

APPROVAL CONDITION 8.1 SILVICULTURE MATRIX

Approval Condition 8.1 Deciduous Leading Mixedwood Transition

i. By August 1, 2020 WeyCo GP shall submit the following updates to the Silviculture Matrix and Annex V acceptable to the Director, Forest Program Management:

a. Silviculture Matrix - incorporate silviculture strategies for Hardwood/Spruce (HwSx) and Hardwood/Pine (HwPI).

	1	2	3	4	5	6	7	8	9	10
	FMP Yield Strata Transition Sources (Current Yield Group) (Natural Yield Types)	FMP Yield Strata Transition Sources (Regenerating Strata)	Managed FMP Yield Strata Landbase Designation Code	Stand Structure (Species Proportions)	Limitations to Crop Establishment (Site, Climate)	Silviculture System	Site Preparation	Seedling Establishment (includes LFN)	Seedling Density (SPH Target per Species Type)	Reforestation Phase Intervention (Post-seedling establishment)
1	Deciduous AB, CD density D_AB D_CD <i>Base 10 Stratum= I-D</i>	Pure Deciduous CD density BASIC D_CD	WEYG1901	Pure hardwood (Aw, Pb or Bw) by stocking at Establishment and by crown closure/density at Performance.	Cold, wet soils, competition (grass, forbs), possible low suckering potential, insects and disease, and soil compaction	Clearcut; clearcut with retention; understory avoidance where feasible	site prep to create microsites is not required; debris management where required	Deciduous = LFN Coniferous= may plant where objectives are to replace harvested secondary conifer volume on the landscape or to reforest areas affected by compaction that do not regenerate from onsite deciduous suckering	Deciduous= expect natural growth dynamics of pioneer deciduous to yield densities >10,000 sph from suckering to capture site and reduce effects of competition Coniferous= may plant between 1400 -1800 sph of conifer, focusing on roads, landings and other areas likely to have low D stocking (conifer replacement strategy)	None anticipated. Fill planting with coniferous or deciduous will be used where there are non-productive voids, to reforest roads and landings or to meet conifer replacement strategy targets.
2	Mixedwood-Hardwood/ Pine DC_PL <i>Base 10 Stratum= II-DC-PI</i>	Mixedwood-Hardwood/ Pine CD density BASIC HwPI	WEYG1902	Deciduous leading mixedwood stand by stocking at Establishment and by crown closure/density at Performance; Pine as the primary conifer	Mixed wood stands with pine are typically a drier moisture regime, with increased potential for effects of drought & lower deciduous suckering potential. Pine species are less tolerant to shade and competition in association with hardwood species grown on the same site; past insect and disease on the site may affect Pine regenerating stands (esp. Armillaria).	Clearcut; clearcut with retention; understory avoidance where feasible	mechanical site prep to create elevated microsites to reduce competition for conifer establishment	Deciduous= LFN suckering Coniferous= Plant PI Larch replacement= LFN	Coniferous= planting density increased to 800-1400 sph; combination of all created single microsites plus natural planting spots if required to achieve target spacing & density Deciduous= expect natural growth dynamics of pioneer deciduous to yield densities >10,000 sph from suckering	Grass, shrub and/ or deciduous competition will be a factor affecting survival and/ or the proportion of the conifer in the regenerating stand. A chemical, mechanical or manual stand tending intervention may be required to reduce competition or to reach coniferous proportion targets. Will fill-in plant conifer if required to meet minimum stocking standards (RSA), depending on significance of cumulative mortality, or to reach coniferous proportion targets.
3	Mixedwood-Hardwood/ Spruce DC_Sx <i>Base 10 Stratum= III-DC-Sx</i>	Mixedwood-Hardwood/ Spruce CD density BASIC HwSx	WEYG1903	Deciduous leading mixedwood stand by stocking at Establishment and by crown closure/density at Performance; Spruce as the primary conifer	Cold, wet soils, competition (shrubs, grass, forbs), possible low suckering potential (dry sites with coarse soils), insects and disease, deep duff, soil compaction. Deciduous domination of over story canopy may reduce coniferous growth & survival.	Clearcut; clearcut with retention; understory avoidance where feasible	mechanical site prep to create elevated microsites to reduce competition for conifer establishment	Deciduous= LFN suckering Coniferous= Plant Sw or Sb Larch replacement= LFN	Coniferous= planting density increased to 800-1400 sph; combination of all created single microsites plus natural planting spots if required to achieve target spacing & density Deciduous= expect natural growth dynamics of pioneer deciduous to yield densities >10,000 sph from suckering	Grass, shrub and/ or deciduous competition will be a factor affecting survival and/ or the proportion of the conifer in the regenerating stand. A chemical, mechanical or manual stand tending intervention may be required to reduce competition or to reach coniferous proportion targets. Will fill-in plant conifer if required to meet minimum stocking standards (RSA), depending on significance of cumulative mortality, or to reach coniferous proportion targets.

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4	Deciduous with conifer understory D_US Mixedwood-Spruce/ Hardwood CD_Sx *Sx= Sw or Sb <i>Base 10 Stratum= IV-CD-Sw</i> <i>Sb leading</i> <i>Base 10 Stratum= VI-CD_Sb</i>	Mixedwood-Spruce/ Hardwood CD density BASIC SwHw *SbHw	WEYG1904 *WEYG1906	Spruce leading mixedwood stand by stocking at Establishment and by crown closure/density at Performance	Cold, wet soils, competition (shrubs, grass, forbs), possible low suckering potential (dry sites with coarse soils), insects and disease, deep duff, soil compaction. Deciduous domination of over story canopy may reduce coniferous growth & survival.	Clearcut; clearcut with retention; understory avoidance where feasible	dry soils= straight plant; cold/ wet soils = mechanical site prep to create elevated microsites rich sites= mechanical site prep to create elevated microsites to reduce competition	Deciduous= LFN suckering Coniferous= Plant Sw or Sb Larch replacement= LFN	Coniferous= planting density 1200 sph; combination of all created single microsites plus natural planting spots if required to achieve target spacing & density Increase planting density up to 2,000sph if required on cold/ wet soils. Deciduous= expect natural growth dynamics of pioneer deciduous to yield densities >10,000 sph from suckering	Grass, shrub and/ or deciduous competition may be a factor affecting survival and/ or the proportion of the desired species in the regenerating stand. A chemical, mechanical or manual stand tending intervention may be required to reduce competition or to reach coniferous proportion targets. Will fill-in plant conifer if required to meet 80% minimum stocking standards (RSA), depending on significance of cumulative mortality, or to reach coniferous proportion targets.
5	Mixedwood-Pine/ Hardwood CD_PL <i>Base 10 Stratum= V-CD-PI</i>	Mixedwood-Pine/ Hardwood CD density BASIC PIHw	WEYG1905	Pine (PI) leading mixedwood stand by stocking at Establishment and by crown closure/density at Performance	Pine-leading mixed wood stands are typically a drier moisture regime, with increased potential for effects of drought & lower deciduous suckering potential. Pine species are less tolerant to shade and competition in association with hardwood species grown on the same site; past insect and disease on the site may affect Pine regenerating stands (esp. Armillaria).	Clearcut; clearcut with retention; understory avoidance where feasible	dry soils= straight plant; cold/ wet soils = mechanical site prep to create elevated microsites rich sites= mechanical site prep to create elevated microsites to reduce competition	Deciduous= LFN suckering Coniferous= Plant PI Larch replacement= LFN	Coniferous= planting density 1200 sph; combination of all created single microsites plus natural planting spots if required to achieve target spacing & density Increase planting density up to 2,000sph if required on cold/ wet soils. Deciduous= expect natural growth dynamics of pioneer deciduous to yield densities >10,000 sph from suckering	Grass, shrub and/ or deciduous competition may be a factor affecting survival and/ or the proportion of the desired species in the regenerating stand. A chemical, mechanical or manual stand tending intervention may be required to reduce competition or to reach coniferous proportion targets. Will fill-in plant conifer if required to meet 80% minimum stocking standards (RSA), depending on significance of cumulative mortality, or to reach coniferous proportion targets.

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	FMP Yield Strata Transition Sources (Current Yield Group) (Natural Yield Types)	FMP Yield Strata Transition Sources (Regenerating Strata)	Managed FMP Yield Strata Landbase Designation Code	Stand Structure (Species Proportions)	Limitations to Crop Establishment (Site, Climate)	Silviculture System	Site Preparation	Seedling Establishment (includes LFN)	Seedling Density (SPH Target per Species Type)	Reforestation Phase Intervention (Post-seedling establishment)
6	Conifer-Pure Sw AB density C_SW_AB Conifer-Pure Sw CD density C_SW_CD Conifer-Sw leading with other conifers (AB,CD density) C_SWOC <i>Base 10 Stratum= VII-C-Sw</i>	Pure conifer White Spruce leading CD density BASIC Sw	WEYG1907	Spruce (Sw) leading pure conifer by stocking in Establishment and by crown closure/density at Performance	Pure Sw stands tend to favour the mesic to subhygric, medium to rich sites. Higher potential for cold and wet soils (imperfect drainage over clay horizons) which may also increase competition (shrubs, grass, & forbs). Insects and disease. Soil compaction from anthropogenic disturbance may limit establishment and growth. At higher elevations cold soils, short summers may increase winter desiccation.	Clearcut; clearcut with retention; understory avoidance where feasible	dry soils/ shallow duff= straight plant; cold/ wet soils/ deep duff = mechanical site prep to create small elevated microsites rich sites= mechanical site prep that does not elevate microsites to help reduce competition	Plant Sw as leading species. Potential to low density or fill plant PI or Sb if found onsite originally. Larch replacement= LFN	planting= density 1400 sph; combination of all created single microsites plus natural planting spots if required to achieve target spacing & density Increase planting density up to 2,000sph if required on cold/ wet soils. LFN= leave for seed **see Reforestation Phase Intervention if the result is underachieved	Grass and shrub competition (as well as deciduous at lower elevations) may be a factor affecting survival and/ or the proportion of the desired species in the regenerating stand. A chemical, mechanical or manual stand tending intervention may be required to reduce competition or to reach coniferous proportion targets. Will fill-in plant conifer if required to meet 80% minimum stocking standards (RSA), depending on significance of cumulative mortality.
7	Conifer-Pure Sw AB density C_SW_AB Conifer-Pure Sw CD density C_SW_CD Conifer-Sw leading with other conifers (AB,CD density) C_SWOC	Pure conifer White Spruce leading CD density GENETIC Sw_G351p1 (G1 zone, G351 Phase 1)	WEYG1911	Spruce (Sw) leading pure conifer by stocking in Establishment and by crown closure/density at Performance	Pure Sw stands tend to favour the mesic to subhygric, medium to rich sites. Higher potential for cold and wet soils (imperfect drainage over clay horizons) which may also increase competition (shrubs, grass, & forbs). Insects and disease. Soil compaction from anthropogenic disturbance may limit establishment and growth. At higher elevations cold soils, short summers may increase winter desiccation.	Clearcut; clearcut with retention; understory avoidance where feasible	dry soils/ shallow duff= straight plant; cold/ wet soils/ deep duff = mechanical site prep to create small elevated microsites rich sites= mechanical site prep that does not elevate microsites to help reduce competition	Plant Enhanced Sw as per deployment schedule. Larch replacement= LFN	planting density 1400 sph; combination of any created microsites plus natural planting spots if required to achieve target spacing & density	Grass and shrub competition (as well as deciduous at lower elevations) may be a factor affecting survival and/ or the proportion of the desired species in the regenerating stand. A chemical, mechanical or manual stand tending intervention may be required to reduce competition or to reach coniferous proportion targets. Will fill-in plant conifer if required to meet 80% minimum stocking standards (RSA), depending on significance of cumulative mortality.
8	<i>Base 10 Stratum= VII-C-Sw</i>	Pure conifer White Spruce leading CD density GENETIC Sw_G351p2 (G1 zone, G351 phase 2)	WEYG1912							

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9	Conifer-Pure Pine AB density C_PL_AB Conifer-Pure Pine CD density C_PL_CD Conifer-Pine leading with other conifers (AB,CD density) C_PLOC <i>Base 10 Stratum= VIII-C-PI</i>	Pure conifer Pine leading CD density BASIC PI	WEYG1908	Pine (PI) leading pure conifer by stocking in Establishment and by crown closure/density at Performance	High elevation: cold, wet soils, potential for unfavorable conditions for seed cone opening and germination. Winter desiccation especially on SW slopes is also a limiting factor. L/M/U elevations: Potential for drought conditions on coarse-textured well-drained soils. In association with Sb, sites tend towards mesic, with some areas of heavy grass & shrub competition. Mesic sites may experience cold, wet soils from rising soil water after harvest. Insects and disease create a higher mortality potential in Pine	Clearcut; clearcut with retention; understory avoidance where feasible	dry soils/ shallow duff= straight plant; mechanical site preparation to create small elevated microsites Cold/ mesic soils = mechanical site preparation to create small elevated microsites LFN prescription (L/M/U elevations) = mechanical site preparation (drag or lightly scarify) for mixing and exposure of mineral soil and distribution of cone-bearing branches	Plant PI as leading species with option to low density/ fill plant with Sw or Sb if found onsite naturally. Low risk/ high PI cone density sites= option to LFN. Larch replacement= LFN	Planting= density 1400 sph; combination of all created single microsites plus natural planting spots if required to achieve target spacing & density Increase planting density up to 2,000sph if required on cold/ wet soils. LFN= leave for seed with option to low density or fill plant PI or Sw/ Sb if found onsite originally.	Grass and shrub (+ deciduous at lower elevations) competition may be a factor affecting survival and/ or the proportion of the desired species in the regenerating stand. A chemical, mechanical or manual stand tending intervention may be required to reduce competition or to reach coniferous proportion targets. Will fill-in plant conifer if required to meet 80% minimum stocking standards (RSA), depending on significance of cumulative mortality.
10	Conifer-Pure Pine AB density C_PL_AB Conifer-Pure Pine CD density C_PL_CD Conifer-Pine leading with other conifers (AB,CD density) C_PLOC <i>Base 10 Stratum= VIII-C-PI</i>	Pure conifer/ Pine leading CD density GENETIC PI_G147p1 (B1 zone, G147 phase 1)	No seed remaining	Pine (PI) leading pure conifer by stocking in Establishment and by crown closure/density at Performance	High elevation: cold, wet soils, short summers, and the potential for unfavorable conditions for seed cone opening and germination. Winter desiccation especially on Southwest slopes is also a limiting factor. L/M/U elevations: Potential for drought conditions on coarse-textured well-drained soils. In association with Sb, the sites tend towards mesic, with some areas of heavy grass & shrub competition. The mesic sites may experience cold, wet soils from rising soil water after harvest. Insects and disease create a higher mortality potential in Pine	Clearcut; clearcut with retention; understory avoidance where feasible	dry soils/ shallow duff= straight plant; mechanical site prep that does not elevate microsites (i.e. power disc trenching) Cold/ mesic soils = mechanical site preparation to create small elevated microsites	Plant Enhanced PI as per deployment schedule. Larch replacement= LFN	planting density 1400 sph; combination of any created microsites plus natural planting spots if required to achieve target spacing & density	Grass and shrub (+ deciduous at lower elevations) competition may be a factor affecting survival and/ or the proportion of the desired species in the regenerating stand. A chemical, mechanical or manual stand tending intervention may be required to reduce competition or to reach coniferous proportion targets. Will fill-in plant conifer if required to meet 80% minimum stocking standards (RSA), depending on significance of cumulative mortality.
11		Pure conifer/ Pine leading CD density GENETIC PI_G147p2 (B1 zone, G147 phase 2)	WEYG1913							
12		Pure conifer/ Pine leading CD density GENETIC PI_G804 (B1 zone, G804)	WEYG1915							
13		Pure conifer/ Pine leading CD density GENETIC PI_G303 (B2 zone, G303)	WEYG1914							

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14	Conifer-Black Spruce leading C_SB (AB, CD density) <i>Base 10 Stratum= IX-C-Sb</i>	Pure conifer Black Spruce leading CD density BASIC C_SB	WEYG1909	Black spruce (Sb) leading pure conifer by stocking in Establishment and by crown closure/density at Performance	Pure Sb stands favour a wetter moisture regime. Rising water table and/or imperfect/poor drainage, wet, cold soils, low nutrient regime, significant vegetative competition (grass, forbs), deep duff, shallow rooting leading to higher wind throw potential, soil compaction from operations and anthropogenic disturbance are all limiting factors	Clearcut; clearcut with retention; understory avoidance where feasible	dry sites/ duff <10cm= straight plant cold/ wet soils/ deep duff= mechanical site prep to create elevated microsites	Plant Sb as leading species. Potential to low density or fill plant PI or Sw if found onsite originally. Larch replacement= LFN	planting density 1400 sph; combination of any created microsites plus natural planting spots if required to achieve target spacing & density Increase planting density up to 2,000sph if required on cold/ wet soils.	Grass competition may be a factor affecting survival and/ or the proportion of the desired species in the regenerating stand. A chemical, mechanical or manual stand tending intervention may be required to reduce competition or to reach coniferous proportion targets. Will fill-in plant conifer if required to meet 80% minimum stocking standards (RSA), depending on significance of cumulative mortality.
15	All Strata with Larch component 20-40% <i>Base 10 Stratum= as per above</i>	All Strata with Larch component 20-40%	As per designation above	Conifer leading with >=20% - 40% Lt	Stands with higher percentages of Lt establishment tend to favour the mesic to subhygric, medium to rich sites. There is a higher potential for cold and wet soils (imperfect drainage over clay horizons) which may also increase competition (shrubs, grass, & forbs) and mortality and may result in poor growth performance.	Clearcut with Lt avoidance where feasible. Retention opportunities where on Lt grows in patches or clumps and in cold, low, wet pockets where growth may be limited.	dry soils/ shallow duff= straight plant; cold/ wet soils/ deep duff = mechanical site prep to create small elevated microsites	Plant conifer leading species as per current yield group. Potential to low density or fill plant PI, Sw or Sb if found onsite originally. Larch replacement= LFN	Planting= density 1400 sph; combination of all created single microsites plus natural planting spots if required to achieve target spacing & density Increase planting density up to 2,000sph if required on cold/ wet soils.	Grass competition may be a factor affecting survival and/ or the proportion of the desired species in the regenerating stand. A chemical, mechanical or manual stand tending intervention may be required to reduce competition or to reach coniferous proportion targets. Will fill-in plant conifer if required to meet 80% minimum stocking standards (RSA), depending on significance of cumulative mortality.
16	All Strata <i>Base 10 Stratum= as per above</i>	Temporary block roads, landings, processing areas and burn pile locations	As per designation above	All stand structures	cool, wet soils; compaction, nutrient deficiency	Clearcut	ripper decompaction & roll-back, or decompaction & roll-back, or roll-back	plant conifer (PI, Sw) aerial seeding Dx- may plant deciduous	planting density 1400-1800 sph; combination of any created microsites plus natural planting spots if required to achieve target spacing & density aerial seeding density= 12 seeds per square meter	Calamagrostis canadensis and shrub competition may be a factor affecting survival and/ or the proportion of the desired species in the regenerating stand. A chemical, mechanical or manual stand tending intervention may be required to reduce competition or to reach coniferous proportion targets. Will fill-in plant conifer if required to meet 80% minimum stocking standards (RSA), depending on significance of cumulative mortality.

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Column Explanations/expectations:

1. FMP Yield Strata Transition Sources	Natural Yield Types; Current Yield Group (defined in G&Y Plan)
1a. Fd leading strata	Not applicable
1b. D_US (deciduous with conifer understory)	Switch stands as defined in GY-0006
2. FMP Yield Strata Transition Sources	Regenerating Strata. Basic yield curves- planted with natural stock and Genetic yield curves- planted with enhanced stock; defined in G&Y Plan
2a. Incorporating Genetic Gain Approval Dates	Genetic gain will be effective May 1 of the timber year in which it was approved (May 1, 2017) GoA direction 05/30/2018
3. Managed FMP Yield Strata Landbase Designation Code	As per April 7, 2020 letter from Alberta Agriculture and Forestry
4. Stand Structure:	The target proportion of coniferous and deciduous in the regenerated stand based on a standard or productivity objectives set out in the TSA assumptions.
5. Limitations to Crop Establishment:	The factors in climate and on the site that are expected to significantly increase the risk of NOT reaching establishment of the regenerated stand (survival) or the regenerated yield objective (productivity). This will contribute to the justification (good science) for the treatments chosen.
6 Silviculture System:	Harvest method. Choosing a silviculture system as a strategy should be about working with the regenerative silvics of the species to be reforested, operational delivery logistics and productivity objectives.
7. Site Preparation:	Operational site treatment strategies to alleviate site or climatic limitations and/or species to be established. Could be raised bed, drag, mixing and sometimes chemical.
8. Seedling Establishment:	The operational strategy to introduce the seedling to the site. Includes planting, artificial seeding, Leave-for-Natural (LFN). Enhanced regenerating strata will not have an LFN prescription. Larch reestablishment is always LFN.
9. Seedling Density:	An operational strategy that is applied to achieve full site coverage (stocking/density targets) in the initial stages of regeneration to reduce the effects of mortality on the objective. May also be a target set as a minimum objective reached during the and used as an early target in an Alternative Regeneration Standard (ARS) objective, a surrogate measure of early productivity. Reforestation Phase (first 14 years after harvest)
10. Reforestation Phase Intervention:	The Reforestation Phase is Year 0 to Year 14. The objective is to get the regenerated stand to the Performance Stage. In the Reforestation Phase there is the Establishment Stage and Performance Stage and in each of these stages one might choose some type of intervention to ensure the objective is reached. This could include chemical, mechanical or manual treatments for grass and for deciduous competition, fill-in-plant for mortality, etc.

The Silviculture Matrix has been developed as per the ABFMPS Appendix C- Reforestation Strategies.