



INVENTORY OF NATIVE GRASS SEED MIXES IN ALBERTA

Chris Powter, Enviro Q&A Services

Marshall McKenzie and Christina Small, InnoTech Alberta

RECLAMATION
250 KARL CLARK ROAD
EDMONTON, ALBERTA T6N 1E4
CANADA

October 27, 2017

DISCLAIMER

This report was prepared as an accounting of work conducted by InnoTech Alberta. Every possible effort was made to ensure that the work conforms to accepted scientific practice. However, neither InnoTech Alberta, nor any of its employees, make any warranty, expressed or implied, or assumes any legal liability or responsibility for accuracy, completeness, or usefulness of any of the information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Moreover, the methods described in this publication do not necessarily reflect the views or opinions of the individual scientists participating in methodological development or review.

InnoTech Alberta assumes no liability in connection with the information products or services made available. References herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favouring by InnoTech Alberta. All information, products and services are subject to change by InnoTech Alberta without notice.

EXECUTIVE SUMMARY

The Government of Alberta has long been a strong proponent of the use of native species for land reclamation and restoration projects. In 1973, the Department of Agriculture began an evaluation of native species suitable for reclamation of industrially disturbed lands (Vaartnou and Wheeler, 1975). That work eventually led to the creation of the Native Species Research Program at the Alberta Environmental Centre (now InnoTech Alberta) in the late 1970s.

InnoTech Alberta sponsored two workshops in November 2016 to gather stakeholder input for the Business Case to redesign the Native Species Research Program (Small et al., 2016a). One of the recommendations from the Workshops was to:

Develop and maintain a list of existing prescribed native plant seed mixes to help growers identify opportunities and to drive work to provide improved mixes.

This report is a first attempt to inventory native species seed mixes required or recommended for use in Alberta and those that are commercially available. The inventory was developed primarily through web-based searches; as a result there are likely additional resources that were missed.

The report focuses on native grass seed mixes for use in revegetation projects (reclamation, restoration, naturalization and remediation) undertaken for or by government or industry. Mixes labeled agronomic, forage, tame forage, hay, pasture, lawn, turf, etc. are not included in this report. However, some of the mixes contain agronomic species – these may be present to provide a nurse/cover crop that will allow the native species to establish, or they may be present because the mix represents a transition to a fully native mix. Commercial wildflower seed mixes are also not included in this document.

The following opportunities for the native plants community, government agencies and researchers arise based on the inventory of mixes and seed sources found to date.

1. A number of Required Mixes are currently in place which should be a driver for the development and use of native species seed. However the requirements must be enforced to be effective.

OPPORTUNITY: Canvass agencies with Required Seed Mixes and the project proponents who must follow the requirements to determine the level of compliance with the Required Seed Mixes and identify barriers to successful compliance.

OPPORTUNITY: Once barriers have been identified, devise a follow-up action plan to increase compliance.

2. Some municipalities require use of native seed mixes where the revegetation goal is naturalization. Three municipalities (City of Airdrie (2014), City of Calgary (Etwell, pers. comm), and City of Chestermere (2015)) were found to require native seed mixes but leave it to the project proponent to propose a seed mix for approval.

OPPORTUNITY: Obtain information on approved seed mixes to be added to this inventory.

OPPORTUNITY: Work with municipal associations (e.g., Alberta Association of Municipal Districts and Counties and Alberta Urban Municipalities Association) or individual municipalities to increase awareness of the benefits of naturalization and native seed mixes with the ultimate goal of increasing the number of municipalities with Required Seed Mixes.

3. Specifying seed mix requirements in project tender specifications and/or project proposals can be problematic if the species or varieties or adequate volumes are not available.

OPPORTUNITY: Specify alternate species or varieties that will meet the same ecological needs but are more likely to be available (see for example the EnCana CFB Suffield mixes in this inventory).

OPPORTUNITY: Publish suitable alternate species for those currently in the Required Seed Mixes.

4. InnoTech Alberta currently has 22 registered native seed varieties in Alberta representing 17 species but there were 38 species in Required Seed Mixes alone and 48 species in the Required Seed Mixes and Recommended Seed Mixes combined.

OPPORTUNITY: Continue to develop registered native species seed varieties to allow demand for seed in Required Seed Mixes to be fulfilled and to enable the Recommended Seed Mixes to shift to required (with appropriate proof of performance).

5. Even though there is strong interest wetland mitigation and compensation only 19 seed mixes were identified for use in wet soils, wet areas or wetlands.

OPPORTUNITY: Develop and publish recommended seed mixes for wetland mitigation and compensation projects.

6. There are at least two commercial strategies that growers and vendors can adopt: target those species that have the highest demand and volume; and/or, target the low volume species in mixes that often are the key to increasing diversity and ultimate achievement of target ecosystems.

OPPORTUNITY: Continue to produce and update the Alberta Native Plant Council's inventory of native seed producers with an increased emphasis on relating the inventory to, at least, the Required Seed Mixes (and ideally the Recommended Seed Mixes).

OPPORTUNITY: Vendors should increase efforts to relate their available seed or seed mix products to the Required Seed Mix list (and ideally the Recommended Seed Mixes).

7. One of the difficulties in preparing this inventory was the different nomenclature (e.g., common name(s), old scientific name, new scientific name) and seed mix description formats (simple lists, wt %, PLS%, PLS/m², etc.).

OPPORTUNITY: Develop a standard format for seed mix descriptions and require its use in project bid packages and regulatory documents.

ACKNOWLEDGEMENTS

The authors wish to thank the following people who provided access to information and answered our questions:

Aaron Anderson – AltaLink

Kevin Dunse – Pickseed

Al Fedkenheuer – ALCLA Native Plant Solutions

Arden – Wild About Flowers

Tracey Etwell – City of Calgary

Nathan Fontaine – Eastern Irrigation District

Jane Lancaster – Foothills Restoration Forum

Kim Lee – Imaginea Energy

Erick Lutterotti – Gold Medal Seeds Ltd.

Darwin McNeely – TransCanada

M. Anne Naeth – University of Alberta

Esther Stigter – Hannas Seeds

Donna Watt – Foothills Restoration Forum

Sarah Wilkinson – University of Alberta

All photos are courtesy Marshall McKenzie, InnoTech Alberta.

CITATION

This report may be cited as:

Powter, C.B., M. McKenzie and C.C. Small, 2017. Inventory of Native Grass Seed Mixes in Alberta. InnoTech Alberta, Edmonton, Alberta. 120 pp.

TABLE OF CONTENTS

DISCLAIMER	i
EXECUTIVE SUMMARY	ii
ACKNOWLEDGEMENTS.....	iv
CITATION	iv
TABLE OF CONTENTS	v
LIST OF TABLES.....	viii
LIST OF FIGURES.....	xv
LIST OF SPECIES IN THIS REPORT.....	xvi
1.0 INTRODUCTION	1
1.1 REPORT SCOPE	1
1.2 BUILDING A SEED MIX.....	2
1.3 REPORT NOTES.....	3
1.4 LIMITATIONS AND CAVEATS.....	3
2.0 REQUIRED SEED MIXES	5
2.1 ALBERTA TRANSPORTATION MIXES.....	5
2.2 CITY OF EDMONTON.....	8
2.3 CITY OF LETHBRIDGE.....	10
2.4 EASTERN IRRIGATION DISTRICT.....	11
2.5 SUFFIELD MILITARY BASE (1977).....	11
2.6 TOWN OF CANMORE	11
3.0 RECOMMENDED SEED MIXES.....	14
3.1 DUCKS UNLIMITED CANADA	14
3.2 INNO TECH ALBERTA	14
3.2.1 Alberta Innovates – Technology Futures Regional Seed Mixes	14
3.2.2 Alberta Innovates – Technology Futures Wainwright Recommended Mix 20	
3.2.3 Alberta Innovates – Technology Futures Pollinator Mix	20
3.2.4 InnoTech Alberta Recommended Saline Seed Mix	20
3.3 RECOVERY STRATEGIES	21
3.3.1 Dry Mixedgrass Natural Subregion Recovery Strategy	21

3.3.2	Mixed Grass Natural Subregion Recovery Strategy	22
3.3.3	Northern Fescue Natural Subregion Recovery Strategy	26
4.0	OPERATIONAL SEED MIXES.....	29
4.1	ALBERTA CROPLAND CARBON CONVERSION PROTOCOL.....	29
4.2	BENGA MINING LIMITED GRASSY MOUNTAIN COAL PROJECT	30
4.3	BROOKS POWER PROJECT	32
4.4	COALSPUR VISTA MINE.....	32
4.5	COAL VALLEY RESOURCES INC. ROBB TREND COAL MINE	34
4.6	ENCANA CFB SUFFIELD.....	35
4.7	EXPRESS PIPELINE	37
4.8	GRANDE CACHE COAL	41
4.9	LUSCAR LTD. SHEERNESS MINE.....	42
4.10	PARKS CANADA – TRANS CANADA HIGHWAY, BANFF NATIONAL PARK.....	43
4.11	SUNCOR TAILINGS SAND SLOPES	43
4.12	TRANSCANADA KEYSTONE PIPELINE GP LTD. KEYSTONE PIPELINE	44
4.13	TRANS MOUNTAIN PIPELINE ULC TRANS MOUNTAIN EXPANSION PROJECT	46
5.0	RESEARCH AND DEVELOPMENT SEED MIXES	51
5.1	INNO TECH ALBERTA	51
5.1.1	AltaLink Transmission Line Right-of-Way	51
5.1.2	Imaginea Wellsite Enhanced Reclamation and Remediation Demonstration.....	51
5.1.3	Other Research Projects.....	52
5.2	UNIVERSITY OF ALBERTA	62
5.2.1	Bush – Native Seed Mixes for Diversity	62
5.2.2	Cohen-Fernandez – Limestone Quarry Revegetation	66
5.2.3	Desserud and Naeth – Festuca hallii Recovery	67
5.2.4	Erichsen Arychuk – Native Forb Establishment.....	68
5.2.5	Fluker – Impacts of Soil Nutrient Levels and Interspecific Competition... 69	
5.2.6	Hammermeister et al. – Native Prairie Wellsite Reclamation	69
5.2.7	Naeth and Wilkinson – Fire Fuel Break Management.....	71
5.2.8	Naeth et al. – Pipeline Rangeland Revegetation.....	71
5.2.9	Pelech – Native vs. Introduced Comparison.....	72
5.2.10	Pitchford – Aspen Parkland	74

5.2.11	Rojas – City of Edmonton Naturalization	76
5.2.12	Salisbury – Boreal Forest Pipeline Revegetation	77
5.2.13	Sherritt – Festuca hallii and Festuca campestris Revegetation.....	77
5.2.14	Stover – Waterton Lake National Park	78
5.2.15	Wishart – Montane Grassland Pipeline Revegetation	79
5.2.16	Wruck – Parkland Pipeline Seeding vs. Natural Recovery	80
6.0	COMMERCIAL SEED MIXES	81
6.1	GOLD MEDAL SEEDS LTD.....	81
6.1.1	Alberta Hiways Grass Seed Mixtures	81
6.1.2	Forage and Reclamation Mixtures.....	84
6.1.3	Suffield Cluster Mixtures.....	85
6.1.4	Special Areas Native Grass Seed Mixes.....	86
6.2	GPEC GREEN PATCH ENVIRONMENTAL CONSULTING LTD.....	89
6.3	HANNAS SEEDS.....	92
6.4	NORTHSTAR SEED	94
6.5	PICKSEED	96
6.5.1	Foothills Natural Region.....	96
6.5.2	Boreal Forest Natural Region	97
6.5.3	Rocky Mountain Natural Region.....	99
6.5.4	Parkland Natural Region	99
6.5.5	Grassland Natural Region	100
6.5.6	Native Grass Blends.....	102
6.6	SEABORN SEEDS INC.	104
6.7	WILD ABOUT FLOWERS.....	104
7.0	SOURCES OF INDIVIDUAL SPECIES IN MIXES	106
7.1	INNO TECH ALBERTA VARIETIES.....	106
7.2	COMMERCIAL SEED SOURCES	106
8.0	SUMMARY AND OPPORTUNITIES	108
8.1	SUMMARY	108
8.2	OPPORTUNITIES	109
9.0	REFERENCES	111
9.1	ADDITIONAL READING	118

10.0	GLOSSARY	119
10.1	TERMS	119
10.2	ACRONYMS.....	119

LIST OF TABLES

Table 1.	Alberta Transportation Zone 1 mixed wetland seed mix,	5
Table 2.	Alberta Transportation Zone 2 dry mixedwood seed mix.....	6
Table 3.	Alberta Transportation Zone 3 central mixedwood seed mix.....	7
Table 4.	Alberta Transportation Zone 4 mixedgrass and dry mixedgrass seed mix.....	7
Table 5.	Alberta Transportation Zone 5 central parkland seed mix.....	7
Table 6.	Alberta Transportation Zone 6 lower foothills seed mix.	8
Table 7.	City of Edmonton native seed mix – Peace River parkland.	8
Table 8.	City of Edmonton native seed mix - central parkland.....	9
Table 9.	City of Edmonton non-maintained naturalization landscaping - wet meadow seed mix.....	9
Table 10.	City of Edmonton non-maintained naturalization landscaping - dry meadow seed mix.....	9
Table 11.	City of Edmonton non-maintained naturalization landscaping - grassland wet seed mix.....	10
Table 12.	City of Lethbridge dryland seed mixture.....	10
Table 13.	Eastern Irrigation District reclamation seed mix.....	11
Table 14.	Suffield Block native grass seed mix (1977).	11
Table 15.	Town of Canmore mowing tolerant native grass seed mixture - slopes, natural areas and non-maintained areas.	12
Table 16.	Town of Canmore non-mowed native grass seed mixture - slopes, natural areas and non-maintained areas.	12
Table 17.	Town of Canmore wild flower mix - slopes, natural areas and non-maintained areas.	13
Table 18.	Ducks Unlimited Canada loamy range site, simple pasture mix.....	14
Table 19.	AITF seral <i>Festuca hallii</i> grassland mix.....	15
Table 20.	AITF sub-seral <i>Festuca hallii</i> grassland mix.	15
Table 21.	AITF northern fescue grasslands loam soils mix.....	15

Table 22.	AITF mixed grass seed mix.	16
Table 23.	AITF mixed grass depressions and wetlands (including saline sites) mix.	16
Table 24.	AITF dry mixed grass seed mix.	17
Table 25.	AITF dry mixed grass sandy soils (south) mix.	17
Table 26.	AITF foothills fescue seed mix.	18
Table 27.	AITF parkland sandy soil mix.....	18
Table 28.	AITF fescue grassland north sandy soil mix.....	18
Table 29.	AITF Peace River parkland seed mix.	19
Table 30.	Alberta Innovates – Technology Futures Wainwright recommended mix.	20
Table 31.	AITF pollinator mix.	20
Table 32.	InnoTech Alberta recommended saline seed mix.	20
Table 33.	Dry mixedgrass recovery strategy seed mix for loamy, shallow to gravel and gravel range sites.	21
Table 34.	Dry mixedgrass recovery strategy seed mix for blowout and clayey range sites.	21
Table 35.	Dry mixedgrass recovery strategy seed mix for sands, sandy and choppy sandhill range sites.....	22
Table 36.	Dry mixedgrass recovery strategy seed mix for DMGA13 western porcupine grass – needle- and- thread – sand grass sites.....	22
Table 37.	Mixedgrass recovery strategy seed mix for Cypress upland on loamy, shallow to gravel, gravel and thin breaks range sites.	23
Table 38.	Mixedgrass recovery strategy seed mix for Cypress Upland: low elevation dry loamy and blowout range sites.	23
Table 39.	Mixedgrass recovery strategy seed mix for Cypress Upland: saline lowland range sites.....	23
Table 40.	Mixedgrass recovery strategy seed mix for Sweetgrass and Milk River Upland: overflow range sites.....	23
Table 41.	Mixedgrass recovery strategy seed mix for Sweetgrass and Milk River Upland: loamy and thin breaks range sites.	24
Table 42.	Mixedgrass recovery strategy seed mix for Sweetgrass and Milk River Upland: clayey and blowout range sites.....	24
Table 43.	Mixedgrass recovery strategy seed mix for Sweetgrass and Milk River Upland: sandy range sites.	24
Table 44.	Mixedgrass recovery strategy seed mix for Sweetgrass and Milk River Upland: saline lowland range sites.	25
Table 45.	Mixedgrass recovery strategy seed mix for Lethbridge, Vulcan Plain: loamy range sites.....	25

Table 46.	Mixedgrass recovery strategy seed mix for Lethbridge, Vulcan Plain: sandy and sands range sites.	25
Table 47.	Mixedgrass recovery strategy seed mix for Lethbridge, Vulcan Plain: saline lowland range sites.	26
Table 48.	Mixedgrass recovery strategy seed mix for Majorville Upland: loamy ecological range sites.....	26
Table 49.	Northern fescue recovery strategy seed mix for plains rough fescue – sedge plant communities.	26
Table 50.	Northern fescue recovery strategy seed mix for plains rough fescue – western porcupine grass communities.	27
Table 51.	Northern fescue recovery strategy seed mix for blunt sedge – western porcupine grass communities.	27
Table 52.	Northern fescue recovery strategy seed mix for sedge - western wheatgrass communities.	27
Table 53.	Alberta Cropland Carbon Conversion Protocol simple seed mix.....	29
Table 54.	Alberta Cropland Carbon Conversion Protocol diverse seed mix.	29
Table 55.	Benga Mining Limited direct placement mix.	30
Table 56.	Benga Mining Limited grassland, open forest mix.	30
Table 57.	Benga Mining Limited closed conifer forest mix.....	30
Table 58.	Benga Mining Limited mixed forest mix.....	31
Table 59.	Benga Mining Limited treed wetland mix.	31
Table 60.	Brooks Power Project native mix.	32
Table 61.	Coalspur direct placement mix.	32
Table 62.	Coalspur forest mesic or drier mix.	32
Table 63.	Coalspur forest subhygric or wetter mix.....	33
Table 64.	Coalspur steep, watercourse sensitive mix.	33
Table 65.	CVRI lower foothills native mix.	34
Table 66.	CVRI wetland mix.	34
Table 67.	EnCana CFB Suffield wetland margins mix.....	35
Table 68.	EnCana CFB Suffield sandy soil mix.....	35
Table 69.	EnCana CFB Suffield solonetzic soil mix.....	36
Table 70.	Express Seed Mix 1 – aspen parkland.....	37
Table 71.	Express Seed Mix 2 – rough fescue - mixedgrass transition prairie.	38
Table 72.	Express Seed Mix 3 – dry mixedgrass prairie sandy soils.....	39
Table 73.	Express Seed Mix 4 – dry mixedgrass prairie solonetzic soils.....	40

Table 74.	Express Seed Mix 5 – prairie wetlands.	40
Table 75.	GCC mix.	41
Table 76.	Sheerness Mine sandy soil mix.	42
Table 77.	Sheerness Mine loamy soil mix.	42
Table 78.	Sheerness Mine solonetzic soil mix.	42
Table 79.	Sheerness Mine saline soil mix.	42
Table 80.	Parks Canada – Trans Canada Highway – Banff National Park mix.	43
Table 81.	Suncor tailings sand slope hydroseeding mix.	43
Table 82.	Keystone seral <i>Festuca hallii</i> grassland mix.	44
Table 83.	Keystone sub-seral <i>Festuca hallii</i> grassland mix.	44
Table 84.	Keystone depression and wetland (including saline sites) mix.	45
Table 85.	Keystone sandy soils (north) mix.	45
Table 86.	Keystone sandy soils (south) mix.	45
Table 87.	Keystone mixed grass and dry mixed grass mix.	46
Table 88.	Trans Mountain dry or moist soil mix or native erosion control mix CP-1.	46
Table 89.	Trans Mountain wet soil mix CP-2.	47
Table 90.	Trans Mountain wet soil mix DMW-2.	47
Table 91.	Trans Mountain wet soil mix CMW-2.	47
Table 92.	Trans Mountain general dry or moist soils or native erosion control mix LF-1. ...	48
Table 93.	Trans Mountain wet soil mix LF-2.	48
Table 94.	Trans Mountain general dry or moist soils or native erosion control mix M-1. ...	48
Table 95.	Trans Mountain wet soil mix M-2.	49
Table 96.	InnoTech Alberta AltaLink Hansman Lake seed mix.	51
Table 97.	InnoTech Alberta Imaginea wellsite 1 seed mix.	51
Table 98.	ARC northern fescue mesic wellsite modified reclamation mix.	52
Table 99.	ARC northern fescue mesic wellsite simple mix.	53
Table 100.	ARC northern fescue mesic wellsite diverse mix.	53
Table 101.	ARC northern fescue sandy wellsite modified reclamation mix.	54
Table 102.	ARC northern fescue sandy wellsite simple mix.	54
Table 103.	ARC northern fescue sandy wellsite diverse mix.	54
Table 104.	ARC sandy soil wellsite mix.	55
Table 105.	ARC sandy soil wellsite – operator mix.	56

Table 106.	ARC fescue prairie pipeline – ARC seed mix.	56
Table 107.	ARC fescue prairie pipeline – contractor seed mix.	57
Table 108.	ARC Dilberry gravel pit mix.	57
Table 109.	ARC low growing, drought tolerant seed mix for coarse Fort Saskatchewan roadside soils.	58
Table 110.	ARC Fort Saskatchewan green space mix.	58
Table 111.	ARC spill site mix.	59
Table 112.	ARC Rumsey wellsite mix 1.	59
Table 113.	ARC Rumsey wellsite mix 2.	60
Table 114.	AITF foothills fescue mix.	60
Table 115.	AITF foothills fescue wellsite mix.	61
Table 116.	InnoTech Alberta oil sands tailings stabilization mix.....	62
Table 117.	Bush grass mix 1.....	62
Table 118.	Bush grass mix 2.....	63
Table 119.	Bush forbs mix 1.....	63
Table 120.	Bush legume mix 1.....	63
Table 121.	Bush NOVA mix.	64
Table 122.	Bush grass mix 3.....	64
Table 123.	Bush grass mix 4.....	65
Table 124.	Bush forbs mix 2.....	65
Table 125.	Bush legume mix 2.....	66
Table 126.	Bush Ducks Unlimited Canada mix.	66
Table 127.	Cohen-Fernandez limestone quarry seed mix.	67
Table 128.	Desserud and Naeth Ellerslie and Byemoor native mix.....	67
Table 129.	Desserud and Naeth Drumheller native mix.....	67
Table 130.	Erichsen Arychuk grass-forb seed mix.	68
Table 131.	Fluker native mix.	69
Table 132.	Fluker native-introduced mix.	69
Table 133.	Hammermeister et al. dry mixed grass low diversity industry mix.	69
Table 134.	Hammermeister et al. dry mixed grass simple mix.	70
Table 135.	Hammermeister et al. dry mixed grass diverse mix.	70
Table 136.	Naeth and Wilkinson Elk Island mix.	71
Table 137.	Naeth and Wilkinson Jasper mix.	71

Table 138.	Naeth et al. Milo Lateral native seed mix.....	72
Table 139.	Naeth et al. Porcupine Hills Lateral seed mix.....	72
Table 140.	Pelech native pasture mix.....	72
Table 141.	Pelech native hay mix.....	73
Table 142.	Pelech native mix.....	73
Table 143.	Pelech alternate native mix.....	73
Table 144.	Pitchford – Aspen Parkland mix 1.....	74
Table 145.	Pitchford – Aspen Parkland mix 2.....	74
Table 146.	Pitchford – Aspen Parkland mix 1 plus.....	74
Table 147.	Pitchford – Aspen Parkland mix 2 plus.....	75
Table 148.	Rojas – Short grass native seed mix.....	76
Table 149.	Rojas – Tall grass native seed mix.....	76
Table 150.	Salisbury Alliance Pipeline mix.....	77
Table 151.	Sherritt <i>Festuca hallii</i> mix.....	77
Table 152.	Sherritt <i>Festuca campestris</i> mix.....	77
Table 153.	Stover Waterton Lakes National Park wild-collected seed mix.....	78
Table 154.	Wishart montane pipeline mix 1.....	79
Table 155.	Wishart montane pipeline mix 2.....	79
Table 156.	Wishart montane pipeline mix 3.....	79
Table 157.	Wruck Alliance Pipeline sandy soil mix.....	80
Table 158.	GMSL Zone 1 wetland mixed wood native mix.....	81
Table 159.	GMSL Zone 2 wetland mixed wood native mix.....	81
Table 160.	GMSL Zone 3 central mixed wood native mix (with ticklegrass).....	82
Table 161.	GMSL Zone 3 central mixed wood native mix (without ticklegrass).....	82
Table 162.	GMSL Zone 4 mixed grass & dry mixed grass mix.....	82
Table 163.	GMSL Zone 5 central parkland mix.....	83
Table 164.	GMSL Zone 6 lower foothills mix (with tickle grass).....	83
Table 165.	GMSL Zone 6 lower foothills mix (without tickle grass).....	83
Table 166.	GMSL EID reclamation mixture.....	84
Table 167.	GMSL EID prairie mixture.....	84
Table 168.	GMSL SNC native fescue mixture.....	84
Table 169.	GMSL Suffield cluster 2 mixture.....	85

Table 170.	GMSL Suffield cluster 3 mixture.	85
Table 171.	GMSL Suffield cluster 4 mixture.	85
Table 172.	GMSL Suffield cluster 5 mixture.	86
Table 173.	GMSL Suffield cluster 6 mixture.	86
Table 174.	GMSL Special Areas loamy mix 1 (Brown Soil Zone – Dry Mixedgrass).	87
Table 175.	GMSL Special Areas solonetzic mix 1 (Brown Soil Zone – Dry Mixedgrass).	87
Table 176.	GMSL Special Areas sandy mix 1 (Brown Soil Zone – Dry Mixedgrass).	87
Table 177.	GMSL Special Areas loamy mix 2 (Dark Brown Soil Zone – Mixedgrass).	87
Table 178.	GMSL Special Areas solonetzic mix 2 (Dark Brown Soil Zone – Northern Fescue).	88
Table 179.	GMSL Special Areas sandy mix 2 (Dark Brown Sol Zone – Northern Fescue).	88
Table 180.	GMSL Special Areas loamy mix 3 (Dark Brown Soil Zone – Northern Fescue). ..	88
Table 181.	GMSL Special Areas sandy mix 3 (Dark Brown Soil Zone – Central Parkland)...	89
Table 182.	GMSL Special Areas saline mix.	89
Table 183.	GPEC alpine blend.	89
Table 184.	GPEC upper foothills blend.	90
Table 185.	GPEC lower foothills blend.	90
Table 186.	GPEC central blend.	91
Table 187.	GPEC central parkland blend.	91
Table 188.	GPEC mixed grasses blend.	91
Table 189.	Hannas natural blend.	92
Table 190.	Hannas native “A” blend.	92
Table 191.	Hannas dry loamy blend.	92
Table 192.	Hannas moist loamy blend.	93
Table 193.	Hannas sandy blend.	93
Table 194.	Hannas solonetzic clay blend.	93
Table 195.	Hannas saline blend.	94
Table 196.	Northstar foothills native blend.	94
Table 197.	Northstar north/central parkland native blend.	94
Table 198.	Northstar southern prairies native blend.	95
Table 199.	Northstar sandy soils native blend.	95
Table 200.	Northstar wetland native blend.	95
Table 201.	Northstar slope stabilization native blend.	96

Table 202.	Pickseed lower foothills blend.	96
Table 203.	Pickseed lower foothills (sandy slopes) blend.	96
Table 204.	Pickseed upper foothills blend.	97
Table 205.	Pickseed central mixedwood blend.	97
Table 206.	Pickseed central mixedwood with annual ryegrass blend.	98
Table 207.	Pickseed dry mixedwood blend.	98
Table 208.	Pickseed boreal highlands blend.	98
Table 209.	Pickseed subalpine subregion blend.	99
Table 210.	Pickseed alpine subregion blend.	99
Table 211.	Pickseed Peace River parkland blend.	99
Table 212.	Pickseed central parkland blend.	100
Table 213.	Pickseed foothills parkland blend.	100
Table 214.	Pickseed dry mixedgrass / mixed grass prairie blend.	100
Table 215.	Pickseed foothills fescue blend.	101
Table 216.	Pickseed northern fescue blend.	101
Table 217.	Pickseed aspen parkland blend.	102
Table 218.	Pickseed moist mixed grassland blend.	102
Table 219.	Pickseed mixed grassland blend.	103
Table 220.	Pickseed grassland wet blend.	103
Table 221.	Pickseed cypress upland blend.	103
Table 222.	Seaborn Seeds Inc. green native mix.	104
Table 223.	Wild about Flowers prairie meadow native grass seed mix.	104
Table 224.	Wild about Flowers short grass wildflower meadow mix.	105
Table 225.	InnoTech Alberta Native Grass Varieties Currently Available as Certified Seed.	106

LIST OF FIGURES

Figure 1.	Alberta Transportation seed mix zones.	6
Figure 2.	Types of mixes.	108
Figure 3.	Number of species in mixes.	109

LIST OF SPECIES IN THIS REPORT

Scientific names in this report follow the ITIS database – <https://www.itis.gov/servlet/SingleRpt/SingleRpt>. Spelling of common names follows Alberta Agriculture and Forestry (2016). Native/Introduced classification follows Alberta Agriculture and Forestry (2016) and Kershaw (2015).

Common Name	Current Scientific Name	Old Scientific Name	Other Names	Alberta Status
Alfalfa	<i>Medicago sativa</i>			Introduced
Alkali Bluegrass	<i>Poa secunda</i> ssp. <i>juncifolia</i>	<i>Poa juncifolia</i> <i>Poa ampla</i>		
Alkali Grass	<i>Puccinellia distans</i>			Introduced
Alpine Bluegrass	<i>Poa alpina</i>			Native
Alpine Fescue	<i>Festuca brachyphylla</i>			Native
Alpine Timothy	<i>Phleum alpinum</i>			Native
Alsike Clover	<i>Trifolium hybridum</i>			Introduced
American Sweet Vetch	<i>Hedysarum alpinum</i>	<i>Hedysarum alpinum</i> var. <i>americanum</i>	Alpine sweetvetch	Native
American Vetch	<i>Vicia americana</i>			Native
Annual Ryegrass	<i>Lolium multiflorum</i>			Introduced
Annual Sunflower	<i>Helianthus annuus</i>			Native
Ascending Purple Milk Vetch	<i>Astragalus laxmannii</i> var. <i>robustior</i>	<i>Astragalus striatus</i>		Native
Awned Wheatgrass	<i>Elymus trachycaulus</i> ssp. <i>subsecundus</i>	<i>Agropyron subsecundum</i>	<i>Agropyron trachycaulum</i> var. <i>unilaterale</i> Awned Slender Wheatgrass	Native
Beardless Wild Rye	<i>Leymus triticoides</i>			Introduced
Blanket Flower	<i>Gaillardia aristata</i>			Native
Blue Grama	<i>Bouteloua gracilis</i>			Native

Common Name	Current Scientific Name	Old Scientific Name	Other Names	Alberta Status
Bluebunch Wheatgrass	<i>Pseudoroegneria spicata</i>	<i>Agropyron spicatum</i>		Native
Bluejoint	<i>Calamagrostis canadensis</i>		Canada Reed Grass	Native
Brown Eyed Susan	<i>Gaillardia aristata</i>			Native
Canada Bluegrass	<i>Poa compressa</i>			Introduced
Canada Goldenrod	<i>Solidago canadensis</i>			Native
Canada Milk Vetch	<i>Astragalus canadensis</i>			Native
Canada Wild Rye	<i>Elymus canadensis</i>			Native
Cinquefoil	<i>Potentilla spp.</i>			
Columbia Needle Grass	<i>Achnatherum nelsonii</i>	<i>Stipa columbiana</i>	Nelson Achnatherum	Native
Creeping Bentgrass	<i>Agrostis stolonifera</i>		Redtop	Introduced
Creeping Juniper	<i>Juniperus horizontalis</i>			Native
Creeping Red Fescue	<i>Festuca rubra</i>			Introduced
Cut-leaved Anemone	<i>Anemone multifida</i>			Native
False Melic	<i>Schizachne purpurascens</i>		Purple Oatgrass	Native
Field Locoweed	<i>Oxytropis campestris</i>		<i>Oxytropis cusickii</i> <i>Oxytropis monticola</i>	Native
Foothills Rough Fescue	<i>Festuca campestris</i>			Native
Fowl Bluegrass	<i>Poa palustris</i>			Native
Fowl Manna Grass	<i>Glyceria striata</i>			Native
Fringed Brome	<i>Bromus ciliatus</i>			Native
Giant Hyssop	<i>Agastache foeniculum</i>		Blue Giant Hyssop	Native
Giant Wild Rye	<i>Leymus cinereus</i>			Native
Golden Bean	<i>Thermopsis rhombifolia</i>			Native

Common Name	Current Scientific Name	Old Scientific Name	Other Names	Alberta Status
Green Needle Grass	<i>Nassella viridula</i>	<i>Stipa viridula</i>		Native
Hairy Golden Aster	<i>Heterotheca villosa</i>			Native
Hairy Wild Rye	<i>Leymus innovatus</i>	<i>Elymus innovatus</i>		Native
Hard Fescue	<i>Festuca trachyphylla</i>		<i>Festuca ovina</i> <i>var. duriscula</i>	Introduced
Hoary Primrose	<i>Primula incana</i>			Native
Hooker's Oat Grass	<i>Avenula hookeri</i>	<i>Helictotrichon hookeri</i>		Native
Idaho Fescue	<i>Festuca idahoensis</i>			Native
Indian Rice Grass	<i>Achnatherum hymenoides</i>	<i>Orzyopsis hymenoides</i>		Native
Inland Saltgrass	<i>Distichlis spicata</i>			Native
June Grass	<i>Koeleria macrantha</i>	<i>Koeleria gracilis</i>		Native
Kentucky Bluegrass	<i>Poa pratensis</i>			Introduced
Lilac-Flowered Beardtongue	<i>Penstemon gracilis</i>			Native
Little Bluestem	<i>Schizachyrium scoparium</i>			Native
Low Goldenrod	<i>Solidago missouriensis</i>			Native
Meadow Barley	<i>Hordeum brachyantherum</i>			Native
Mountain Brome	<i>Bromus carinatus</i>		<i>Bromus marginatus</i>	Native
Mountain Rice Grass	<i>Oryzopsis asperifolia</i>		White-grained Mountain Rice Grass	Native
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	<i>Stipa comata</i>	<i>Hesperostipa comata</i> ssp. <i>comata</i> Spear Grass	Native
Nodding Brome	<i>Bromus anomalus</i>			Native

Common Name	Current Scientific Name	Old Scientific Name	Other Names	Alberta Status
Nodding Locoweed	<i>Oxytropis deflexa</i>			Native
Northern Sweetvetch	<i>Hedysarum boreale</i>		<i>Hedysarum boreale</i> ssp. <i>mackenzii</i> Northern Hedysarum	Native
Northern Rough Fescue	<i>Festuca altaica</i>	<i>Festuca scabrella</i>	Altai Fescue, Rough Fescue, Northern Fescue	Native
Northern Wheatgrass	<i>Agropyron dasystachyum</i>		<i>Elymus lanceolatus</i> ssp. <i>lanceolatus</i>	Native
Nuttall's Alkali Grass	<i>Puccinellia nuttalliana</i>			Native
Oats	<i>Avena sativa</i>			Introduced
Pale Agoseris	<i>Agoseris glauca</i>			Native
Parry Oatgrass	<i>Danthonia parryi</i>			Native
Plains Reed Grass	<i>Calamagrostis montanensis</i>			Native
Plains Rough Fescue	<i>Festuca hallii</i>	<i>Festuca altaica</i> ssp. <i>hallii</i>	Rough Fescue	Native
Prairie Coneflower	<i>Ratibida columnifera</i>			Native
Prairie Sand Reed	<i>Calamovilfa longifolia</i>		Sand Reed Grass	Native
Prairie Smoke	<i>Geum triflorum</i>			Native
Prickly Rose	<i>Rosa acicularis</i>			Native
Pubescent Wheatgrass	<i>Thinopyrum intermedium</i>		Intermediate Wheatgrass	Introduced
Purple Prairie Clover	<i>Dalea purpurea</i>	<i>Petalostemon purpureum</i>		Native
Richardson Needle Grass	<i>Achnatherum richardsonii</i>	<i>Stipa richardsonii</i>		Native

Common Name	Current Scientific Name	Old Scientific Name	Other Names	Alberta Status
Rocky Mountain Fescue	<i>Festuca saximontana</i>			Native
Saltgrass	<i>Distichlis spicata</i> ssp. <i>stricta</i>	<i>Distichlis stricta</i>		Introduced
Sand Dropseed	<i>Sporobolus cryptandrus</i>			Native
Sand Nut Grass	<i>Cyperus schweinitzii</i>			Native
Sandberg Bluegrass	<i>Poa secunda</i>	<i>Poa sandbergii</i>		Native
Sedge	<i>Carex</i> sp.			
Sheep Fescue	<i>Festuca ovina</i>			Introduced
Showy Locoweed	<i>Oxytropis splendens</i>			Native
Silky Locoweed	<i>Oxytropis sericea</i>			Native
Silky Lupine	<i>Lupinus sericeus</i>			Native
Silverberry	<i>Elaeagnus commutata</i>			Native
Slender Beardtongue	<i>Penstemon procerus</i>			Native
Slender Cinquefoil	<i>Potentilla gracilis</i>			Native
Slender Wheatgrass	<i>Elymus trachycaulus</i> ssp. <i>trachycaulus</i>	<i>Agropyron trachycaulum</i> var. <i>trachycaulum</i>	<i>Agropyron trachycaulum</i> <i>Elymus trachycaulus</i>	Native
Slough Grass	<i>Beckmannia syzigachne</i>			Native
Smooth Aster	<i>Symphyotrichum laeve</i>	<i>Aster laevis</i>		Native
Smooth Brome	<i>Bromus inermis</i>			Introduced
Smooth Fleabane	<i>Erigeron glabellus</i>			Native
Smooth Wildrye	<i>Elymus glaucus</i>			Native
Spike Trisetum	<i>Trisetum spicatum</i>			Native
Stiff Goldenrod	<i>Solidago rigida</i>			Native
Streambank Wheatgrass	<i>Elymus lanceolatus</i> ssp. <i>riparius</i>	<i>Agropyron riparium</i>	<i>Elymus lanceolatus</i>	Native
Streambank Wheatgrass - Sodar	<i>Elymus lanceolatus</i> ssp. <i>psammophilus</i>			Introduced

Common Name	Current Scientific Name	Old Scientific Name	Other Names	Alberta Status
Sulphur Flower Buckwheat	<i>Eriogonum umbellatum</i>			Native
Sun-loving Sedge	<i>Carex pensylvanica</i>			Native
Sweetgrass	<i>Anthoxanthum nitens</i>	<i>Hierachloe odorata</i>		Native
Sweetvetch	<i>Hedysarum spp.</i>			
Tall Fescue	<i>Schedonorus arundinaceus</i>	<i>Festuca elatior</i>		Introduced
Tall Wheatgrass	<i>Thinopyrum elongatum</i>	<i>Agropyron elongatum</i>		Introduced
Thickspike Wheatgrass	<i>Elymus macrourus</i>			Introduced
Tickle Grass	<i>Agrostis scabra</i>		Hair Bentgrass	Native
Timothy	<i>Phleum pratense</i>			Introduced
Tufted Hair Grass	<i>Deschampsia caespitosa</i>			Native
Tufted White Prairie Aster	<i>Symphyotrichum ericoides</i>	<i>Aster ericoides</i>		Native
Vetch	<i>Astragalus spp.</i>			
Violet Wheatgrass	<i>Elymus violaceus</i>	<i>Agropyron violaceum</i>	<i>Elymus trachycaulus ssp. violaceus</i> Broadglumed Wheatgrass	Native
Waxleaf Penstemon	<i>Penstemon nitidus</i>			Native
Western Dock	<i>Rumex occidentalis</i>			Native
Western Meadow-Rue	<i>Thalictrum occidentale</i>			Native
Western Porcupine Grass	<i>Hesperostipa curtiseta</i>	<i>Stipa curtiseta</i>		Native
Western Wheatgrass	<i>Pascopyrum smithii</i>	<i>Agropyron smithii</i>		Native
White Clover	<i>Trifolium repens</i>			Introduced
White Prairie Clover	<i>Dalea candida</i>	<i>Petalostemon candidum</i>		Native

Common Name	Current Scientific Name	Old Scientific Name	Other Names	Alberta Status
Wild Bergamot	<i>Monarda fistulosa</i>			Native
Wild Blue Flax	<i>Linum lewisii</i>		<i>Linum perenne</i>	Native
Wild Licorice	<i>Glycyrrhiza lepidota</i>			Native
Yarrow	<i>Achillea millefolium</i>			Native
Yellow Evening Primrose	<i>Oenothera biennis</i>			Native
Yellow Penstemon	<i>Penstemon confertus</i>			Native

NOTE: Selecting the appropriate scientific name for the wheatgrasses that were listed in the source documents with old scientific names or just common names was extremely challenging. This was particularly true for Awned, Northern, Slender and Streambank wheatgrasses. Readers should consult the source documents to ensure that the correct name assignments have been made.

NOTE: For the purposes of this report and the accompanying Excel file, when the source document authors simply listed Vetch the genus *Astragalus* was assigned; however it could also be *Hedysarum* or *Vicia*.

1.0 INTRODUCTION

The Government of Alberta has long been a strong proponent of the use of native species for land reclamation and restoration projects. In 1973, the Department of Agriculture began an evaluation of native species suitable for reclamation of industrially disturbed lands (Vaartnou and Wheeler, 1975). That work eventually led to the creation of the Native Species Research Program at the Alberta Environmental Centre (now InnoTech Alberta) in the late 1970s.

InnoTech Alberta sponsored two workshops in November 2016 to gather stakeholder input for the Business Case to redesign the Native Species Research Program (Small et al., 2016a). One of the recommendations from the Workshops was to:

Develop and maintain a list of existing prescribed native plant seed mixes to help growers identify opportunities and to drive work to provide improved mixes.

This report is a first attempt to inventory native grass seed mixes required or recommended for use in Alberta and those that are commercially available. The inventory was developed primarily through web-based searches. Although some direct contact was made with researchers and seed providers there are likely additional resources that were missed.

This report is intended to be a living document – updated periodically with input from the Native Plants Community.

1.1 REPORT SCOPE

The report focuses on native grass seed mixes for use in revegetation projects (reclamation, restoration, naturalization and remediation) undertaken for or by government or industry. Mixes labeled agronomic, forage, tame forage, hay, pasture, lawn, turf, park, etc. are not included in this report. However, some of the mixes contain agronomic species – these may be present to provide a nurse/cover crop that will allow the native species to establish, or they may be present because the mix represents a transition to a fully native mix. Commercial wildflower seed mixes are also not included in this document.

While the majority of seed mixes in the inventory are sourced from materials produced since 2010, there are mixes dating back as far as 1977 to provide some perspective and insights into the extent of progress in seed mix design.

Some of the commercial mixes reported here are marketed for both large-scale projects and smaller projects such as homes or acreages – readers should check with the vendor to determine availability and volumes.

The report is divided into sections based on seed mix type:

- Section 2 lists mixes required by various government agencies;
- Section 3 lists mixes that are recommended for use by various organizations;
- Section 4 lists proposed or deployed operational mixes;

- Section 5 lists mixes used in research and development projects; and,
- Section 6 lists commercial mixes.

A summary table of all of these mixes, as well as vendors who supply seed for individual species that are found in the mixes is available as an Excel file to allow for sorting and searches.

1.2 BUILDING A SEED MIX

The following factors must be considered when developing a seed mix (adapted from Alberta Energy Regulator, 2003; Alberta Sustainable Resource Development, 2006; Gabruch et al., nd; Golden Acre Seeds, nd; Lowen and Walker, 1988; Native Plant Working Group, 2000; Pickseed, nd; Small et al., 2016; Smreciu et al., 2003; Tannas and Webb, 2016; Town of Canmore, 2016; Ziemkiewicz, 1983):

- Determine if natural recovery is an option (or regulatory expectation).
- Determine target vegetation (outcome).
 - o The target can be site specific (i.e., match adjacent conditions) or regulatory (e.g., Wellsite Criteria).
 - o The target may be a climax community or more likely an earlier stage along the recovery trajectory to a climax community.
 - o Target vegetation communities and species should be determined based on a site-specific vegetation assessment.
 - o Balance the goals for a site – e.g., erosion control (dense stands) vs. natural invasion (sparse stands).
- Identify the environmental conditions at the site and surrounding area – soil, vegetation, climate, level and type of disturbance, and any residual impacts.
- Review the characteristics of each species proposed for the mix.
 - o Ensure that no species will overwhelm the others.
- Determine availability of desired species.
 - o Seed suppliers need long lead times to produce new seed.
 - o Determine if alternative species are suitable (substitution).
- Assess the source and quality (purity, weeds) of desired species seed.
 - o Ensure the seed lots and mix are weed free (obtain weed certificates).
- Calculate Pure Live Seed (PLS) for each species (as an alternative to % weight).
 $\% \text{ PLS} = \% \text{ germination} \times \% \text{ purity}$
 where $\% \text{ purity} = 100 - \% \text{ inert material}$.
- Determine appropriate seeding rate (ideally on a seeds (PLS)/m² basis).
 - o Seeding rate can be modified based on seeding method (drill seeding is preferred to broadcast), season and plant establishment factors).
 - o Determine if minimum or maximum seeding rates have been set by regulators.

- Calculate the percentage of seeds for each species in the mix.
- Calculate operational seeding rate (kg/ha).
- Review the proposed seed mix with the landowner / land manager, and where required, obtain their approval.

1.3 REPORT NOTES

The following notes are provided to assist readers in interpreting the lists in this document:

- Where the common or scientific name is missing in the source document efforts have been made to infer the appropriate name; readers are encouraged to review the source documents and make their own interpretations.
- Older reference sources contain scientific names that have since been changed; this report uses the current names (based on searches of the ITIS database¹); see the list of species names at the front of this report. Readers are encouraged to review the source documents and make their own interpretations.
- Where there are multiple spellings of common names in source documents (e.g., Wheat Grass vs. Wheatgrass) this report uses the spelling in Alberta Agriculture and Forestry's website *Alberta Range Plants and Their Classification*². Where species names are not found in that resource, the ITIS database is used.
- Many mixes are described by species name and % in the source materials; this report assumes that % means wt %.
- Most mixes are described in terms of wt % or PLS/m², or both; some mixes are simply species lists or are described in different units (e.g., Garbuch et al. (nd) describe a Loamy Range Site simple pasture mix in seeds/lb and PLS lb/acre); contact vendors for more details.
- Some sources provide lists of suitable species for various environments but do not provide a specific seed mix recommendation (e.g., Innovista, nd; Native Plant Working Group, 2000; Parks Canada, 2011; Town of Banff, nd; Vaartnou and Wheeler, 1975) – these lists are not included in this report but do provide useful information when creating seed mixes.

1.4 LIMITATIONS AND CAVEATS

As noted above this is an initial inventory of native grass seed mixes in Alberta. Readers should be aware of the following limitations and caveats in using this report:

- Mention of a particular mix, species, cultivar or variety, wt% or PLS/m² value does not constitute endorsement by InnoTech Alberta.
- The list is not exhaustive – mixes are likely to have been missed; this can be corrected in later versions of this report.

¹ See <https://www.itis.gov/servlet/SingleRpt/SingleRpt>

² See [http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/agdex146](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex146)

- Care should be taken in assessing the “nativeness” of the species listed in the mixes:
 - some of the listed species (e.g., *Festuca ovina*) may be considered introduced (Alberta Agriculture and Forestry, 2016), some may be considered invasive (e.g., *Poa compressa*) and others undesirable (e.g., *Medicago sativa*).
 - sources of the seed in the mix are not always specified – they could be local, regional, provincial or extra-provincial – contact vendors for further details.
- Some mixes specify a variety or cultivar but most do not – check with vendors if the seed is common or not.
- Inclusion of a mix, or species in a commercial mix, does not necessarily imply that suitable volumes will be available when required – check with vendors.



2.0 REQUIRED SEED MIXES

Some government agencies mandate use of native species in reclamation projects. Examples of these are provided below.

2.1 ALBERTA TRANSPORTATION MIXES

Alberta Transportation's *Environmental Management System Manual* (Alberta Transportation, 2016; p. 75) requires consultants to follow Design Bulletin No. 25 *Grass Seed Mixtures used on Highway and Bridge Projects* (Alberta Infrastructure and Transportation, 2005) when an area to be seeded is larger than one hectare. The Bulletin divides the province into six regions (Figure 1), each with its own native species seed mix to be used when the adjacent land has native species communities (as determined by a vegetation assessment). Where the adjacent land is non-native two agronomic mixes are specified.

The six Alberta Transportation seed mixes are listed below.

Table 1. Alberta Transportation Zone 1 mixed wetland seed mix,

Common Name	Scientific Name	Wt %
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	40
Fringed Brome	<i>Bromus ciliatus</i>	15
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	15
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10
Rocky Mountain Fescue	<i>Festuca saximontana</i>	10
Fowl Bluegrass	<i>Poa palustris</i>	10

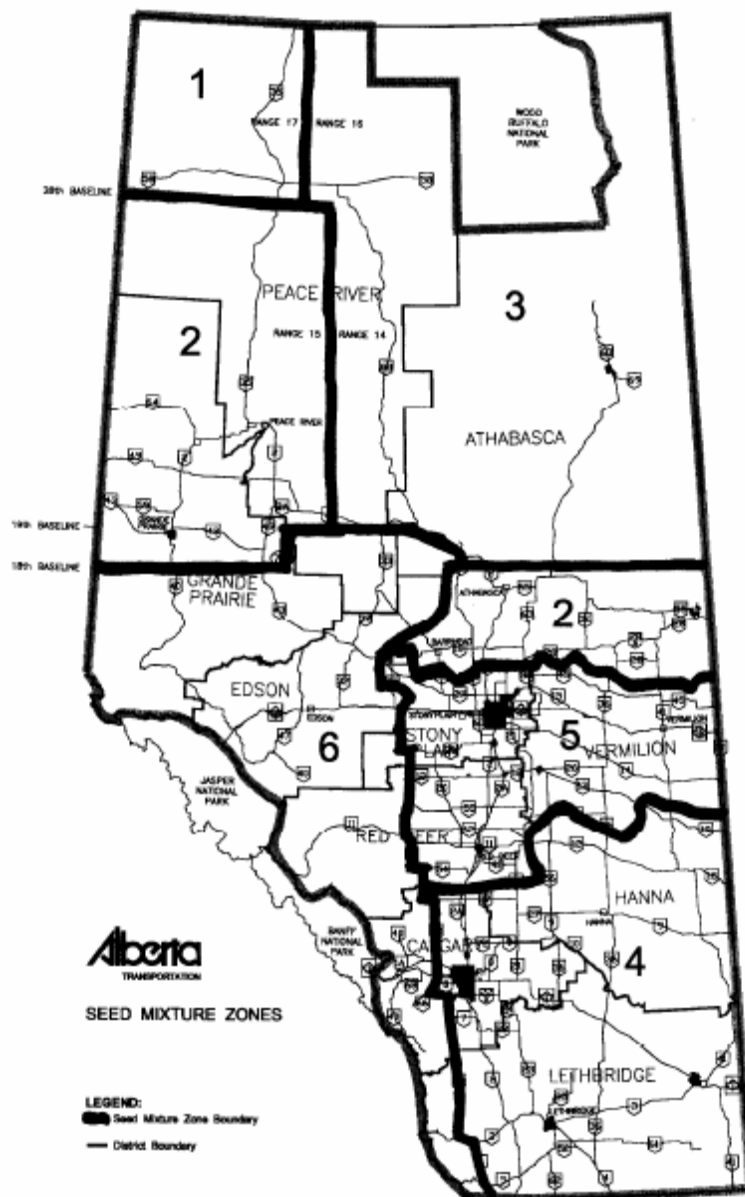


Figure 1. Alberta Transportation seed mix zones.

Table 2. Alberta Transportation Zone 2 dry mixedwood seed mix.

Common Name	Scientific Name	Wt %
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	35
Fringed Brome	<i>Bromus ciliatus</i>	20
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	15
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	10

Common Name	Scientific Name	Wt %
Rocky Mountain Fescue	<i>Festuca saximontana</i>	10
Fowl Bluegrass	<i>Poa palustris</i>	10

Table 3. Alberta Transportation Zone 3 central mixedwood seed mix.

Common Name	Scientific Name	Wt %
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	35
Rocky Mountain Fescue	<i>Festuca saximontana</i>	20
Tickle Grass	<i>Agrostis scabra</i>	10
Fringed Brome	<i>Bromus ciliatus</i>	10
Canada Wild Rye	<i>Elymus canadensis</i>	10
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	10
Fowl Bluegrass	<i>Poa palustris</i>	5

Table 4. Alberta Transportation Zone 4 mixedgrass and dry mixedgrass seed mix.

Common Name	Scientific Name	Wt %
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	30
Canada Wild Rye	<i>Elymus canadensis</i>	15
Mountain Brome	<i>Bromus carinatus</i>	15
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10
Alkali Grass	<i>Puccinellia distans</i>	10
Needle-and-Thread Grass	<i>Stipa comata</i>	10
Western Wheatgrass	<i>Pascopyrum smithii</i>	5
Indian Rice Grass	<i>Achnatherum hymenoides</i>	5

Table 5. Alberta Transportation Zone 5 central parkland seed mix.

Common Name	Scientific Name	Wt %
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	25
Fringed Brome	<i>Bromus ciliatus</i>	15
Green Needle Grass	<i>Nassella viridula</i>	15
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10

Common Name	Scientific Name	Wt %
Canada Wild Rye	<i>Elymus canadensis</i>	10
Indian Rice Grass	<i>Achnatherum hymenoides</i>	10
Nuttall's Alkali Grass	<i>Puccinellia nuttalliana</i>	10
Western Wheatgrass	<i>Pascopyrum smithii</i>	5

Table 6. Alberta Transportation Zone 6 lower foothills seed mix.

Common Name	Scientific Name	Wt %
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	30
Smooth Wild Rye	<i>Elymus glaucus</i>	20
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10
Tickle Grass	<i>Agrostis scabra</i>	10
Fringed Brome ¹	<i>Bromus ciliatus</i>	10
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	10
Foothills Rough Fescue	<i>Festuca campestris</i>	10

¹ Fringed brome must be coated.

2.2 CITY OF EDMONTON

The City of Edmonton's Design and Construction Standards (City of Edmonton, 2017) require use of native seed mixes for habitat restoration to fully re-establish a target level of ecosystem function and biodiversity as defined by the reference habitat. Native grass species can also be used when establishing landscapes with a natural aesthetic. Five seed mixes are prescribed (two native and three naturalization):

Table 7. City of Edmonton native seed mix – Peace River parkland.

Common Name	Latin Name	Wt %
Awed Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	35
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	25
Rocky Mountain Fescue	<i>Festuca saximontana</i>	15
Western Wheatgrass	<i>Pascopyrum smithii</i>	15
June Grass	<i>Koeleria macrantha</i>	5
Western Porcupine Grass	<i>Hesperostipa curtiseta</i>	5

Table 8. City of Edmonton native seed mix - central parkland.

Common Name	Scientific Name	Wt %
Green Needle Grass	<i>Nassella viridula</i>	20
Awed Wheatgrass	<i>Elymus trachycaulus</i> ssp. <i>subsecundus</i>	15
Slender Wheatgrass	<i>Elymus trachycaulus</i> ssp. <i>trachycaulus</i>	15
Western Wheatgrass	<i>Pascopyrum smithii</i>	15
Rocky Mountain Fescue	<i>Festuca saximontana</i>	10
Sloughgrass	<i>Beckmannia syzigachne</i>	5
Idaho Fescue	<i>Festuca idahoensis</i>	5
Alkali Bluegrass	<i>Poa secunda</i> ssp. <i>juncifolia</i>	5
June Grass	<i>Koeleria macrantha</i>	5
Sandberg Bluegrass	<i>Poa secunda</i>	5

Table 9. City of Edmonton non-maintained naturalization landscaping - wet meadow seed mix.

Common Name	Scientific Name	Wt %
Fowl Bluegrass	<i>Poa palustris</i>	30
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	20
Giant Wild Rye	<i>Leymus cinereus</i>	15
Awed Wheatgrass	<i>Elymus trachycaulus</i> ssp. <i>subsecundus</i>	10
Western Wheatgrass	<i>Pascopyrum smithii</i>	10
Slough Grass	<i>Beckmannia syzigachne</i>	10
Annual Ryegrass	<i>Lolium multiflorum</i>	5

Table 10. City of Edmonton non-maintained naturalization landscaping - dry meadow seed mix.

Common Name	Scientific Name	Wt %
June Grass	<i>Koeleria macrantha</i>	20
Rough Fescue	<i>Festuca campestris</i>	20
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	20
Streambank Wheatgrass	<i>Elymus lanceolatus</i> ssp. <i>riparius</i>	15
Green Needle Grass	<i>Nassella viridula</i>	10

Common Name	Scientific Name	Wt %
Sheep Fescue	<i>Festuca ovina</i>	10
Annual Ryegrass	<i>Lolium multiflorum</i>	5

Table 11. City of Edmonton non-maintained naturalization landscaping - grassland wet seed mix.
For use in areas that experience spring flooding followed by dry conditions as the spring and summer progress.

Common Name	Scientific Name	Wt %
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	20
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	20
Nodding Brome grass	<i>Bromus anomalus</i>	20
Slough Grass	<i>Beckmannia syzigachne</i>	10
Alkali Bluegrass	<i>Poa secunda ssp. juncifolia</i>	10
Annual Ryegrass	<i>Lolium multiflorum</i>	10
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	5
Tickle Grass	<i>Agrostis scabra</i>	5

2.3 CITY OF LETHBRIDGE

The City of Lethbridge's Construction Specifications (City of Lethbridge, 2014) require use of the following seed mix in land reclamation for road right of way and disturbed areas:

Table 12. City of Lethbridge dryland seed mixture.

Common Name	Scientific Name	Wt %
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	30
Western Wheatgrass	<i>Pascopyrum smithii</i>	20
Green Needle Grass	<i>Nassella viridula</i>	15
June Grass	<i>Koeleria macrantha</i>	10
Streambank Wheatgrass	<i>Elymus lanceolatus</i>	10
Blue Grama	<i>Bouteloua gracilis</i>	10
Indian Rice Grass	<i>Achnatherum hymenoides</i>	5

The document also provides lists of species potentially suitable for coulee restoration and for a wildflower mix but requires a site evaluation to formulate the appropriate mix for the environmental conditions.

2.4 EASTERN IRRIGATION DISTRICT

The Eastern Irrigation District requires the use of the following reclamation seed mix (Eastern Irrigation District, 2017).

Table 13. Eastern Irrigation District reclamation seed mix.

Common Name	Scientific Name	Wt %
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	20
June Grass	<i>Koeleria macrantha</i>	20
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	15
Western Wheatgrass	<i>Pascopyrum smithii</i>	15
Sandberg Bluegrass	<i>Poa secunda</i>	10
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	10
Blue Grama	<i>Bouteloua gracilis</i>	10

Note: The mix was changed in 2014, replacing 10% Intermediate Wheatgrass (*Thinopyrum intermedium*) with 10% Slender Wheatgrass, as the latter is native to North America and has better grazing value (Eastern Irrigation District, 2014).

2.5 SUFFIELD MILITARY BASE (1977)

Based on the advice of the Suffield Environmental Advisory Committee (SEAC), there was to be no seeding of any kind on the Suffield Military Base unless approved by SEAC. Where seeding was required the following native mix was to be used (Bohme, 1977).

Table 14. Suffield Block native grass seed mix (1977).

Common Name	Scientific Name	Rate (lb/acre)
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	5
Western Wheatgrass	<i>Pascopyrum smithii</i>	5
Northern Wheatgrass or Thickspike Wheatgrass	<i>Agropyron dasystachyum</i> <i>Elymus macrourus</i>	5

2.6 TOWN OF CANMORE

The Town of Canmore's Construction and Landscaping Standards (Town of Canmore, 2016) provides two native grass mixes and one wildflower mix that must be used (Tables 9 – 11). The Construction and Landscaping Standards also state that the following species should not be

used as substitutions into native mixes because they are either non-native or there is a high risk of them being non-native even if a registered variety:

- Rocky Mountain Fescue (*Festuca saximontana* – DNA proven native varieties not available)
- Sheep's Fescue (*Festuca ovina* – not native)
- Creeping Fescue (*Festuca rubra* – not native)
- Hard Fescue (*Festuca ovina*)

Table 15. Town of Canmore mowing tolerant native grass seed mixture - slopes, natural areas and non-maintained areas.

Common Name	Scientific Name	Wt % ¹
Idaho Fescue	<i>Festuca idahoensis</i>	35
Alpine Blue Grass	<i>Poa alpina</i>	20
Blue Grama	<i>Bouteloua gracilis</i>	15
Western Wheatgrass and/or Northern Wheatgrass	<i>Pascopyron smithii</i> <i>Agropyron dasystachyum</i> ²	10
June Grass	<i>Koeleria macrantha</i>	10

¹ The mix also calls for 10% Manhattan III Perennial Ryegrass (*Lolium perenne*) as a nurse crop.

² The document lists northern Wheatgrass as *Elymus lanceolatus* with *Agropyron dasystachyum* in brackets.

Table 16. Town of Canmore non-mowed native grass seed mixture - slopes, natural areas and non-maintained areas.

Common Name	Scientific Name	Wt % ¹
Idaho Fescue	<i>Festuca idahoensis</i>	25
Foothills Rough Fescue	<i>Festuca campestris</i>	15
June Grass	<i>Koeleria macrantha</i>	15
Alpine Blue Grass	<i>Poa alpina</i>	15
Western Wheatgrass and/or Northern Wheatgrass	<i>Pascopyron smithii</i> <i>Agropyron dasystachyum</i> ²	10

¹ The mix also calls for

10% Manhattan III Perennial Ryegrass (*Lolium perenne*) as a nurse crop; and,

10% Optional species – use one or a number of the following species depending on site characteristics (Alkali Bluegrass – *Poa ampla*, Parry's Oat Grass – *Danthonia parryii*, Western Porcupine Grass – *Hesperostipa curtiseta*, Mountain Brome – *Bromus carinatus*, Alpine Timothy – *Phleum alpinum*, or Tufted Hair Grass – *Deschampsia caespitosa*).

² The document lists northern Wheatgrass as *Elymus lanceolatus* with *Agropyron dasystachyum* in brackets.

Table 17. Town of Canmore wild flower mix - slopes, natural areas and non-maintained areas.

Common Name	Scientific Name	Wt %
Yarrow	<i>Achillea millefolium</i>	25
Blue flax	<i>Linum lewisii</i>	25
Brown Eyed Susan	<i>Gaillardia aristata</i>	25
Canada Milk Vetch	<i>Astragalus canadensis</i>	25



3.0 RECOMMENDED SEED MIXES

Many government agencies and other organizations recognize the value of using native species in reclamation, restoration, naturalization and remediation projects and strongly encourage their use (Alberta Energy Regulator, 2003, 2014; Alberta Environment and Parks, 2016; EDA Collaborative Inc., 1994; Municipal District of Bighorn, nd; Special Areas Board, nd).

3.1 DUCKS UNLIMITED CANADA

Ducks Unlimited Canada provides a mixed grass prairie mix suitable for Saskatchewan and southeastern Alberta (Garbuch et al., nd).

Table 18. Ducks Unlimited Canada loamy range site, simple pasture mix.

Common Name	Scientific Name	Seeds/lb.	PLS lb./acre
Western Wheatgrass	<i>Pascopyrum smithii</i>	110,000	2.0
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	154,000	1.0
Green Needle Grass	<i>Nassella viridula</i>	181,000	2.0
Awne Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	138,000	1.3
June Grass	<i>Koeleria macrantha</i>	2,000,000	0.1
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	135,000	0.3
Purple Prairie Clover	<i>Dalea purpurea</i>	300,000	0.1
		TOTAL	6.8

3.2 INNOTECH ALBERTA

Staff at InnoTech Alberta (and its predecessors Alberta Innovates – Technology Futures and Alberta Research Council) are occasionally requested for seed mix recommendations from government and industry and/or receive funding to develop seed mix recommendations as part of a research project. The following mixes have been recommended for a variety of uses.

3.2.1 Alberta Innovates – Technology Futures Regional Seed Mixes

In 2014 Alberta Innovates – Technology Futures (AITF) prepared recommendations for revegetation practices to be applied in the natural regions and sub-regions of Alberta. The recommendations included operating practices and seed mixes, as well as alternate species to be used in the mixes as required.

Table 19. AITF seral *Festuca hallii* grassland mix.

Common Name	Scientific Name	PLS %
Plains Rough Fescue	<i>Festuca hallii</i>	30
Western Porcupine Grass	<i>Hesperostipa curtiseta</i>	15
Awne Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	13
Hooker's Oat Grass	<i>Avenula hookeri</i>	11
June Grass	<i>Koeleria macrantha</i>	7
Rocky Mountain Fescue	<i>Festuca saximontana</i>	7
Green Needle Grass	<i>Nassella viridula</i>	6
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	5
Canada Milk Vetch	<i>Astragalus canadensis</i>	3
American Vetch	<i>Vicia americana</i>	3

Table 20. AITF sub-seral *Festuca hallii* grassland mix.

Common Name	Scientific Name	PLS %
Plains Rough Fescue	<i>Festuca hallii</i>	15
Western Porcupine Grass	<i>Hesperostipa curtiseta</i>	15
Green Needle Grass	<i>Nassella viridula</i>	10
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10
Western Wheatgrass	<i>Pascopyrum smithii</i>	10
Hooker's Oat Grass	<i>Avenula hookeri</i>	10
Awne Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	8
June Grass	<i>Koeleria macrantha</i>	7
Rocky Mountain Fescue	<i>Festuca saximontana</i>	7
Canada Milk Vetch	<i>Astragalus canadensis</i>	4
American Vetch	<i>Vicia americana</i>	4

Table 21. AITF northern fescue grasslands loam soils mix.

Common Name	Scientific Name	PLS %
Plains Rough Fescue	<i>Festuca hallii</i>	40
Nodding Brome Grass	<i>Bromus anomalus</i>	10

Common Name	Scientific Name	PLS %
Western Porcupine Grass	<i>Hesperostipa curtiseta</i>	10
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	7
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	6
Awned Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	6
Rocky Mountain Fescue	<i>Festuca saximontana</i>	6
June Grass	<i>Koeleria macrantha</i>	6
Green Needle Grass	<i>Nassella viridula</i>	5
Canada Wild Rye	<i>Elymus canadensis</i>	4

Table 22. AITF mixed grass seed mix.

Common Name	Scientific Name	PLS %
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	15
Blue Grama	<i>Bouteloua gracilis</i>	10
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	10
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10
Western Wheatgrass	<i>Pascopyrum smithii</i>	10
Green Needle Grass	<i>Nassella viridula</i>	10
June Grass	<i>Koeleria macrantha</i>	10
Plains Reed Grass	<i>Calamagrostis montanensis</i>	5
Canada Milk Vetch	<i>Astragalus canadensis</i>	5
Purple Prairie Clover	<i>Dalea purpurea</i>	5
Rocky Mountain Fescue	<i>Festuca saximontana</i>	5
American Vetch	<i>Vicia americana</i>	5

Table 23. AITF mixed grass depressions and wetlands (including saline sites) mix.

Common Name	Scientific Name	PLS %
Western Wheatgrass	<i>Pascopyrum smithii</i>	20
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	20
Alkali Blue Grass	<i>Poa juncifolia ssp. juncifolia</i>	10
Nuttall's' Alkali Grass	<i>Puccinellia nuttalliana</i>	10

Common Name	Scientific Name	PLS %
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	10
Slough Grass	<i>Beckmannia syzigachne</i>	10
Sweet Grass	<i>Anthoxanthum nitens</i>	10
Fowl Blue Grass	<i>Poa palustris</i>	10

Table 24. AITF dry mixed grass seed mix.

Common Name	Scientific Name	PLS %
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	15
Blue Grama	<i>Bouteloua gracilis</i>	10
Plains Reed Grass	<i>Calamagrostis montanensis</i>	10
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	10
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10
Western Wheatgrass	<i>Pascopyrum smithii</i>	10
June Grass	<i>Koeleria macrantha</i>	10
Rocky Mountain Fescue	<i>Festuca saximontana</i>	10
American Vetch	<i>Vicia americana</i>	10
Green Needle Grass	<i>Nassella viridula</i>	5

Table 25. AITF dry mixed grass sandy soils (south) mix.

Common Name	Scientific Name	PLS %
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	20
Indian Rice Grass	<i>Achnatherum hymenoides</i>	20
Sand Drop Seed	<i>Sporobolus cryptandrus</i>	15
Canada Wild Rye	<i>Elymus canadensis</i>	10
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10
Sand Reed Grass	<i>Calamovilfa longifolia</i>	10
Awned Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	5
Canada Milk Vetch	<i>Astragalus canadensis</i>	5
American Vetch	<i>Vicia americana</i>	5

Table 26. AITF foothills fescue seed mix.

Common Name	Scientific Name	PLS %
Foothills Rough Fescue	<i>Festuca campestris</i>	54
Rocky Mountain Fescue	<i>Festuca saximontana</i>	10
June Grass	<i>Koeleria macrantha</i>	10
Idaho Fescue	<i>Festuca idahoensis</i>	10
Green Needle Grass	<i>Nassella viridula</i>	3
Awed Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	3
Western Porcupine Grass	<i>Hesperostipa curtisetia</i>	2
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	2
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	2
Parry's Oat Grass	<i>Danthonia parryi</i>	2
Western Wheatgrass	<i>Pascopyrum smithii</i>	2

Table 27. AITF parkland sandy soil mix.

Common Name	Scientific Name	PLS %
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	15
Indian Rice Grass	<i>Achnatherum hymenoides</i>	15
Sand Drop Seed	<i>Sporobolus cryptandrus</i>	10
Canada Wild Rye	<i>Elymus canadensis</i>	10
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10
Sand Reed Grass	<i>Calamovilfa longifolia</i>	10
Rocky Mountain Fescue	<i>Festuca saximontana</i>	8
June Grass	<i>Koeleria macrantha</i>	7
Awed Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	5
Canada Milk Vetch	<i>Astragalus canadensis</i>	5
American Vetch	<i>Vicia americana</i>	5

Table 28. AITF fescue grassland north sandy soil mix.

Common Name	Scientific Name	PLS %
Plains Rough Fescue	<i>Festuca hallii</i>	20

Common Name	Scientific Name	PLS %
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	10
Canada Wild Rye	<i>Elymus canadensis</i>	10
Rocky Mountain Fescue	<i>Festuca saximontana</i>	10
Nodding Brome Grass	<i>Bromus anomalus</i>	5
Prairie Sand Reed	<i>Calamovilfa longifolia</i>	5
Indian Rice Grass	<i>Achnatherum hymenoides</i>	5
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	5
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	5
Awned Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	5
Western Wheatgrass	<i>Pascopyrum smithii</i>	5
Green Needle Grass	<i>Nassella viridula</i>	5
June Grass	<i>Koeleria macrantha</i>	5
Blue Grama	<i>Bouteloua gracilis</i>	5

Table 29. AITF Peace River parkland seed mix.

Common Name	Scientific Name	PLS %
Western Porcupine	<i>Hesperostipa curtiseta</i>	25
Rocky Mountain Fescue	<i>Festuca saximontana</i>	20
Fringed Brome Grass	<i>Bromus ciliatus</i>	10
Indian Rice Grass	<i>Achnatherum hymenoides</i>	8
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	7
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	7
Western Wheatgrass	<i>Pascopyrum smithii</i>	7
Green Needle Grass	<i>Nassella viridula</i>	7
Blue Grama	<i>Bouteloua gracilis</i>	5
Tickle Grass	<i>Agrostis scabra</i>	2
June Grass	<i>Koeleria macrantha</i>	2

3.2.2 Alberta Innovates – Technology Futures Wainwright Recommended Mix

In 2016, Alberta Innovates – Technology Futures recommended the following mix for use on high traffic areas on CFB Wainwright.

Table 30. Alberta Innovates – Technology Futures Wainwright recommended mix.

Common Name	Scientific Name	Wt %
Blue Grama	<i>Bouteloua gracilis</i>	50
Rocky Mountain Fescue	<i>Festuca saximontana</i>	30
June Grass	<i>Koeleria macrantha</i>	15
Ticklegrass	<i>Agrostis scabra</i>	5

3.2.3 Alberta Innovates – Technology Futures Pollinator Mix

In 2016, AITF recommended the following forb mix to be seeded into forage crops in the Lethbridge area at a rate of 320 seeds/m² to support pollinators (the mix was also seeded at InnoTech Alberta's Vegreville facility).

Table 31. AITF pollinator mix.

Common Name	Scientific Name	Wt %
Smooth Blue Aster	<i>Symphyotrichum laeve</i>	20
Wild Bergamot	<i>Monarda fistulosa</i>	20
Giant Hyssop	<i>Agastache foeniculum</i>	20
Annual Sunflower	<i>Helianthus annuus</i>	20
Common Yarrow	<i>Achillea millefolium</i>	20

3.2.4 InnoTech Alberta Recommended Saline Seed Mix

In 2016 InnoTech Alberta recommended the use of the following mix for saline areas in eastern Alberta.

Table 32. InnoTech Alberta recommended saline seed mix.

Common Name	Scientific Name	Wt %
Nuttall's Alkali Grass	<i>Puccinellia nuttaliana</i>	25
Fowl Bluegrass	<i>Poa palustris</i>	10
Alkali Bluegrass	<i>Poa secunda ssp. juncifolia</i>	10
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	20

Common Name	Scientific Name	Wt %
Ticklegrass	<i>Agrostis scabra</i>	20
Western Wheatgrass	<i>Pascopyrum smithii</i>	15

3.3 RECOVERY STRATEGIES

A series of recovery strategies have been developed by multi-stakeholder groups to support the intent of the Reclamation Criteria for Grasslands and to provide guidance for reclamation practitioners, contractors, landowners and Government of Alberta regulatory authorities (Gramineae Services Ltd., 2013). The strategies are not intended to be prescriptive, but rather strive to present options and pathways to enable selection of the most appropriate recovery strategy for the type of industrial disturbance on a site specific basis. The purpose is to provide the tactical expectations of what is required to reach the outcome of restoration over time.

A draft of the recovery strategy for the foothills fescue, foothills parkland and montane natural subregions of Alberta with nine seed mixes is in prep (Lancaster et al., 2017b).

3.3.1 Dry Mixedgrass Natural Subregion Recovery Strategy

Gramineae Services Ltd. (2013) provided a series of example seed mixes that could be used to restore dry mixedgrass sites to specific target plant communities.

Table 33. Dry mixedgrass recovery strategy seed mix for loamy, shallow to gravel and gravel range sites.

Common Name	Scientific Name	Wt %
Needle- and- Thread Grass	<i>Hesperostipa comata</i>	40
Blue Grama	<i>Bouteloua gracilis</i>	25
June Grass	<i>Koeleria macrantha</i>	15
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	10
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10

Table 34. Dry mixedgrass recovery strategy seed mix for blowout and clayey range sites.

Common Name	Scientific Name	Wt %
Needle- and- Thread Grass	<i>Hesperostipa comata</i>	20
June Grass	<i>Koeleria macrantha</i>	20
Western Wheatgrass	<i>Pascopyrum smithii</i>	16
Blue Grama	<i>Bouteloua gracilis</i>	12
Sandberg Bluegrass	<i>Poa secunda</i>	12

Common Name	Scientific Name	Wt %
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	10

Table 35. Dry mixedgrass recovery strategy seed mix for sands, sandy and choppy sandhill range sites.

Common Name	Scientific Name	Wt %
Needle- and- Thread Grass	<i>Hesperostipa comata</i>	35
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	15
Blue Grama	<i>Bouteloua gracilis</i>	12
Western Wheatgrass	<i>Pascopyrum smithii</i>	10
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	10
June Grass	<i>Koeleria macrantha</i>	10
Sand Grass	<i>Calamovilfa longifolia</i>	8

Table 36. Dry mixedgrass recovery strategy seed mix for DMGA13 western porcupine grass – needle- and- thread – sand grass sites.

Common Name	Scientific Name	Wt %
Western Porcupine Grass	<i>Hesperostipa curtisetia</i>	30
Needle- and- Thread Grass	<i>Hesperostipa comata</i>	25
June Grass	<i>Koeleria macrantha</i>	15
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	10
Blue Grama	<i>Bouteloua gracilis</i>	10
Sand Grass	<i>Calamovilfa longifolia</i>	5
Western Wheatgrass	<i>Pascopyrum smithii</i>	5

3.3.2 Mixed Grass Natural Subregion Recovery Strategy

Neville et al. (2014) provided a series of example seed mixes that could be used to restore mixedgrass sites to specific target plant communities.

Table 37. Mixedgrass recovery strategy seed mix for Cypress upland on loamy, shallow to gravel, gravel and thin breaks range sites.

Common Name	Scientific Name	Wt %
Plains Rough Fescue	<i>Festuca hallii</i>	50
Western Porcupine Grass	<i>Hesperostipa curtiseta</i>	30
June Grass	<i>Koeleria macrantha</i>	10
Awned Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	5
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	5

Table 38. Mixedgrass recovery strategy seed mix for Cypress Upland: low elevation dry loamy and blowout range sites.

Common Name	Scientific Name	Wt %
Needle- and- Thread Grass	<i>Hesperostipa comata</i>	30
Plains Rough Fescue	<i>Festuca hallii</i>	25
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	15
June Grass	<i>Koeleria macrantha</i>	10
Western Wheatgrass	<i>Pascopyrum smithii</i>	10
Sandberg Bluegrass	<i>Poa secunda</i>	10

Table 39. Mixedgrass recovery strategy seed mix for Cypress Upland: saline lowland range sites.

Common Name	Scientific Name	Wt %
Western Wheatgrass	<i>Pascopyrum smithii</i>	30
Salt Grass	<i>Distichlis spicata ssp. stricta</i>	25
Sandberg Bluegrass	<i>Poa secunda</i>	20
Nuttall's Alkali Grass	<i>Puccinellia nuttalliana</i>	15
June Grass	<i>Koeleria macrantha</i>	10

Table 40. Mixedgrass recovery strategy seed mix for Sweetgrass and Milk River Upland: overflow range sites.

Common Name	Scientific Name	Wt %
Needle- And- Thread Grass	<i>Hesperostipa comata</i>	30

Common Name	Scientific Name	Wt %
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	20
Idaho Fescue	<i>Festuca idahoensis</i>	15
Green Needle Grass	<i>Nassella viridula</i>	15
Western Wheatgrass	<i>Pascopyrum smithii</i>	10
June Grass	<i>Koeleria macrantha</i>	10

Table 41. Mixedgrass recovery strategy seed mix for Sweetgrass and Milk River Upland: loamy and thin breaks range sites.

Common Name	Scientific Name	Wt %
Needle- And- Thread Grass	<i>Hesperostipa comata</i>	30
Sandberg Bluegrass	<i>Poa secunda</i>	20
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	20
Idaho Fescue	<i>Festuca idahoensis</i>	10
June Grass	<i>Koeleria macrantha</i>	10
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	10

Table 42. Mixedgrass recovery strategy seed mix for Sweetgrass and Milk River Upland: clayey and blowout range sites.

Common Name	Scientific Name	Wt %
Needle- And- Thread Grass	<i>Hesperostipa comata</i>	30
Blue Grama	<i>Bouteloua gracilis</i>	15
Idaho Fescue	<i>Festuca idahoensis</i>	15
Western Wheatgrass	<i>Pascopyrum smithii</i>	10
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10
Sandberg Bluegrass	<i>Poa secunda</i>	10
June Grass	<i>Koeleria macrantha</i>	10

Table 43. Mixedgrass recovery strategy seed mix for Sweetgrass and Milk River Upland: sandy range sites.

Common Name	Scientific Name	Wt %
Needle- And- Thread Grass	<i>Hesperostipa comata</i>	50

Common Name	Scientific Name	Wt %
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10
Sand Grass	<i>Calamovilfa longifolia</i>	10
June Grass	<i>Koeleria macrantha</i>	10
Sandberg Bluegrass	<i>Poa secunda</i>	10
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	10

Table 44. Mixedgrass recovery strategy seed mix for Sweetgrass and Milk River Upland: saline lowland range sites.

Common Name	Scientific Name	Wt %
Western Wheatgrass	<i>Pascopyrum smithii</i>	30
Salt Grass	<i>Distichlis spicata ssp. stricta</i>	25
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	15
June Grass	<i>Koeleria macrantha</i>	15
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	15

Table 45. Mixedgrass recovery strategy seed mix for Lethbridge, Vulcan Plain: loamy range sites.

Common Name	Scientific Name	Wt %
Needle- And- Thread Grass	<i>Hesperostipa comata</i>	40
Blue Grama	<i>Bouteloua gracilis</i>	25
June Grass	<i>Koeleria macrantha</i>	10
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	10
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	5
Western Wheatgrass	<i>Pascopyrum smithii</i>	5
Sandberg Bluegrass	<i>Poa secunda</i>	5

Table 46. Mixedgrass recovery strategy seed mix for Lethbridge, Vulcan Plain: sandy and sands range sites.

Common Name	Scientific Name	Wt %
Needle- And- Thread Grass	<i>Hesperostipa comata</i>	35
Blue Grama	<i>Bouteloua gracilis</i>	30

Common Name	Scientific Name	Wt %
June Grass	<i>Koeleria macrantha</i>	15
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	10
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10
Prairie Sand Reed	<i>Calamovilfa longifolia</i>	5

Table 47. Mixedgrass recovery strategy seed mix for Lethbridge, Vulcan Plain: saline lowland range sites.

Common Name	Scientific Name	Wt %
Salt Grass	<i>Distichlis spicata ssp. stricta</i>	40
Western Wheatgrass	<i>Pascopyrum smithii</i>	20
Fowl Bluegrass	<i>Poa palustris</i>	20
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	20

Table 48. Mixedgrass recovery strategy seed mix for Majorville Upland: loamy ecological range sites.

Common Name	Scientific Name	Wt %
Western Porcupine Grass	<i>Hesperostipa curtiseta</i>	45
Needle- and- Thread Grass	<i>Hesperostipa comata</i>	20
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	10
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10
June Grass	<i>Koeleria macrantha</i>	10
Western Wheatgrass	<i>Pascopyrum smithii</i>	5

3.3.3 Northern Fescue Natural Subregion Recovery Strategy

Lancaster et al. (2017a) provided four example seed mixes that could be used to restore northern fescue sites to specific target plant communities.

Table 49. Northern fescue recovery strategy seed mix for plains rough fescue – sedge plant communities.

Common Name	Scientific Name	Wt %
Plains Rough Fescue	<i>Festuca hallii</i>	50

Common Name	Scientific Name	Wt %
Western Porcupine Grass	<i>Hesperostipa curtiseta</i>	35
Western Wheatgrass	<i>Pascopyrum smithii</i>	5
June Grass	<i>Koeleria macrantha</i>	5
Awned Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	5

Table 50. Northern fescue recovery strategy seed mix for plains rough fescue – western porcupine grass communities.

Common Name	Scientific Name	Wt %
Plains Rough Fescue	<i>Festuca hallii</i>	38
Western Porcupine Grass	<i>Hesperostipa curtiseta</i>	30
June Grass	<i>Koeleria macrantha</i>	10
Blue Grama	<i>Bouteloua gracilis</i>	10
Western Wheatgrass	<i>Pascopyrum smithii</i>	5
Canada Wild Rye	<i>Elymus canadensis</i>	5
Awned Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	2

Table 51. Northern fescue recovery strategy seed mix for blunt sedge – western porcupine grass communities.

Common Name	Scientific Name	Wt %
Western Porcupine Grass	<i>Hesperostipa curtiseta</i>	35
Needle- And- Thread Grass	<i>Hesperostipa comata</i>	25
Plains Rough Fescue	<i>Festuca hallii</i>	20
Blue Grama	<i>Bouteloua gracilis</i>	5
Awned Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	5
June Grass	<i>Koeleria macrantha</i>	5
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	5

Table 52. Northern fescue recovery strategy seed mix for sedge - western wheatgrass communities.

Common Name	Scientific Name	Wt %
Plains Rough Fescue	<i>Festuca hallii</i>	50

Common Name	Scientific Name	Wt %
Western Porcupine Grass	<i>Hesperostipa curtiseta</i>	30
June Grass	<i>Koeleria macrantha</i>	10
Awned Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	5
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	5



4.0 OPERATIONAL SEED MIXES

The mixes in this section have been used or proposed for use in revegetation of a variety of disturbance types. They differ from the R&D mixes in Section 5 in that these are to be, or have been, deployed in an operational context rather than being tested in smaller areas.

4.1 ALBERTA CROPLAND CARBON CONVERSION PROTOCOL

McNeil (2014) listed two Dry Prairie seed mixes for use when converting cropland to native prairie for carbon credit purposes.

Table 53. Alberta Cropland Carbon Conversion Protocol simple seed mix.

Common Name	Scientific Name	Seeding Rate (PLS kg/ha)
Western Wheatgrass	<i>Pascopyrum smithii</i>	2.3
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	1.2
Green Needle Grass	<i>Nassella viridula</i>	2.3
Awed Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	1.5
June Grass	<i>Koeleria macrantha</i>	0.1
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	0.3
Purple Prairie Clover	<i>Dalea purpurea</i>	0.1
	TOTAL	7.9

Table 54. Alberta Cropland Carbon Conversion Protocol diverse seed mix.

Common Name	Scientific Name	Seeding Rate (PLS kg/ha)
Western Wheatgrass	<i>Pascopyrum smithii</i>	1.2
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	0.9
Green Needle Grass	<i>Nassella viridula</i>	1.8
Awed Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	0.6
Canada Wild Rye	<i>Elymus canadensis</i>	0.1
Little Bluestem	<i>Schizachyrium scoparium</i>	1.2
Needle-and-Thread Grass	<i>Stipa comata</i>	0.9
June Grass	<i>Koeleria macrantha</i>	0.1
Blue Grama	<i>Bouteloua gracilis</i>	0.4

Prairie Sand Reed	<i>Calamovilfa longifolia</i>	0.4
Purple Prairie Clover	<i>Dalea purpurea</i>	0.2
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	0.1
Total		7.8

4.2 BENGAL MINING LIMITED GRASSY MOUNTAIN COAL PROJECT

In their Environmental Impact Assessment (EIA), Bengal Mining Limited proposed five seed mixes for their Grassy Mountain Coal Project near Crowsnest Pass (Bengal Mining Limited, 2015).

Table 55. Bengal Mining Limited direct placement mix.

Common Name	Scientific Name	Wt %
Annual Ryegrass	<i>Lolium multiflorum</i>	65
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	25
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	8
Ticklegrass	<i>Agrostis scabra</i>	2

Seeded at 50 kg/ha, no fertilizer

Table 56. Bengal Mining Limited grassland, open forest mix.

Common Name	Scientific Name	Wt %
Annual Ryegrass	<i>Lolium multiflorum</i>	40
Foothills Rough Fescue	<i>Festuca campestris</i>	15
Mountain Brome	<i>Bromus carinatus</i>	10
June Grass	<i>Koeleria macrantha</i>	10
Awned Slender Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	10
American Vetch	<i>Vicia americana</i>	5
Richardson Needle Grass	<i>Achnatherum richardsonii</i>	5
Columbia Needle Grass	<i>Achnatherum nelsonii</i>	5

Seeded at 60 to 70 kg/ha

Table 57. Bengal Mining Limited closed conifer forest mix.

Common Name	Scientific Name	Wt %
-------------	-----------------	------

Annual Ryegrass	<i>Lolium multiflorum</i>	40
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	15
Awned Slender Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	15
Foothills Rough Fescue	<i>Festuca campestris</i>	10
Fringed Brome	<i>Bromus ciliatus</i>	10
American Vetch	<i>Vicia americana</i>	5
Ticklegrass	<i>Agrostis scabra</i>	5

Seeded at 60 to 70 kg/ha

Table 58. Benga Mining Limited mixed forest mix.

Common Name	Scientific Name	Wt %
Annual Ryegrass	<i>Lolium multiflorum</i>	40
Foothills Rough Fescue	<i>Festuca campestris</i>	10
Streambank Wheatgrass	<i>Elymus lanceolatus ssp. riparius</i>	10
Awned Slender Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	10
Fringed Brome	<i>Bromus ciliatus</i>	5
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	5
Ticklegrass	<i>Agrostis scabra</i>	5
Fowl Bluegrass	<i>Poa palustris</i>	5
Slough Grass	<i>Beckmannia syzigachne</i>	5
American Vetch	<i>Vicia americana</i>	3
American Alpine Sweetvetch	<i>Hedysarum alpinum</i>	2

Seeded at 60 to 70 kg/ha

Table 59. Benga Mining Limited treed wetland mix.

Common Name	Scientific Name	Wt %
Annual Ryegrass	<i>Lolium multiflorum</i>	45
Slough Grass	<i>Beckmannia syzigachne</i>	20
Fowl Bluegrass	<i>Poa palustris</i>	20
Streambank Wheatgrass	<i>Elymus lanceolatus ssp. riparius</i>	10
White Clover	<i>Trifolium repens</i>	5

Seeded at 60 to 70 kg/ha

4.3 BROOKS POWER PROJECT

In their EIA for the proposed Brooks Power Project, Fording Coal Limited (2002) provided a native species seed mix for areas of the mine that would not be cultivated.

Table 60. Brooks Power Project native mix.

Common Name	Scientific Name	Wt %
Western Wheatgrass	<i>Pascopyrum smithii</i>	30
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	25
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	20
Green Needle Grass	<i>Nassella viridula</i>	20
June Grass	<i>Koeleria macrantha</i>	5

4.4 COALSPUR VISTA MINE

In their Environmental Impact Assessment for the proposed Vista Coal Mine Project near Hinton, Coalspur Mines Ltd. (2012) proposed four mixes to be aerial seeded.

Table 61. Coalspur direct placement mix.

Common Name	Scientific Name	Wt %
Annual Ryegrass	<i>Lolium multiflorum</i>	65
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	25
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	8
Ticklegrass	<i>Agrostis scabra</i>	2

Seeded at 50 kg/ha.

Table 62. Coalspur forest mesic or drier mix.

Common Name	Scientific Name	Wt %
Annual Ryegrass	<i>Lolium multiflorum</i>	40
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	15
Dutch White Clover	<i>Trifolium repens</i>	8
Alpine Bluegrass	<i>Poa alpina</i>	8
Mountain Brome	<i>Bromus carinatus</i>	7
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	6

Northern Wheatgrass	<i>Agropyron dasystachyum</i>	5
Awne Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	4
Rough Fescue	<i>Festuca campestris</i>	3
American Vetch	<i>Vicia americana</i>	2
Ticklegrass	<i>Agrostis scabra</i>	2

Seeded at 60 to 70 kg/ha.

Table 63. Coalspur forest subhygric or wetter mix.

Common Name	Scientific Name	Wt %
Annual Ryegrass	<i>Lolium multiflorum</i>	40
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	20
Tufted Wheatgrass	<i>Deschampsia caespitosa</i>	8
Awne Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	7
Streambank Wheatgrass	<i>Elymus lanceolatus ssp. riparius</i>	7
Dutch White Clover	<i>Trifolium repens</i>	6
Fowl Bluegrass	<i>Poa palustris</i>	4
Slough Grass	<i>Beckmannia syzigachne</i>	4
Canada Milkvech	<i>Astragalus canadensis</i>	2
Ticklegrass	<i>Agrostis scabra</i>	2

Seeded at 60 to 70 kg/ha.

Table 64. Coalspur steep, watercourse sensitive mix.

Common Name	Scientific Name	Wt %
Annual Ryegrass	<i>Lolium multiflorum</i>	45
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	29
Boreal Creeping Red Fescue	<i>Festuca rubra</i>	8
Dutch White Clover	<i>Trifolium repens</i>	7
Awne Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	6
Alpine Bluegrass	<i>Poa alpina</i>	5

Seeded at 70 to 80 kg/ha.

4.5 COAL VALLEY RESOURCES INC. ROBB TREND COAL MINE

Coal Valley Resources Inc. (CVRI) identified three reclamation seed mixes in their Robb Trend Project EIA: one is a mix of native species with a strong component of agronomics; the two others reported here are the Lower Foothills Native Mix and the Wetland Mix. The mine is located near Edson.

Table 65. CVRI lower foothills native mix.

Common Name	Scientific Name	Wt %
Fringed Brome	<i>Bromus ciliatus</i>	18
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	15
Canada Bluegrass	<i>Poa compressa</i>	15
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	15
Hairy Wild Rye	<i>Leymus innovatus</i>	15
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10
Alpine Timothy	<i>Phleum alpinum</i>	7
Spike Trisetum	<i>Trisetum spicatum</i>	5

Seeded at 60 kg/ha

Table 66. CVRI wetland mix.

Common Name	Scientific Name	Wt %
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	20
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	20
Hairy Wild Rye	<i>Leymus innovatus</i>	15
Streambank Wheatgrass	<i>Elymus lanceolatus ssp. riparius</i>	10
Slough Grass	<i>Beckmannia syzigachne</i>	10
Annual Rye Grass	<i>Lolium multiflorum</i>	10
Fowl Bluegrass	<i>Poa palustris</i>	10
Canada Bluegrass	<i>Poa compressa</i>	5

Seeded at 60 kg/ha

4.6 ENCANA CFB SUFFIELD

The following example seed mixes are provided in the Environmental Impact Statement report for Encana's Shallow Gas Infill Development. Each mix identifies preferred and alternate varieties and/or species.

Table 67. EnCana CFB Suffield wetland margins mix.

Common Name	Scientific Name	seeds/g	PLS	est%	PLS/m ²	plt/m ²	kg/ha	%/wt	total kg
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	1250	91	5	682	34	6.0	59.9	90
Revenue Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	353	83	25	32	8	1.1	10.9	16
Adanac Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	353	86	25	32	8	1.1	10.5	16
Alkali Bluegrass	<i>Poa secunda ssp. juncifolia</i>	2022	53	12	201	24	1.9	18.7	28
Totals	N/A	4	N/A	N/A	946.8	74.2	10.0	100	150

Table 68. EnCana CFB Suffield sandy soil mix.

Common Name	Scientific Name	seeds /g	PLS	est %	PLS/m ²	plt/m ²	kg/h a	%/w t	total kg
Streambank Wheatgrass	<i>Elymus lanceolatus ssp. riparius</i>	344	92	25	16	4	0.5	8.1	51
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	345	92	25	12	3	0.4	6.0	38
Western Wheatgrass	<i>Pascopyrum smithii</i>	242	92	30	7	2	0.3	4.8	30
Revenue Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	353	83	25	24	6	0.8	13.1	82
Adanac Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	353	86	25	16	4	0.5	8.4	53
Goshen	<i>Calamovilfa longifolia</i>	603	82	10	34	3	0.7	11.0	69

Common Name	Scientific Name	seeds /g	PLS	est %	PLS/m ²	plt/m ²	kg/ha	%/wt	total kg
Prairie Sand Reed									
Green Needle Grass	<i>Nassella viridula</i>	398	88	10	40	4	1.1	18.2	114
Indian Rice Grass	<i>Achnatherum hymenoides</i>	518	86	10	50	5	1.1	17.9	112
Sheep Fescue	<i>Festuca ovina</i>	1498	88	15	67	10	0.5	8.1	51
June Grass	<i>Koeleria macrantha</i>	3300	80	15	74	11	0.3	4.5	28
Totals	N/A	10	N/A	N/A	339	52	6	100	627

Note: Choose 4 to 5 species from this list for a final mix and change combinations frequently across sites.

Table 69. EnCana CFB Suffield solonetzic soil mix.

Common Name	Scientific Name	seeds /g	PLS	est%	PLS/m ²	plt/m ²	kg/ha	%/wt	total kg
Western Wheatgrass	<i>Pascopyrum smithii</i>	242	92	30	7	2	0.3	4.0	29.94
Revenue Slender Wheatgrass	<i>Elymus trachycaulus</i> ssp. <i>trachycaulus</i>	353	83	25	24	6	0.8	11.0	81.91
Adanac Slender Wheatgrass	<i>Elymus trachycaulus</i> ssp. <i>trachycaulus</i>	353	86	25	16	4	0.5	7.1	52.70
Streambank Wheatgrass	<i>Elymus lanceolatus</i> ssp. <i>riparius</i>	344	92	25	68	17	2.1	28.8	214.86
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	345	92	25	24	6	0.8	10.1	75.61
Green Needle Grass	<i>Nassella viridula</i>	398	81	10	40	4	1.2	16.6	124.08
Sheep Fescue	<i>Festuca ovina</i>	1498	88	15	67	10	0.5	6.8	50.57
June Grass	<i>Koeleria macrantha</i>	3300	80	10	100	10	0.4	5.1	37.88
Alkali	<i>Poa secunda</i>	2022	53	12	83	10	0.8	10.4	77.76

Common Name	Scientific Name	seeds /g	PLS	est%	PLS/m ²	plt/m ²	kg/ha	%/wt	total kg
Bluegrass	<i>ssp. juncifolia</i>								
Totals	N/A	9	N/A	N/A	429	69	7.5	100	745.33

Note: Choose 4 to 5 species from this list for a final mix and change combinations frequently across sites.

4.7 EXPRESS PIPELINE

Express Pipeline is a 24 inch crude oil pipeline that extends from Kinder Morgan's tank farm near Hardisty, Alberta, south 434 km to cross the US border at Wildhorse, Alberta. Portions of the RoW cross native prairie in the Central Parkland, Northern Fescue, Mixedgrass and Dry Mixedgrass Natural Subregions of Alberta. Five seed mixes were developed for the project based on detailed vegetation inventories (Gramineae Services Ltd. et al., 2008; Kestrel Research Inc. and Gramineae Services Ltd., 2011).

Table 70. Express Seed Mix 1 – aspen parkland.

Common Name	Scientific Name	seeds/g	PLS	est %	PLS/m ²	plt/m ²	kg/ha	%/wt	total kg
Streambank Wheatgrass	<i>Elymus lanceolatus ssp. riparius</i>	344	92	25	28	7	0.9	5.8	124
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	345	97	25	27	7	0.8	5.3	113
Western Wheatgrass	<i>Pascopyrum smithii</i>	242	92	25	20	5	0.9	5.9	126
Revenue Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	353	83	25	20	5	0.7	4.4	96
Adanac Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	353	86	25	28	7	0.9	6	129
Newfield Green Needle Grass	<i>Nassella viridula</i>	398	95	10	172	17	4.5	29.6	636
June Grass – Prairie Seeds	<i>Koeleria macrantha</i>	3300	90	10	200	20	0.7	4.4	94

Common Name	Scientific Name	seeds/g	PLS	est %	PLS/m ²	plt/m ²	kg/ha	%/wt	total kg
Sheep Fescue	<i>Festuca ovina</i>	1498	88	5	120	6	0.9	5.9	127
Roes Plains Rough Fescue	<i>Festuca hallii</i>	386	77	20	150	30	5	32.8	704
Totals		9	N/A	N/A	764	104	15	100	2,149

Table 71. Express Seed Mix 2 – rough fescue - mixedgrass transition prairie.

Common Name	Scientific Name	seeds/g	PLS	est %	PLS/m ²	plt/m ²	kg/ha	%/wt	total kg
Streambank Wheatgrass	<i>Elymus lanceolatus</i> ssp. <i>riparius</i>	344	92	25	60	15	1.9	16.3	664
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	345	92	25	24	6	0.8	6.5	265
Western Wheatgrass	<i>Pascopyrum smithii</i>	242	92	25	24	6	1.1	9.3	377
Revenue Slender Wheatgrass	<i>Elymus trachycaulus</i> ssp. <i>trachycaulus</i>	353	83	25	20	5	0.7	5.9	239
Adanac Slender Wheatgrass	<i>Elymus trachycaulus</i> ssp. <i>trachycaulus</i>	353	86	25	28	7	0.9	7.9	323
Blight Green Needle Grass	<i>Nassella viridula</i>	398	88	10	43	4	1.2	10.4	425
Indian Rice Grass	<i>Achnatherum hymenoides</i>	518	86	10	50	5	1.1	9.7	393
Gillespie June Grass	<i>Koeleria macrantha</i>	3300	84	10	71	7	0.3	2.2	89
Roes Plains Rough Fescue	<i>Festuca hallii</i>	386	77	10	25	3	0.8	7.3	296
Petherbridge Rough Fescue	<i>Festuca hallii</i>	386	77	10	85	8	2.9	24.6	1000
Totals		10	N/A	N/A	429	66	12	100	4,069

Table 72. Express Seed Mix 3 – dry mixedgrass prairie sandy soils.

Common Name	Scientific Name	seeds/g	PLS	est %	PLS/m ²	plt/m ²	kg/ha	%/wt	total kg
Streambank Wheatgrass	<i>Elymus lanceolatus ssp. riparius</i>	344	92	25	26	6	0.8	5.4	324
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	345	92	25	24	6	0.8	5.1	302
Western Wheatgrass	<i>Pascopyrum smithii</i>	242	92	25	24	6	1.1	7.2	431
Revenue Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	353	83	25	16	4	0.5	3.7	218
Adanac Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	353	85	25	24	6	0.8	5.3	316
ND 95 Prairie Sand Reed	<i>Calamovilfa longifolia</i>	603	61	10	42	4	1.1	7.6	455
Goshen Prairie Sand Reed	<i>Calamovilfa longifolia</i>	603	82	10	34	3	0.7	4.6	277
Blight Green Needle Grass	<i>Nassella viridula</i>	398	88	10	40	4	1.1	7.7	457
Indian Rice Grass	<i>Achnatherum hymenoides</i>	518	86	10	200	20	4.5	30.1	1796
Sheep Fescue	<i>Festuca ovina</i>	1498	88	5	200	10	1.5	10.2	607
Canada Bluegrass	<i>Poa compressa</i>	5555	80	2	500	10	1.1	7.5	450
June Grass – Prairie Seeds	<i>Koeleria macrantha</i>	3300	80	5	221	11	0.8	5.6	335
Totals		12	N/A	N/A	1351	91	15	100	5,968

Table 73. Express Seed Mix 4 – dry mixedgrass prairie solonetzic soils.

Common Name	Scientific Name	seeds/g	PLS	est %	PLS/m ²	plt/m ²	kg/ha	%/wt	total kg
Western Wheatgrass	<i>Pascopyrum smithii</i>	242	92	25	20	5	0.9	7.8	737
Revenue Slender Wheatgrass	<i>Elymus trachycaulus</i> ssp. <i>trachycaulus</i>	353	83	25	18	5	0.6	5.4	515
Adanac Slender Wheatgrass	<i>Elymus trachycaulus</i> ssp. <i>trachycaulus</i>	353	86	25	25	6	0.8	7.1	676
Streambank Wheatgrass	<i>Elymus lanceolatus</i> ssp. <i>riparius</i>	344	92	25	61	15	1.9	16.7	1589
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	345	92	25	24	6	0.8	6.5	620
Green Needle Grass – MB	<i>Nassella viridula</i>	398	88	10	40	4	1.1	9.9	937
Green Needle Grass – AB	<i>Nassella viridula</i>	398	81	10	40	4	1.2	10.7	1017
Sheep Fescue	<i>Festuca ovina</i>	1498	88	5	200	10	1.5	13.1	1244
June Grass – Prairie Seeds	<i>Koeleria macrantha</i>	3300	80	5	200	10	0.8	6.5	621
Alkali Bluegrass	<i>Poa secunda</i> ssp. <i>juncifolia</i>	2022	53	5	200	10	1.9	16.1	1530
Totals		10	N/A	N/A	829	75	12	100	9486

Table 74. Express Seed Mix 5 – prairie wetlands.

Common Name	Scientific Name	seeds/g	PLS	est %	PLS/m ²	plt/m ²	kg/ha	%/wt	total kg
Western Wheatgrass	<i>Pascopyrum smithii</i>	242	92	25	48	12	2.2	14.8	129
Revenue	<i>Elymus</i>	353	83	25	28	7	1.0	6.6	57

Common Name	Scientific Name	seeds/g	PLS	est %	PLS/m ²	plt/m ²	kg/ha	%/wt	total kg
Slender Wheatgrass	<i>trachycaulus</i> ssp. <i>trachycaulus</i>								
Adanac Slender Wheatgrass	<i>Elymus trachycaulus</i> ssp. <i>trachycaulus</i>	353	86	25	28	7	0.9	6.3	55
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	1250	91	5	682	34	6.0	41.3	360
Alkali Bluegrass	<i>Poa secunda</i> ssp. <i>juncifolia</i>	2022	53	5	482	24	4.5	31.0	270
Totals		5	N/A	N/A	1268	84.2	14.5	100	872

4.8 GRANDE CACHE COAL

In their 2001 Environmental Impact Assessment for the Grande Cache Coal Project, Grande Cache Coal Company (GCC, 2001) proposed initial seeding of their mountain coal mine with a grass/legume mixture that would be in place for at least three years and up to five years before it is supplemented with tree and shrub cover.

Table 75. GCC mix.

Common Name	Scientific Name	Wt %
Highlander Slender Wheatgrass	<i>Elymus trachycaulus</i> ssp. <i>trachycaulus</i>	25
Mountaineer Broadglumed Wheatgrass	<i>Elymus violaceus</i>	25
PS Alfalfa	<i>Medicago sativa</i>	15
Alpine Bluegrass	<i>Poa alpina</i>	10
Alpine Fescue	<i>Festuca brachyphylla</i>	10
Sheep Fescue or Rough Fescue	<i>Festuca ovina</i> or <i>Festuca campestris</i>	10
Wild Vetch	<i>Astragalus</i> spp.	5

4.9 LUSCAR LTD. SHEERNESS MINE

In the “current state of knowledge on native species use” section in the Brooks Power Project EIA mentioned above the authors noted that the following seed mixes were recommended for use in Luscar Ltd.’s Sheerness Mine near Hanna (Luscar Ltd., 1996).

Table 76. Sheerness Mine sandy soil mix.

Common Name	Scientific Name	Wt %
Pubescent Wheatgrass	<i>Thinopyrum intermedium</i>	50
Prairie Sand Reed	<i>Calamovilfa longifolia</i>	15
Indian Rice Grass	<i>Achnatherum hymenoides</i>	15
Sand Dropseed	<i>Sporobolus cryptandrus</i>	15
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	15

Table 77. Sheerness Mine loamy soil mix.

Common Name	Scientific Name	Wt %
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	30
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	20
Green Needle Grass	<i>Nassella viridula</i>	20
Western Wheatgrass	<i>Pascopyrum smithii</i>	20
Tall Fescue	<i>Schedonorus arundinaceus</i>	10

Table 78. Sheerness Mine solonetzic soil mix.

Common Name	Scientific Name	Wt %
Western Wheatgrass	<i>Pascopyrum smithii</i>	60
Blue Grama or June Grass	<i>Bouteloua gracilis</i> or <i>Koeleria macrantha</i>	30
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10

Table 79. Sheerness Mine saline soil mix.

Common Name	Scientific Name	Wt %
Western Wheatgrass	<i>Pascopyrum smithii</i>	25
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	25

Common Name	Scientific Name	Wt %
Alkali Grass	<i>Puccinellia distans</i>	25
Beardless Wild Rye	<i>Leymus triticoides</i>	25

4.10 PARKS CANADA – TRANS CANADA HIGHWAY, BANFF NATIONAL PARK

The following mix was proposed for use in disturbed areas associated with twinning of the Trans Canada Highway through Banff National Park (Hammer, 1996).

Table 80. Parks Canada – Trans Canada Highway – Banff National Park mix.

Common Name	Scientific Name
Northern Wheatgrass	<i>Agropyron dasystachyum</i>
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>
Fringed Brome	<i>Bromus ciliatus</i>
Tufted Hair Grass	<i>Deschampsia caespitosa</i>
Fowl Bluegrass	<i>Poa palustris</i>
Rocky Mountain Fescue	<i>Festuca saximontana</i>
June Grass	<i>Koeleria macrantha</i>
Alpine Bluegrass	<i>Poa alpina</i>

Plus 5% Perennial Ryegrass (*Lolium perenne*) as cover crop.

4.11 SUNCOR TAILINGS SAND SLOPES

Tuttle (1991) described Suncor's tailings sand slope hydroseeding mix, which included eight species combined with hydromulch, tackifier and starter fertilizer.

Table 81. Suncor tailings sand slope hydroseeding mix.

Common Name	Scientific Name	Wt %
Violet Wheatgrass	<i>Elymus violaceus</i>	48
Sheep Fescue	<i>Festuca ovina</i>	10
Fowl Bluegrass	<i>Poa palustris</i>	10
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	9
Meadow Barley	<i>Hordeum brachyantherum</i>	9
Red Top	<i>Agrostis stolonifera</i>	5
Alsike Clover	<i>Trifolium hybridum</i>	5

Kentucky Bluegrass	<i>Poa pratensis</i>	4
--------------------	----------------------	---

4.12 TRANSCANADA KEYSTONE PIPELINE GP LTD. KEYSTONE PIPELINE

Six seed mixes were proposed for the Alberta portion of the Keystone pipeline, based on comments from Alberta Sustainable Resource Development, Special Areas and Environment Canada Canadian Wildlife Service (TransCanada Keystone Pipeline GP Ltd., 2008). Hooker's oat grass and Sweetgrass are to be used if available. Primary method of application is drill seeding with an application rate of 10 kg/ha. Broadcast seeding may be used on steep slopes, with an application rate of 15 kg/ha.

Table 82. Keystone seral *Festuca hallii* grassland mix.

Common Name	Scientific Name	Wt %
Plains Rough Fescue	<i>Festuca hallii</i>	25
Awed Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	20
Green Needle Grass	<i>Nassella viridula</i>	20
Hooker's Oat Grass	<i>Avenula hookeri</i>	15
Western Porcupine Grass	<i>Hesperostipa curtisetia</i>	10
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	5
Canada Milk Vetch	<i>Astragalus canadensis</i>	2
American Vetch	<i>Vicia americana</i>	2
June Grass	<i>Koeleria macrantha</i>	1

Table 83. Keystone sub-seral *Festuca hallii* grassland mix.

Common Name	Scientific Name	Wt %
Green Needle Grass	<i>Nassella viridula</i>	30
Awed Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	24
Plains Rough Fescue	<i>Festuca hallii</i>	10
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10
Western Wheatgrass	<i>Pascopyrum smithii</i>	10
Western Porcupine Grass	<i>Hesperostipa curtisetia</i>	10
June Grass	<i>Koeleria macrantha</i>	2
Canada Milk Vetch	<i>Astragalus canadensis</i>	2
American Vetch	<i>Vicia americana</i>	2

Table 84. Keystone depression and wetland (including saline sites) mix.

Common Name	Scientific Name	Wt %
Western Wheatgrass	<i>Pascopyrum smithii</i>	20
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	20
Alkali Bluegrass	<i>Poa secunda ssp. juncifolia</i>	10
Nuttall's Alkali Grass	<i>Puccinellia nuttalliana</i>	10
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	10
Slough Grass	<i>Beckmannia syzigachne</i>	10
Sweet Grass	<i>Anthoxanthum nitens</i>	10
Fowl Bluegrass	<i>Poa palustris</i>	10

Table 85. Keystone sandy soils (north) mix.

Common Name	Scientific Name	Wt %
Indian Rice Grass	<i>Achnatherum hymenoides</i>	25
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	20
Plains Rough Fescue	<i>Festuca hallii</i>	15
Canada Wild Rye	<i>Elymus canadensis</i>	15
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10
Awned Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	5
Prairie Sand Reed	<i>Calamovilfa longifolia</i>	5
Sweet Grass	<i>Anthoxanthum nitens</i>	3
Canada Milk Vetch	<i>Astragalus canadensis</i>	1
American Vetch	<i>Vicia americana</i>	1

Note: Canada wild rye was listed twice at 10% and 5%.

Table 86. Keystone sandy soils (south) mix.

Common Name	Scientific Name	Wt %
Indian Rice Grass	<i>Achnatherum hymenoides</i>	25
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	20
Canada Wild Rye	<i>Elymus canadensis</i>	18

Common Name	Scientific Name	Wt %
Sand Drop Seed	<i>Sporobolus cryptandrus</i>	15
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10
Awne Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	5
Prairie Sand Reed	<i>Calamovilfa longifolia</i>	5
Canada Milk Vetch	<i>Astragalus canadensis</i>	1
American Vetch	<i>Vicia americana</i>	1

Table 87. Keystone mixed grass and dry mixed grass mix.

Common Name	Scientific Name	Wt %
Needle-and-Thread	<i>Hesperostipa comata</i>	15
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	15
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	15
Western Wheatgrass	<i>Pascopyrum smithii</i>	15
Green Needle Grass	<i>Nassella viridula</i>	15
Blue Grama	<i>Bouteloua gracilis</i>	10
Plains Reed Grass	<i>Calamagrostis montanensis</i>	10
June Grass	<i>Koeleria macrantha</i>	3
Canada Milk Vetch	<i>Astragalus canadensis</i>	1
American Vetch	<i>Vicia americana</i>	1

4.13 TRANS MOUNTAIN PIPELINE ULC TRANS MOUNTAIN EXPANSION PROJECT

Natural regeneration of Trans Mountain Pipeline (Trans Mountain) disturbances is the preferred method of revegetation where appropriate but seeding will occur on sites susceptible to wind and water erosion and weed establishment. Seed mixes have been designed for specific pipeline segments (Trans Mountain ULC, 2016).

Table 88. Trans Mountain dry or moist soil mix or native erosion control mix CP-1.

This mix is used in several areas.

Common Name	Scientific Name	Wt %
Slender Wheatgrass or Awne Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i> or <i>Elymus trachycaulus ssp. subsecundus</i>	25

Common Name	Scientific Name	Wt %
Fringed Brome ultracoat	<i>Bromus ciliatus</i>	20
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	20
Pincher Brand Smooth Wildrye ultracoat	<i>Elymus glaucus</i>	15
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	10
June Grass	<i>Koeleria macrantha</i>	10

Table 89. Trans Mountain wet soil mix CP-2.

This mix is used in the Edmonton/Acheson area.

Common Name	Scientific Name	Wt %
Canada Wildrye	<i>Elymus canadensis</i>	25
Slough Grass	<i>Beckmannia syzigachne</i>	20
Slender Wheatgrass or Awned Wheatgrass	<i>Elymus trachycaulus</i> ssp. <i>trachycaulus</i> or <i>Elymus trachycaulus</i> ssp. <i>subsecundus</i>	20
June Grass	<i>Koeleria macrantha</i>	20
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	15

Table 90. Trans Mountain wet soil mix DMW-2.

This mix is used in the Smithfield area.

Common Name	Scientific Name	Wt %
Slough Grass	<i>Beckmannia syzigachne</i>	35
Slender Wheatgrass or Awned Wheatgrass	<i>Elymus trachycaulus</i> ssp. <i>trachycaulus</i> or <i>Elymus trachycaulus</i> ssp. <i>subsecundus</i>	20
June Grass	<i>Koeleria macrantha</i>	20
Western Wheatgrass	<i>Pascopyrum smithii</i>	15
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	10

Table 91. Trans Mountain wet soil mix CMW-2.

This mix is used in the Lobstick area.

Common Name	Scientific Name	Wt %
-------------	-----------------	------

Common Name	Scientific Name	Wt %
Canada Wild Rye	<i>Elymus canadensis</i>	30
Slough Grass	<i>Beckmannia syzigachne</i>	20
Fringed Brome	<i>Bromus ciliatus</i>	20
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	10
Western Wheatgrass	<i>Pascopyrum smithii</i>	10
June Grass	<i>Koeleria macrantha</i>	10

Table 92. Trans Mountain general dry or moist soils or native erosion control mix LF-1.
This mix is used in the Niton and Drinnan areas.

Common Name	Scientific Name	Wt %
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	25
Fringed Brome	<i>Bromus ciliatus</i>	25
Canada Wild Rye	<i>Elymus canadensis</i>	20
Foothills Rough Fescue	<i>Festuca campestris</i>	15
June Grass	<i>Koeleria macrantha</i>	15

Table 93. Trans Mountain wet soil mix LF-2.
This mix is used in the Niton and Drinnan areas.

Common Name	Scientific Name	Wt %
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	30
Fowl Bluegrass	<i>Poa palustris</i>	20
Slough Grass	<i>Beckmannia syzigachne</i>	20
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	15
June Grass	<i>Koeleria macrantha</i>	15

Table 94. Trans Mountain general dry or moist soils or native erosion control mix M-1.
This mix is used in the Pedley and Entrance areas.

Common Name	Scientific Name	Wt %
Fringed Brome	<i>Bromus ciliatus</i>	25

Common Name	Scientific Name	Wt %
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	20
Rocky Mountain Fescue	<i>Festuca saximontana</i>	15
Pincher Brand Smooth Wild Rye	<i>Elymus glaucus</i>	15
Canada Wild Rye	<i>Elymus canadensis</i>	15
June Grass	<i>Koeleria macrantha</i>	10

Table 95. Trans Mountain wet soil mix M-2.
This mix is used in the Pedley and Entrance areas.

Common Name	Scientific Name	Wt %
Slender Wheatgrass or Awned Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i> or <i>Elymus trachycaulus ssp. subsecundus</i>	30
Pincher Brand Smooth Wildrye	<i>Elymus glaucus</i>	25
Fringed Brome	<i>Bromus ciliatus</i>	20
Tickle Grass	<i>Agrostis scabra</i>	10
Spike Trisetum	<i>Trisetum spicatum</i>	10
Bluejoint	<i>Calamagrostis canadensis</i>	5



5.0 RESEARCH AND DEVELOPMENT SEED MIXES

5.1 INNOTECH ALBERTA

InnoTech Alberta and its predecessor organizations have evaluated native species performance using a variety of mixes in several research projects.

5.1.1 AltaLink Transmission Line Right-of-Way

A 3-year dune revegetation and stabilization study was designed to test soil management and vegetation establishment techniques on the AltaLink transmission line right-of-way (RoW), in the Central Parkland Subregion near Metiskow (McKenzie et al., 2016).

Table 96. InnoTech Alberta AltaLink Hansman Lake seed mix.

Common Name	Scientific Name	Wt %
June Grass	<i>Koeleria macrantha</i>	36
Rocky Mountain Fescue	<i>Festuca saximontana</i>	35
Canada Wild Rye	<i>Elymus canadensis</i>	20
Indian Rice Grass	<i>Achnatherum hymenoides</i>	5
Sand Dropseed	<i>Sporobolus cryptandrus</i>	2
Sweetgrass	<i>Anthoxanthum nitens</i>	2

5.1.2 Imaginea Wellsite Enhanced Reclamation and Remediation Demonstration

A demonstration trial was designed and established at three Imaginea Energy Corp. wellsites (1 active water injection well and 2 reclaimed) within the Dry Mixedgrass Natural Subregion of Alberta (Small et al., 2016b). One site was impacted by a salt water release; the other two had been reclaimed but revegetation had been unsuccessful. Biochar and plant growth promoting rhizobacteria (PGPR) were evaluated as tools to enhance revegetation on those sites.

Table 97. InnoTech Alberta Imaginea wellsite 1 seed mix.

Common Name	Scientific Name	PLS (%)	1000 Seed Weight (g)	Weight Required (kg)	Germination (%)	PLS Weight (kg)	Source - Purity
Western Wheatgrass	<i>Pascopyrum smithii</i>	20	3.04	17.64	92	19.05	BY - 0.1% ergot
Blue Grama	<i>Bouteloua gracilis</i>	18	0.46	2.40	96	2.50	GMS - Clean
S2 June Grass	<i>Koeleria</i>	18	0.38	1.98	80	2.38	IA - Clean

Common Name	Scientific Name	PLS (%)	1000 Seed Weight (g)	Weight Required (kg)	Germination (%)	PLS Weight (kg)	Source - Purity
	<i>macrantha</i>						
Sandberg Bluegrass	<i>Poa secunda</i>	18	0.28	1.46	94	1.55	BY - Clean
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	12	2.19	7.62	93	8.16	BY - Clean
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	7	4.91	9.97	90	10.97	GMS - Clean
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	7	3.31	6.72	92	7.26	BY - Clean
Total		100					

This seed mix was approved by Alberta Energy Regulator staff as it is located on public land.

PLS = Pure Live Seed; BY = BrettYoung Seeds; GMS = Gold Metal Seeds; IA = InnoTech Alberta Breeder Seed

Clean = no weed seeds (ergot)

Wellsite 2 and the spill site were seeded to the Eastern Irrigation District mix.

5.1.3 Other Research Projects

The following mixes were used in projects for which there is no formal report available to cite. Information was provided by InnoTech Alberta staff.

5.1.3.1 Alberta Research Council Northern Fescue Wellsite Revegetation

In 1996 and 1977, the Alberta Research Council (ARC) established plots to assess the performance of three native seed mixes and natural recovery in revegetation of wellsites on mesic and sandy sites in the Municipal District of Provost, County of Paintearth and Special Area #2.

Table 98. ARC northern fescue mesic wellsite modified reclamation mix.

Common Name	Scientific Name	PLS/m ²
Plains Rough Fescue	<i>Festuca hallii</i>	400
Adanac/Revenue/Highlander Slender Wheatgrass ¹	<i>Elymus trachycaulus ssp. trachycaulus</i>	200

¹ varieties at a ratio of 1:1:1

Table 99. ARC northern fescue mesic wellsite simple mix.

Common Name	Scientific Name	PLS/m ²
Plains Rough Fescue	<i>Festuca hallii</i>	400
Green Needle Grass	<i>Nassella viridula</i>	100
Hillcrest Awned Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	45
June Grass	<i>Koeleria macrantha</i>	30
Western Porcupine Grass	<i>Hesperostipa curtiseta</i>	25

Table 100. ARC northern fescue mesic wellsite diverse mix.

Common Name	Scientific Name	PLS/m ²
Plains Rough Fescue	<i>Festuca hallii</i>	400
Green Needle Grass	<i>Nassella viridula</i>	50
Adanac/Revenue/Highlander Slender Wheatgrass ¹	<i>Elymus trachycaulus ssp. trachycaulus</i>	40
Western Porcupine Grass	<i>Hesperostipa curtiseta</i>	25
Critana Northern Wheatgrass ² Sodar Streambank Wheatgrass	<i>Agropyron dasystachyum</i> <i>Elymus lanceolatus ssp. psammophilus</i>	20
June Grass	<i>Koeleria macrantha</i>	15
Walsh Western Wheatgrass	<i>Pascopyrum smithii</i>	10
Rocky Mountain Fescue	<i>Festuca saximontana</i>	6
Hairy Golden Aster	<i>Heterotheca villosa</i>	10
American Vetch	<i>Vicia americana</i>	8
Yarrow	<i>Achillea millefolium</i>	2
Cut-leaved Anemone	<i>Anemone multifida</i>	2
Smooth Fleabane	<i>Erigeron glabellus</i>	2
Blanket Flower	<i>Gaillardia aristata</i>	2
Sweetvetch	<i>Hedysarum spp.</i>	2
Slender Beardtongue	<i>Penstemon procerus</i>	2
Slender Cinquefoil	<i>Potentilla gracilis</i>	2
Stiff Goldenrod	<i>Solidago rigida</i>	2

¹ varieties at a ratio of 1:1:1

² varieties at a ratio of 1:1

Table 101. ARC northern fescue sandy wellsite modified reclamation mix.

Common Name	Scientific Name	PLS/m ²
Prairie Sand Reed	<i>Calamovilfa longifolia</i>	125
Canada Wildrye	<i>Elymus canadensis</i>	375

Table 102. ARC northern fescue sandy wellsite simple mix.

Common Name	Scientific Name	PLS/m ²
Prairie Sand Reed	<i>Calamovilfa longifolia</i>	130
Green Needle Grass	<i>Nassella viridula</i>	105
Hillcrest Awned Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	105
Plains Rough Fescue	<i>Festuca hallii</i>	80
Western Porcupine Grass	<i>Hesperostipa curisetia</i>	80

Table 103. ARC northern fescue sandy wellsite diverse mix.

Common Name	Scientific Name	PLS/m ²
Prairie Sand Reed	<i>Calamovilfa longifolia</i>	125
Plains Rough Fescue	<i>Festuca hallii</i>	75
Western Porcupine Grass	<i>Hesperostipa curisetia</i>	40
Green Needle Grass	<i>Nassella viridula</i>	25
Hillcrest Awned Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	25
Canada Wildrye	<i>Elymus canadensis</i>	25
Indian Rice Grass	<i>Achnatherum hymenoides</i>	25
June Grass	<i>Koeleria macrantha</i>	35
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	35
Critana Northern Wheatgrass ² Sodar Streambank Wheatgrass	<i>Agropyron dasystachyum</i> <i>Elymus lanceolatus ssp. psammophilus</i>	35
Walsh Western Wheatgrass	<i>Pascopyrum smithii</i>	30
Ascending Purple Milk Vetch	<i>Astragalus striatus</i>	11.4
Silky Locoweed	<i>Oxytropis sericea</i>	10.1
American Vetch	<i>Vicia americana</i>	1.8

Common Name	Scientific Name	PLS/m ²
Purple Prairie Clover	<i>Dalea purpurea</i>	1.5
Wild Licorice	<i>Glycyrrhiza lepidota</i>	0.2
Golden Bean	<i>Thermopsis rhombifolia</i>	0.1

¹ varieties at a ratio of 1:1

5.1.3.2 Alberta Research Council Sandy Soil Wellsite Reclamation

In May 2002, ARC conducted an evaluation trial of an indigenous native seed mix, composed of species common and adapted to the sandy soils southeast of Edgerton. The species included in the seed mix were based on their dominance in the plant community of the sandy uplands of the Central Parkland Subregion and seed availability. The performance of this mix was compared against the mix used by the wellsite operator.

Table 104. ARC sandy soil wellsite mix.

Common Name	Scientific Name	PLS/m ²
Blue Grama	<i>Bouteloua gracilis</i>	50
Prairie Sand Reed	<i>Calamovilfa longifolia</i>	50
Sand Nut Grass	<i>Cyperus schweinitzii</i>	25
Canada Wild Rye	<i>Elymus canadensis</i>	50
Rocky Mountain Fescue	<i>Festuca saximontana</i>	50
June Grass	<i>Koeleria macrantha</i>	50
Indian Rice Grass	<i>Achnatherum hymenoides</i>	50
False Melic	<i>Schizachne purpurascens</i>	25
Sand Dropseed	<i>Sporobolus cryptandrus</i>	50
Common Yarrow	<i>Achillea millefolium</i>	10
Blanket Flower	<i>Gaillardia aristata</i>	10
Hairy Golden Aster	<i>Heterotheca villosa</i>	10
Wild Blue Flax	<i>Linum lewisii</i>	10
Lilac-Flowered Beardtongue	<i>Penstemon gracilis</i>	10
Slender Blue Beardtongue	<i>Penstemon procerus</i>	10
White Prairie Clover	<i>Petalostemon candidum</i>	10
Prairie Coneflower	<i>Ratibida columnifera</i>	10
Low Goldenrod	<i>Solidago missouriensis</i>	10

Common Name	Scientific Name	PLS/m ²
Stiff Goldenrod	<i>Solidago rigida</i>	10

The total seeding rate was 500 pure live seeds/m² (PLS), which equated to a seeding rate of 9.9 kg/ha.

Table 105. ARC sandy soil wellsite – operator mix.

Common Name	Scientific name	% PLS
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	5
Awed Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	5
Blue Grama	<i>Bouteloua gracilis</i>	5
Prairie Sand Reed	<i>Calamovilfa longifolia</i>	25
Canada Wild Rye	<i>Elymus canadensis</i>	10
Plains Rough Fescue	<i>Festuca hallii</i>	5
Rocky Mountain Fescue	<i>Festuca saximontana</i>	10
June Grass	<i>Koeleria macrantha</i>	5
Indian Rice Grass	<i>Achnatherum hymenoides</i>	25
Western Porcupine Grass	<i>Hesperostipa curtisetia</i>	5

Seeded at 16 kg/ha.

5.1.3.3 Alberta Research Council Fescue Prairie Pipeline Reclamation

In 2004 ARC established plots on a pipeline to compare native seed mixes (ARC- and contractor-supplied), natural recovery and a mix of seeds swathed from the area.

Table 106. ARC fescue prairie pipeline – ARC seed mix.

Common Name	Scientific Name	Wt %
Rough Fescue	<i>Festuca hallii</i>	30
Blue Grama	<i>Bouteloua gracilis</i>	20
June Grass	<i>Koeleria macrantha</i>	20
Canada Wildrye	<i>Elymus canadensis</i>	10
Nodding Brome	<i>Bromus anomalus</i>	10
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	2.5
Awed Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	2.5

Common Name	Scientific Name	Wt %
Sedge	<i>Carex sp.</i>	1
Prairie Coneflower	<i>Ratibida columnifera</i>	1
Yarrow	<i>Achillea millefolium</i>	1
Low Goldenrod	<i>Solidago missouriensis</i>	1
Yellow Evening Primrose	<i>Oenothera biennis</i>	1

Table 107. ARC fescue prairie pipeline – contractor seed mix.

Common Name	Scientific Name	Wt %
Rough Fescue	<i>Festuca hallii</i>	50
Western Porcupine Grass	<i>Hesperostipa curtisetia</i>	10
Northern Wheatgrass or Awned Wheatgrass	<i>Agropyron dasystachyum</i> or <i>Elymus trachycaulus ssp. subsecundus</i>	10
Western Wheatgrass	<i>Pascopyrum smithii</i>	10
Green Needle Grass	<i>Nassella viridula</i>	10
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	5
June Grass or Blue Grama	<i>Koeleria macrantha</i> or <i>Bouteloua gracilis</i>	5

5.1.3.4 Alberta Research Council Dilberry Gravel Pit

In 2008, a gravel pit near Dilberry Lake Provincial Park was seeded to mix of species found to naturally occur near the site.

Table 108. ARC Dilberry gravel pit mix.

Common Name	Scientific Name	Wt %
Plains Rough Fescue	<i>Festuca hallii</i>	20
June Grass	<i>Koeleria macrantha</i>	20
Blue Grama	<i>Bouteloua gracilis</i>	15
Canada Wild Rye	<i>Elymus canadensis</i>	10
Sheep Fescue	<i>Festuca saximontana</i>	5-10
Nodding Brome	<i>Bromus anomalus</i>	8
Awned Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	5

Common Name	Scientific Name	Wt %
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	5
Common Yarrow	<i>Achillea millefolium</i>	1
Sun-loving Sedge	<i>Carex pensylvanica</i>	1
Blanket Flower	<i>Gaillardia aristata</i>	1
Hookers Oat Grass	<i>Avenula hookeri</i>	1
Hairy Golden Aster	<i>Heterotheca villosa</i>	1
Hoary Primrose	<i>Primula incana</i>	1
Low Goldenrod	<i>Solidago missouriensis</i>	1
Spear Grass	<i>Hesperostipa comata</i>	1

5.1.3.5 Alberta Research Council Fort Saskatchewan Roadside and Green Space Mixes

Two seed mixes for Fort Saskatchewan roadsides and green spaces were designed and trialed in 2008.

Table 109. ARC low growing, drought tolerant seed mix for coarse Fort Saskatchewan roadside soils.

Common Name	Scientific Name	Wt %
June Grass	<i>Koeleria macrantha</i>	35
Rocky Mountain Fescue	<i>Festuca saximontana</i>	35
Blue Grama	<i>Bouteloua gracilis</i>	28
Early Yellow Locoweed	<i>Oxytropis sericea</i>	2

Table 110. ARC Fort Saskatchewan green space mix.

Common Name	Scientific Name	Wt %
June Grass	<i>Koeleria macrantha</i>	25
Rocky Mountain Fescue	<i>Festuca saximontana</i>	25
Fringed Brome	<i>Bromus anomalus</i>	15
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	12
Blue Grama	<i>Bouteloua gracilis</i>	10
Hairy Wild Rye	<i>Elymus innovatus</i>	5
Green Needle Grass	<i>Nassella viridula</i>	3

Common Name	Scientific Name	Wt %
Western Yarrow	<i>Achillea millefolium</i>	2
Hooker's Oatgrass	<i>Avenula hookeri</i>	1
Rigid Goldenrod	<i>Solidago rigida</i>	1

5.1.3.6 Alberta Research Council Spill Site Phytoremediation Forage Reclamation Mix

In 2008, two wellsites north of Wainwright with evident spills were seeded to the following mix.

Table 111. ARC spill site mix.

Common Name	Scientific Name	Wt %
Canada Wild Rye	<i>Elymus canadensis</i>	20
Awed Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	15
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	10
Nodding Brome	<i>Bromus anomalus</i>	10
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	10
Rocky Mountain Fescue	<i>Festuca saximontana</i>	10
Alkali Grass	<i>Puccinellia nuttalliana</i>	10
Green Needle Grass	<i>Nassella viridula</i>	10
Canada Milk Vetch	<i>Astragalus canadensis</i>	5

5.1.3.7 Alberta Research Council Rumsey Wellsite Revegetation

In 2008 and 2009, three wellsites in the Rumsey Parkland received herbicide applications to kill the non-native plant communities and reseeded to two native species mixes.

Table 112. ARC Rumsey wellsite mix 1.

Common Name	Scientific Name	Wt %
Plains Rough Fescue	<i>Festuca hallii</i>	54
Blue Grama	<i>Bouteloua gracilis</i>	15
June Grass	<i>Koeleria macrantha</i>	15
Green Needle Grass	<i>Nassella viridula</i>	5
Yarrow	<i>Achillea millefolium</i>	3

Common Name	Scientific Name	Wt %
Low Goldenrod	<i>Solidago missouriensis</i>	2
Western Porcupine Grass	<i>Hesperostipa curtiseta</i>	2
Hooker's Oat Grass	<i>Avenula hookeri</i>	1.5
Slender Wheatgrass	<i>Elymus trachycaulus</i>	1
Sedge	<i>Carex spp</i>	1
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	0.5

Table 113. ARC Rumsey wellsite mix 2.

Common Name	Scientific Name	Wt %
June Grass	<i>Koeleria macrantha</i>	15.5
Blue Grama	<i>Bouteloua gracilis</i>	15
Slender Wheatgrass	<i>Elymus trachycaulus</i>	15
Plains Rough Fescue (collection 2)	<i>Festuca hallii</i>	14.5
Rocky Mountain Fescue	<i>Festuca saximontana</i>	12.5
Plains Rough Fescue	<i>Festuca hallii</i>	10.5
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	5
Green Needle Grass	<i>Nassella viridula</i>	5
Yarrow	<i>Achillea millefolium</i>	3
Low Goldenrod	<i>Solidago missouriensis</i>	2.5
Sedge	<i>Carex spp.</i>	1
Hookers Oat Grass	<i>Avenula hookeri</i>	0.5

5.1.3.8 Alberta Innovates – Technology Futures Foothills Fescue Pipeline Revegetation

In fall of 2010, Alberta Innovates – Technology Futures (AITF) seeded two sites along a pipeline right-of-way near the town of Longview. The seed mix consisted of the major grass species of the Rough Fescue – Idaho Fescue – Parry Oat grass plant community.

Table 114. AITF foothills fescue mix.

Common Name	Scientific Name	Wt %
Foothills Rough Fescue	<i>Festuca campestris</i>	57

Common Name	Scientific Name	Wt %
Rocky Mountain Fescue	<i>Festuca saximontana</i>	15
Hairy Wild Rye	<i>Elymus innovatus</i>	10
Idaho Fescue	<i>Festuca idahoensis</i>	5
Awne Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	5
Richardson Needle Grass	<i>Achnatherum richardsonii</i>	3

5.1.3.9 Alberta Innovates – Technology Futures Foothills Fescue Wellsite Reclamation

In fall of 2011, a new study area was located on a wellsite near Del Bonita. The Foothills Fescue Rangeland Plant Community Guide was consulted to design the seed mix for a Northern and Western Wheatgrass - green needle grass plant community with the addition of Parry's oatgrass (*Danthonia parryi*) and Idaho fescue (*Festuca idahoensis*) to favour many other late seral foothills fescue plant communities. Wheatgrasses and early colonizers were restricted in percentages and emphasis was placed on plant community diversity.

Table 115. AITF foothills fescue wellsite mix.

Common Name	Scientific Name	PLS %
Foothills Rough Fescue	<i>Festuca campestris</i>	41
Western Porcupine Grass	<i>Hesperostipa curtisetia</i>	8
Western Wheatgrass	<i>Pascopyrum smithii</i>	4
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	5
June Grass	<i>Koeleria macrantha</i>	5
Idaho Fescue	<i>Festuca idahoensis</i>	6
Parry's Oatgrass	<i>Danthonia parryi</i>	5
Green Needle Grass	<i>Nassella viridula</i>	5
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	6
Awne Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	5
Cultivated Oats	<i>Avena sativa</i>	10

5.1.3.10 Alberta Innovates – Technology Futures Oil Sands Tailings Sand Stabilization

In 2011, AITF evaluated a mix of native species and oats (as a nurse crop) for stabilization of oil sands tailings sand.

Table 116. InnoTech Alberta oil sands tailings stabilization mix.

Common Name	Scientific Name	Wt %
Oats	<i>Avena sativa</i>	37.5
Adanac Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	16.9
Rocky Mountain Fescue	<i>Festuca saximontana</i>	13.8
Fringed Brome Grass	<i>Bromus ciliatus</i>	9.3
Spike Trisetum	<i>Trisetum spicatum</i>	7.5
Nortran Tufted Hair Grass	<i>Deschampsia caespitosa</i>	6.2
ARC Centennial Canada Wild Rye	<i>Elymus canadensis</i>	4.4
June Grass	<i>Koeleria macrantha</i>	4.4

Fringe brome grass and June grass were treated with a seed treatment fungicide for the control of seed rot and damping off diseases.

5.2 UNIVERSITY OF ALBERTA

5.2.1 Bush – Native Seed Mixes for Diversity

Ten seed mixes were planted near Vegreville in 1994; two “standard-of-the-day” seed mixes provided by industry (NOVA Gas Transmission Ltd. and Ducks Unlimited) and eight seed mixes designed for this study (Bush, 1998). The seed mixes were designed to test varying levels and types of grass, forb and legume diversity. Many of the species used had not been previously tested for reclamation. Howat (2001) conducted follow-up assessments of the seeding treatments.

Table 117. Bush grass mix 1.

Common Name	Scientific Name	PLS/m ²
Plains Rough Fescue	<i>Festuca hallii</i>	18.7
Awne Wheatgrass and Slender Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus and Elymus trachycaulus ssp. trachycaulus</i>	14.7
Nodding Bromegrass	<i>Bromus anomalus</i>	57.9
Western Porcupine Grass	<i>Hesperostipa curti seta</i>	51.8
Western Wheatgrass	<i>Pascopyrum smithii</i>	6.3

Table 118. Bush grass mix 2.

Common Name	Scientific Name	PLS/m ²
Plains Rough Fescue	<i>Festuca hallii</i>	13.8
Awne Wheatgrass and Slender Wheatgrass	<i>Elymus trachycaulus</i> ssp. <i>subsecundus</i> and <i>Elymus trachycaulus</i> ssp. <i>trachycaulus</i>	19.8
Nodding Bromegrass	<i>Bromus anomalus</i>	42.2
Western Porcupine Grass	<i>Hesperostipa curtiseta</i>	37.9
Western Wheatgrass	<i>Pascopyrum smithii</i>	4.3
Blue Grama	<i>Bouteloua gracilis</i>	0.4
Fringed Brome	<i>Bromus ciliatus</i>	3
June Grass	<i>Koeleria macrantha</i>	16.1
Fowl Bluegrass	<i>Poa palustris</i>	25.3
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	12.8
Green Needle Grass	<i>Nassella viridula</i>	5.1

Table 119. Bush forbs mix 1.

Common Name	Scientific Name	PLS/m ²
Plains Rough Fescue	<i>Festuca hallii</i>	13.8
Awne Wheatgrass and Slender Wheatgrass	<i>Elymus trachycaulus</i> ssp. <i>subsecundus</i> and <i>Elymus trachycaulus</i> ssp. <i>trachycaulus</i>	10.8
Nodding Bromegrass	<i>Bromus anomalus</i>	42.2
Western Porcupine Grass	<i>Hesperostipa curtiseta</i>	38.1
Western Wheatgrass	<i>Pascopyrum smithii</i>	4.4
Yarrow	<i>Achillea millefolium</i>	1.6
Wild Bergamot	<i>Monarda fistulosa</i>	0.4
Yellow Evening Primrose	<i>Oenothera biennis</i>	0.3
Slender Beardtongue	<i>Penstemon procerus</i>	2.8
Western Dock	<i>Rumex occidentalis</i>	1.5

Table 120. Bush legume mix 1.

Common Name	Scientific Name	PLS/m ²
Plains Rough Fescue	<i>Festuca hallii</i>	13.8

Common Name	Scientific Name	PLS/m ²
Awed Wheatgrass and Slender Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus and Elymus trachycaulus ssp. trachycaulus</i>	10.8
Nodding Brome grass	<i>Bromus anomalus</i>	42.2
Western Porcupine Grass	<i>Hesperostipa curtisetata</i>	37.9
Western Wheatgrass	<i>Pascopyrum smithii</i>	4.3
Yarrow	<i>Achillea millefolium</i>	1.1
Wild Bergamot	<i>Monarda fistulosa</i>	0.4
Yellow Evening Primrose	<i>Oenothera biennis</i>	0.3
Showy Locoweed	<i>Oxytropis splendens</i>	1.7
Nodding Locoweed	<i>Oxytropis deflexa</i>	6.5

Table 121. Bush NOVA mix.

Common Name	Scientific Name	PLS/m ²
Awed Wheatgrass and Slender Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus and Elymus trachycaulus ssp. trachycaulus</i>	19.4
Western Wheatgrass	<i>Pascopyrum smithii</i>	8.8
June Grass	<i>Koeleria macrantha</i>	16.1
Green Needle Grass	<i>Nassella viridula</i>	4.5
Streambank Wheatgrass	<i>Elymus lanceolatus ssp. riparius</i>	28.5
Sheep Fescue	<i>Festuca ovina</i>	31.8
Creeping Red Fescue	<i>Festuca rubra</i>	19.4
Foothills Rough Fescue	<i>Festuca campestris</i>	25.0
Alpine Bluegrass	<i>Poa alpina</i>	15.8

Table 122. Bush grass mix 3.

Common Name	Scientific Name	PLS/m ²
Plains Rough Fescue	<i>Festuca hallii</i>	29.0
Awed Wheatgrass and Slender Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus and Elymus trachycaulus ssp. trachycaulus</i>	10.7
Western Wheatgrass	<i>Pascopyrum smithii</i>	4.6
Nodding Brome grass	<i>Bromus anomalus</i>	73.2

Common Name	Scientific Name	PLS/m ²
Western Porcupine Grass	<i>Hesperostipa curtiseta</i>	37.9

Table 123. Bush grass mix 4.

Common Name	Scientific Name	PLS/m ²
Plains Rough Fescue	<i>Festuca hallii</i>	24.0
Awne Wheatgrass and Slender Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus and Elymus trachycaulus ssp. trachycaulus</i>	15.7
Western Wheatgrass	<i>Pascopyrum smithii</i>	2.7
Nodding Bromegrass	<i>Bromus anomalus</i>	58.1
Western Porcupine Grass	<i>Hesperostipa curtiseta</i>	23.7
June Grass	<i>Koeleria macrantha</i>	24.1
Green Needle Grass	<i>Nassella viridula</i>	7.6
Blue Grama	<i>Bouteloua gracilis</i>	0.2
Fringed Brome	<i>Bromus ciliatus</i>	1.5
Fowl Bluegrass	<i>Poa palustris</i>	36.7
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	6.3

Table 124. Bush forbs mix 2.

Common Name	Scientific Name	PLS/m ²
Plains Rough Fescue	<i>Festuca hallii</i>	23.9
Awne Wheatgrass and Slender Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus and Elymus trachycaulus ssp. trachycaulus</i>	6.7
Western Wheatgrass	<i>Pascopyrum smithii</i>	2.8
Nodding Bromegrass	<i>Bromus anomalus</i>	57.9
Western Porcupine Grass	<i>Hesperostipa curtiseta</i>	23.7
Yarrow	<i>Achillea millefolium</i>	0.6
Wild Bergamot	<i>Monarda fistulosa</i>	0.2
Yellow Evening Primrose	<i>Oenothera biennis</i>	0.3
Slender Beardtongue	<i>Penstemon procerus</i>	4.0
Western Dock	<i>Rumex occidentalis</i>	1.1

Table 125. Bush legume mix 2.

Common Name	Scientific Name	PLS/m ²
Plains Rough Fescue	<i>Festuca hallii</i>	24.0
Awned Wheatgrass and Slender Wheatgrass	<i>Elymus trachycaulus</i> ssp. <i>subsecundus</i> and <i>Elymus trachycaulus</i> ssp. <i>trachycaulus</i>	6.8
Western Wheatgrass	<i>Pascopyrum smithii</i>	2.7
Nodding Bromegrass	<i>Bromus anomalus</i>	58.1
Western Porcupine Grass	<i>Hesperostipa curtisetia</i>	23.7
Yarrow	<i>Achillea millefolium</i>	0.6
Wild Bergamot	<i>Monarda fistulosa</i>	0.2
Yellow Evening Primrose	<i>Oenothera biennis</i>	0.3
Showy Locoweed	<i>Oxytropis splendens</i>	2.6
Nodding Locoweed	<i>Oxytropis deflexa</i>	3.2

Table 126. Bush Ducks Unlimited Canada mix.

Common Name	Scientific Name	PLS/m ²
Awned Wheatgrass and Slender Wheatgrass	<i>Elymus trachycaulus</i> ssp. <i>subsecundus</i> and <i>Elymus trachycaulus</i> ssp. <i>trachycaulus</i>	5.6
Western Wheatgrass	<i>Pascopyrum smithii</i>	13.1
Green Needle Grass	<i>Nassella viridula</i>	11.5
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	18.6
Tall Wheatgrass	<i>Thinopyrum elongatum</i>	4.1
Alfalfa	<i>Medicago sativa</i>	2.4

5.2.2 Cohen-Fernandez – Limestone Quarry Revegetation

A seed mix consisting of 5 grasses and one forb was seeded in fall 2007 and spring 2008 on a limestone quarry at Exshaw (Cohen-Fernandez, 2012). The native plant species were chosen for their potential adaptability to quarry site conditions due to their tolerance to dry slopes, rocky or gravelly sites, alkaline soils and grazing. A nitrogen fixing forb was included to increase available soil nitrogen. The species, except *Bromus* and *Vicia*, had been previously tested on limestone quarry material in the greenhouse.

Table 127. Cohen-Fernandez limestone quarry seed mix.

Common Name	Scientific Name	Wt %
Alpine Blue Grass	<i>Poa alpina</i>	20
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	15
Hairy Wild Rye	<i>Elymus innovatus</i>	15
Rocky Mountain Fescue	<i>Festuca saximontana</i>	15
Sentinel Spike Trisetum	<i>Trisetum spicatum</i>	15
Mountain Brome Grass	<i>Bromus carinatus</i>	10
American Vetch	<i>Vicia americana</i>	10

5.2.3 Desserud and Naeth – *Festuca hallii* Recovery

Desserud and Naeth (2013) evaluated the recovery of *Festuca hallii* by comparing monoculture seeding to mixes of native grass species seeded in 2007 on plots in central Alberta (additional information in Desserud (2011)).

Table 128. Desserud and Naeth Ellerslie and Byemoor native mix.

Common Name	Scientific Name	Wt %	kg/ha	PLS %	PLS seeds/m ²
Green Needle Grass	<i>Nassella viridula</i>	40	2.7	45	48
June Grass	<i>Koeleria macrantha</i>	35	2.3	99	801
Rough Fescue	<i>Festuca hallii</i>	20	1.3	95	113
Awned Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	3	0.2	95	5
Western Wheatgrass	<i>Pascopyrum smithii</i>	2	0.1	67	2

Table 129. Desserud and Naeth Drumheller native mix.

Common Name	Scientific Name	Wt %	kg/ha	PLS %	PLS seeds/m ²
Blue Grama	<i>Bouteloua gracilis</i>	30	2.0	70	256
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	25	1.7	45	19
Rough Fescue	<i>Festuca hallii</i>	20	1.3	95	113
June Grass	<i>Koeleria macrantha</i>	20	1.3	99	457
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	3	0.2	95	5

Common Name	Scientific Name	Wt %	kg/ha	PLS %	PLS seeds/m ²
Western Wheatgrass	<i>Pascopyrum smithii</i>	2	0.1	67	2

5.2.4 Erichsen Arychuk – Native Forb Establishment

Sites at Ellerslie and Elk Island National Park were drill seeded in fall 1997 or spring 1998 to a mix of six native grasses, then broadcast seeded with ten native forb species commonly found in undisturbed aspen parkland ecosystems for which seed was available. The seed mix consisted of 70% grasses and 30% forbs by weight (each species had equal amounts of pure live seed (PLS) to give theoretically equal numbers of plants from each species). The 70:30 ratio of grasses to forbs represented percent cover and species number in Aspen Parkland.

Table 130. Erichsen Arychuk grass-forb seed mix.

Common Name	Scientific Name	g/m ²
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	110.00
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	92.30
Blue Grama Grass	<i>Bouteloua gracilis</i>	15.50
Northern Rough Fescue	<i>Festuca altaica</i>	65.00
June Grass	<i>Koeleria macrantha</i>	7.30
Green Needle Grass	<i>Nassella viridula</i>	57.00
Common Yarrow	<i>Achillea millefolium</i>	1.04
Smooth Aster	<i>Aster laevis</i>	7.24
Blanket Flower	<i>Gaillardia aristata</i>	23.66
Wild Blue Flax	<i>Linum lewisii</i>	12.21
Wild Bergamot	<i>Monarda fistulosa</i>	4.34
Purple Prairie Clover	<i>Dalea purpurea</i>	12.09
Prairie Coneflower	<i>Ratibida columnifera</i>	16.26
Canada Goldenrod	<i>Solidago canadensis</i>	6.11
Low Goldenrod	<i>Solidago missouriensis</i>	7.96
Wild Vetch	<i>Vicia americana</i>	87.30
Total Forb Seed		178.21
Total Seed		525.30

5.2.5 Fluker – Impacts of Soil Nutrient Levels and Interspecific Competition

Three native species were compared to three introduced species to determine if they have higher survivability and biomass on low nutrient soils at Ellerslie and the Genessee coal mine (Fluker, 1998). The species were seeded in 1996 alone and in six mixes – only the pure native mix and the six-species mix are reported here.

Table 131. Fluker native mix.

Common Name	Scientific Name	g/m ²
Walsh Western Wheatgrass	<i>Pascopyrum smithii</i>	0.45
Green Needle Grass	<i>Nassella viridula</i>	0.20
Wild Vetch	<i>Vicia americana</i>	2.70

Table 132. Fluker native-introduced mix.

Common Name	Scientific Name	g/m ²
Walsh Western Wheatgrass	<i>Pascopyrum smithii</i>	0.23
Green Needle Grass	<i>Nassella viridula</i>	0.10
Wild Vetch	<i>Vicia americana</i>	1.35
Magna Smooth Brome	<i>Bromus inermis</i>	0.22
Climax Timothy	<i>Phleum pretense</i>	0.03
Aurora Alsike Clover	<i>Trifolium hybridum</i>	0.05

5.2.6 Hammermeister et al. – Native Prairie Wellsite Reclamation

Three seed mixes (a low diversity seed mix commonly used by industry, a simple mix of species more typically dominant in native prairie, and a diverse seed mix) were compared to an unseeded treatment located in the Dry Mixed Grass Natural Subregion near Medicine Hat, Brooks and Bow Island in 1996 (Hammermeister et al., 2003; more information may be found Hammermeister, 2001; further analysis of the sites was carried out by Soulodre, 2001).

Table 133. Hammermeister et al. dry mixed grass low diversity industry mix.

Common Name	Scientific Name	PLS %
Western Wheatgrass	<i>Pascopyrum smithii</i>	50
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	30
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	15
Green Needle Grass	<i>Nassella viridula</i>	5

Table 134. Hammermeister et al. dry mixed grass simple mix.

Common Name	Scientific Name	PLS %
Blue Grama	<i>Bouteloua gracilis</i>	30
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	30
June Grass	<i>Koeleria macrantha</i>	20
Western Wheatgrass	<i>Pascopyrum smithii</i>	10
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10

Table 135. Hammermeister et al. dry mixed grass diverse mix.

Common Name	Scientific Name	PLS %
Blue Grama	<i>Bouteloua gracilis</i>	22
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	22
Western Wheatgrass	<i>Pascopyrum smithii</i>	7
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	7
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	7
Green Needle Grass	<i>Nassella viridula</i>	7
June Grass	<i>Koeleria macrantha</i>	7
Indian Rice Grass	<i>Achnatherum hymenoides</i>	7
Canada Wild Rye	<i>Elymus canadensis</i>	3
American Vetch	<i>Vicia americana</i>	1.85
Prairie Coneflower	<i>Ratibida columnifera</i>	1.33
Common Yarrow	<i>Achillea millefolium</i>	1.25
Broom Weed	<i>Gutierrezia sarothrae</i>	1.17
Purple Prairie Clover	<i>Dalea purpurea</i>	1.17
Tufted White Prairie Aster	<i>Symphyotrichum ericoides</i>	1.08
Missouri Goldenrod	<i>Solidago missouriensis</i>	1.08
Ascending Purple Milk Vetch	<i>Astragalus striatus</i>	1.00
Blanket Flower	<i>Gaillardia aristata</i>	0.33
White Prairie Clover	<i>Dalea candida</i>	0.33
Three-Flowered Avens	<i>Geum triflorum</i>	0.33

Common Name	Scientific Name	PLS %
Northern Sweetvetch	<i>Hedysarum spp.</i>	0.03
Golden Bean	<i>Thermopsis rhombifolia</i>	0.03

5.2.7 Naeth and Wilkinson – Fire Fuel Break Management

Performance of seeded native grasses relative to non-native species in fire fuel breaks in aspen parkland in Elk Island National Park and in montane forest in Jasper National Park was assessed. The Jasper sites were seeded in May 2004 and the Elk Island sites were seeded in June 2004 at 25 kg/ha.

Table 136. Naeth and Wilkinson Elk Island mix.

Common Name	Scientific Name	Wt %
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	20
Western Wheatgrass	<i>Pascopyrum smithii</i>	20
Fringed Brome	<i>Bromus ciliatus</i>	18
Green Needle Grass	<i>Nassella viridula</i>	15
Indian Rice Grass	<i>Achnatherum hymenoides</i>	10
Canada Wild Rye	<i>Elymus canadensis</i>	10
June Grass	<i>Koeleria macrantha</i>	7

Table 137. Naeth and Wilkinson Jasper mix.

Common Name	Scientific Name	Wt %
Hairy Wild Rye	<i>Elymus innovatus</i>	25
Fringed Brome	<i>Bromus ciliatus</i>	25
Rocky Mountain Fescue	<i>Festuca saximontana</i>	20
Alpine Blue Grass	<i>Poa alpina</i>	20
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	10

5.2.8 Naeth et al. – Pipeline Rangeland Revegetation

In 1986, NOVA Gas Transmission Ltd. (NGTL) initiated a long-term revegetation monitoring program to assess revegetation efforts on two pipelines in native rangelands in southeastern and southwestern Alberta (Naeth et al. 1997). The Milo Lateral runs through the Dry Mixed Grass and Mixed Grass Ecoregions – four sites were established and seeded to a native mix or a

non-native mix or both. The Porcupine Hills Lateral runs through the Aspen Parkland, Montane and Fescue Grassland Ecoregions – four sites were established.

Table 138. Naeth et al. Milo Lateral native seed mix.

Common Name	Scientific Name	Wt %
Walsh Western Wheatgrass	<i>Pascopyrum smithii</i>	25
Elbee Northern Wheatgrass	<i>Agropyron dasystachyum</i>	25
Nuttall's Alkali Grass	<i>Puccinellia nuttaliana</i>	25
Revenue Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	17
Reubens Canada Bluegrass	<i>Poa compressa</i>	8

Table 139. Naeth et al. Porcupine Hills Lateral seed mix.

Common Name	Scientific Name	Wt %
Sodar Streambank Wheatgrass	<i>Elymus lanceolatus ssp. psammophilus</i>	45
Elbee Northern Wheatgrass	<i>Agropyron dasystachyum</i>	15
Rough Fescue	<i>Festuca hallii</i>	14
Revenue Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	10
Rangelander Alfalfa	<i>Medicago sativa</i>	5
Durar Hard Fescue	<i>Festuca trachyphylla</i>	3
Covar Sheep Fescue	<i>Festuca ovina</i>	3
June Grass	<i>Koeleria macrantha</i>	3
Reubens Canada Bluegrass	<i>Poa compressa</i>	2

5.2.9 Pelech – Native vs. Introduced Comparison

Pelech (1997) assessed the performance of nine plant species mixes (four native, four introduced and one mixed) seeded in 1995 at the Lacombe Research Centre.

Table 140. Pelech native pasture mix.

Common Name	Scientific Name
Plains Rough Fescue	<i>Festuca hallii</i>
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>
Nodding Brome grass	<i>Bromus anomalus</i>
Purple Prairie Clover	<i>Dalea purpureum</i>

Common Name	Scientific Name
June Grass	<i>Koeleria macrantha</i>
Parry Oat Grass	<i>Danthonia parryi</i>

Table 141. Pelech native hay mix.

Common Name	Scientific Name
Foothills Rough Fescue	<i>Festuca campestris</i>
Western Wheatgrass	<i>Pascopyrum smithii</i>
Nodding Brome grass	<i>Bromus anomalus</i>
American Vetch	<i>Vicia americana</i>
Green Needle Grass	<i>Nassella viridula</i>
Tufted Hair Grass	<i>Deschampsia caespitosa</i>

Table 142. Pelech native mix.

Common Name	Scientific Name
Western Porcupine Grass	<i>Hesperostipa curtiseta</i>
Northern Wheatgrass	<i>Agropyron dasystachyum</i>
Nodding Brome grass	<i>Bromus anomalus</i>
American Vetch	<i>Vicia americana</i>
Idaho Fescue	<i>Festuca idahoensis</i>
Parry Oat Grass	<i>Danthonia parryi</i>

Table 143. Pelech alternate native mix.

Common Name	Scientific Name
Plains Rough Fescue	<i>Festuca hallii</i>
Western Wheatgrass	<i>Pascopyrum smithii</i>
Nodding Brome grass	<i>Bromus anomalus</i>
Purple Prairie Clover	<i>Dalea purpureum</i>
June Grass	<i>Koeleria macrantha</i>
Western Porcupine Grass	<i>Hesperostipa curtiseta</i>

5.2.10 Pitchford – Aspen Parkland

Pitchford (2000) evaluated spring (1997) and fall (1998) seeding of four native species mixes at Ellerslie and Elk Island National Park.

Table 144. Pitchford – Aspen Parkland mix 1.

Common Name	Scientific Name
Northern Wheatgrass	<i>Agropyron dasystachyum</i>
Slender Wheatgrass	<i>Elymus trachycaulus ssp. Trachycaulus</i>
Blue Grama	<i>Bouteloua gracilis</i>
Plains Rough Fescue	<i>Festuca hallii</i>
June Grass	<i>Koeleria macrantha</i>
Green Needle Grass	<i>Nassella viridula</i>

Table 145. Pitchford – Aspen Parkland mix 2.

Common Name	Scientific Name
Northern Wheatgrass	<i>Agropyron dasystachyum</i>
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>
Red Top	<i>Agrostis stolonifera</i>
Blue Grama	<i>Bouteloua gracilis</i>
Mountain Brome Grass	<i>Bromus carinatus</i>
Plains Rough Fescue	<i>Festuca hallii</i>
Sheep Fescue	<i>Festuca ovina</i>
June Grass	<i>Koeleria macrantha</i>
Fowl Bluegrass	<i>Poa palustris</i>
Green Needle Grass	<i>Nassella viridula</i>

Table 146. Pitchford – Aspen Parkland mix 1 plus.

Common Name	Scientific Name
Northern Wheatgrass	<i>Agropyron dasystachyum</i>
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>
Blue Grama	<i>Bouteloua gracilis</i>
Plains Rough Fescue	<i>Festuca hallii</i>

Common Name	Scientific Name
June Grass	<i>Koeleria macrantha</i>
Green Needle Grass	<i>Nassella viridula</i>
Yarrow	<i>Achillea millefolium</i>
Smooth Aster	<i>Symphyotrichum laeve</i>
Blanket Flower	<i>Gaillardia aristata</i>
Wild Blue Flax	<i>Linum lewisii</i>
Wild Bergamot	<i>Monarda fistulosa</i>
Purple Prairie Clover	<i>Dalea purpurea</i>
Prairie Coneflower	<i>Ratibida columnifera</i>
Canada Goldenrod	<i>Solidago canadensis</i>
Low Goldenrod	<i>Solidago missouriensis</i>
American Vetch	<i>Vicia americana</i>

Note – this appears to be the same mix (site?) as the Erichsen Arychuk grass-forb seed mix described above (with the exception of *Festuca altaica* / *Festuca hallii*).

Table 147. Pitchford – Aspen Parkland mix 2 plus.

Common Name	Scientific Name
Northern Wheatgrass	<i>Agropyron dasystachyum</i>
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>
Red Top	<i>Agrostis stolonifera</i>
Blue Grama	<i>Bouteloua gracilis</i>
Mountain Brome Grass	<i>Bromus carinatus</i>
Plains Rough Fescue	<i>Festuca hallii</i>
Sheep Fescue	<i>Festuca ovina</i>
June Grass	<i>Koeleria macrantha</i>
Fowl Bluegrass	<i>Poa palustris</i>
Green Needle Grass	<i>Nassella viridula</i>
Yarrow	<i>Achillea millefolium</i>
Smooth Aster	<i>Symphyotrichum laeve</i>
Blanket Flower	<i>Gaillardia aristata</i>
Wild Blue Flax	<i>Linum lewisii</i>

Common Name	Scientific Name
Wild Bergamot	<i>Monarda fistulosa</i>
Purple Prairie Clover	<i>Dalea purpurea</i>
Prairie Coneflower	<i>Ratibida columnifera</i>
Canada Goldenrod	<i>Solidago canadensis</i>
Low Goldenrod	<i>Solidago missouriensis</i>
American Vetch	<i>Vicia americana</i>

5.2.11 Rojas – City of Edmonton Naturalization

Rojas (2016) evaluated selected native forb species performance in a naturalized area in the City of Edmonton (Terwillegar Recreation Centre) based on survival, health and growth. Short grass and tall grass mixes were seeded in 2014.

Table 148. Rojas – Short grass native seed mix.

Common Name	Scientific Name	Wt %
Spike Trisetum	<i>Trisetum spicatum</i>	30
Mountainview June Grass	<i>Koeleria macrantha</i>	25
Plateau Rocky Mountain Fescue	<i>Festuca saximontana</i>	25
Glacier Alpine Blue Grass	<i>Poa alpina</i>	20

Seeded at 150 kg/ha

Table 149. Rojas – Tall grass native seed mix.

Common Name	Scientific Name	Wt %
Rough Fescue	<i>Festuca hallii</i>	30
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	15
Western Wheatgrass	<i>Pascopyrum smithii</i>	15
Canada Wild Rye	<i>Elymus canadensis</i>	10
Awne Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	10
Hooker's Oat Grass	<i>Avenula hookeri</i>	10
Green Needle Grass	<i>Nassella viridula</i>	10

Seeded at 35 kg/ha

5.2.12 Salisbury – Boreal Forest Pipeline Revegetation

In the winter of 2000 Salisbury (2004) broadcast seeded a mix of species selected by Alliance Pipeline Ltd. as suitable for the Whitecourt area based on its previous use at similar locations and compared the results to a natural recovery area.

Table 150. Salisbury Alliance Pipeline mix.

Common Name	Scientific Name	Wt %
Fowl Bluegrass	<i>Poa palustris</i>	20
Rocky Mountain Fescue	<i>Festuca ovina</i>	15
Fringed Brome	<i>Bromus ciliatus</i>	15
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	15
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	15
June Grass	<i>Koeleria macrantha</i>	10
Hairy Wild Rye	<i>Elymus innovatus</i>	5
Mountain Rice Grass	<i>Oryzopsis asperifolia</i>	5

5.2.13 Sherritt – *Festuca hallii* and *Festuca campestris* Revegetation

Sherritt (2012) evaluated whether *Festuca hallii* (plains rough fescue) and *Festuca campestris* (foothills rough fescue) could be restored by seeding as a monoculture versus seeding in a mix with closely associated species following gas well site disturbances. The *Festuca hallii* plots were located in the Rumsey Block; the *F. campestris* plots were located west of Stavely. Both sites were seeded in 2008.

Table 151. Sherritt *Festuca hallii* mix.

Common Name	Scientific Name	Wt %
Plains Rough Fescue	<i>Festuca hallii</i>	30
Western Porcupine Grass	<i>Hesperostipa curtiseta</i>	30
June Grass	<i>Koeleria macrantha</i>	20
Hooker's Oat Grass	<i>Avenula hookeri</i>	20

Table 152. Sherritt *Festuca campestris* mix.

Common Name	Scientific Name	Wt %
Foothills Rough Fescue	<i>Festuca campestris</i>	30

Common Name	Scientific Name	Wt %
Parry Oatgrass	<i>Danthonia parryi</i>	30
June Grass	<i>Koeleria macrantha</i>	20
Idaho Fescue	<i>Festuca idahoensis</i>	20

5.2.14 Stover – Waterton Lake National Park

Stover (2013) investigated the effectiveness of broadcast-seeding a wild-collected native species mix at three disturbed foothills fescue grassland sites undergoing restoration in 2011.

Table 153. Stover Waterton Lakes National Park wild-collected seed mix.

Common Name	Scientific Name	Seeding Rate (kg/ha)
Columbia Needle Grass	<i>Achnatherum nelsonii</i>	0.2912
Pale Agoseris	<i>Agoseris glauca</i>	0.0156
Cut-leaved Anemone	<i>Anemone multifida</i>	0.1032
Mountain Brome	<i>Bromus carinatus</i>	8.508
Parry Oatgrass	<i>Danthonia parryi</i>	1.212
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	0.84
Sulphur Flower Buckwheat	<i>Eriogonum umbellatum</i>	0.2
Foothills Rough Fescue	<i>Festuca campestris</i>	0.4436
Idaho Fescue	<i>Festuca idahoensis</i>	1.4244
Brown Eyed Susan	<i>Gaillardia aristata</i>	0.6352
Sticky Purple Geranium	<i>Geranium viscosissimum</i>	0.0132
Prairie Smoke	<i>Geum triflorum</i>	0.0088
Vetch	<i>Hedysarum spp.</i>	0.0484
June Grass	<i>Koeleria macrantha</i>	0.0872
Wild Blue Flax	<i>Linum lewisii</i>	0.0576
Silky Lupine	<i>Lupinus sericeus</i>	0.52
Field Locoweed	<i>Oxytropis campestris</i>	0.006
Yellow Penstemon	<i>Penstemon confertus</i>	0.2168
Waxleaf Penstemon	<i>Penstemon nitidus</i>	0.102
Slender Cinquefoil	<i>Potentilla gracilis</i>	0.12
Cinquefoil	<i>Potentilla spp.</i>	0.182

Common Name	Scientific Name	Seeding Rate (kg/ha)
Western Meadow-Rue	<i>Thalictrum occidentale</i>	0.0012

5.2.15 Wishart – Montane Grassland Pipeline Revegetation

Wishart (1983) assessed the performance of three grass/forb/shrub seed mixes on the Trans Mountain Pipeline through Jasper National Park.

Table 154. Wishart montane pipeline mix 1.

Common Name	Scientific Name	Wt %
Slender Wheatgrass	<i>Elymus trachycaulus</i>	30
Hairy Wild Rye	<i>Leymus innovatus</i>	30
Alpine Bluegrass #1	<i>Poa alpina</i>	20
Northern Sweetvetch	<i>Hedysarum boreale</i>	10
Creeping Juniper	<i>Juniperus horizontalis</i>	10

Table 155. Wishart montane pipeline mix 2.

Common Name	Scientific Name	Wt %
Streambank Wheatgrass	<i>Elymus lanceolatus ssp. riparius</i>	30
June Grass	<i>Koeleria macrantha</i>	20
Kentucky Bluegrass	<i>Poa pratensis</i>	20
Creeping Bentgrass	<i>Agrostis stolonifera</i>	10
Vetch	<i>Astragalus spp.</i>	10
Prickly Rose	<i>Rosa acicularis</i>	10

Table 156. Wishart montane pipeline mix 3.

Common Name	Scientific Name	Wt %
Wheatgrass	<i>Agropyron spp.</i>	30
Rocky Mountain Fescue	<i>Festuca saximontana</i>	30
Alpine Bluegrass #2	<i>Poa alpina</i>	20
American Sweet Vetch	<i>Hedysarum alpinum</i>	10
Silverberry	<i>Elaeagnus commutata</i>	10

5.2.16 Wruck – Parkland Pipeline Seeding vs. Natural Recovery

Wruck (2004) compared shallow topsoil stripping versus conventional stripping combined with erosion control techniques (cover cropping and straw crimping) and seeding native species versus natural recovery were evaluated in reclamation of a pipeline right-of-way in sandhills of the Alberta Aspen Parkland. Plots were seeded to the Alliance Pipeline Mix #7 at a rate of 9 kg/ha in fall of 1999. Wruck noted the following problems occurred with the planned seed mix (shown in Table 155): *Festuca rubra* was seeded instead of *Festuca hallii*; the Sheep Fescue may have been *Festuca saximontana* (based on its appearance in the seeded plots but not the natural recovery ones).

Table 157. Wruck Alliance Pipeline sandy soil mix.

Common Name	Scientific Name	Wt %
Sheep Fescue	<i>Festuca ovina</i>	25
Plains Rough Fescue	<i>Festuca hallii</i>	25
Green Needle Grass	<i>Nassella viridula</i>	15
Indian Rice Grass	<i>Achnatherum hymenoides</i>	15
June Grass	<i>Koeleria macrantha</i>	10
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10



6.0 COMMERCIAL SEED MIXES

The Alberta Native Plant Council maintains a listing of native plant material sources (Alberta Native Plant Council, 2016).

Readers should contact vendors to determine ecological variety, source locality, species availability and volumes.

6.1 GOLD MEDAL SEEDS LTD.

Gold Metal Seeds Ltd.³ (GMSL; 2017a,b,c,d,e) offers a suite of native species seed mixes for a variety of uses.

6.1.1 Alberta Hiways Grass Seed Mixtures

GMSL offers mixes for each of the six Alberta Transportation seed zones (see section 2.1; Gold Metal Seeds Ltd., 2017a).

Table 158. GMSL Zone 1 wetland mixed wood native mix.

Common Name	Scientific Name	Wt %
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	40
Fringed Brome grass	<i>Bromus ciliatus</i>	15
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	15
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10
Rocky Mountain Fescue	<i>Festuca saximontana</i>	10
Fowl Bluegrass	<i>Poa palustris</i>	10

Table 159. GMSL Zone 2 wetland mixed wood native mix.

Common Name	Scientific Name	Wt %
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	35
Fringed Brome grass	<i>Bromus ciliatus</i>	20
Northern Wheatgrass	<i>Deschampsia caespitosa</i>	15

³ See <http://www.goldmedalseeds.ca/index.html>

Common Name	Scientific Name	Wt %
Tufted Hair Grass	<i>Agropyron dasystachyum</i>	10
Rocky Mountain Fescue	<i>Festuca saximontana</i>	10
Fowl Bluegrass	<i>Poa palustris</i>	10

Table 160. GMSL Zone 3 central mixed wood native mix (with ticklegrass).

Common Name	Scientific Name	Wt %
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	30
Rocky Mountain Fescue	<i>Festuca saximontana</i>	20
Tickle Grass	<i>Agrostis scabra</i>	15
Fringed Brome grass	<i>Bromus ciliatus</i>	10
Canada Wild Rye	<i>Elymus canadensis</i>	10
Tufted Hair Grass	<i>Agropyron dasystachyum</i>	10
Fowl Bluegrass	<i>Poa palustris</i>	5

Table 161. GMSL Zone 3 central mixed wood native mix (without ticklegrass).

Common Name	Scientific Name	Wt %
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	35
Rocky Mountain Fescue	<i>Festuca saximontana</i>	25
Fringed Brome grass	<i>Bromus ciliatus</i>	15
Canada Wild Rye	<i>Elymus canadensis</i>	10
Tufted Hair Grass	<i>Agropyron dasystachyum</i>	10
Fowl Bluegrass	<i>Poa palustris</i>	5

Table 162. GMSL Zone 4 mixed grass & dry mixed grass mix.

Common Name	Scientific Name	Wt %
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	30
Canada Wild Rye	<i>Elymus canadensis</i>	15
Mountain Brome grass	<i>Bromus carinatus</i>	15
Northern Wheatgrass	<i>Deschampsia caespitosa</i>	10
Alkali Grass	<i>Puccinellia distans</i>	10

Common Name	Scientific Name	Wt %
Needle- and- Thread Grass	<i>Hesperostipa comata</i>	10
Indian Rice Grass	<i>Achnatherum hymenoides</i>	5

Table 163. GMSL Zone 5 central parkland mix.

Common Name	Scientific Name	Wt %
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	25
Fringed Brome grass	<i>Bromus ciliatus</i>	15
Green Needle Grass	<i>Nassella viridula</i>	15
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10
Alkali Grass	<i>Puccinellia distans</i>	10
Canada Wild Rye	<i>Elymus canadensis</i>	10
Indian Rice Grass	<i>Achnatherum hymenoides</i>	10
Western Wheatgrass	<i>Pascopyrum smithii</i>	5

Table 164. GMSL Zone 6 lower foothills mix (with tickle grass).

Common Name	Scientific Name	Wt %
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	30
Smooth Wild Rye	<i>Elymus glaucus</i>	20
Tickle Grass	<i>Agrostis scabra</i>	10
Fringed Brome grass	<i>Bromus ciliatus</i>	10
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	10
Foothills Rough Fescue	<i>Festuca campestris</i>	10

Table 165. GMSL Zone 6 lower foothills mix (without tickle grass).

Common Name	Scientific Name	Wt %
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	30
Smooth Wild Rye	<i>Elymus glaucus</i>	25
Fringed Brome grass	<i>Bromus ciliatus</i>	15
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10

Common Name	Scientific Name	Wt %
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	10
Foothills Rough Fescue	<i>Festuca campestris</i>	10

6.1.2 Forage and Reclamation Mixtures

GMSL offers several mixes for forage and reclamation seeding (Gold Metal Seeds Ltd., 2017b).

Table 166. GMSL EID reclamation mixture.

Common Name	Scientific Name	Wt %
Needle- and- Thread Grass	<i>Hesperostipa comata</i>	20
June Grass	<i>Koeleria macrantha</i>	20
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	15
Western Wheatgrass	<i>Pascopyrum smithii</i>	15
Blue Grama	<i>Bouteloua gracilis</i>	10
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	10
Sandberg Bluegrass	<i>Poa secunda</i>	10

Table 167. GMSL EID prairie mixture.

Common Name	Scientific Name	Wt %
Western Wheatgrass	<i>Pascopyrum smithii</i>	30
Pubescent Wheatgrass	<i>Thinopyrum intermedium</i>	20
Green Needle Grass	<i>Nassella viridula</i>	20
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	15
Annual Ryegrass	<i>Lolium multiflorum</i>	10
Sheep Fescue	<i>Festuca ovina</i>	5

Table 168. GMSL SNC native fescue mixture.

Common Name	Scientific Name	Wt %
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	30
Awned Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	25
Green Needle Grass	<i>Nassella viridula</i>	15

Common Name	Scientific Name	Wt %
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10
Idaho Fescue	<i>Festuca idahoensis</i>	10
Rough Fescue	<i>Festuca hallii</i>	5
June Grass	<i>Koeleria macrantha</i>	5

6.1.3 Suffield Cluster Mixtures

GMSL offers 5 native Suffield cluster mixtures (Gold Metal Seeds Ltd., 2017c).

Table 169. GMSL Suffield cluster 2 mixture.

Common Name	Scientific Name	Wt %
Needle- and- Thread Grass	<i>Hesperostipa comata</i>	45
Blue Grama	<i>Bouteloua gracilis</i>	25
June Grass	<i>Koeleria macrantha</i>	10
Western Wheatgrass	<i>Pascopyrum smithii</i>	5
Prairie Sand Reed	<i>Calamovilfa longifolia</i>	5
Indian Rice Grass	<i>Achnatherum hymenoides</i>	5

Table 170. GMSL Suffield cluster 3 mixture.

Common Name	Scientific Name	Wt %
Western Wheatgrass	<i>Pascopyrum smithii</i>	40
Prairie Sand Reed	<i>Calamovilfa longifolia</i>	30
Needle- and- Thread Grass	<i>Hesperostipa comata</i>	10
Indian Rice Grass	<i>Achnatherum hymenoides</i>	10
June Grass	<i>Koeleria macrantha</i>	5
Blue Grama	<i>Bouteloua gracilis</i>	5

Table 171. GMSL Suffield cluster 4 mixture.

Common Name	Scientific Name	Wt %
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	45
June Grass	<i>Koeleria macrantha</i>	15

Common Name	Scientific Name	Wt %
Blue Grama	<i>Bouteloua gracilis</i>	10
Needle- and- Thread Grass	<i>Hesperostipa comata</i>	10
Western Wheatgrass	<i>Pascopyrum smithii</i>	5
Prairie Sand Reed	<i>Calamovilfa longifolia</i>	5
Inland Saltgrass	<i>Distichlis spicata</i>	5
Green Needle Grass	<i>Nassella viridula</i>	5

Table 172. GMSL Suffield cluster 5 mixture.

Common Name	Scientific Name	Wt %
Needle- and- Thread Grass	<i>Hesperostipa comata</i>	30
June Grass	<i>Koeleria macrantha</i>	20
Blue Grama	<i>Bouteloua gracilis</i>	20
Green Needle Grass	<i>Nassella viridula</i>	15
Western Wheatgrass	<i>Pascopyrum smithii</i>	5
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	5
Inland Saltgrass	<i>Distichlis spicata</i>	5

Table 173. GMSL Suffield cluster 6 mixture.

Common Name	Scientific Name	Wt %
Blue Grama	<i>Bouteloua gracilis</i>	35
June Grass	<i>Koeleria macrantha</i> =	20
Needle- and- Thread Grass	<i>Hesperostipa comata</i>	20
Inland Saltgrass	<i>Distichlis spicata</i>	15
Western Wheatgrass	<i>Pascopyrum smithii</i>	5
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	5

6.1.4 Special Areas Native Grass Seed Mixes

GMSL offers nine seed mixes for use in Special Areas Board land.

Table 174. GMSL Special Areas loamy mix 1 (Brown Soil Zone – Dry Mixedgrass).

Common Name	Scientific Name	Wt %
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	70
Western Wheatgrass	<i>Pascopyrum smithii</i>	15
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	9
Blue Grama	<i>Bouteloua gracilis</i>	5
June Grass	<i>Koeleria macrantha</i>	1

Table 175. GMSL Special Areas solonetzic mix 1 (Brown Soil Zone – Dry Mixedgrass).

Common Name	Scientific Name	Wt %
Western Wheatgrass	<i>Pascopyrum smithii</i>	45
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	35
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10
Sandberg Bluegrass	<i>Poa secunda</i>	5
Blue Grama	<i>Bouteloua gracilis</i>	3
June Grass	<i>Koeleria macrantha</i>	2

Table 176. GMSL Special Areas sandy mix 1 (Brown Soil Zone – Dry Mixedgrass).

Common Name	Scientific Name	Wt %
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	50
Western Wheatgrass	<i>Pascopyrum smithii</i>	20
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	20
Prairie Sand Reed	<i>Calamovilfa longifolia</i>	8
Blue Grama	<i>Bouteloua gracilis</i>	1
June Grass	<i>Koeleria macrantha</i>	1

Table 177. GMSL Special Areas loamy mix 2 (Dark Brown Soil Zone – Mixedgrass).

Common Name	Scientific Name	Wt %
Western Porcupine Grass	<i>Hesperostipa curtiseta</i>	60
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	18
Western Wheatgrass	<i>Pascopyrum smithii</i>	10

Common Name	Scientific Name	Wt %
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	10
June Grass	<i>Koeleria macrantha</i>	1
Blue Grama	<i>Bouteloua gracilis</i>	1

Table 178. GMSL Special Areas solonetzic mix 2 (Dark Brown Soil Zone – Northern Fescue).

Common Name	Scientific Name	Wt %
Western Wheatgrass	<i>Pascopyrum smithii</i>	35
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	25
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	20
Western Porcupine	<i>Hesperostipa curtisetia</i>	12
Plains Rough Fescue	<i>Festuca hallii</i>	5
June Grass	<i>Koeleria macrantha</i>	2
Sandberg Bluegrass	<i>Poa secunda</i>	1

Table 179. GMSL Special Areas sandy mix 2 (Dark Brown Sol Zone – Northern Fescue).

Common Name	Scientific Name	Wt %
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	55
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	20
Western Porcupine	<i>Hesperostipa curtisetia</i>	15
Prairie Sand Reed	<i>Calamovilfa longifolia</i>	7
June Grass	<i>Koeleria macrantha</i>	1
Sandberg Bluegrass	<i>Poa secunda</i>	1
Blue Grama	<i>Bouteloua gracilis</i>	1

Table 180. GMSL Special Areas loamy mix 3 (Dark Brown Soil Zone – Northern Fescue).

Common Name	Scientific Name	Wt %
Western Porcupine	<i>Hesperostipa curtisetia</i>	55
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	15
Plains Rough Fescue	<i>Festuca hallii</i>	12
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	12

Common Name	Scientific Name	Wt %
Western Wheatgrass	<i>Pascopyrum smithii</i>	5
June Grass	<i>Koeleria macrantha</i>	1

Table 181. GMSL Special Areas sandy mix 3 (Dark Brown Soil Zone – Central Parkland).

Common Name	Scientific Name	Wt %
Western Porcupine Grass	<i>Hesperostipa curtiseta</i>	80
Plains Rough Fescue	<i>Festuca hallii</i>	10
Prairie Sand Reed	<i>Calamovilfa longifolia</i>	8
June Grass	<i>Koeleria macrantha</i>	1
Blue Grama	<i>Bouteloua gracilis</i>	1

Table 182. GMSL Special Areas saline mix.

Common Name	Scientific Name	Wt %
Western Wheatgrass	<i>Pascopyrum smithii</i>	40
Salt Grass	<i>Distichlis spicata</i>	20
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	18
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	12
Green Needle Grass	<i>Nassella viridula</i>	8
June Grass	<i>Koeleria macrantha</i>	1
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	1

6.2 GPEC GREEN PATCH ENVIRONMENTAL CONSULTING LTD.

GPEC (Green Patch Environmental Consulting Ltd., nd) has native species mixes available (see list below) as well as seed for individual species (see section 7.2). Only species are listed in the mixes – no information was available online about the ratio of seeds for each species.

Table 183. GPEC alpine blend.

Common Name	Scientific Name
Rocky Mountain Fescue or Idaho Fescue	<i>Festuca saximontana</i> or <i>Festuca idahoensis</i>
Adanac Slender Wheatgrass	<i>Elymus trachycaulus</i> ssp. <i>trachycaulus</i>

Common Name	Scientific Name
Glacier Alpine Bluegrass	<i>Poa alpina</i>
Sentinel Spike Trisetum	<i>Trisetum spicatum</i>
Violet Wheatgrass	<i>Elymus violaceus</i>
Hairy Wild Rye or Smooth Wild Rye	<i>Leymus innovatus</i> or <i>Elymus glaucus</i>
Rough Fescue	<i>Festuca hallii</i>

Table 184. GPEC upper foothills blend.

Common Name	Scientific Name
Fringed Brome or Nodding Brome grass	<i>Bromus ciliatus</i> or <i>Bromus anomalus</i>
Hillcrest Awned Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>
Hairy Wild Rye or Smooth Wild Rye	<i>Leymus innovatus</i> or <i>Elymus glaucus</i>
Nortran Tufted Hair Grass	<i>Deschampsia caespitosa</i>
Butte Rocky Mountain Fescue or Idaho Fescue	<i>Festuca saximontana</i> or <i>Festuca idahoensis</i>
June Grass	<i>Koeleria macrantha</i>

Table 185. GPEC lower foothills blend.

Common Name	Scientific Name
Fowl Bluegrass	<i>Poa palustris</i>
Fringed Brome or Nodding Brome grass	<i>Bromus ciliatus</i> or <i>Bromus anomalus</i>
Elbee Northern Wheatgrass	<i>Agropyron dasystachyum</i>
Nortran Tufted Hair Grass	<i>Deschampsia caespitosa</i>
Hillcrest Awned Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>
Hairy Wild Rye or Smooth Wild Rye	<i>Leymus innovatus</i> or <i>Elymus glaucus</i>
Rough Fescue	<i>Festuca hallii</i>

Table 186. GPEC central blend.

Common Name	Scientific Name
Nortran Tufted Hair Grass	<i>Deschampsia caespitosa</i>
Hillcrest Awned Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>
Fringed Brome or Nodding Brome	<i>Bromus ciliatus</i> or <i>Bromus anomalus</i>
Fowl Blue Grass	<i>Poa palustris</i>
Slough Grass	<i>Beckmannia syzigachne</i>
June Grass	<i>Koeleria macrantha</i>
Wild Rye or Smooth Wild Rye	<i>Leymus innovatus</i> or <i>Elymus glaucus</i>
Elbee Northern Wheatgrass	<i>Agropyron dasystachyum</i>

Table 187. GPEC central parkland blend.

Common Name	Scientific Name
Walsh Western Wheatgrass	<i>Pascopyrum smithii</i>
Adanac Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>
Butte Rocky Mountain Fescue or Idaho Fescue	<i>Festuca saximontana</i> or <i>Festuca idahoensis</i>
Green Needle Grass	<i>Nassella viridula</i>
Northern Wheatgrass	<i>Agropyron dasystachyum</i>
Rough Fescue	<i>Festuca hallii</i>
June Grass	<i>Koeleria macrantha</i>
Hillcrest Awned Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>

Table 188. GPEC mixed grasses blend.

Common Name	Scientific Name
Walsh Western Wheatgrass	<i>Pascopyrum smithii</i>
Adanac Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>
Northern Wheatgrass	<i>Agropyron dasystachyum</i>
Green Needle Grass	<i>Nassella viridula</i>
Needle-and-Thread Grass	<i>Hesperostipa comata</i>

Common Name	Scientific Name
June Grass	<i>Koeleria macrantha</i>
Hillcrest Awned Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>

6.3 HANNAS SEEDS

Hannas Seeds provides species lists for seven recommended native grass seed mixes in their Spring 2017 price list (Hannas Seeds, 2017).

Table 189. Hannas natural blend.

Common Name	Scientific Name	Wt %
Green Needle Grass	<i>Nassella viridula</i>	20
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	20
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	20
Western Wheatgrass	<i>Pascopyrum smithii</i>	20
Blue Grama	<i>Bouteloua gracilis</i>	10
Rough Fescue	<i>Festuca hallii</i>	10

Table 190. Hannas native “A” blend.

Common Name	Scientific Name	Wt %
Sheep Fescue	<i>Festuca ovina</i>	35
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	35
Alkali Grass	<i>Puccinellia distans</i>	5
Blue Grama	<i>Bouteloua gracilis</i>	5
Green Needle Grass	<i>Nassella viridula</i>	5
Indian Rice Grass	<i>Achnatherum hymenoides</i>	5
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	5
Western Wheatgrass	<i>Pascopyrum smithii</i>	5

Table 191. Hannas dry loamy blend.

Common Name	Scientific Name	Wt %
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	25
Green Needle Grass	<i>Nassella viridula</i>	20

Common Name	Scientific Name	Wt %
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	20
Western Wheatgrass	<i>Pascopyrum smithii</i>	20
June Grass	<i>Koeleria macrantha</i>	10
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	5

Table 192. Hannas moist loamy blend.

Common Name	Scientific Name	Wt %
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	25
Green Needle Grass	<i>Nassella viridula</i>	20
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	20
Western Wheatgrass	<i>Pascopyrum smithii</i>	20
Rough Fescue	<i>Festuca hallii</i>	10
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	5

Table 193. Hannas sandy blend.

Common Name	Scientific Name	Wt %
Indian Rice Grass	<i>Achnatherum hymenoides</i>	25
Canada Wild Rye	<i>Elymus canadensis</i>	20
Prairie Sand Reed	<i>Calamovilfa longifolia</i>	15
Green Needle Grass	<i>Nassella viridula</i>	10
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	10
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10
Sand Dropseed	<i>Sporobolus cryptandrus</i>	10

Table 194. Hannas solonetzic clay blend.

Common Name	Scientific Name	Wt %
Western Wheatgrass	<i>Pascopyrum smithii</i>	35
Blue Grama	<i>Bouteloua gracilis</i>	20
June Grass	<i>Koeleria macrantha</i>	20
Green Needle Grass	<i>Nassella viridula</i>	10

Common Name	Scientific Name	Wt %
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	5

Table 195. Hannas saline blend.

Common Name	Scientific Name	Wt %
Alkali Grass	<i>Puccinellia distans</i>	25
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	25
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	25
Western Wheatgrass	<i>Pascopyrum smithii</i>	25

6.4 NORTHSTAR SEED

Northstar Seed offers six seed blends (Northstar Seed, 2017).

Table 196. Northstar foothills native blend.

Common Name	Scientific Name	Wt %
Rocky Mountain Fescue	<i>Festuca saximontana</i>	30
Foothills Rough Fescue	<i>Festuca campestris</i>	25
Mountain Brome	<i>Bromus carinatus</i>	15
June Grass	<i>Koeleria macrantha</i>	10
Awne Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	10
Alpine Blue Grass	<i>Poa alpina</i>	10

Table 197. Northstar north/central parkland native blend.

Common Name	Scientific Name	Wt %
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	20
Canada Wild Rye	<i>Elymus canadensis</i>	20
Fringed Brome	<i>Bromus ciliatus</i>	15
Rocky Mountain Fescue	<i>Festuca saximontana</i>	15
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	15
Green Needle Grass	<i>Nassella viridula</i>	10

Common Name	Scientific Name	Wt %
June Grass	<i>Koeleria macrantha</i>	5

Table 198. Northstar southern prairies native blend.

Common Name	Scientific Name	Wt %
Plains Rough Fescue	<i>Festuca hallii</i>	20
Green Needle Grass	<i>Nassella viridula</i>	20
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	15
Western Wheatgrass	<i>Pascopyrum smithii</i>	15
June Grass	<i>Koeleria macrantha</i>	15
Blue Grama	<i>Bouteloua gracilis</i>	10
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	5

Table 199. Northstar sandy soils native blend.

Common Name	Scientific Name	Wt %
Prairie Sand Reed	<i>Calamovilfa longifolia</i>	20
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	15
Blue Grama	<i>Bouteloua gracilis</i>	15
Green Needle Grass	<i>Nassella viridula</i>	15
Indian Rice Grass	<i>Achnatherum hymenoides</i>	15
Needle-and-Thread Grass	<i>Hesperostipa comata</i>	10

Table 200. Northstar wetland native blend.

Common Name	Scientific Name	Wt %
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	20
Fowl Bluegrass	<i>Poa palustris</i>	20
Canada Wild Rye	<i>Elymus canadensis</i>	20
Slough Grass	<i>Beckmannia syzigachne</i>	15
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	15
Tickle Grass	<i>Agrostis scabra</i>	10

Table 201. Northstar slope stabilization native blend.

Common Name	Scientific Name	Wt %
Rocky Mountain Fescue	<i>Festuca saximontana</i>	40
Streambank Wheatgrass	<i>Elymus lanceolatus ssp. riparius</i>	20
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	20
Canada Wild Rye	<i>Elymus canadensis</i>	20

6.5 PICKSEED

Pickseed has 15 reclamation mixtures divided amongst five natural regions in Alberta (Pickseed, 2017a) as well as five native grass blends for the prairie-wide region (Pickseed, 2017b).

6.5.1 Foothills Natural Region

Table 202. Pickseed lower foothills blend.

Common Name	Scientific Name	Wt %
Mountain Brome	<i>Bromus carinatus</i>	30
Fringed Brome – GroKoted	<i>Bromus ciliatus</i>	25
Awned Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	25
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	5
Rocky Mountain Fescue	<i>Festuca saximontana</i>	5
Slough Grass	<i>Beckmannia syzigachne</i>	3
Fowl Bluegrass	<i>Poa palustris</i>	2
Tickle Grass	<i>Agrostis scabra</i>	2
June Grass	<i>Koeleria macrantha</i>	2
Spike Trisetum	<i>Trisetum spicatum</i>	1

Table 203. Pickseed lower foothills (sandy slopes) blend.

Common Name	Scientific Name	Wt %
Streambank Wheatgrass	<i>Elymus lanceolatus ssp. riparius</i>	35
Fringed Brome – GroKoted	<i>Bromus ciliatus</i>	35
Rocky Mountain Fescue	<i>Festuca saximontana</i>	20
June Grass	<i>Koeleria macrantha</i>	5

Common Name	Scientific Name	Wt %
Spike Trisetum	<i>Trisetum spicatum</i>	3
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	2

Table 204. Pickseed upper foothills blend.

Common Name	Scientific Name	Wt %
Mountain Brome	<i>Bromus carinatus</i>	23
Rocky Mountain Fescue	<i>Festuca saximontana</i>	10
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	20
Fowl Bluegrass	<i>Poa palustris</i>	2
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	2
Alpine Bluegrass	<i>Poa alpina</i>	5
June Grass	<i>Koeleria macrantha</i>	3
Fringed Brome – GroKoted	<i>Bromus ciliatus</i>	15
Sloughgrass	<i>Beckmannia syzigachne</i>	5
Violet Wheatgrass	<i>Elymus violaceus</i>	15

6.5.2 Boreal Forest Natural Region

Table 205. Pickseed central mixedwood blend.

Common Name	Scientific Name	Wt %
Awed Wheatgrass	<i>Bromus carinatus</i>	34
Rocky Mountain Fescue	<i>Festuca saximontana</i>	15
Fringed Brome – GroKoted	<i>Bromus ciliatus</i>	35
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	3
June Grass	<i>Koeleria macrantha</i>	3
Tickle Grass	<i>Agrostis scabra</i>	2
Spike Trisetum	<i>Trisetum spicatum</i>	5
Fowl Bluegrass	<i>Poa palustris</i>	3

Table 206. Pickseed central mixedwood with annual ryegrass blend.

Common Name	Scientific Name	Wt %
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	25
Canada Wild Rye	<i>Elymus canadensis</i>	20
Fowl Bluegrass	<i>Poa palustris</i>	16
Streambank Wheatgrass	<i>Elymus lanceolatus ssp. riparius</i>	15
Rocky Mountain Fescue	<i>Festuca saximontana</i>	13
Annual Ryegrass	<i>Lolium multiflorum</i>	9
June Grass	<i>Koeleria macrantha</i>	2

Table 207. Pickseed dry mixedwood blend.

Common Name	Scientific Name	Wt %
Fringed Brome – GroKoted	<i>Bromus ciliatus</i>	30
Awned Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	20
Streambank Wheatgrass	<i>Elymus lanceolatus ssp. riparius</i>	17
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	15
Rocky Mountain Fescue	<i>Festuca saximontana</i>	8
Slough Grass	<i>Beckmannia syzigachne</i>	5
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	3
Fowl Bluegrass	<i>Poa palustris</i>	2

Table 208. Pickseed boreal highlands blend.

Common Name	Scientific Name	Wt %
Awned Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	32
Fringed Brome – GroKoted	<i>Bromus ciliatus</i>	32
Rocky Mountain Fescue	<i>Festuca saximontana</i>	15
Fowl Bluegrass	<i>Poa palustris</i>	5
Slough Grass	<i>Beckmannia syzigachne</i>	5
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	3
June Grass	<i>Koeleria macrantha</i>	3
Spike Trisetum	<i>Trisetum spicatum</i>	3

Common Name	Scientific Name	Wt %
Tickle Grass	<i>Agrostis scabra</i>	2

6.5.3 Rocky Mountain Natural Region

Table 209. Pickseed subalpine subregion blend.

Common Name	Scientific Name	Wt %
Mountain Brome	<i>Bromus carinatus</i>	28
Awed Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	25
Fringed Brome – GroKoted	<i>Bromus ciliatus</i>	15
Idaho Fescue	<i>Festuca idahoensis</i>	8
Rocky Mountain Fescue	<i>Festuca saximontana</i>	7
June Grass	<i>Koeleria macrantha</i>	5
Alpine Bluegrass	<i>Poa alpina</i>	5
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	3
Fowl Bluegrass	<i>Poa palustris</i>	2
Spike Trisetum	<i>Trisetum spicatum</i>	2

Table 210. Pickseed alpine subregion blend.

Common Name	Scientific Name	Wt %
Alpine Bluegrass	<i>Poa alpina</i>	43
Awed Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	35
Rocky Mountain Fescue	<i>Festuca saximontana</i>	20
Spike Trisetum	<i>Trisetum spicatum</i>	2

6.5.4 Parkland Natural Region

Table 211. Pickseed Peace River parkland blend.

Common Name	Scientific Name	Wt %
Awed Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	35
Highlander Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	25
Rocky Mountain Fescue	<i>Festuca saximontana</i>	15

Common Name	Scientific Name	Wt %
Western Wheatgrass	<i>Pascopyrum smithii</i>	15
June Grass	<i>Koeleria macrantha</i>	5
Western Porcupine Grass	<i>Hesperostipa curtisetata</i>	5

Table 212. Pickseed central parkland blend.

Common Name	Scientific Name	Wt %
Green Needle Grass	<i>Nassella viridula</i>	20
Awne Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	15
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	15
Western Wheatgrass	<i>Pascopyrum smithii</i>	15
Rocky Mountain Fescue	<i>Festuca saximontana</i>	10
Slough Grass	<i>Beckmannia syzigachne</i>	5
Idaho Fescue	<i>Festuca idahoensis</i>	5
Alkali Bluegrass	<i>Poa secunda ssp. juncifolia</i>	5
June Grass	<i>Koeleria macrantha</i>	5
Sandberg Bluegrass	<i>Poa secunda</i>	5

Table 213. Pickseed foothills parkland blend.

Common Name	Scientific Name	Wt %
Fringed Brome	<i>Bromus ciliatus</i>	20
Mountain Brome	<i>Bromus carinatus</i>	20
Highlander Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	20
Awne Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	20
Rocky Mountain Fescue	<i>Festuca saximontana</i>	15
Idaho Fescue	<i>Festuca idahoensis</i>	5

6.5.5 Grassland Natural Region

Table 214. Pickseed dry mixedgrass / mixed grass prairie blend.

Common Name	Scientific Name	Wt %
-------------	-----------------	------

Common Name	Scientific Name	Wt %
Highlander Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	25
Green Needle Grass	<i>Nassella viridula</i>	20
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	15
Western Wheatgrass	<i>Pascopyrum smithii</i>	15
Purple Prairie Clover	<i>Dalea purpurea</i>	10
Alkali Bluegrass	<i>Poa secunda ssp. juncifolia</i>	5
Sandberg Bluegrass	<i>Poa secunda</i>	5
June Grass	<i>Koeleria macrantha</i>	5

Table 215. Pickseed foothills fescue blend.

Common Name	Scientific Name	Wt %
Awne Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	20
Green Needle Grass	<i>Nassella viridula</i>	20
Rocky Mountain Fescue	<i>Festuca saximontana</i>	17
Highlander Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	15
Western Wheatgrass	<i>Pascopyrum smithii</i>	10
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10
Purple Prairie Clover	<i>Dalea purpurea</i>	5
June Grass	<i>Koeleria macrantha</i>	3

Table 216. Pickseed northern fescue blend.

Common Name	Scientific Name	Wt %
Awne Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	15
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	15
Western Wheatgrass	<i>Pascopyrum smithii</i>	15
Green Needle Grass	<i>Nassella viridula</i>	15
Rocky Mountain Fescue	<i>Festuca saximontana</i>	10
Idaho Fescue	<i>Festuca idahoensis</i>	10
Slough Grass	<i>Beckmannia syzigachne</i>	5
Alkali Bluegrass	<i>Poa secunda ssp. juncifolia</i>	5

Common Name	Scientific Name	Wt %
June Grass	<i>Koeleria macrantha</i>	5
Sandberg Bluegrass	<i>Poa secunda</i>	5

6.5.6 Native Grass Blends

Table 217. Pickseed aspen parkland blend.

Common Name	Scientific Name	Wt %
Fringed Brome grass	<i>Bromus ciliatus</i>	20
Green Needle Grass	<i>Nassella viridula</i>	20
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	15
Western Wheatgrass	<i>Pascopyrum smithii</i>	15
Rocky Mountain Fescue	<i>Festuca saximontana</i>	10
Sloughgrass	<i>Beckmannia syzigachne</i>	5
Idaho Fescue	<i>Festuca idahoensis</i>	5
Alkali Bluegrass	<i>Poa secunda ssp. juncifolia</i>	5
June Grass	<i>Koeleria macrantha</i>	5

Table 218. Pickseed moist mixed grassland blend.

Common Name	Scientific Name	Wt %
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	20
Rocky Mountain Fescue	<i>Festuca saximontana</i>	20
Western Wheatgrass	<i>Pascopyrum smithii</i>	15
Green Needle Grass	<i>Nassella viridula</i>	15
Idaho Fescue	<i>Festuca idahoensis</i>	10
Slough Grass	<i>Beckmannia syzigachne</i>	5
Alkali Bluegrass	<i>Poa secunda ssp. juncifolia</i>	5
June Grass	<i>Koeleria macrantha</i>	5
Purple Prairie Clover	<i>Dalea purpurea</i>	5

Table 219. Pickseed mixed grassland blend.

Common Name	Scientific Name	Wt %
Sheep Fescue	<i>Festuca ovina</i>	25
Green Needle Grass	<i>Nassella viridula</i>	15
Needle-and-Thread Grass	<i>Hesperostipa comata ssp. comata</i>	10
Indian Rice Grass	<i>Achnatherum hymenoides</i>	10
Western Wheatgrass	<i>Pascopyrum smithii</i>	10
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10
Alkali Grass	<i>Puccinellia distans</i>	10
Blue Grama	<i>Bouteloua gracilis</i>	5
June Grass	<i>Koeleria macrantha</i>	5

Table 220. Pickseed grassland wet blend.

Common Name	Scientific Name	Wt %
Mountain Brome	<i>Bromus carinatus</i>	25
Violet Wheatgrass	<i>Elymus violaceus</i>	25
Sheep Fescue	<i>Festuca ovina</i>	15
Western Wheatgrass	<i>Pascopyrum smithii</i>	12
Fowl Bluegrass	<i>Poa palustris</i>	5
Slough Grass	<i>Beckmannia syzigachne</i>	5
June Grass	<i>Koeleria macrantha</i>	3
Spike Trisetum	<i>Trisetum spicatum</i>	3
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	3
Canada Bluegrass	<i>Poa compressa</i>	2
Tickle Grass	<i>Agrostis scabra</i>	2

Table 221. Pickseed cypress upland blend.

Common Name	Scientific Name	Wt %
Rocky Mountain Fescue	<i>Festuca saximontana</i>	25
Mountain Brome	<i>Bromus carinatus</i>	20
Bluebunch Wheatgrass	<i>Pseudoroegneria spicata</i>	15

Common Name	Scientific Name	Wt %
Green Needle Grass	<i>Nassella viridula</i>	15
Western Wheatgrass	<i>Pascopyrum smithii</i>	10
Idaho Fescue	<i>Festuca idahoensis</i>	10
June Grass	<i>Koeleria macrantha</i>	3
Canada Bluegrass	<i>Poa compressa</i>	2

6.6 SEABORN SEEDS INC.

Seaborn Seeds Inc. (2013) supplies a green native mix.

Table 222. Seaborn Seeds Inc. green native mix.

Common Name	Scientific Name	Wt %
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	20
Tufted Hair Grass	<i>Deschampsia caespitosa</i>	12
Alpine Bluegrass	<i>Poa alpina</i>	10
Rocky Mountain Fescue	<i>Festuca saximontana</i>	10
Sheep Fescue	<i>Festuca ovina</i>	10
Mountain Brome	<i>Bromus carinatus</i>	9
Annual Ryegrass	<i>Lolium multiflorum</i>	6
Canada Bluegrass	<i>Poa compressa</i>	6
Alpine Timothy	<i>Phleum alpinum</i>	5
Hair Bentgrass	<i>Agrostis scabra</i>	3
Fowl Bluegrass	<i>Poa palustris</i>	3
Fowl Manna Grass	<i>Glyceria striata</i>	3
Fringed Brome	<i>Bromus ciliatus</i>	3

6.7 WILD ABOUT FLOWERS

Wild about Flowers (2017) has two seed mixes available (prairie meadow and shortgrass wildflower meadow).

Table 223. Wild about Flowers prairie meadow native grass seed mix.

Common Name	Scientific Name
-------------	-----------------

Common Name	Scientific Name
Rocky Mountain Fescue	<i>Festuca saximontana</i>
Rough Fescue	<i>Festuca hallii</i>
Blue Grama	<i>Bouteloua gracilis</i>
June Grass	<i>Koeleria macrantha</i>
Tickle Grass	<i>Agrostis scabra</i>
Needle-and-Thread Grass	<i>Hesperostipa comata</i>

Table 224. Wild about Flowers short grass wildflower meadow mix.

Common Name	Scientific Name
Blue Sheep Fescue	<i>Festuca ovina</i>
Rocky Mountain Fescue	<i>Festuca saximontana</i>
June Grass	<i>Koeleria macrantha</i>
Alpine Bluegrass	<i>Poa alpina</i>

NOTE: This mix also contains 22 species of wildflowers⁴.

Wild about Flowers also has 14 wildflower mixes for a variety of ecological conditions⁵.



⁴ See Short Grass Wildflower Seed Mix batch 1701 at http://wildaboutflowers.ca/seed_mix_contents.php

⁵ See http://www.wildaboutflowers.ca/seed_mix_contents.php

7.0 SOURCES OF INDIVIDUAL SPECIES IN MIXES

7.1 INNOTECH ALBERTA VARIETIES

InnoTech Alberta's Breeder Seed Program has released 19 commercial native species varieties for use in reclamation of disturbed lands (Small et al., 2016). Additional varieties are at various stages of development and registration.

Table 225. InnoTech Alberta Native Grass Varieties Currently Available as Certified Seed.

Common Name	Scientific name	Variety	Collection Site
Alpine Bluegrass	<i>Poa alpina</i>	Blueridge	Eastern Slopes, AB
Alpine Bluegrass	<i>Poa alpina</i>	Glacier	Eastern Slopes, AB
Alpine Fescue	<i>Festuca brachyphylla</i>	Vista	Eastern slopes
Awne'd Or Bearded Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	Hillcrest	Eastern Slopes, AB
Awne'd Wheatgrass	<i>Elymus trachycaulus ssp. subsecundus</i>	Metisko	Central Parkland
Blue Grama	<i>Bouteloua gracilis</i>	Badlands	Special Areas, Central Parkland
Canada Milkve'tch	<i>Astragalus canadensis</i>	Aspen	Central Parkland
Canada Wild Rye	<i>Elymus canadensis</i>	Centennial	Ribstone, Wainwright area, Hardisty
Green Needle Grass	<i>Nassella viridula</i>	Grouse	Alberta prairies
Indian Rice Grass	<i>Achnatherum hymenoides</i>	Porter	Ribstone, AB
June Grass	<i>Koeleria macrantha</i>	Mountain View	Crowsnest Pass
June Grass	<i>Koeleria macrantha</i>	Prairie	Alberta prairies
Nodding Brome	<i>Bromus anomalus</i>	Hillbilly	Central Parkland
Plains Rough Fescue	<i>Festuca hallii</i>	Bison	Northern fescue region
Rocky Mountain Fescue	<i>Festuca saximontana</i>	Plateau	Eastern slopes, AB
Rocky Mountain Fescue	<i>Festuca saximontana</i>	Butte	Butte, Waterton Lakes
Slender Wheatgrass	<i>Elymus trachycaulus ssp. trachycaulus</i>	Highlander	Eastern Slopes, AB
Spike Trisetum	<i>Trisetum spicatum</i>	Sentinel	Eastern slopes, AB
Violet Or Broadglumed Wheatgrass	<i>Elymus violaceus</i>	Mountaineer	Eastern Slopes, AB

7.2 COMMERCIAL SEED SOURCES

The following Alberta-based commercial sources for the species in the mixes were found. Species have been included if they were identified by the vendor as being currently available and/or historically available and/or potentially available on request. The information is provided in the Excel file.

ALCLA Native Plant Restoration Inc. – <http://www.alclanativeplants.com/> (updated species list provided by Al Fedkenheuer via e-mail)

BrettYoung – <http://www.brettyoung.ca/professional-turf-and-reclamation/seed/native-grasses>

Gold Metal Seeds Ltd. (GMSL) – http://www.goldmedalseeds.ca/reclamation_pricelis.html

Green Patch Environmental Consulting Ltd. (GPEC) – <https://www.gpec.ca/native-grass.htm>

Hannas Seeds – <http://www.hannasseeds.com/view-page.aspx?id=9&Name=Grass-Seed>

Northstar Seed – Native & Reclamation Seed Guide – <http://www.northstarseed.com/wp-content/uploads/2017/02/Native-and-Reclamation-Guide-2017.pdf>

Pick Seed – http://www.pickseed.com/Admin/Public/DWSDownload.aspx?File=%2fFiles%2fFiles%2fCanada+Files%2f2018-Product-Guide%2fWestern-PAGES%2fNative-seed-for-reclamation_West.pdf

Sunshine Seeds – http://www.sunshinseeds.ca/native_grass_seed.html

Wild About Flowers – http://www.wildaboutflowers.ca/browse_latin_plant_name.php

Readers should contact vendors to determine ecological variety, source locality, species availability and volumes.



8.0 SUMMARY AND OPPORTUNITIES

8.1 SUMMARY

223 native grass seed mixes were identified, consisting of 17 required mixes, 34 recommended mixes, 43 operational mixes, 62 R&D mixes and 67 commercial mixes (Figure 2). The majority of mixes (100) were for the Grasslands zone, followed by Parkland (59) and the Mountains and Foothills (39). Only 6 mixes were for the Boreal zone.

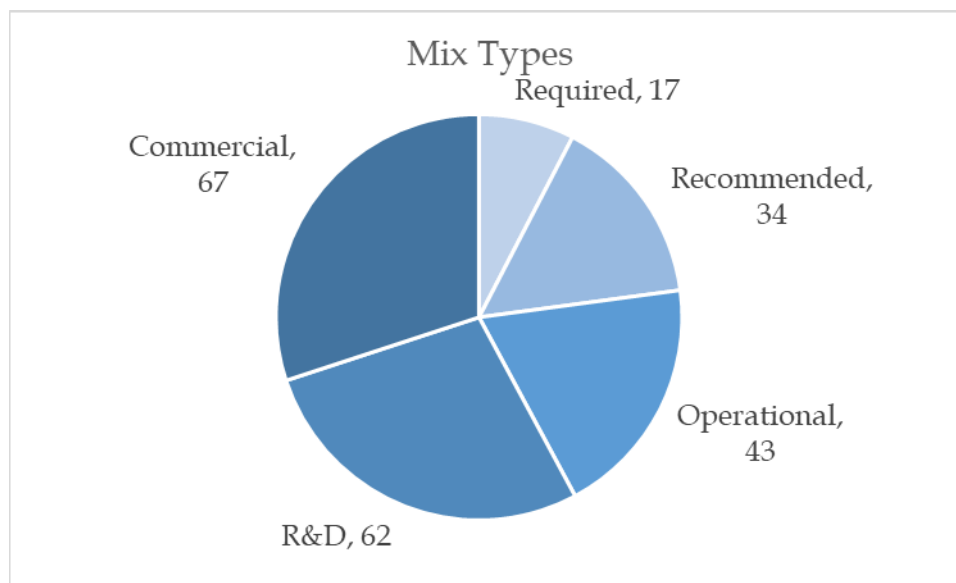


Figure 2. Types of mixes.

161 species and varieties/sources⁶ were included in the mixes. Mixes with six species were most common (Figure 3; mean = 7.51; median = 7); the number of species in a mix ranged from a low of 2 to a high of 22.

123 mixes use common seed; 99 included reference to a specific variety or source and 23 to an InnoTech Alberta variety.

The top five species found in the mixes were: *Koeleria macrantha* (135 mixes); *Agropyron dasystachyum* (107); *Elymus trachycaulus ssp. trachycaulus* (109); *Pascopyrum smithii* (97); and, *Nassella viridula* (74).

The majority of mixes (155) were described in terms of weight % for each species, which ranged from a low of 1% in several mixes to a high of 80% (*Hesperostipa curtiseta*) in the GMSL Special Areas sandy mix 3 (Dark Brown Soil Zone – Central Parkland).

⁶ Some of the mixes noted a source (e.g., Alberta or Manitoba or Prairie Seeds) rather than a variety name.

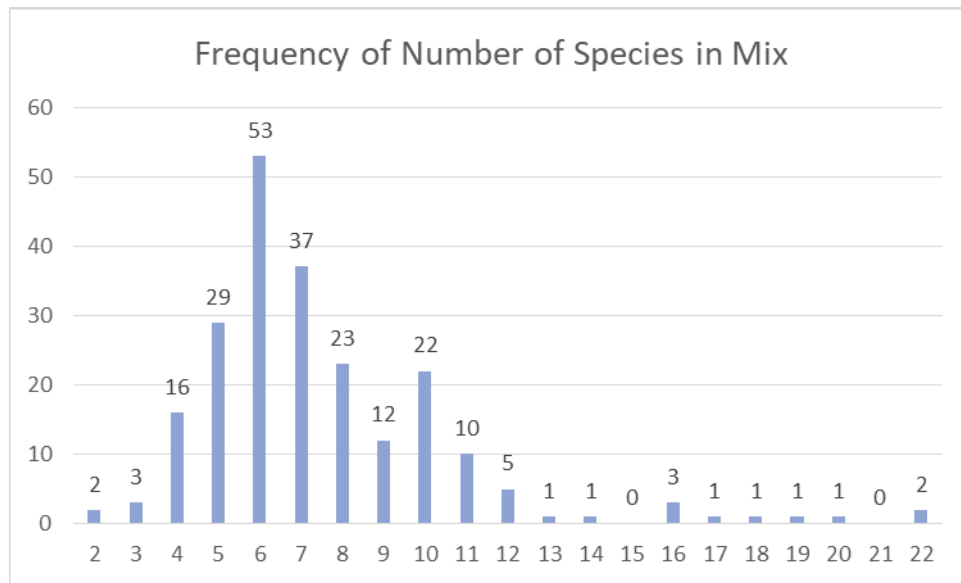


Figure 3. Number of species in mixes.

8.2 OPPORTUNITIES

The following opportunities for the native plants community, government agencies and researchers arise based on the inventory of mixes and seed sources found to date.

1. A number of Required Mixes are currently in place which should be a driver for the development and use of native species seed. However the requirements must be enforced to be effective.

OPPORTUNITY: Canvass agencies with Required Seed Mixes and the project proponents who must follow the requirements to determine the level of compliance with the Required Seed Mixes and identify barriers to successful compliance.

OPPORTUNITY: Once barriers have been identified, devise a follow-up action plan to increase compliance.

2. Some municipalities require use of native seed mixes where the revegetation goal is naturalization. Three municipalities (City of Airdrie (2014), City of Calgary (Etwell, pers. comm), and City of Chestermere (2015)) were found to require native seed mixes but leave it to the project proponent to propose a seed mix for approval.

OPPORTUNITY: Obtain information on approved seed mixes to be added to this inventory.

OPPORTUNITY: Work with municipal associations (e.g., Alberta Association of Municipal Districts and Counties and Alberta Urban Municipalities Association) or individual municipalities to increase awareness of the benefits of naturalization and native seed mixes with the ultimate goal of increasing the number of municipalities with Required Seed Mixes.

3. Specifying seed mix requirements in project tender specifications and/or project proposals can be problematic if the species or varieties or adequate volumes are not available.

OPPORTUNITY: Specify alternate species or varieties that will meet the same ecological needs but are more likely to be available (see for example the EnCana CFB Suffield mixes in this inventory).

OPPORTUNITY: Publish suitable alternate species for those currently in the Required Seed Mixes.

4. InnoTech Alberta currently has 22 registered native seed varieties in Alberta representing 17 species but there were 38 species in Required Seed Mixes alone and 48 species in the Required Seed Mixes and Recommended Seed Mixes combined.

OPPORTUNITY: Continue to develop registered native species seed varieties to allow demand for seed in Required Seed Mixes to be fulfilled and to enable the Recommended Seed Mixes to shift to required (with appropriate proof of performance).

5. Even though there is strong interest wetland mitigation and compensation only 19 seed mixes were identified for use in wet soils, wet areas or wetlands.

OPPORTUNITY: Develop and publish recommended seed mixes for wetland mitigation and compensation projects.

6. There are at least two commercial strategies that growers and vendors can adopt: target those species that have the highest demand and volume; and/or, target the low volume species in mixes that often are the key to increasing diversity and ultimate achievement of target ecosystems.

OPPORTUNITY: Continue to produce and update the Alberta Native Plant Council's inventory of native seed producers with an increased emphasis on relating the inventory to, at least, the Required Seed Mixes (and ideally the Recommended Seed Mixes).

OPPORTUNITY: Vendors should increase efforts to relate their available seed or seed mix products to the Required Seed Mix list (and ideally the Recommended Seed Mixes).

7. One of the difficulties in preparing this inventory was the different nomenclature (e.g., common name(s), old scientific name, new scientific name) and seed mix description formats (simple lists, wt %, PLS%, PLS/m², etc.).

OPPORTUNITY: Develop a standard format for seed mix descriptions and require its use in project bid packages and regulatory documents.

9.0 REFERENCES

- Alberta Agriculture and Forestry, 2016. Alberta Range Plants and Their Classification. Alberta Agriculture and Forestry, Edmonton, Alberta. Agdex 134/06. 9 pp.
[http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/agdex146/\\$file/134_06.pdf?OpenElement](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex146/$file/134_06.pdf?OpenElement)
- Alberta Energy Regulator, 2003. Best Management Practices for Pipeline Construction in Native Prairie Environments. Alberta Energy Regulator, Calgary, Alberta. 133 pp.
<https://www.aer.ca/documents/applications/BestManagementPracticesPipeline.pdf>
- Alberta Energy Regulator, 2014. Principles for Minimizing Surface Disturbance in Native Prairie and Parkland Areas. Manual 007. Alberta Energy Regulator, Calgary, Alberta. 8 pp.
<https://www.aer.ca/documents/manuals/Manual007.pdf>
- Alberta Environment and Parks, 2016. Requirements for Conservation and Reclamation Plans (C&R Plans) for Peat Operations in Alberta. Alberta Environment and Parks, Edmonton, Alberta. 17 pp. <http://aep.alberta.ca/land/land-management/surface-material-applications/documents/RequirementsPeatOperations-May25-2016.pdf>
- Alberta Infrastructure and Transportation, 2005. Alberta Infrastructure and Transportation Design Bulletin No. 25: Grass Seed Mixtures used on Highway and Bridge Projects. Revised 2005-10-26. Alberta Infrastructure and Transportation, Edmonton, Alberta. 9 pp.
<https://www.transportation.alberta.ca/Content/docType233/Production/DesignBulletin25.pdf>
- Alberta Native Plant Council, 2016. Native Plant Source List (2016 version – Excel file). Alberta Native Plant Council, Edmonton, Alberta. <http://anpc.ab.ca/wp-content/uploads/2015/01/ANPC-Native-Plant-Source-2016Mar23.xlsx>
- Alberta Sustainable Resource Development, 2006. Industrial Operational Guidelines for the Twin River Provincial Grazing Reserves (PGR). Alberta Sustainable Resource Development, Edmonton, Alberta. 8 pp. <http://aep.alberta.ca/land/provincial-grazing-reserves/southeast-pgrs/documents/TwinRiverIndustrialGuidelines-PGR.pdf>
- Alberta Transportation, 2016. Environmental Management System Manual (v. 13). Alberta Transportation, Edmonton, Alberta. 102 pp.
<https://www.transportation.alberta.ca/Content/docType245/Production/EMSManual.pdf>
- Benga Mining Limited, 2015. Grassy Mountain Coal Project Environmental Impact Assessment. Benga Mining Limited, Blairmore, Alberta. Section F, Table F3.5-3.
ftp://ftp.gov.ab.ca/env/fs/eia/2015-11-BengaMiningGrassyMountainCoal/2015Dec_OriginalEIASubmitted/2-BengaGrassyMtnEIA.pdf
- Bohme, V.E., 1977. Letter from V.E. Bohme, Suffield Environmental Advisory Committee to G. Morgan, Alberta Energy Company Ltd., Calgary, Alberta.
<http://www.ceaa.gc.ca/050/documents/29493/29493E.pdf>
-

- Bush, C.D., 1998. Native Seed Mixes for Diverse Plant Communities. M.Sc. Thesis. Department of Renewable Resources, University of Alberta, Edmonton, Alberta. 95 pp.
<https://era.library.ualberta.ca/files/47429b96r/MQ28920.pdf>
- City of Airdrie, 2014. Standard Landscape Guidelines & Specifications – Revised Edition. City of Airdrie, Parks Department, Airdrie, Alberta. 38 pp.
<https://www.airdrie.ca/getDocument.cfm?ID=2353>
- City of Chestermere, 2015. Landscape Standards and Specifications. City of Chestermere, Development and Infrastructure Services, Chestermere, Alberta. Various pagings.
<http://www.chestermere.ca/DocumentCenter/View/4699>
- City of Edmonton, 2017. Design and Construction Standards. Volume 5: Landscaping. June 2017 Edition. City of Edmonton, Edmonton, Alberta.
https://www.edmonton.ca/documents/Design_and_Construction_Landscaping.pdf
- City of Lethbridge, 2014. City of Lethbridge Construction Specifications. Section 07050 – Seeding. City of Lethbridge, Lethbridge, Alberta. 4 pp. <http://www.lethbridge.ca/Doing-Business/Planning-Development/Urban-Construction-Right-of-Way-Coordination/Documents/Section2007050.pdf>
- Coalspur Mines Ltd., 2012. Coalspur Vista Coal Mine Project Environmental Impact Assessment. Section F – Reclamation Plan. Coalspur Mines Ltd., Hinton, Alberta. pp. F-32 to F-33. <ftp://ftp.gov.ab.ca/env/fs/eia/2012-04-CoalspurMinesLtdVistaCoalMineProject/Working%20PDF/OriginalApplication/Section%20F%20-%20Reclamation%20Plan%20revised.pdf>
- Coal Valley Resources Inc., 2012. Robb Trend Project. Section F – Reclamation Plan; Table F.4-5. Coal Valley Resources Inc., Edson, Alberta. ftp://ftp.gov.ab.ca/env/fs/eia/2012-04-CoalValleyResourcesIncRobbTrend/EIA_&_SIRs_CD/Working%20PDF/EIA_SIR1/OriginalApplication/07%20Section%20F%20-%20Reclamation%20Plan.pdf
- Cohen-Fernandez, A.C., 2012. Reclamation of a Limestone Quarry to a Natural Plant Community. Ph.D. Thesis. Department of Renewable Resources, University of Alberta, Edmonton, Alberta. 224 pp.
https://era.library.ualberta.ca/files/fj236378q/Cohen_Anayansi_Spring%202012.pdf
- Desserud, P.A., 2011. Rough Fescue (*Festuca hallii*) Ecology and Restoration in Central Alberta. Ph.D. Thesis. Department of Renewable Resources, University of Alberta, Edmonton, Alberta. 197 pp. https://era.library.ualberta.ca/files/pg15bg177/Desserud_Peggy_Fall%202011.pdf
- Desserud, P.A. and M.A. Naeth, 2013. Promising results in central Alberta with rough fescue (*Festuca hallii*) seeding following disturbance. Native Plants Journal 14(1): 25-32.
- Eastern Irrigation District, 2014. Minutes June 24, 2014 Regular Directors Meeting. Eastern Irrigation District, Brooks, Alberta. pp. 54-55.
https://www.eid.ca/documents/board/Minutes_2014_June_24.pdf
- Eastern Irrigation District, 2017. EID Reclamation Seed Mix. Eastern Irrigation District, Brooks, Alberta. 1 pp.

EDA Collaborative Inc., 1994. Roadways and Parks Naturalization Masterplan. City of Edmonton, Parks and Recreation. Edmonton, Alberta.
https://www.edmonton.ca/city_government/documents/naturalization_master_plan.pdf

EnCana Corporation, 2007. EnCana Shallow Gas Infill Development in CFB Suffield National Wildlife Area. Environmental Impact Statement – Appendix H: Conceptual Reclamation Plan. pp. H-39 – H-41. http://www.ceaa-acee.gc.ca/050/documents_staticpost/cearref_15620/132.pdf

Erichsen Arychuk, C.J., 2001. Native Forb Establishment on Disturbed Sites in the Aspen Parkland. M.Sc. Thesis. Department of Renewable Resources, University of Alberta, Edmonton, Alberta. 141 pp.

Etwell, T., City of Calgary, Parks. Personal communication with Chris Powter, October 5, 2017.

Fluker, M.G., 1998. Growth Response of Select Native and Introduced Plant Species to Soil Nutrient Levels and Interspecific Competition. M.Sc. Thesis. Department of Renewable Resources, University of Alberta, Edmonton, Alberta. 254 pp.
<https://era.library.ualberta.ca/files/1n79h7213/MQ34362.pdf>

Fording Coal Limited, 2002. Brooks Power Project Environmental Impact Assessment. Fording Coal Limited, Calgary, Alberta. Vol. 2, section 6.4.2.

Gabruch, L.K., D.B. Wark, C.G. Penner and J. Giles, nd. Rebuilding Your Land with Native Grasses: A Producers Guide. Ducks Unlimited Canada, Brandon, Manitoba. 12 pp.
http://www.albertapcf.org/rsu_docs/rebuilding-your-land-with-native-grasses.pdf

Golden Acre Seeds, nd. Peace Forage Seeding Tool: Seed Mix Calculator.
<http://www.peaceforagetool.ca/seed-mix-calculator>

Gold Metal Seeds Ltd., 2017a. Alberta Hiways Grass Seed Mixtures. Gold Metal Seeds Ltd., Brooks, Alberta. 2 pp.

Gold Metal Seeds Ltd., 2017b. 2017 Forage & Reclamation Mixtures. Gold Metal Seeds Ltd., Brooks, Alberta. 1 pp.

Gold Metal Seeds Ltd., 2017c. Native Suffield Cluster Mixtures. Gold Metal Seeds Ltd., Brooks, Alberta. 1 pp.

Gold Metal Seeds Ltd., 2017d. 2017 Special Areas Native Grass Seed Mixes. Gold Metal Seeds Ltd., Brooks, Alberta. 2 pp.

Gramineae Services Ltd., 2013. Recovery Strategies for Industrial Development in Native Prairie: The Dry Mixedgrass Natural Subregion of Alberta. First Approximation. Prepared for Alberta Environment and Sustainable Resource Development, Lands Division. 134 pp.
<http://aep.alberta.ca/land/land-management/native-grassland/documents/RecoveryStrategiesDryMixedGrass-Feb2013.pdf>

Gramineae Services Ltd., Kestrel Research Inc. and CorPirate Services, 2008. Field Observations of the Recovery of Native Rangeland Plant Communities on Express Pipeline. Canadian Energy Pipeline Association, Calgary, Alberta. 26 pp.

Grande Cache Coal Company, 2001. Grande Cache Coal Project Environmental Impact Assessment. Volume 2 Environmental Management, Section 5 Reclamation Plan. Grande

Cache Coal Company, Calgary, Alberta. p. 5-18. <ftp://ftp.gov.ab.ca/env/fs/EIA/2001-10-GrandeCacheCoalCompanyGrandeCacheCoalProject/Document/Volume%20%20-%20Environmental%20Management.pdf>

Green Patch Environmental Consulting Ltd., nd. Native Grass Seed. Green Patch Environmental Consulting Ltd., Edmonton, Alberta. <http://www.gpec.ca/native-grass.htm>

Government of Alberta, 2016. Enforcement Actions: 1 Oct 2015 – 31 Dec 2015. Alberta Environment and Parks, Compliance Assurance, Operations Division, Edmonton, Alberta. 15 pp. <http://aep.alberta.ca/about-us/compliance-assurance-program/environmental-protection-commission-reports/documents/Enforcement-4thQuarterReport-2016B.pdf>

Hammer, O., 1996. Reclamation, Trans Canada Highway Twinning, Banff National Park. IN: Conservation and Reclamation: An Ecosystem Perspective. Proceedings of the Canadian Land Reclamation Association 21st Annual Meeting. September 18-20, 1996, Calgary Alberta,. pp. 63-65.

Hammermeister, A.M., 2001. An Ecological Analysis of Prairie Rehabilitation on Petroleum Wellsites in Southeast Alberta. Ph.D. Thesis. Department of Renewable Resources, University of Alberta, Edmonton, Alberta. 121 pp.

Hammermeister, A.M., M.A. Naeth, J.J. Schoenau and V.O. Biederbeck, 2003. Soil and Plant Response to Wellsite Rehabilitation on Native Prairie in Southeastern Alberta, Canada. Canadian Journal of Soil Science 83: 507-519.

Hannas Seeds, 2017. Spring 2017 Price List. Hannas Seeds, Lacombe, Alberta. 11 pp.

Howat, D.R., 1998. Enhancing Biodiversity on Reclaimed Land. M.Sc. Thesis. Department of Renewable Resources, University of Alberta, Edmonton, Alberta. 123 pp. <https://era.library.ualberta.ca/files/m613n092j/MQ28947.pdf>

Innovista, nd. Native Plant Landscaping Guide for Innovista Industrial Park. Innovista, Hinton, Alberta. 25 pp. <http://www.hinton.ca/DocumentCenter/Home/View/1634>

Kershaw, L., 2015. 2015 ACIMS Plant Species Ranking – October, 2015. Alberta Native Plant Council, Edmonton, Alberta. http://anpc.ab.ca/wp-content/uploads/2015/11/AB-Species-Ranks2015OctL_Kershaw.xlsx

Kestrel Research Inc. and Gramineae Services Ltd., 2011. Long Term Recovery of Native Prairie from Industrial Disturbance: Express Pipeline Revegetation Monitoring Project 2010. Report prepared for Kinder Morgan Canada, TransCanada PipeLines, ConocoPhillips Canada, and ASRD Public Lands Division. Various pagings. <https://static1.squarespace.com/static/5342d33fe4b0d2725fefb31b/t/53598a46e4b0c9059ae90946/1398377030679/Express+Pipeline+Monitoring+Report+September+2010.pdf>

Lancaster, J., B. Adams, P. Desserud, R. Adams and M. Neville, 2017a. Recovery Strategies for Industrial Development in Native Prairie for the Northern Fescue Natural Subregion of Alberta. First Approximation. Prepared for Alberta Environment and Sustainable Resource Development, Public Lands Division. 129 pp. <https://static1.squarespace.com/static/5342d33fe4b0d2725fefb31b/t/58d0b13a1b631b0941599917/1490071954784/Recovery+Strategies+NF+NSR+First+Approximation+Mar+16+2017-R-sec.pdf>

Lancaster J., B. Adams, P. Desserud, R. Adams and M. Neville, 2017b. Recovery Strategies for Industrial Development in Native Grasslands for the Foothills Fescue, Foothills Parkland and Montane Natural Subregions of Alberta – First Approximation. Prepared for the Foothills Restoration Forum.

Lowen, K. and D. Walker, 1988. Buying Seed: The Pitfalls and Blunders and how to Avoid Them. IN: Alberta Conservation & Reclamation Conference '88. Proceedings of a Conference Sponsored by the Canadian Land Reclamation Association and Soil and Water Conservation Society. September 22-23, 1988, Kananaskis Village, Alberta. pp. 139-144.

Luscar Ltd., 1996. Application for Approval under the *Environmental Protection and Enhancement Act* and Amendment of the Alberta Energy and Utilities Board Licence No. C93-27. Cited in Fording Coal Limited (2002).

McKenzie, M., C. Small and Q. Barber, 2016. Reclamation of a Transmission Line Right-of-Way in Southeastern Alberta: 2016 Monitoring Report. Prepared by Alberta Innovates – Technology Futures, Edmonton, Alberta for AltaLink Management Ltd., Calgary, Alberta. 40 pp.

McNeil, R., 2013. Conversion of Cultivated Lands to Native Perennials in the Dry Prairies (Framework #1). Prepared for North American Waterfowl Management Program and Alberta Agriculture and Rural Development. LandWise Inc., Lethbridge, Alberta. 28 pp.

<http://www.abnawmp.ca/media/protected/ae1dc7e4-c8a4-4bb4-89b4-31ebd195896b.docx> (species mix table also available in McNeil, R., 2014. Conversion of Annual Cropland to Native Prairie. PowerPoint presentation. http://www.pcap-sk.org/docs/15_nprwpresentatio/2014_NPRRW_Ron-McNeil.pdf)

Municipal District of Bighorn, nd. Native Species. <http://mdbighorn.ca/242/Native-Species>

Naeth, M.A., A.T. Lees, J. Bietz, B.D. Irving and A.W. Fedkenheuer, 1997. Rangeland revegetation monitoring on two pipeline rights-of-way in southern Alberta. NGTL Environmental Research Monographs 1997-2. NOVA Gas Transmission Ltd., Calgary, Alberta. 58 pp. <https://era.library.ualberta.ca/files/b2b88qc24s/Naeth20et20al20-20Rangeland20Revegetation20Monitoring20on20Two20Pipeline20Rights-of-way20in20Southern20Alberta.PDF>

Naeth, M.A. and S.R. Wilkinson, 2009. Effect of Fire Fuel Break Management on Rehabilitation of Montane and Aspen Parkland Plant Communities at Elk Island and Jasper National Parks: Final Report. Prepared by University of Alberta for Elk Island national Park and jasper national Park. 23 pp.

Native Plant Working Group, 2000. Native Plant Revegetation Guidelines for Alberta. H. Sinton-Gerling (ed.). Alberta Agriculture, Food and Rural Development and Alberta Environment. Edmonton, Alberta. 58 pp. <https://open.alberta.ca/dataset/783a58b0-cc85-4e4f-a2f9-478a0516f03b/resource/c366b71a-1f3d-4436-a410-e2c8b5fd8195/download/2001-NativePlantRevegetationGuidelinesForAlberta-Feb-2001.pdf>

Neville, M., J. Lancaster, B. Adams and P. Desserud, 2014. Recovery Strategies for Industrial Development in Native Prairie for the Mixedgrass Natural Subregion of Alberta. First Approximation. Prepared for Alberta Environment and Sustainable Resource Development, Public Lands Division. 168 pp. <http://aep.alberta.ca/land/land-management/native-grassland/documents/RecoveryStrategiesMixedGrass-Mar2014.pdf>

- Northstar Seed, 2017. Native & Reclamation Seed Guide. Northstar Seed, Okotoks, Alberta. 24 pp. <http://www.northstarseed.com/wp-content/uploads/2017/02/Native-and-Reclamation-Guide-2017.pdf>
- Parks Canada, 2011. Recommended Plant Species for Landscaping in Banff National Park. Parks Canada, Ottawa, Ontario. 12 pp. <http://www.wildsmart.ca/pdf/files/recommendedplantspecies.pdf>
- Pelech, W.E., 1997. Performance of Selected Native and Introduced Plant Species under Mowing and Herbicide Management during the Establishment Period. M.Sc. Thesis. University of Alberta, Department of renewable Resources, Edmonton, Alberta. <https://era.library.ualberta.ca/files/2227mr68p/MQ22652.pdf>
- Pickseed, nd. Native Grass Characteristics Chart and Substitution Chart. Pickseed, Edmonton, Alberta. 3 pp. <http://www.pickseed.com/Admin/Public/DWSDownload.aspx?File=%2fFiles%2fFiles%2fCanada+2017+Product+Guide%2fForage-Tech-Sheets%2fNative-Seed-Characteristics-and-Substitution-Chart.pdf>
- Pickseed, 2017a. Alberta Blends. <http://www.pickseed.com/Admin/Public/DWSDownload.aspx?File=%2fFiles%2fFiles%2fCanada+2017+Product+Guide%2fForage-Tech-Sheets%2fAlberta-Reclamation-Guide.pdf>
- Pickseed, 2017b. Native Grass Mixes – Prairie Wide Region. http://www.pickseed.com/Admin/Public/DWSDownload.aspx?File=%2fFiles%2fFiles%2fCanada+2017+Product+Guide%2fForage-Tech-Sheets%2fNativegrass_mixes_Prairies.pdf
- Pitchford, C.L., 2000. Season of Seeding, Mowing and Seed Mix Richness for Native Plant Community Development in the Aspen Parkland. M.Sc. Thesis. University of Alberta, Department of renewable Resources, Edmonton, Alberta. 230 pp. <https://era.library.ualberta.ca/files/3x816p96x/MQ60164.pdf>
- Rojas, J.A., 2016. Urban Naturalization for Green Spaces in the City of Edmonton, Alberta, Canada. M.Sc. Thesis, University of Alberta, Department of Renewable Resources, Edmonton, Alberta. 112 pp. https://era.library.ualberta.ca/files/c8k71nh16h/Aguilar_Rojas_Jaime_201603_MSc.pdf
- Salisbury, B.E., 2004. Natural Recovery versus Seeding on a Pipeline Right-of-Way in a Boreal Mixedwood Forest in Central Alberta. M.Sc. Thesis, University of Alberta, Department of Renewable Resources, Edmonton, Alberta. 114 pp.
- Seaborn Seeds Inc., 2013. Native Seed List – February 20, 2013. Seaborn Seeds Inc., Rocky Mountain House, Alberta. <http://www.crookedpost.ca/seed/nativeSeed.htm>
- Sherritt, D.E., 2012. *Festuca hallii* (Vasey) Piper (Plains Rough Fescue) and *Festuca Campestris* Rydb (Foothills Rough Fescue) Response to Seed Mix Diversity and Mycorrhizae. M.Sc. Thesis, University of Alberta, Department of Renewable Resources, Edmonton, Alberta. 74 pp. [https://era.library.ualberta.ca/files/wp988k341/Sherritt_Darin_Fall_2012\[1\].pdf](https://era.library.ualberta.ca/files/wp988k341/Sherritt_Darin_Fall_2012[1].pdf)
- Small, C.C., Q. Barber, M. Mackenzie and C.B. Powter, 2016a. Native Species Research Program Workshop: Looking to the Future of Native Plants in Alberta: Summary Report. InnoTech Alberta, Reclamation Team, Edmonton, Alberta. 65 pp.

Small, C.C., D. Degenhardt, J. Yang, M. McKenzie and A. Underwood, 2016b. Enriched Biochar and Plant Growth Promoting Rhizobacteria (PGPR) for Enhanced Reclamation and Remediation of Disturbed Soils. 2016 Project Establishment Report Prepared by InnoTech Alberta, Edmonton, Alberta for Imaginea Energy Corp., Calgary, Alberta. 46 pp.

Smreciu, A., H. Sinton, D. Walker and J. Bietz, 2003. Establishing Native plant Communities. Alberta Agriculture, Food and Rural Development, Edmonton, Alberta. 93 pp.

[http://www1.agric.gov.ab.ca/\\$Department/deptdocs.nsf/all/agdex6123/\\$FILE/580_3.pdf](http://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/all/agdex6123/$FILE/580_3.pdf)

Soulodre, E.M.J., 2001. Restoration Ecology of Cattle Grazing on Mixed Prairie Wellsites: A Hierarchical Approach. M.Sc. Thesis. University of Alberta, Department of Renewable Resources, Edmonton, Alberta. 153 pp.

Special Areas Board, nd. Invasive Introduced Forages on Reclamation Sites. Special Areas Board, Hanna, Alberta. Policy 06-06. 2 pp. https://specialareas.ab.ca/wp-content/uploads/2015/02/PDF-Policies-POLICY_06-06.pdf

Stover, H.J., 2013. Non-Native Plant Management and Restoration of Foothills Fescue Grassland in Waterton Lakes National Park, Alberta. M.Sc. Thesis. University of Alberta, Department of Renewable Resources, Edmonton, Alberta. 226 pp.

https://era.library.ualberta.ca/files/sf2685382/Stover_Holly_Fall%202013.pdf

Tannas, S. and M. Webb, 2016. Plant Material Selection and Seed Mix Design for Native Grassland Restoration Projects. Foothills Restoration Forum, Alberta. 31 pp.

Town of Banff, nd. Banff Design Guidelines. Land Use By-Law 31-3. Town of Banff, Banff, Alberta. Various pagings. <https://banff.ca/DocumentCenter/View/638>

Town of Canmore, 2016. Construction and Landscaping Standards. Town of Canmore, Engineering Services, Canmore, Alberta. Various pagings.

<https://canmore.ca/documents/engineering/engineering-reference-documents/740-engineering-landscaping-guidelines-approval-pending-2016/file>

TransCanada Keystone Pipeline GP Ltd., 2008. Canadian Segment of the Keystone Pipeline Project. Environmental Protection Plan for the New Pipeline in Alberta. Revision 2. Appendix J Reclamation Seed Mixes. Prepared by Jacques Whitford AXYS Ltd., Calgary, Alberta.

<https://apps.neb-one.gc.ca/REGDOCS/File/Download/530729>

Trans Mountain Pipeline ULC, 2016. Trans Mountain Expansion Project Environmental Plans. Volume 6 – Environmental Plans, Section 9 – Reclamation Plans. Trans Mountain Pipeline ULC, Calgary, Alberta. <https://www.transmountain.com/uploads/pages/1474051112-Reclamation-Plans.pdf>

Tuttle, S., 1991. An Overview of Land Reclamation at Suncor. IN: Powter, C.B. (Compiler). Land Reclamation of Oil Sands & Heavy Oil Developments. Proceedings of the Alberta Reclamation Conference '90. Alberta Chapter, Canadian Land Reclamation Association.

Vaartnou, H. and G.W. Wheeler, 1975. Establishment and survival of ground cover plantings on disturbed areas in Alberta. Final report of Phase I. Alberta Agriculture, Plant Industry Laboratory, Edmonton, Alberta. 48 pp. <http://hdl.handle.net/10402/era.29243>

Wild about Flowers, 2017. Native Grass Seed Mixes. Wild about Flowers, Okotoks, Alberta. http://www.wildaboutflowers.ca/native_grass_seed_mixes.php

- Wishart, D., 1983. Revegetating a Pipeline Right-of-Way on a Montane Grassland. M.Sc. Thesis. University of Alberta, Department of Forest Science, Edmonton, Alberta. 233 pp.
- Wruck, G.W., 2004. Revegetation and Spatial Pattern of Pipeline Reclamation in Sandhills of Alberta Aspen Parkland. M.Sc. Thesis. University of Alberta, Department of Renewable Resources, Edmonton, Alberta. 105 pp.
- Ziemkiewicz, P.F., 1983. Revegetation of Oil and Gas Disturbances: A Method for Selecting Seed Mixes, Fertilizers and Application Methods. IN: Reclamation: Planning – Practice – Results. Proceedings of the Eighth Annual Meeting of the Canadian Land Reclamation Association. August 21-24, 1983, Waterloo, Ontario. pp. 319-326.

9.1 ADDITIONAL READING

- Alberta Sustainable Resource Development, 2010. Industrial Activity in Foothills Fescue Grasslands: Guidelines for Minimizing Surface Disturbance. Alberta Sustainable Resource Development, Lands Division, Edmonton, Alberta. 17 pp.
<http://aep.alberta.ca/land/grazing-range-management/documents/Grassland-MinimizingSurfaceDisturbance.pdf>
- Iwaasa, A.D., M.P. Schellenberg and B. McConkey, 2012. Re-establishment of Native Mixed Grassland Species into Annual Cropping Land. *Prairie Soils & Crops Journal* 5: 85-95.
<https://prairiesoilsandcrops.ca/articles/volume-5-9-screen.pdf>
- Minnesota Board of Water & Soil Resources, 2017. Native Vegetation Establishment and Enhancement Guidelines. Minnesota Board of Water & Soil Resources, Saint Paul, Minnesota. 63 pp. http://www.bwsr.state.mn.us/native_vegetation/seeding_guidelines.pdf
- Morgan, J.P., D.R. Collicutt and J.D. Thompson, 1995. Restoring Canada's Native Prairies: A Practical Manual. Manitoba Naturalists Society, Winnipeg, Manitoba. 84 pp.
<http://www.naturenorth.com/RCNP/RCNP.pdf>
- Natives First, nd. Native Restoration Guidelines. La Crosse Seed, La Crosse, Wisconsin, USA. 6 pp. <http://www.lacrosseseed.com/wp-content/uploads/Natives-First-Restoration-Guidelines.pdf>
- Neufeld, C., 2010. Assessment of the Native Plant Materials Industry in Western Canada and the Northern United States – Results from the Providers and Users of Native Plant Materials. Native Plant Society of Saskatchewan. Saskatoon, Saskatchewan. 96 pp. http://www.pcap-sk.org/rsu_docs/documents/Native_Plant_Market_Assessment_Final_Report.pdf
- Smyth, C.R., 1997. Early Succession Patterns with a Native Species Seed Mix on Amended and Unamended Coal Mine Spoil in the Rocky Mountains of Southeastern British Columbia, Canada. *Arctic and Alpine Research* 29(2): 184-195.
- Watt, D., 2012. Recovery Strategies for Industrial Development in Native Prairie: Mixedgrass Natural Subregion. Industry Workshop December 10th, 2012 Summary. 5 pp.
<https://static1.squarespace.com/static/5342d33fe4b0d2725fefb31b/t/5359869de4b005715e512c9f/1398376093200/Recovery+Strategies+Mixedgrass+Dec+10+12+Industry+Workshop+Summary.pdf>

10.0 GLOSSARY

10.1 TERMS

Agronomic

Introduced annual cereals, forage and turf species.

Breeder Seed

Breeder seed crops are those crops certified by the CSGA as being produced by a recognized Plant Breeder under conditions, such as third party audited Quality Management Systems, which have ensured that the specific characteristics of the variety have been maintained. Breeder seed is the original source for all increases of seed crops of other pedigreed classes.

Common Seed

Mon-pedigreed seed whose varietal origin or purity is uncertain. Common seed can also include seed that has lost its pedigreed status because it has been found not to meet the varietal purity standard or the prescribed quality standard.

Introduced (Exotic)

A species that is not native to a particular area.

Native

Plant species that is indigenous to a particular natural region; they were in that region prior to the time of Euro-American settlement.

Natural Subregion

The six natural regions of Alberta are sub-divided into 20 subregions based on recurring landscape patterns relative to other parts of the natural region.

Variety (Cultivar, Ecovar)

A variety denotes a group of cultivated plants, including hybrids constituted by controlled cross-pollination, that:

- are distinguished by common morphological, physiological, cytological, chemical or other characteristics; and,
- retain their characteristics when reproduced.

A variety must therefore be distinguishable, uniform, and stable.

10.2 ACRONYMS

AITF	Alberta Innovates – Technology Futures
ARC	Alberta Research Council
CVRI	Coal Valley Resources Inc.
EIA	Environmental Impact Assessment
EID	Eastern Irrigation District

GMSL	Gold Metal Seeds Ltd.
GPEC	Green Patch Environmental Consulting Ltd.
nd	No Date (in citations and references)
PLS	Pure Live Seed
SEAC	Suffield Environmental Advisory Committee
Wt %	Weight Percent