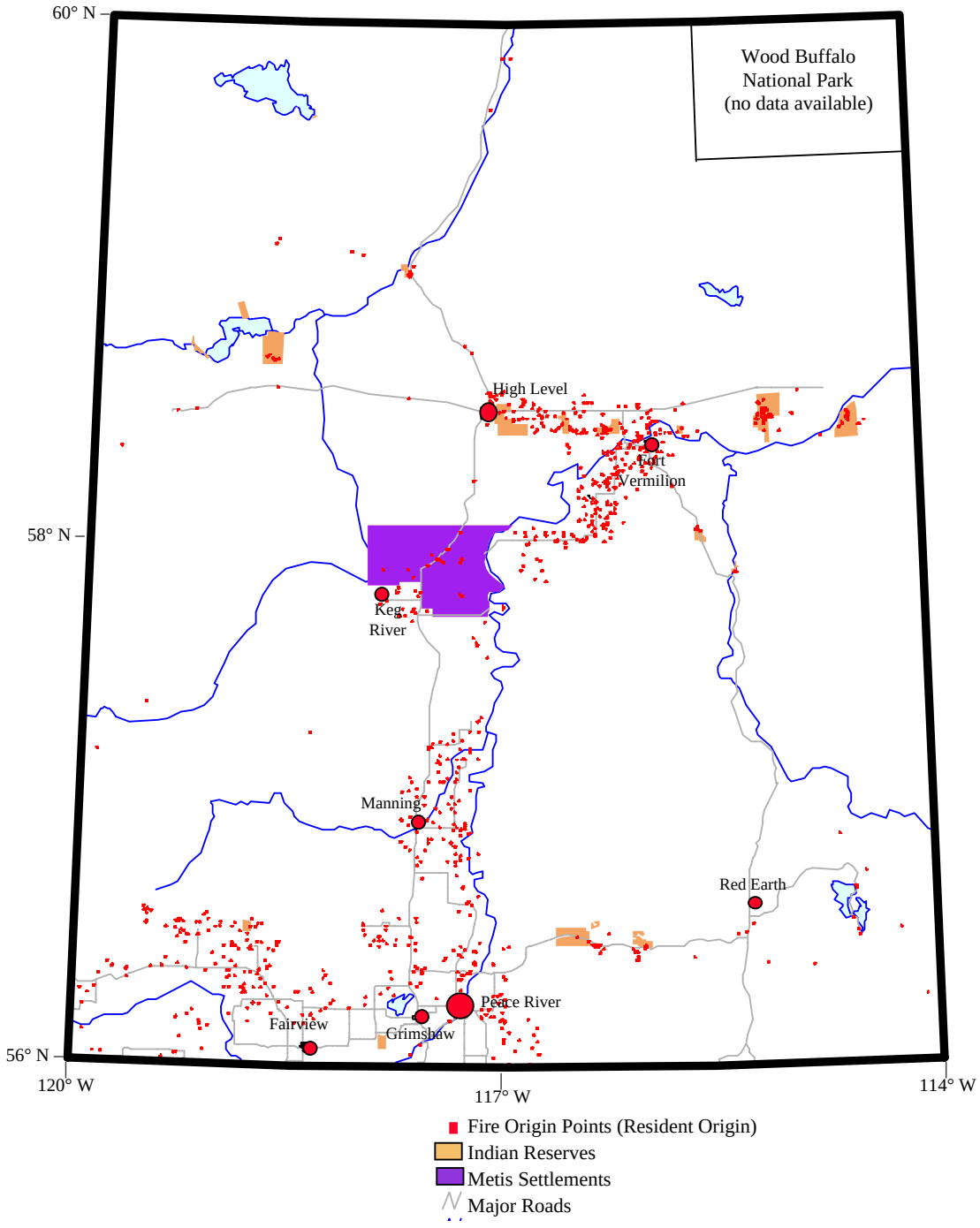

Figure 7-4. Location of fire origins (1961–1995) caused by residents (from Stelfox and Wynnes 1999; data source: ASRD Fire Database).

7.3 Fire Size

The majority of the fires identified within the Province's Fire Database (from 1961 to 1995) are relatively small (Table 7-2). Approximately 88% of all wildfires are 10 hectares or smaller. However, the remaining 12% of fire starts are responsible for virtually all of the area burnt. Fires greater than 1,000 hectares account for only 1% of all fire starts yet account for 95% of the area burnt.

Table 7-2. Proportion of fire count and area burned for each fire size class. (from Stelfox and Wynnes 1999 (revised); data source: ASRD Fire Database).

Fire Size Class (ha)	Number of Fires	Percent of Fires	Area Burned (ha)	Percent Area Burned
Less than 0.1 ha	2,632	40%	93	0%
0.1 to 1.0 ha	1,780	27%	943	0%
1 to 10 ha	1,446	21%	4,833	0%
10 to 100 ha	575	90%	18,668	1%
100 to 1,000 ha	158	20%	51,257	3%
1,000 to 10,000 ha	57	10%	234,875	14%
Greater than 10,000 ha	28	0%	1,346,061	81%
Total			1,656,731.30	

The location and extent of Class E fires (> 200 ha) which occurred within northwestern Alberta since the 1930s is presented in Figure 7-5. It should be noted that ASRD staff indicate that the spatial fire records for the 1930 and 1940 fires is likely incomplete. The distribution of these fires is patchy, with large areas left relatively unscathed. Even within fire incidents, undisturbed patches are common.

7.4 Fire Season

Wildfire can, and does, occur year-round. However, wildfire ignition and its subsequent spread is closely related to a combination of weather and fuel conditions. It is not surprising that data summaries compiled by DMI indicate fire incidence and extent peak in mid-summer, when temperatures are at their highest (Table 7-3 and Figure 7-6 and Figure 7-7). Total number of fire starts are relatively high from May to August, reaching a peak in July with 568 starts (August is not far behind, averaging 532 fire starts). July fires tend to be the most devastating. With an average fire size of 97.8 hectares, July fires account for almost 74% of the area burned.

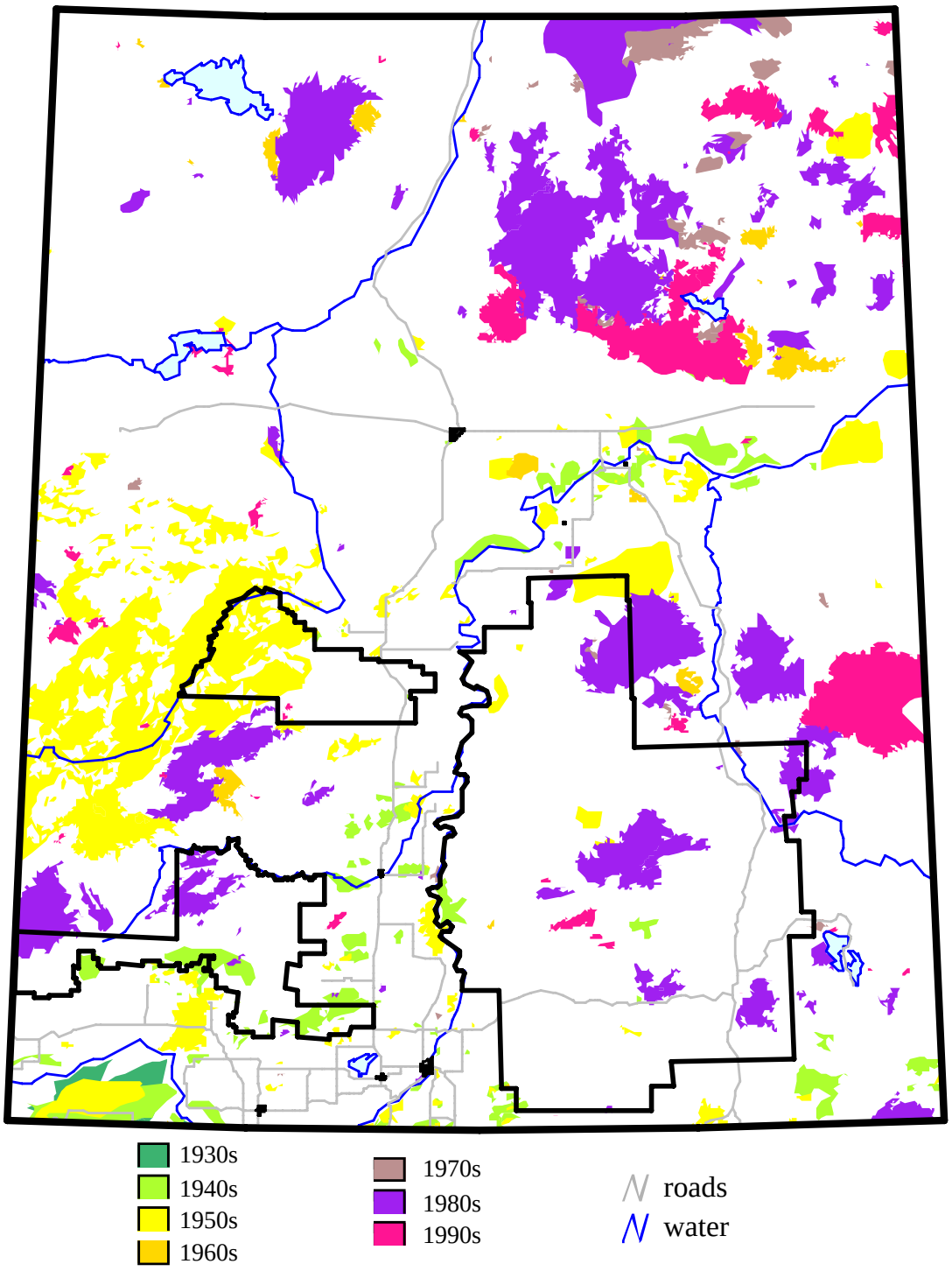

Figure 7-5. Location and extent of wildfires larger than 200 ha. within northwest Alberta since 1930 (from Stelfox and Wynnes 1999; data source: ASRD Fire Database).

Table 7-3. Average monthly fire size (ha) (1983–1992) (from Stelfox and Wynnes 1999; data source: ASRD Fire Database).

Month	Fire Count	Area Burned (ha)	Mean Fire Size (ha)	Standard Deviation
January	6	52.3	8.7	20.2
February	7	1.1	0.2	0.2
March	11	6.7	0.6	0.8
April	108	3,841.20	35.6	158.1
May	350	5,116.20	14.6	81.1
June	432	6,486.80	15	184.8
July	568	55,569.10	97.8	1,170.70
August	532	2,337.40	4.4	40.7
September	107	1,770.20	16.5	90.1
October	77	137.9	1.8	5.6
November	10	1.1	0.1	0
December	7	4.9	0.7	1.5
Total	2,215	75,324.90	34	601.8

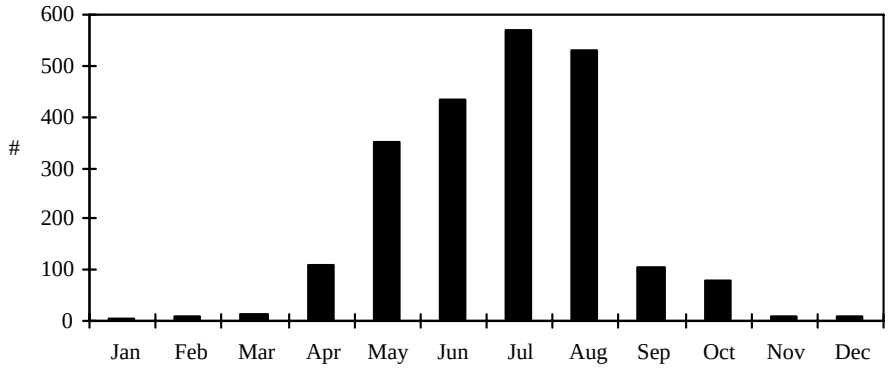

Figure 7-6. Frequency of fire during each month (1983–1992) (from Stelfox and Wynnes 1999; data source: ASRD Fire Database).

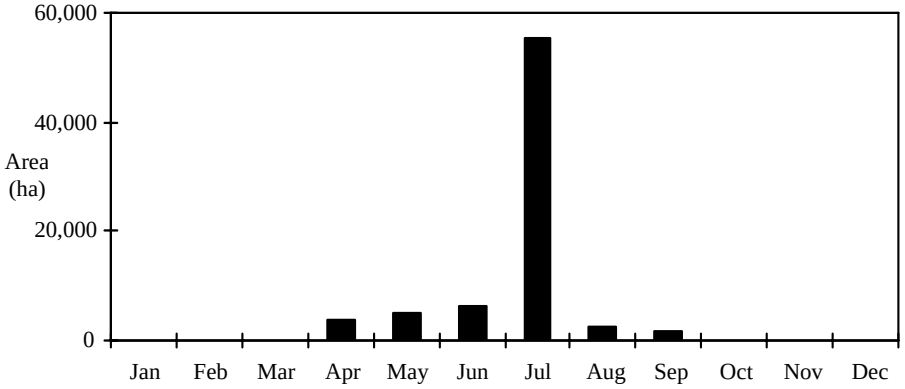

Figure 7-7. Area burned by fire during each month (1983–1992) (from Stelfox and Wynnes 1999; data source: ASRD Fire Database).

7.5 Annual Variation in Fire Severity

The potential for wildfire ignition and its subsequent spread is related to a combination of weather, fuel and ignition potential. Presence of human ignition sources impacts fire ignition potential, while intensity of fire suppression impacts fire spread and extent. Over the short term, fuel and human influences remain relatively consistent. The primary contributor to short-term variance in fire frequency and spread should therefore be weather-related influences (lightning strikes, fuel moisture, wind speed, etc.).

Figure 7-8 summarizes the frequency of fires on an annual basis in northwestern Alberta for a 35 year period. Number of fires starts per year ranged from a low of 36 in 1962 to a high of 431 in 1980. Dramatic as this variation is, the range in annual area burnt is much greater (Figure 7-9). In 1962 only 207 hectares were consumed by fire. In 1981 and 1982, 401,017 and 577,302 hectares were lost to fire respectively.

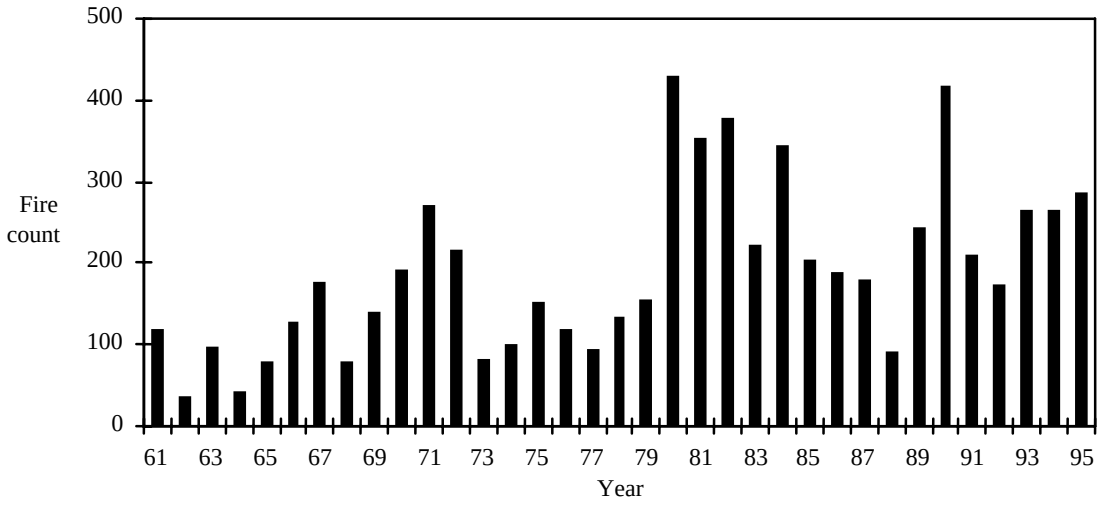

Figure 7-8. Number of fires in northwest Alberta (1961–1995) (from Stelfox and Wynnes 1999; data source: ASRD Fire Database).

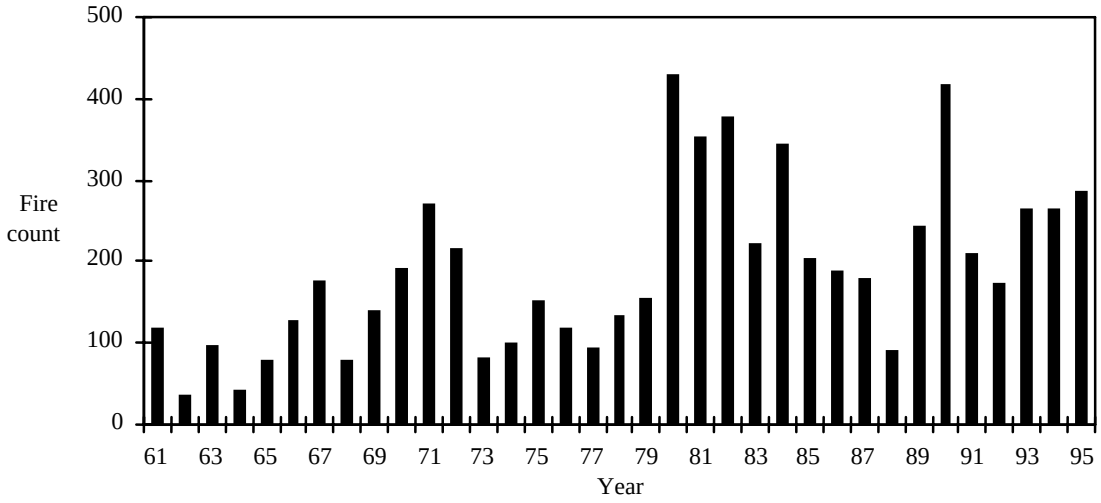

Figure 7-9. Area burned by fires in northwest Alberta (1961–1995) (from Stelfox and Wynnes 1999; data source: ASRD Fire Database).

7.6 Influence of Vegetation on Fire Severity

Wildfire ignition and spread is strongly influenced by availability of fuel. Although wildfires will consume standing timber, they also rely on the duff, downed woody debris and understorey vegetation (shrubs, grass, etc.) for additional fuel sources. These varied fuel sources will display different characteristics in terms of moisture content (and fuel availability) at different times.

Although forest cover does not describe the full variation in wildfire fuel characteristics, broad vegetation types can provide a useful summary of some of the main differences. DMI utilized a subset of the ASRD Fire Database (1983 to 1992) that contained forest cover information to examine the relationship between fire incidence and forest cover. Fuel type was recorded for the fire origin point and may not reflect the fuel composition of the entire fire area. Figure 7-10 and Figure 7-11 summarize the frequency of fire starts and total area burnt, by broad forest cover class.

Fire starts peaked in May in grass and deciduous cover types. Fire incidence was highest in pine stands in June, while white spruce and mixedwood stands and muskegs had highest frequencies in July. Fire starts in black spruce stands climbed throughout the summer, peaking in August.

The largest fires in white spruce and deciduous stands occurred during May. In mixedwood, black spruce and muskeg types, fire size peaked in July while loss due to fire in pine types was highest in June, the same month that showed the highest fire incidence.

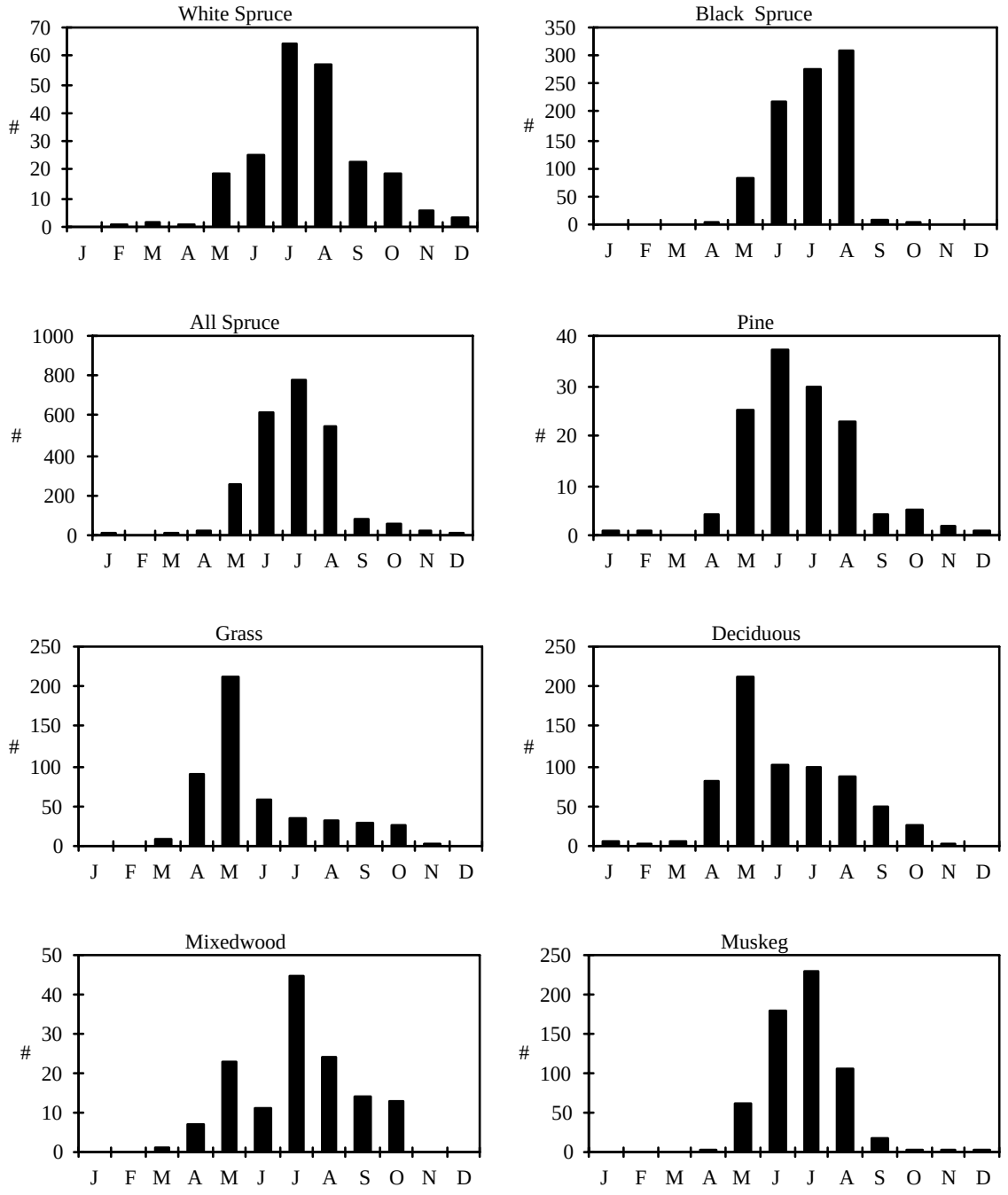

Figure 7-10. Fire frequency of different fuel types for each month (1983–1992) (from Stelfox and Wynnes 1999; data source: ASRD Fire Database).

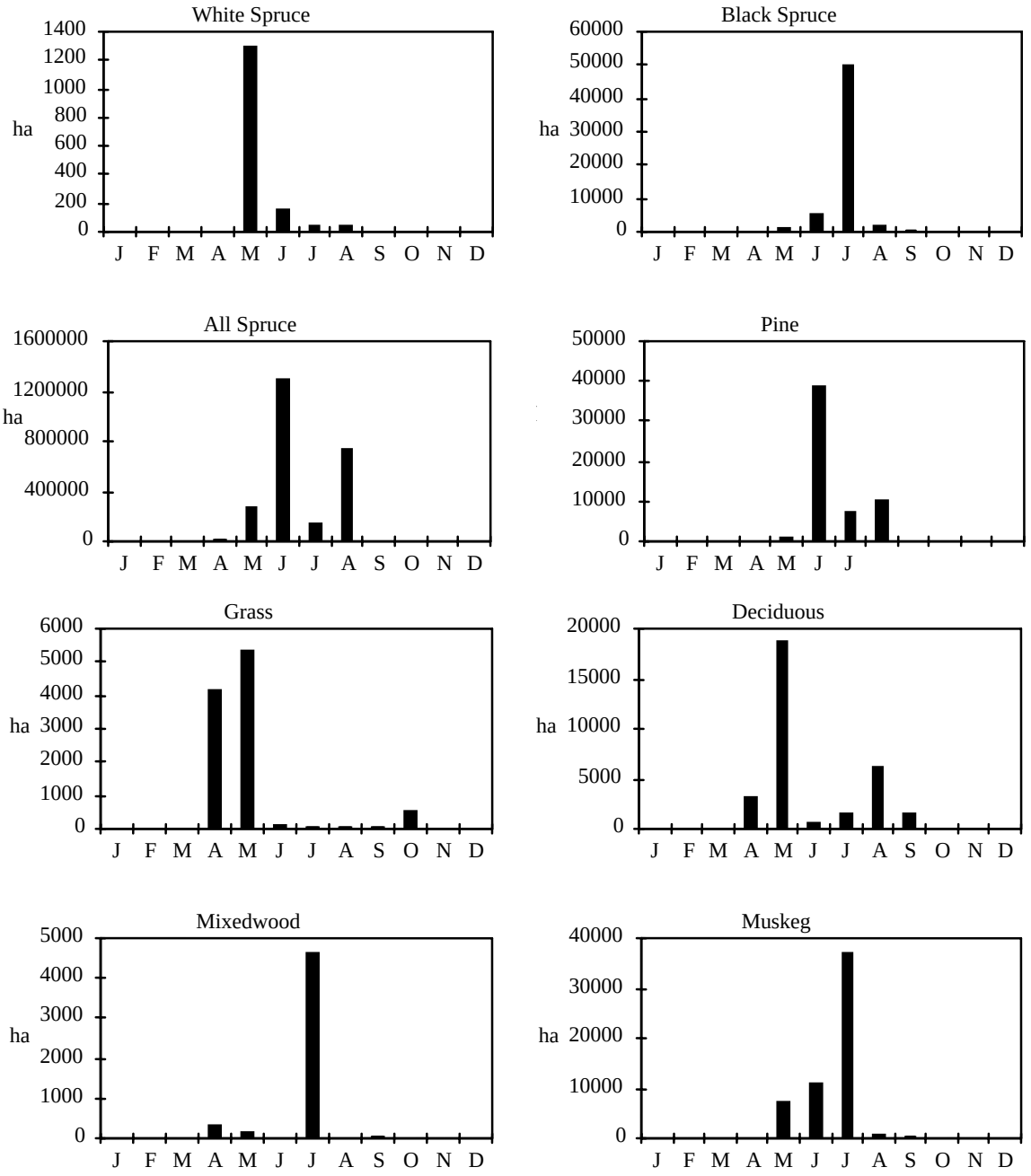

Figure 7-11. Area (ha) burned by different fuel type in each month (1983–1992) (from Stelfox and Wynnes 1999; data source: ASRD Fire Database).

8. Regional Profile

Manning Diversified's FMA Area lies primarily within the Northern Lights No. 22 Municipal District (Figure 1-2). Manning Diversified's processing facilities are located east of the FMA Area, approximately 24 km north of the town of Manning. Economic benefits from Manning Diversified's forestry operations and processing facilities are highest within the town of Manning and within the surrounding Northern Lights No. 22 Municipal District. The following section summarizes some of the social and economic characteristics of the area.

Northwestern Alberta was inhabited primarily by First Nation peoples until the mid 1800s. At this time European explorers and fur-traders began arriving in the region and they were soon followed by early settlers. In the early 1900s the flow of settlers increased, with homesteaders locating along the fertile lands in the Peace Country. Completion of the railway to Peace River and Grand Prairie in 1916 improved access into the region, resulting in a further increase in the number of homesteaders. Additional waves of settlers arrived after World War I and during the late 1920s. For the next several decades, population growth continued within existing populations.

Petroleum exploration and development fueled an additional influx of population in the 1960s and 1970s. More recently, the development of the forestry sector in the region and strong oil and gas activity has helped sustain local populations. To this day, the town of Manning remains strongly rooted in its agricultural heritage.

An overview of the population growth of the region and the town of Manning, compared to that of the Province of Alberta, is provided in Figure 8-1, based on Statistics Canada 2001 Community Profiles website.

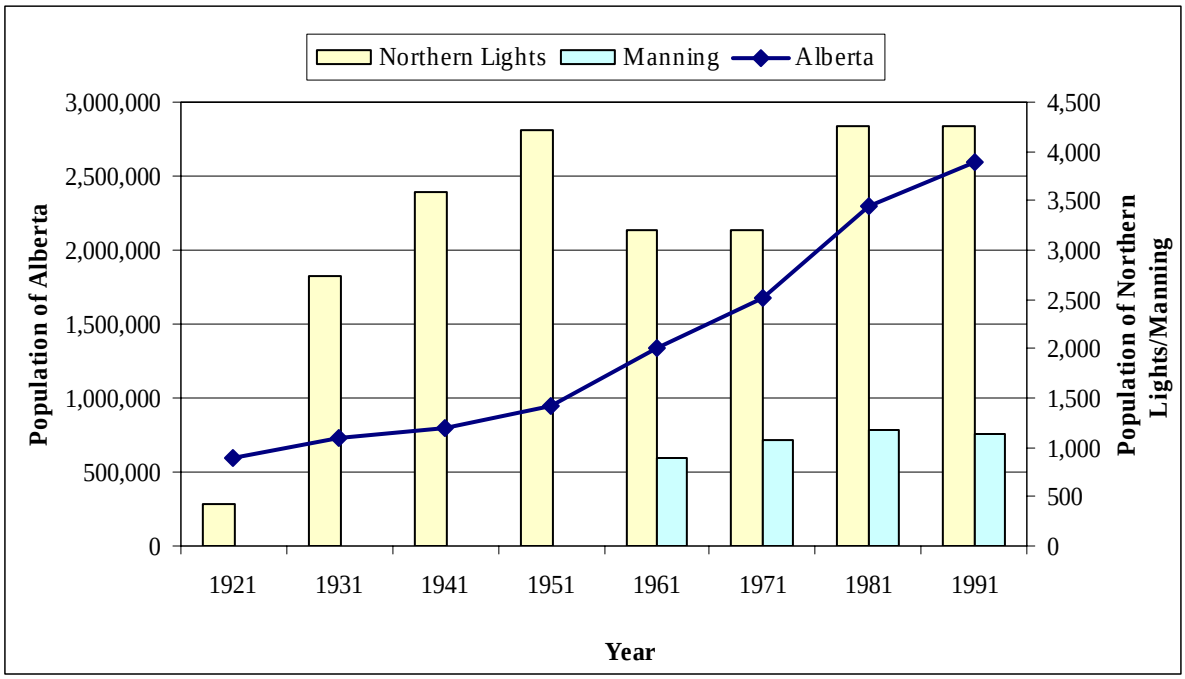

Figure 8-1. Population of growth of Northern Lights District and town of Manning compared to Province of Alberta.

The age distribution within the town of Manning and the Northern Lights is quite consistent (Figure 8-2) (Statistics Canada Community Profiles, 2001). In 2001, almost one third of the populations in both were between 25 and 44 years of age. An additional one third of the populations in both were under 25 years of age. A higher proportion of elderly (i.e., 75 years and older) are located in Manning than in Northern Lights.

In 2001, approximately 80% of males and 65% of females in the region earned income (Statistics Canada Community Profiles, 2001). This was comparable to the Provincial employment participation rates (80% for males, 67% for females). In 2001 the unemployment rate within the town of Manning was extremely low (averaging 2.9%) while the rate within Northern Lights was 7.2%, which was slightly higher than the Provincial average of 5.2%.

A breakdown of employment by industry, based on 2001 data, is provided in Figure 8-3 (Statistics Canada Community Profiles, 2001). Manufacturing/construction, business and other services account for much of the employment in Manning while the agriculture/resource based industries and manufacturing/construction dominate the Northern Lights economy.

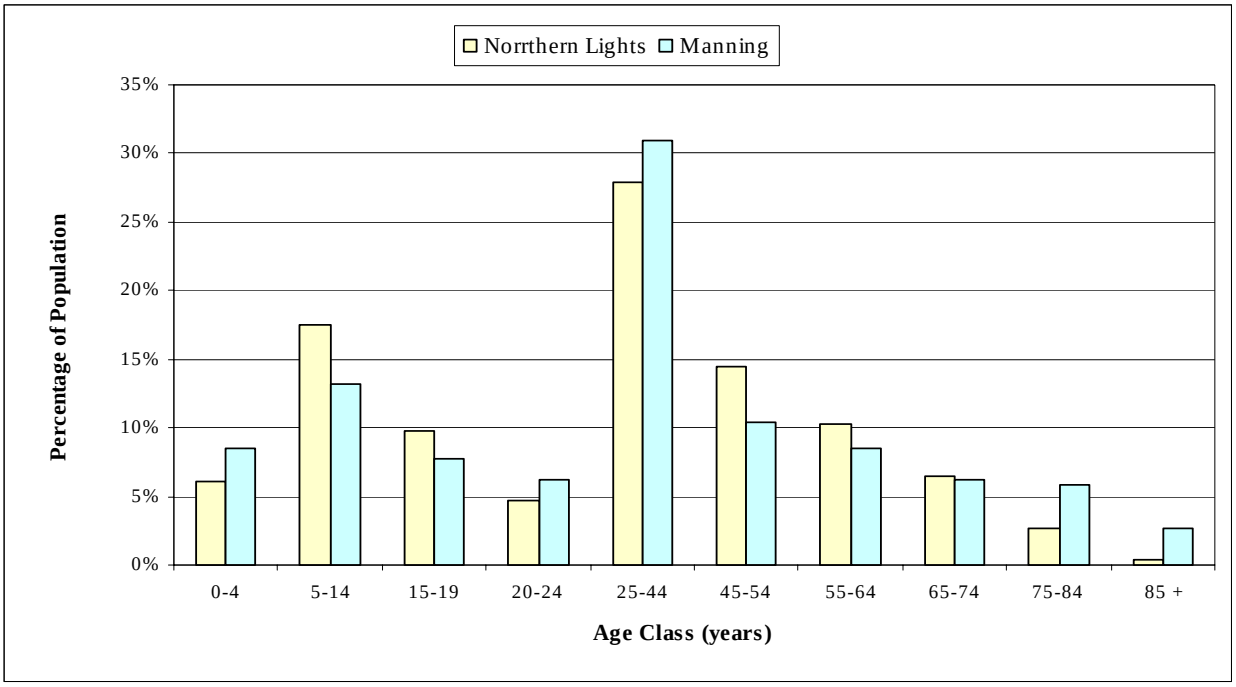

Figure 8-2. Age distribution of residents of Northern Lights District (No. 22) and town of Manning (Statistics Canada Community Profiles, 2001). .

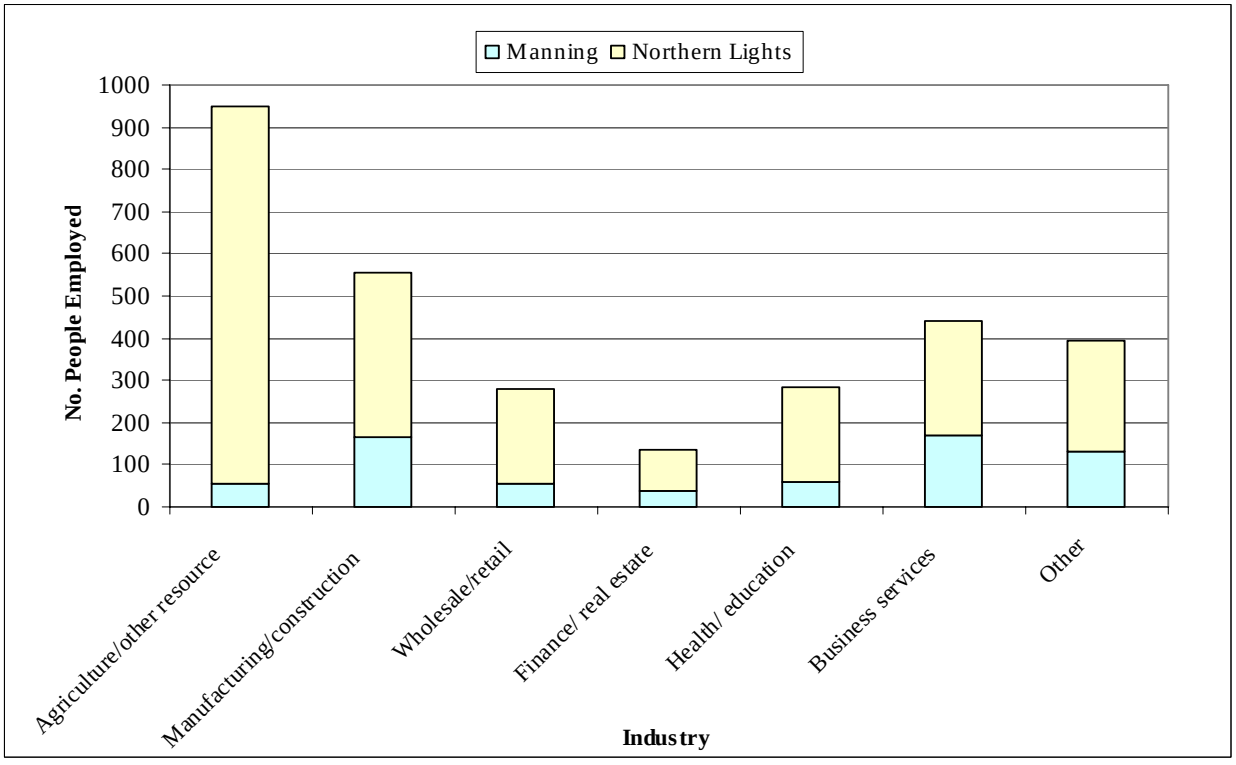

Figure 8-3. Summary of employment in Northern Lights District and town of Manning by industry ((Statistics Canada Community Profiles, 2001).

9. Other Resource Users

9.1 Oil and Gas Industry

The oil and gas industry is very active within the FMA Area. The industry first made its presence known in the region in the 1960s and since then it has become increasingly important economically. Oil and gas companies that are very active in the FMA Area include:

In P6:

- ARC Resources Ltd.
- Bonavista Petroleum Ltd.
- Cyries Energy Inc.
- Encana Corporation
- Penn West Petroleum Ltd.
- Prime West Oil and Gas

In P9

- ARC Resources Ltd.
- Canadian Natural Resources Limited
- Devon Canada Corporation
- Husky Oil Operations Limited
- Ketch Resources Ltd.
- Lightning Energy Ltd.
- Samson Canada Ltd.
- Talisman Energy Inc.
- Tusk Energy

The oil and gas industry has been responsible for developing much of the road access in FMUs P6 and P9. The majority of the seismic and wellsite activity occurs over the winter months, and this is reflected in the type of access that is developed. There is heavy reliance on winter-only roads. Additional all-weather access has also been developed, primarily in FMU P6.

9.2 Registered Trappers

The FMA Area encompasses 36 different traplines (Figure 9-1). For many of the Trapline licenses, only a portion of the License falls within the FMA Area. The average size of an individual license within the FMA Area is 16,547 ha, based on all 36 traplines.

9.3 Guiding and Outfitting

Commercial guiding and outfitting enterprises within Alberta are allocated and managed on the basis of Wildlife Management Units (WMUs). The FMA Area is located within three separate WMUs: WMU 524, WMU 527 and WMU 537 (Figure 9-2). Approximately 15 guides/outfitters are active within the FMA Area, concentrating primarily on black bear and moose (Table 9-1).

Table 9-1. Summary of outfitters and allocations within the FMA Area.

MWU		No. Guides/Outfitters		WMU Allocations
		Total	Within FMA	
524	Most of P9 (excluding northeast) and western portion of P6	15	8	71 black bear
				68 moose
				20 mule deer
				6 white-tailed deer
527	Most of P6, excluding west and northern portions	11	3	58 black bear
				23 moose
				32 mule deer
				38 white-tailed deer
				8 elk
537	Northeast corner of P9	11	4	25 black bear
				30 moose
				8 mule deer
				3 white-tailed deer

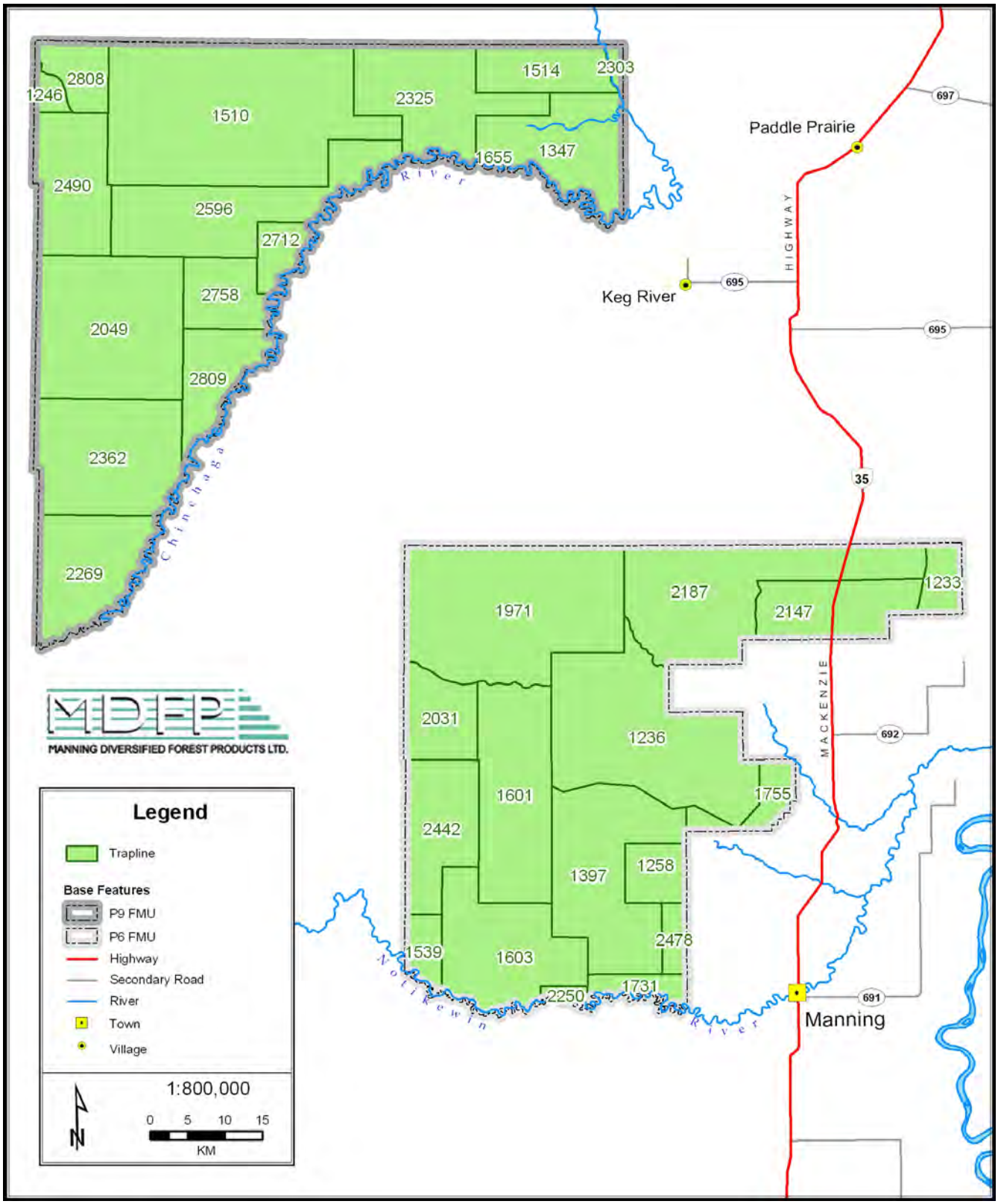

Figure 9-1. Trapline licenses within the FMA Area.

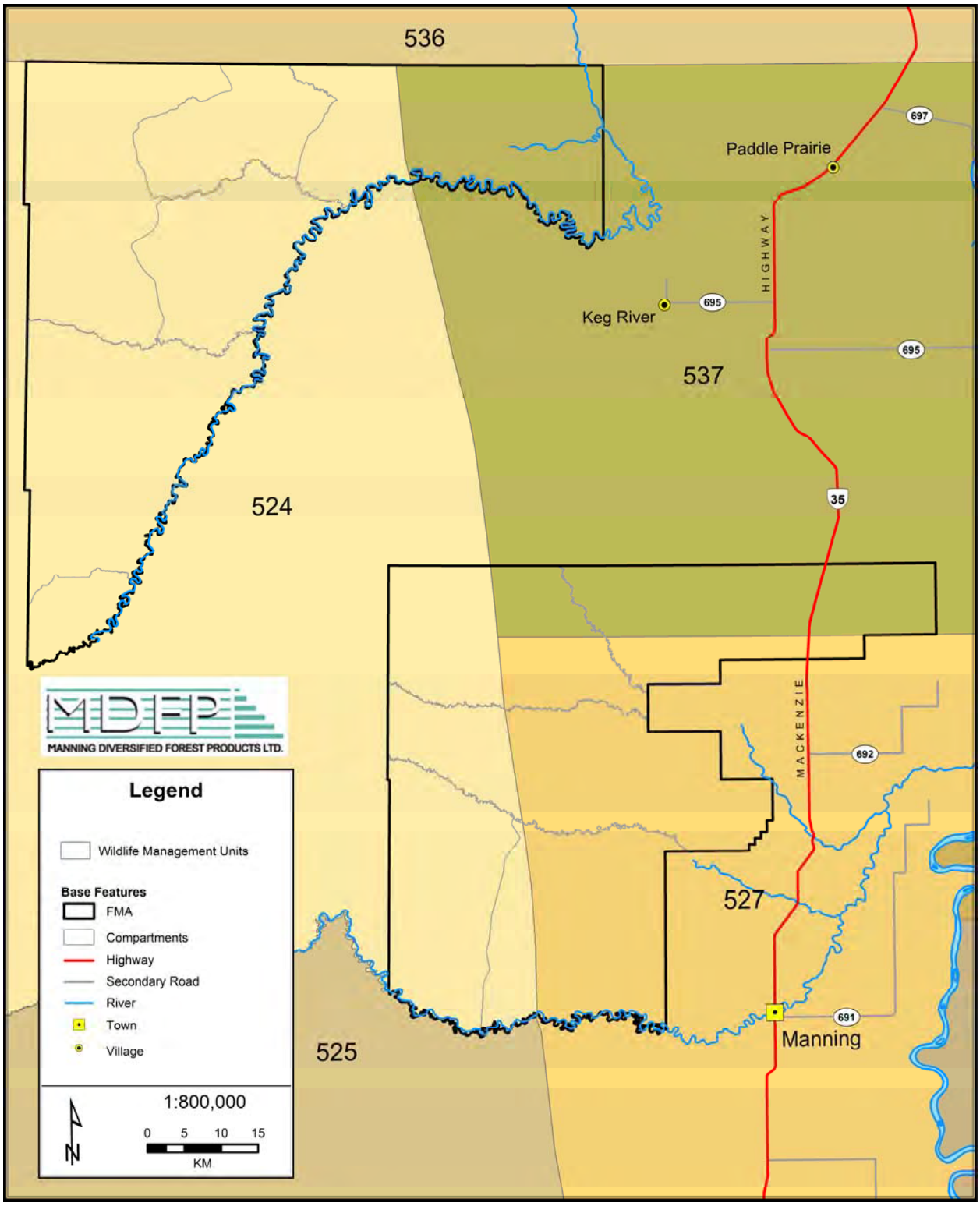

Figure 9-2. Wildlife Management Units within the FMA Area.

9.4 Tourism

Tourism facilities in the FMA Area are generally restricted to the Twin Lakes Recreation Area, and the Twin Lakes Paradise Motel and Restaurant (Lodge), both of which are located in the extreme north of P6, close to Highway 35 (Figure 9-3).

Twin Lakes Recreation Area is a Provincial Recreation Area that offers camping and boating facilities. The Recreation Area is stocked with rainbow trout and is popular with fishermen. A 3 km looped nature trail allows access to the second of the Twin Lakes.

Twin Lakes Paradise Motel and Restaurant (Lodge) is a motel/restaurant complex that caters to tourists in the summer and resource sector workers during the winter months. The site includes a motel with restaurant, several RV sites, camp-style accommodations and a helipad site.

9.5 Grazing

There are no Grazing dispositions within the FMA Area.

9.6 First Nations

There are no First Nations Reservations within or immediately adjacent to the FMA Area.

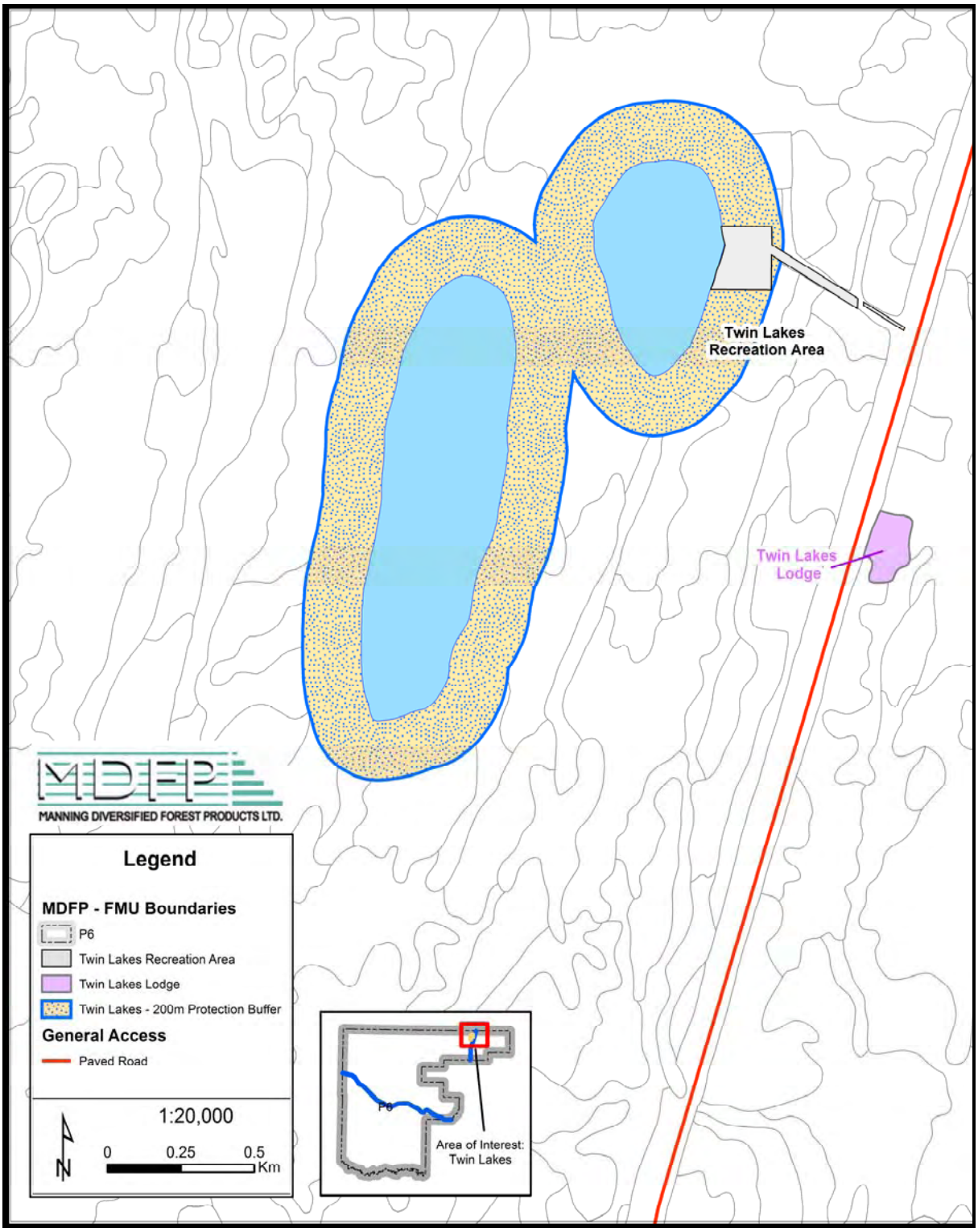

Figure 9-3. Location of Twin Lakes Recreation Area and Twin Lakes Paradise Motel and Restaurant.

10. References

Alberta Environmental Protection. 1994. Natural Regions and Sub-regions of Alberta: Summary. Alberta Environmental Protection. Pub. No. I/531.

Alberta Sustainable Resource Development. 2001. Wildfire management in Alberta. Publication 1/857.

Alberta Sustainable Resource Development. 2004. Draft Natural Sub-region fact sheets. (Documentation provided at presentation of Draft Natural Sub-regions).

Bobrowsky, P. T., D. G. E. Liverman and N. Catto. 1993. Geological constraints regarding the ice-free corridor in northeastern British Columbia and northwestern Alberta. GAC/MAC Joint Annual Meeting, Program and Abstract, 1, A-10.

Dyck, A. S. and V. K. Prest. 1987. Paleogeography of northern North America 18,000-5.000 years ago. Geological Survey of Canada Map 1703A (1:12 500 000). (cited in Geographic Dynamics Corp. 2000).

Edwards, W. A. D and D Scafe. 1996. Mapping and resource exploration of the Tertiary and preglacial sand and gravel formation of Alberta. Alberta Research Council, Alberta Geological Survey (cited in Geographic Dynamics Corp., 2000)

Environment Canada. Climatic Normals (1961-1990). Available from http://www.climate.weatheroffice.ec.gc.ca/ climateData/canada_e.html, internet, accessed 2005.

Geographic Dynamics Corp. 2000. Development of Ecosections and Landscape Management Units, and a review of the glacial history of the Manning Diversified Forest Products Ltd. FMA Area.

Laing, B. R. 2004. Integrating drainage enforcement into existing raster digital elevation models and the development of the hydrological drainage basins of the Manning Diversified Forest Products Ltd. Forest Management Area. Manning Diversified Forestry Research Fund. Progress and Final Report (based on University of Saskatchewan M.Sc. Thesis).

Scrimgeour, G., Hvenegaard, P., Wildeman, A., Tchir, J. and S. Kendall. 2003. Stream fish management: Defining relationships between landscape characteristics and fish communities in the Notikewin River Basin, Alberta. Alberta Conservation Association and Alberta Research Council. Northern Watershed Project Final Report No. 2. 109 pp.

Statistics Canada. Community Profiles – 2001. Available from http://www12.statcan.ca/english/profil01/CP01/Index.cfm?Lang=E., accessed June 15, 2004.

Stelfox, J. B. and B. Wynnes. 1999. A physical, biological and land use synopsis of the boreal forest's Natural Regions of northwestern Alberta. Internal document prepared for Daishowa-Marubeni International Ltd.

Strong, W. and J. M. Thompson (Ecological Land Surveys). 1995. Ecodistricts of Alberta: Summary of biophysical attributes. Alberta Environmental Protection, Resource Data Division.

Appendix I Watershed Development Report

The Forestry Corp. Project Number:P445
For additional information, please contact:
The Forestry Corp.
101-11710 Kingsway Avenue
Edmonton, AB
T5G 0X5
(780) 452-5878
www.forcorp.com