Spray Lake Sawmills

Detailed Forest Management Plan 2001 – 2026

Chapter 3 – Long Term Road Strategy

December 15, 2006

Chapter 3 – Long-Term Road Strategy

Access is important in the FMA for a number of reasons. There are environmental and social reasons for limiting access development over time. There is also the need to ensure the entire FMA can be accessed for timber extraction. To address these factors, SLS committed to developing a mainline road strategy for the FMA.

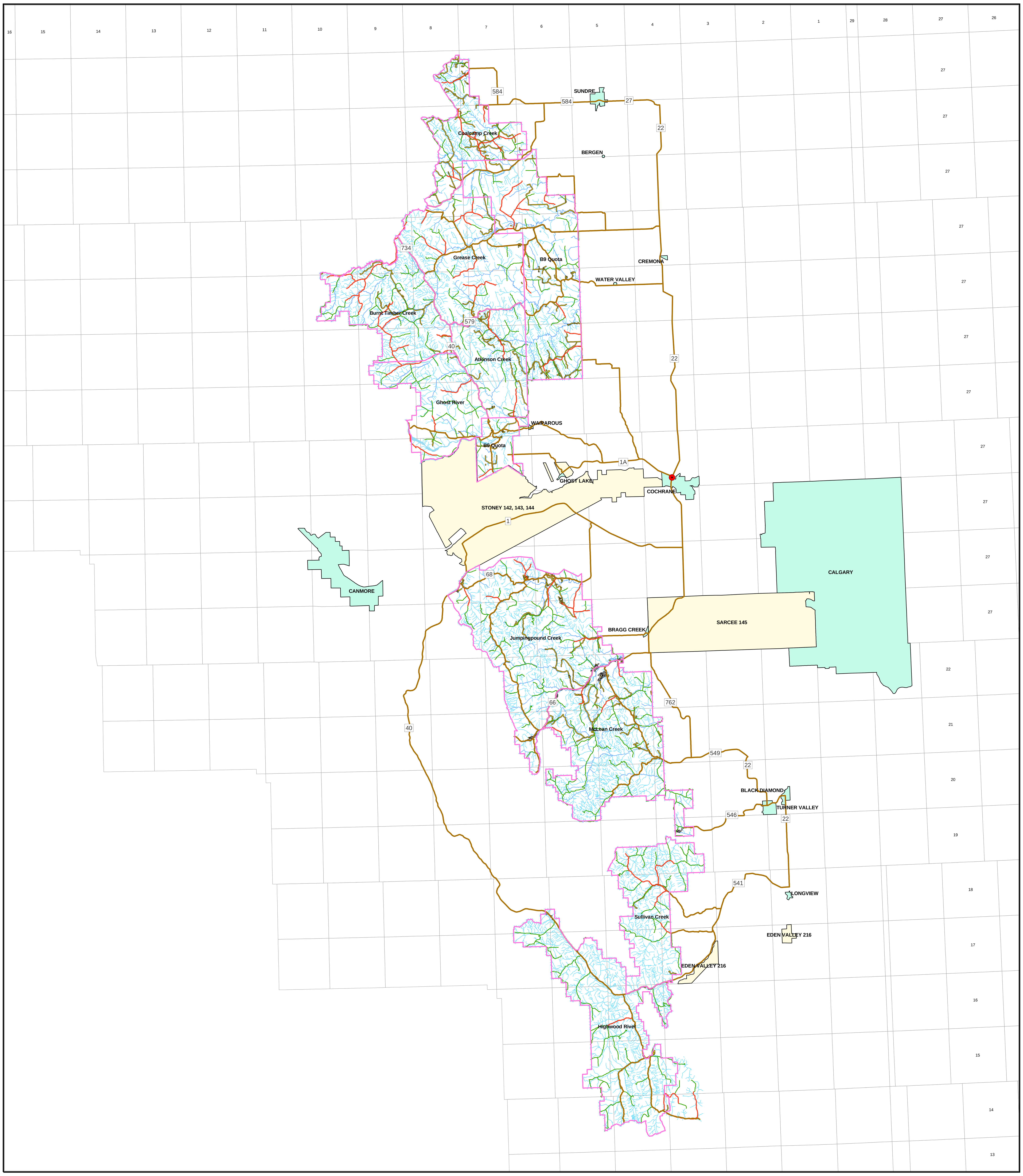
To accomplish this, SLS contracted Tesera Systems Inc. to develop mainline routes on the FMA using the Linear Feature Projection Model (LFPM). The LFPM allows linear features to be projected over the land base given operational design specifications. The Road Network Modeling is included in Chapter 3 as Appendix 3.1.

Figure 3.1 shows the projected mainline road results for the FMA. As indicated in the Tesera report, the road options generated by the model are not meant to be applied rigidly in the field as operational factors including terrain stability were not part of the data set. What the model does show is potential road corridors for use in developing compartment access plans and for use in discussions with other stakeholders to minimize the number of access corridors on the landscape.

The discussions with SRD and stakeholders will include road location and road tenure. SLS's access objectives, strategies and ground rules implications are in Chapter 5.1 of the DFMP and address integration, road tenure and road reclamation.

In addition to the mainline roads, Figure 3.1 also shows the next class of road noted as "operational" roads generated by the model. The map also shows the existing roads as provided by the Alberta Government. The intent is not to duplicate roads, but to show both the modeled road system in conjunction with the existing road network to provide options when developing compartment and operating access plans. As indicated in Chapter 5.1, "access no longer required will be promptly reclaimed as per the applicable Ground Rules and the SLS Road Maintenance and Abandonment Plan."

In addition to this, Trees Consulting conducted a field validation of the spatial harvest sequence from 2006 - 2016 and the operational accessibility. In general, the areas sequenced to 2016 are accessible by either the corridors identified by the model or by existing roads and trails.



Spray Lake Sawmills

Road Network Modelling - Mainline Model Outputs

Legend

- Mill Site
- Model Input Main Roads
- Model Output Mainlines
- Model Output Operational
- Major Streams/Rivers
- Streams
- Polygon Hydrographic Features

Existing Major Roads

- Highway
- Paved - Two Lane
- Gravel
- Reserve
- Urban Areas
- SLS Compartments

UTM Nad83 Zone 11 Projection
Scale: 1 : 268,000
April 18, 2006

0 2.5 5 10 15 20 25 30 Kilometers

File: D:\Spray_Lakes\Road_Moldeling\Mapping\030206_sc_update\SLS_All_FMAs_v6_op_clp.mxd

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Report

Road Network Modelling on the Spray Lake Sawmills (1980) Ltd. Forest Management Area

Appendix 3.1 of the SLS DFMP

Prepared for:

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1.0 Introduction

In April of 2004, Spray Lake Sawmills (1980) Ltd. had requested that Tesera Systems Ltd. perform the road network modeling to assist in preparation of their 20-year Access Management Plan as part of the Detailed Forest Management Plan (DFMP) submission. This report will outline the steps performed and the data used to develop Mainline routes on the FMA using the Linear Feature Projection Model (LFPM). The LFPM allows linear features (road, pipelines, transmission lines, etc.) to be projected over the land base given operational design specifications (maximum grades, maximum percent side slope, switchback radius and distance limits between switchbacks, areas where road can't be built and areas where road is to be minimized, etc.).

2.0 Road Modelling – GIS Inputs

The following sections outline the data inputs and assumptions made during the process and the road design specifications that Spray Lake Sawmills (SLS) had provided.

2.1 Establish Base Road Network

The first step in this process is creating a road network that currently exists. These roads can be of various lifespans and status including mainlines to temporarily deactivated roads within blocks. As well, roads that are currently in the planning/approval stages with the government can also be incorporated. This allows for a linkage between ongoing operations and the strategic objectives in the DFMP or Access Management Plan.

In this case, only specifically identified routes both within and extending beyond the FMA were delineated since the design standards of many of the existing roads within the FMA could not be validated. Most of the roads associated with historical industrial activities (e.g. logging, oil & gas operations, etc.) typically had different standards for road construction and maintenance so these were deleted from the existing road network so that the Linear Feature Projection Model (LFPM) could project new roads without the influence of any existing roads that may not follow SLS' road design specifications.

2.2 Clean Existing Road Network

The road network was checked for topological correctness and then each road segment had the downstream (preceding) road segment identified. This allows LFPM to move haul volume through the network to the destination if the scheduling model is used to also schedule road construction activities.

2.3 Determine Road Exclusion Areas

The areas within the FMA where roads could not be constructed were explicitly identified. The model was then instructed not to build roads in these areas. A listing of those areas are described following:

- ? Permanent Sample Plots;
- ? Areas outside the FMA;
- ? Prime Protection IRP Zone; and
- ? Private lands and/or No esip (Patent) IRP zones.

2.3.1 Permanent Sample Plots

The permanent sample plot locations were identified through the PSP field listed in the net land base coverage. Any record with a value of "100" in the PSP field was extracted from the net land base and dissolved to reduce unnecessary linework.

2.3.2 Areas Outside the FMA

The areas outside of the FMA were identified through the FMU field listed in the net land base coverage. Any record with a value of "OUT" in the FMU field was extracted from the net land base and dissolved to reduce unnecessary linework.

2.3.3 Prime Protection IRP Zone

The areas within the Prime Protection Zone were identified through the IRP_TYPE and the RMA 'A' fields listed in the net land base coverage. Any record with a value of "Prime Protection" in the IRP_TYPE field and a value of "100" in the RMA 'A' field was extracted from the net land base and dissolved to reduce unnecessary linework.

2.3.4 Private lands and/or No esip (Patent) IRP zones

The areas within the Private lands and/or No esip (Patent) zones were identified through the IRP_TYPE and the RMA 'A' fields listed in the net land base coverage. Any record with a value of "no esip (Patent)" in the IRP_TYPE field and a value of "100" in the RMA 'A' field was extracted from the net land base and dissolved to reduce unnecessary linework.

Note: All the coverages were derived from the net land base coverage created by Golder and Associates, in May 2004.

2.4 Determine Road Restriction Areas

The areas within the FMA where the intent was to minimize road construction activities were identified, and are listed below:

- Non-Forested areas;
- Non-Productive areas;
- Critical Wildlife IRP Zones;
- Riparian Areas;
- Slope > 40%; and
- Shrubs/Herbaceous Areas.

These areas were identified for minimal development since legislation does not preclude activities in these areas (legislation and policies are in place that enable "best practices" but not road exclusion). The intent is to minimize road construction within these areas by applying penalties to road construction within the above zones.

In the case of watercourse crossings, the assumption is that these crossings are being constructed perpendicular (90 degrees) to the watercourse.

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The majority of the data layers used in the model were derived from the AVI data within the net land base coverage. The following subsections outline how each layer was derived.

2.4.1 Non-Forest Areas

For this layer, the areas were extracted from the net land base coverage using the following AVI fields: NFL, ANTH_VEG, MOD1 and MOD2. Where NFL had a record containing “BR” (Brush), ANTH_VEG didn’t have a value and the area was not within a clearcut (specified by MOD1 or MOD2 containing “CC” – this was the Non-Forested coverage.

2.4.2 Non-Productive Areas

For this layer, the areas were extracted from the net land base coverage using the following AVI fields: NAT_NON, ANTH_VEG, MOD1, MOD2 and SP1. Where NAT_NON or ANTH_VEG didn’t have a value, SP1 didn’t have a value and the area was not within a clearcut (specified by MOD1 or MOD2 containing “CC” – this was the Non-Productive coverage.

2.4.3 Critical Wildlife IRP Zones

The critical wildlife IRP zone was identified through the IRP_TYPE field listed in the net land base coverage. Any record with a “Critical Wildlife” value was extracted from the net land base and dissolved to reduce unnecessary linework.

2.4.4 Riparian Areas

The riparian areas coverage was based on the riparian buffering performed by Golder and Associates when developing the net land base. The buffered streams/rivers and lakes were extracted from the net land base data and the resulting extracted data was dissolved to reduce unnecessary linework in the coverages.

2.4.5 Slopes > 40%

The slopes greater than 40% coverage was derived from the Digital Elevation Model provided by SLS. The LFPM generates a slope coverage and a contour coverage from the DEM. Areas greater than 40% slope were identified and saved as a separate coverage.

2.4.6 Shrubs/Herbaceous Areas

For this layer, the areas were extracted from the net land base coverage using the AVI fields, NFL, MOD1 and MOD2. Where NFL had a record containing “HF” (Herbaceous Forbs), “HG” (Herbaceous Grassland), “SC” (Shrub Closed Canopy) or “SO” (Shrub Open Canopy) and the area was not within a clearcut (specified by MOD1 or MOD2 containing “CC” – this was the Shrubs/Herbaceous coverage.

Note: All the coverages were derived from the net land base coverage created by Golder and Associates, in May 2004.

2.5 Determine Exit Points (Mill Locations)

The model requires the establishment of exit points (mill locations) so that it can develop routes based on a shortest-path algorithm to the final destination. In this case the mill location in Cochrane was used as the exit point.

2.6 Wetlands, Rivers and Streams

It was assumed that roads could be built across Flooded Areas, Ponds, Rivers, Streams and Wetlands, however actual location of these features were used to minimize development from crossing these water features. The AVI field used to distinguish these water features was the NAT_NON field; the various entities of the NAT_NON field used are listed below:

? NWL (Seasonal thaws, lakes, ponds)
? NWR (River)
? NWF (Flooded)

The features were combined into a coverage called "water_poly_crossing", which indicated that a crossing could occur over the feature but a penalty would be applied.

In the case of the Lakes, these were removed from the water_poly crossing coverage since roads do not cross lakes. Lakes were identified using the HYDROP_NON field in the netdown, which indicated the 100 if the polygon was a lake and 0 if the polygon was not a lake. If a lake was present it was removed from the water_poly crossing file.

2.7 Digital Elevation Model (DEM)

Using the DEM that SLS had provided (which was based on the Alberta Government DEM), the model develops a contour coverage. The original DEM was based on 1:60,000 aerial photos taken in 1982 and interpolated to 25m pixels (scale of 1:50,000). The model uses the contour data to determine the slope percentages for the landscape. The DEM is one of the main drivers in determining where roads will be positioned on the land base.

3.0 Road Modelling – Mainline Design Specifications

LFPM can project roads from strategic to operational levels, however in this case only the mainline access routes were generated and used in the long-term Access Management Planning exercise that SLS is required to provide as part of the DFMP requirements. The specifications that were used are listed in *Table 1*.

Table 1. Mainline Design Specifications

Description	Specification
Fixed landing Locations	No fixed landings were assigned. SLS decks logs at the roadside where there is a side slope grade of <= 25%.
Minimum Distance Between landings	400 metres
Adverse/Favourable Grades	10 %
Horizontal Radius curve limit	30 metres
Side Slope Limit *	40 %
Switchback Radius	30 metres
Minimum Distance between Switchbacks	60 metres
Distance from Edge (minimum width of an "un-accessed" area before a road will be constructed) **	2,000 metres

** LFMP selects areas where the side slope is less than 40 % to consider for the road projection.*

*** For example, 50 metres means that an area has to be wider than 100 metres before it requires a road.*

4.0 LFPM Processing and Evaluation

Once the input files are derived, the road design specifications and number of iterations are entered into the model. The model then goes through the flowing steps:

1. Uses a triangulation routine to calculate slopes
2. A user-defined node density is used to determine the end points of roads.
3. Using the end points, the model projects the roads based on the road design specifications.
4. The model runs a number of iterations using the same parameters but choosing different end points, resulting in different road networks.
5. The model then evaluates each road network iteration, using the penalties that were assigned to the limit the number of stream crossings as well as the road restriction areas. The penalties are then ranked according to the lowest to highest penalty occurrence, the lowest penalty solution being the best outcome from a modeling standpoint. However, the best outcome (lowest ranked solution) may not be the best in terms of meeting operational reality.

In the case of SLS, the mainline access routes were reviewed by Tjerk Huismann and Ed Kulcsar and confirmed to be within the operational guidelines. A 1:250,000 scale map (*Appendix 1*) is included with this report which outlines the mainline routes that were generated by the model, shown in red. The roads in brown are the base routes that were used as the input to the LFPM.

5.0 Conclusion

Using LFPM represents a cost efficient way to project roads or other linear features on the land base. The mainline options generated in this process are not meant to represent reality, as there are operational factors including terrain stability that wasn't included with the SLS data. This process is intended to be a guide in developing Access Management Plans and operational site level plans, allowing for a quick generation of planned access throughout the FMA while considering all the known factors that influence access. The operational staff, will take these proposed mainline routes and evaluate/implement them according to site considerations that are assessed in the field.