Suncor Mine Advance Plan (D&R) and Cumulative Effects Assessment

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Prepared for:

Suncor Inc.

Prepared by:

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This report is one of a series of reports prepared for Suncor Inc. Oil Sands Group for the Environmental Impact Assessment for the development and operation of the Steepbank Mine, north of Fort McMurray, Alberta. These reports provided information and analysis in support of Suncor's application to the Alberta Energy Utilities Board and Alberta Environmental Protection to develop and operate the Steepbank Mine, and associated reclamation of the current mine (Lease 86/17) with Consolidated Tailings technology.

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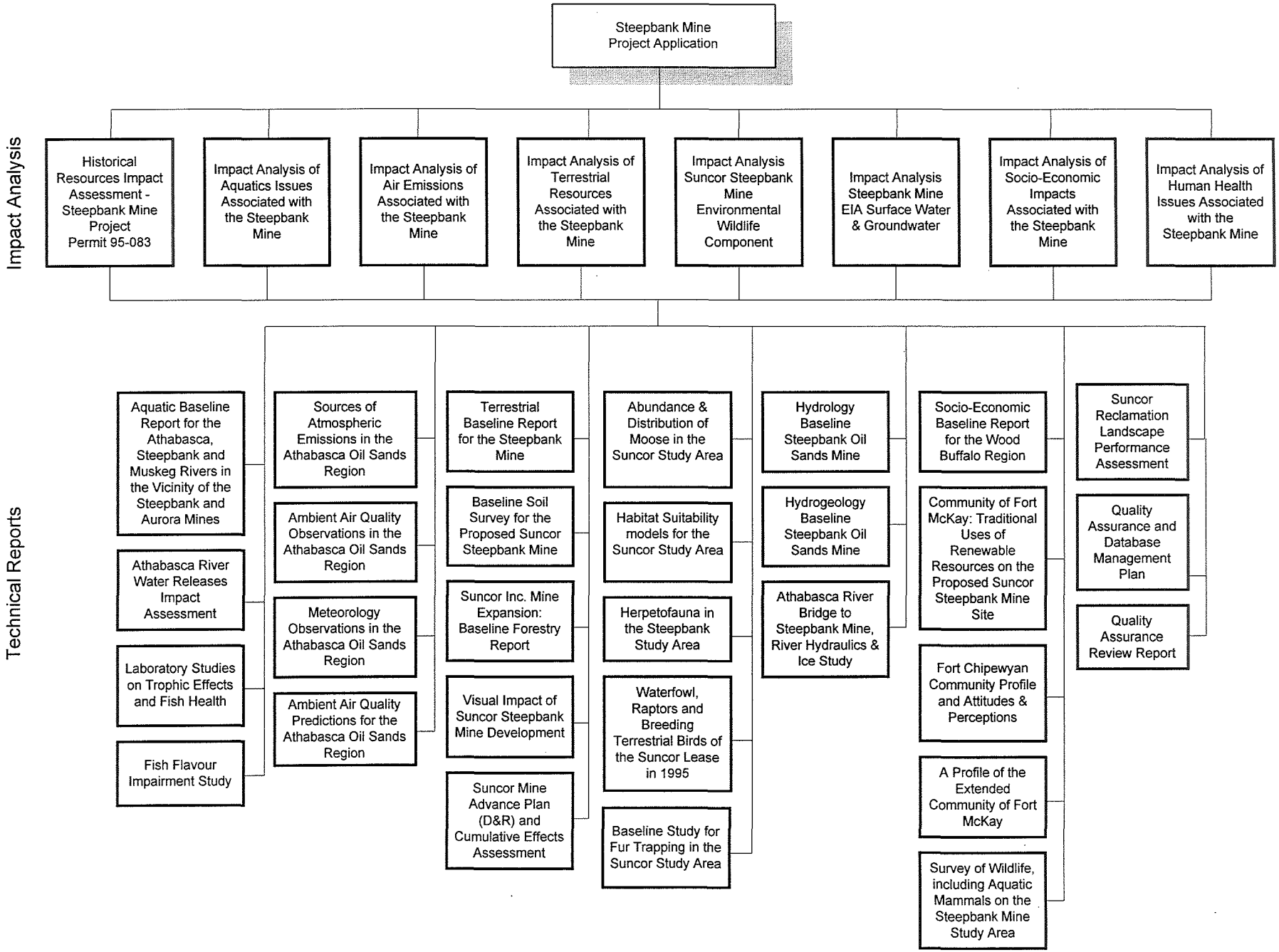

Reports Prepared for the Steepbank Mine Environmental Assessment

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1.0 INTRODUCTION

The Steepbank Mine Advance Plan and Cumulative Effects Assessment report provides a detailed summary of the baseline data used in the preparation of the Steepbank Mine project Environmental Impact Assessment (Golder Associates 1996a) and the Terrestrial Impact Analysis report (Golder Associates 1996b).

In this report, data is provided showing the development of the Suncor Local Study Area, including the advancement and reclamation of the Steepbank Mine, and reclamation of Lease 86/17. This is presented using figures and tables for selected time periods from 1995 through 2020. A long-term scenario, predicting the future condition of reclaimed areas is also presented in this analysis.

A cumulative assessment of vegetation change in response to development in a regional context is also provided. This considers other oil sands operators as well as forestry operations. The Regional Study Area is shown in Figure 1.0.

2.0 APPROACH

Satellite imagery (Landsat) was used to classify vegetation types (ELC types) within the study area. Detailed field data collected by scientists on the ground, in addition to ancillary data including aerial photography and a digital elevation model (DEM), were used to classify vegetation, land-use and land-cover types using Landsat Thematic Mapper (TM) data. These data were subsequently integrated with soils and terrain classification using a computer-based Geographic Information System (GIS) to produce the 1995 baseline terrestrial resource database for the Suncor Local Study Area.

A similar approach was taken on a more generalized scale at the Regional Study Area level involving a joint-effort in the collection of ground data by scientists acting for both Suncor and Syncrude. These combined data were used to classify Landsat TM data and to produce the Regional Study Area ELC Ecosite Classification (Figure 2.0).

The evolution of the Suncor Local Study Area over time (including both the advancement and reclamation of the proposed Steepbank Mine, and reclamation of Lease 86/17) was mapped using a Geographic Information System (GIS) for the 2001, 2010, 2010 and 2020 assessment years. A conceptual long-term planned scenario was also generated, which reflected the reclaimed ELC cover-types at an anticipated state of climax after a period of succession. An ELC cover type is based on the integration of vegetation cover with terrain, soil and drainage conditions. They were identified primarily on the basis of vegetation cover as detected on the satellite imagery. It was not however, technically feasible to realistically model the natural succession of undisturbed ELC cover-types for each assessment year, and these values remain as constants based on their 1995 baseline distributions.

The GIS maps were analyzed to determine the hectares of each of the ELC cover-types within a given area. In this manner the potential net impacts, offset by reclamation activity, could be determined at each of the assessment time periods. This information formed the basis of the Suncor Steepbank Mine EIA for the Local Study Area.

The Cumulative Impact Assessment was based on a similar evolution of the Regional Study Area which incorporated the mapped data of the mining and reclamation activities of Suncor, in addition to Syncrude's proposed Aurora Mine project and continued development of the Mildred Lake Mine. Map coverages were produced for the years 1995 and 2020 and their corresponding ELC cover-type hectares derived using a GIS. These data formed the basis for a Cumulative Impact Assessment (CIA) within the Regional Study Area.

3.0 METHODS

The classification of the Landsat TM data for the Local Study Area was based on field data and ancillary aerial photography (Figure 3.0). Individual field data sites were assumed to be representative of homogeneous cover-types which were precisely located using a Global Positioning System (GPS). These data were used to generate spectral profiles used in the classification process.

The resulting spectral profiles of each cover-type were used to digitally classify data derived from geo-referenced Landsat TM imagery using GIS/Remote Sensing computer software. An accuracy assessment was then conducted to determine potential uncertainty in the classification. The ELC classification data were manipulated, displayed and analyzed using a GIS to determine class hectareage within selected areas of the Suncor Local Study Area. This formed the basis of the 1995 baseline terrestrial database.

Mine advance plans for the Steepbank Mine project, as well as reclamation plans for Lease 86/17 and the Steepbank Mine were provided by Suncor (Tuttle 1995, Suncor. 1996). These data were digitized and imported into a GIS for the assessment years 2001, 2010, 2020 and a long-term planned scenario. These date were integrated with the 1995 baseline data to form a chronology of map coverages representing proposed Suncor operations. The data were converted using a GIS into hectares to determine the net vegetation balances at each assessment year. Hectarages were also determined for the Lease 86/17 and Steepbank Mine project footprints.

An ELC classification for the Regional Study Area was also produced using data derived from geo-referenced Landsat TM satellite imagery. This involved incorporating field data from both Suncor and Syncrude baseline studies. The data were used to generate spectral profiles for each ELC cover-type class, and subsequently used to guide the computer classification of the satellite imagery. The resulting classification was subjected to an accuracy assessment process to determine potential uncertainty in the classification predictions.

The Regional Study Area ELC Classification was then analyzed using a GIS to determine the hectares of each cover type within the study area. Digitized mine advance plans obtained from

Syncrude for both the proposed Aurora Mine and expanded Mildred Lake developments were incorporated with existing mine advance maps from Suncor (Bovar 1996). These data were incorporated with the 1995 Regional ELC Classification to produce a regional chronology of proposed Syncrude and Suncor mine advancement for each of the assessment years. Complete mapped information regarding the regional contribution of Solv-Ex, Alpac and the Northlands development was not available at the time of report completion. However, hectareage estimates were provided by each of these operators which were utilized in the assessment (BOVAR 1995, Rymer 1996). These data are provided in this report for the 1995 baseline and year 2020 only.

4.0 RESULTS

4.1 Suncor Local Study Area Vegetation Balance

Table 4.1 shows the total net coverage of each vegetation type for 1995, 2001, 2010, 2020 and the long-term scenario for the Suncor Local Study Area. This table includes both the effects of reclamation (and subsequent evolution), as well as mine advance. The long-term scenario is also shown as a percentage of the 1995 baseline in order to show the anticipated level of recovery for each of the potentially affected cover types.

The proposed Steepbank Mine advance is shown chronologically in Figures 4.1 through 4.5.

4.2 Suncor Steepbank Mine Incremental Impact On Vegetation Types

Table 4.2 shows the progression of the Steepbank Mine through the various EIA assessment years against the 1995 baseline ELC Vegetation Types. The maximum mine impact area by vegetation coverage is shown in year 2020.

4.3 Suncor Lease 87/17 Vegetation Balance

Table 4.3 shows the total net coverage estimates of the ELC Vegetation Types for each assessment year within Lease 86/17 only. Reclamation and mine advance are both factored. Note, the actual area of disturbance in Lease 86/17 is 3,367 ha although for this analysis a buffer area was included which raised the hectareage to 3875.

4.4 Local Study Area Vegetation Balance by ELC Type (Ecosection)

Table 4.4 shows the total net coverage estimates of ELC vegetation (ecosites) classes within the following ELC terrain (ecosections) classes for each assessment year:

Riparian Terraces: Includes the Upper floodplain of the Athabasca River (largely upper terraces and incorporated islands).

Riparian Escarpment:	Escarpment Slopes of the Athabasca and Steepbank Rivers.
Midland:	Includes an upland unit located on the west side of the river, and south of Suncor Lease 86/17
Midland Drainages:	This landform represents glacial meltwater channels now supporting open standing and slow moving water, peatlands, shrub-dominated wetlands and open water/emergent vegetation wetlands.
Upland:	Located on the east side of the Athabasca River, this terrain type largely supports a complex of bog and fen units, including a myriad of small drainages to the Athabasca River.
Highland:	This Ecosite represents an area of increased elevation and till parent material, primarily supporting mixedwood and white spruce dominated mixedwood stands with intermittent depressional areas of open tamarack fens. Some aspen-dominated stands are also presents.

4.5 Cumulative Vegetation Impact Assessment, Year 2020 Relative to 1995 Baseline

The cumulative impacts of Suncor and the other major operators within the Regional Study Area for year 2020 is described in Table 4.5. The results are expressed in terms of ELC vegetation (land use class) losses (negative values) and gains (positive values).

The central portion of the Regional Study Area showing the cumulative impacts of proposed Suncor and Syncrude activities in both 1995 and 2020 is provided in Figure 4.6 and 4.7 respectively.

4.6 Local Study Area ELC Classification Accuracy

Table 4.6 provides an overview of the individual and overall class accuracies of the Suncor Local Study Area ELC Classification.

4.7 Regional Study Area ELC Classification Accuracy

A summary of the individual and overall class accuracies of the Regional Study Area ELC Classification is provided in Table 4.7.

5.0 CONCLUSION

The data provided in this report provides quantitative information on vegetation change anticipated to occur as a result of the proposed developments within the Athabasca Oil Sands Region. The data is presented for the Suncor Local Study Area as well as within a larger Regional Study Area.

By incorporating other anticipated developments within the region, this report provides the basis for a long range, integrated resource management plan for this region.

6.0 REFERENCES

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TABLES

TABLE 4.1
LOCAL STUDY AREA VEGETATION BALANCE

ELC Vegetation/Landuse Class	Total Coverage Area (ha)					Longterm % of
	1995	2001	2010	2020	Longterm	1995 Baseline
Closed Jack Pine	2760	2701	2581	2536	2532	92
Closed White Spruce	3443	3408	3295	3265	3259	95
Closed Deciduous Forest	5778	5643	5184	5105	6225	108
Closed Mixedwood	2622	2807	2862	3188	5240	200
Closed Mixed Coniferous, Black Spruce Dominant	1440	1420	1355	1329	1328	92
Peatland: Closed Black Spruce Bog	2995	2952	2808	2604	2597	87
Peatland: Black Spruce-Tamarack Fen	3453	3430	3165	2626	2615	76
Closed Mixedwood, White Spruce Dominant	845	825	1012	1200	2804	332
Peatland: Open Black Spruce Bog	6032	6008	5873	5277	5263	87
Peatland: Open Tamarack Fen	2109	2098	2097	2085	2085	99
Wetland Closed Shrub Complex	2673	2640	2539	2586	2881	108
Wetland Open Water - Emergent Vegetation Zone	1345	1345	1333	1313	1767	131
Disturbed/Herb, Grasses	2071	2325	2745	3865	1342	65
Sparsely-Vegetated: Natural	283	283	283	283	283	100
Sparsely-Vegetated: Lease 86/17	1765	1498	1396	386	0	0
Sparsely-Vegetated: Steepbank Mine	0	232	588	1562	0	0
Industrial Open Water	607	606	1105	1011	0	0
Total Area	**40221**	**40221**	**40221**	**40221**	**40221**	**100**

TABLE 4.2
SUNCOR STEEPBANK MINE INCREMENTAL IMPACT ON VEGETATION TYPES

ELC Vegetation/Landuse Class	Coverage Area (ha)				
	1995	2001	2010	2020	Total
Closed Jack Pine	0	39	122	46	207
Closed White Spruce	0	17	129	61	208
Closed Deciduous Forest	0	107	448	128	683
Closed Mixedwood	0	4	20	15	40
Closed Mixed Coniferous, Black Spruce Dominant	0	15	66	26	107
Peatland: Closed Black Spruce Bog	0	5	87	179	271
Peatland: Black Spruce-Tamarack Fen	0	10	265	550	825
Closed Mixedwood, White Spruce Dominant	0	12	13	2	27
Peatland: Open Black Spruce Bog	0	1	135	625	761
Peatland: Open Tamarack Fen	0	0	1	12	13
Wetland Shrub Complex	0	7	75	19	101
Disturbed/Herb, Grasses	0	1	20	28	49
Wetland Open Water - Emergent Vegetation Zone	0	0	1	1	2
Total Area	**0**	**219**	**1383**	**1692**	**3294**

TABLE 4.3
LEASE 86/17 VEGETATION BALANCE

ELC Vegetation/Landuse Class	Coverage Area (ha)				
	1995	2001	2010	2020	Longterm (Planned)
Closed Jack Pine	4	4	4	4	4
Closed White Spruce	0	0	20	48	46
Closed Deciduous Forest	31	31	31	65	65
Closed Mixedwood	2	2	70	386	1528
Peatland: Closed Black Spruce Bog	258	255	197	171	170
Peatland: Closed Black Spruce - Tamarack Fen	3	3	3	3	3
Closed Mixedwood, White Spruce Dominant	56	56	253	433	1198
Closed Lodgepole Pine (Reclaimed)	0	0	0	25	25
Peatland: Black Spruce - Tamarack Fen	1	1	1	1	1
Wetland Shrub Complex	173	164	140	193	301
Disturbed/Herb, Grasses	941	1206	1202	1547	273
Industrial/Sparsely Vegetated (Primarily Lease 86/17)	1860	1607	1504	495	160
Wetland Open Water - Emergent Vegetation Zone	0	0	0	0	101
Industrial Open Water	546	546	450	504	0
Total Area	**3875**	**3875**	**3875**	**3875**	**3875**

TABLE 4.4
LOCAL STUDY AREA VEGETATION BALANCE BY ELC TYPE (ECOSECTION)

ELC Terrain Class	ELC Vegetation Class	Coverage Area (ha) 1995	2001	2010	2020	Longterm (Planned)
Riparian Flood Plain		1474	1474	1474	1474	1474
	Closed Jack Pine	26	25	25	25	25
	Closed White Spruce	177	177	137	136	136
	Closed Deciduous Forest	372	370	351	351	453
	Closed Mixedwood, White Spruce Dominant	255	252	250	250	250
	Wetland Shrub Complex	560	554	521	522	520
	Disturbed/Herb, Grasses	1	1	88	89	1
	Industrial/Sparsely-Vegetated	41	41	41	41	41
	Industrial Open Water	44	43	43	43	43
	Lease 97 Mine Infrastructure (Sparsely-Vegetated)		7	6	6	
	Lease 97 Active Mine Area			5		
	Lease 97 Dyke 11 (Sparsely-Vegetated)			1		
	Lease 97 West Overburden Storage (Sparsely-Vegetated)				6	
	Subtotal Area	**1474**	**1469**	**1469**	**1469**	**1470**
	Subtotal Cumulative Rounding & Interpolation Error	**0**	**5**	**5**	**5**	**4**
Riparian River Terraces		2228	2228	2228	2228	2228
	Closed Jack Pine	130	110	104	104	103
	Closed White Spruce	665	646	592	580	578
	Closed Deciduous Forest	937	866	710	700	1057
	Closed Mixedwood					21
	Closed Mixedwood, White Spruce Dominant	308	296	288	287	285
	Wetland Shrub Complex	124	122	116	116	116
	Disturbed/Herb, Grasses	57	57	151	200	52
	Industrial/Sparsely-Vegetated	7	7	7	7	7
	Industrial Open Water	1	1	1	1	1
	Lease 97 Mine Infrastructure (Sparsely-Vegetated)		88	135	159	
	Lease 97 Pit 7/A,B (Sparsely-Vegetated)			3	2	
	Lease 97 Pit 8/A,B, Dyke 11B, Dyke 12 (Sparsely-Vegetated)				40	
	Lease 97 Active Mine Area			38		
	Lease 97 Dyke 11 (Sparsely-Vegetated)			60		
	Lease 97 North Overburden Storage (Sparsely-Vegetated)		28	14		
	Lease 97 West Overburden Storage (Sparsely-Vegetated)				17	17
	Subtotal Area	**2227**	**2219**	**2219**	**2212**	**2236**
	Subtotal Cumulative Rounding & Interpolation Error	**0**	**9**	**9**	**15**	**-9**
Riparian Escarpment		4024	4024	4024	4024	4024
	Closed Jack Pine	465	440	346	325	323
	Closed White Spruce	365	363	324	290	289
	Closed Deciduous Forest	1647	1616	1350	1265	1784
	Closed Mixedwood	63	61	52	50	623
	Closed Mixed Coniferous, Black Spruce Dominant	241	225	160	148	147
	Peatland:Closed Black Spruce Bog	283	273	228	177	175
	Peatland: Open Tamarack Fen	518	504	371	255	250
	Closed Mixedwood, White Spruce Dominant	91	90	88	87	110
	Peatland: Open Black Spruce Bog	16	15	15	11	11
	Peatland: Black Spruce-Tamarack Fen	28	25	25	22	22
	Wetland Shrub Complex	192	189	154	149	178
	Disturbed/Herb, Grasses	110	110	199	328	73
	Industrial/Sparsely-Vegetated	5	5	5	5	5
	Industrial Open Water	0	0	0	0	6
	Lease 97 Mine Infrastructure (Sparsely-Vegetated)		22	14	99	
	Lease 97 Pit 7/A,B (Sparsely-Vegetated)			432	436	
	Lease 97 Pit 8/A,B, Dyke 11B, Dyke 12 (Sparsely-Vegetated)				353	
	Lease 97 Active Mine Area		45	132	0	
	Lease 97 Dyke 11 (Sparsely-Vegetated)			5		
	Lease 97 East Gravel Pit (Sparsely-Vegetated)		3			
	Lease 97 North Overburden Storage (Sparsely-Vegetated)		10	97		
	Subtotal Area	**4023**	**3996**	**3997**	**4000**	**3996**
	Subtotal Cumulative Rounding & Interpolation Error	**0**	**27**	**26**	**24**	**27**
Midland		5665	5665	5665	5665	5665
	Closed Jack Pine	332	331	331	331	331
	Closed White Spruce	364	363	363	363	363
	Closed Deciduous Forest	946	945	945	945	945
	Closed Mixedwood	141	139	139	139	139
	Closed Mixed Coniferous, Black Spruce Dominant	395	394	394	394	394
	Peatland:Closed Black Spruce Bog	905	901	901	901	901
	Peatland: Open Tamarack Fen	1197	1194	1194	1194	1194
	Closed Mixedwood, White Spruce Dominant	10	10	10	10	10
	Peatland: Open Black Spruce Bog	131	130	130	130	130
	Peatland: Black Spruce-Tamarack Fen	94	94	94	94	94
	Wetland Shrub Complex	578	575	575	575	575
	Disturbed/Herb, Grasses	479	478	478	478	478
	Industrial/Sparsely-Vegetated	93	92	92	92	92
	Subtotal Area	**5665**	**5645**	**5645**	**5645**	**5645**
	Subtotal Cumulative Rounding & Interpolation Error	**0**	**21**	**21**	**21**	**21**

TABLE 4.4
LOCAL STUDY AREA VEGETATION BALANCE BY ELC TYPE (ECOSECTION)

Midland Drainage		2700	2700	2700	2700	2700
	Closed Jack Pine	328	327	327	327	327
	Closed White Spruce	165	165	165	165	165
	Closed Deciduous Forest	570	569	569	569	569
	Closed Mixedwood	28	28	28	28	28
	Closed Mixed Coniferous, Black Spruce Dominant	81	81	81	81	81
	Peatland:Closed Black Spruce Bog	57	55	55	55	55
	Peatland: Open Tamarack Fen	341	341	341	341	341
	Closed Mixedwood, White Spruce Dominant	47	46	46	46	46
	Peatland: Black Spruce-Tamarack Fen	53	53	53	53	53
	Wetland Shrub Complex	603	599	599	599	599
	Disturbed/Herb, Grasses	387	385	385	385	385
	Industrial/Sparsely-Vegetated	26	25	25	26	25
	Industrial Open Water	16	16	16	16	16
	Subtotal Area	**2700**	**2689**	**2689**	**2689**	**2689**
	Subtotal Cumulative Rounding & Interpolation Error	**0**	**12**	**12**	**12**	**12**

Upland		16792	16792	16792	16792	16792
	Closed Jack Pine	1180	1171	1151	1127	1127
	Closed White Spruce	1363	1352	1351	1340	1340
	Closed Deciduous Forest	1206	1179	1160	1144	1243
	Closed Mixedwood	1721	1700	1689	1676	2025
	Closed Mixed Coniferous, Black Spruce Dominant	723	720	719	705	705
	Peatland:Closed Black Spruce Bog	1490	1469	1427	1299	1295
	Peatland: Black Spruce-Tamarack Fen	1394	1388	1256	832	827
	Closed Mixedwood, White Spruce Dominant	26	26	25	25	854
	Peatland: Open Black Spruce Bog	5886	5862	5727	5136	5122
	Peatland: Open Tamarack Fen	1309	1303	1303	1294	1294
	Wetland Shrub Complex	399	391	388	377	546
	Disturbed/Herb, Grasses	91	88	241	838	81
	Industrial/Sparsely-Vegetated	3	3	3	3	3
	Industrial Open Water					229
	Lease 97 Mine Infrastructure (Sparsely-Vegetated)		1	5	112	
	Lease 97 Pit 7/A,B (Sparsely-Vegetated)				233	
	Lease 97 Pit 8/A,B, Dyke 11B, Dyke 12 (Sparsely-Vegetated)			235	377	
	Lease 97 Active Mine Area				163	
	Lease 97 East Gravel Pit (Sparsely-Vegetated)		29			
	Subtotal Area	**16791**	**16681**	**16680**	**16681**	**16691**
	Subtotal Cumulative Rounding & Interpolation Error	**1**	**111**	**111**	**111**	**101**

Highland		2030	2030	2030	2030	2030
	Closed Jack Pine	287	286	286	286	286
	Closed White Spruce	334	333	333	333	333
	Closed Deciduous Forest	51	51	51	51	51
	Closed Mixedwood	657	655	655	655	655
	Closed Mixed Coniferous, Black Spruce Dominant	48	47	47	47	47
	Peatland: Black Spruce-Tamarack Fen	612	609	609	609	609
	Wetland Shrub Complex	43	43	43	43	43
	Subtotal Area	**2030**	**2024**	**2024**	**2024**	**2024**
	Subtotal Cumulative Rounding & Interpolation Error	**0**	**6**	**6**	**6**	**6**

Suncor Lease 86/17		3875	3875	3875	3875	3875
	Closed Jack Pine	4	4	4	4	4
	Closed White Spruce	0	0	20	48	46
	Closed Deciduous Forest	31	31	31	65	65
	Closed Mixedwood	2	2	70	386	1528
	Peatland: Closed Black Spruce Bog	258	255	197	171	170
	Peatland: Closed Black Spruce - Tamarack Fen	3	3	3	3	3
	Closed Mixedwood, White Spruce Dominant	56	56	253	433	1198
	Closed Lodgepole Pine (Reclaimed)	0	0	0	25	25
	Peatland: Black Spruce - Tamarack Fen	1	1	1	1	1
	Wetland Shrub Complex	173	164	140	193	301
	Disturbed/Herb, Grasses	941	1206	1202	1547	273
	Industrial/Sparsely Vegetated	1860	1607	1504	495	160
	Wetland Open Water - Emergent Vegetation Zone	0	0	0	0	101
	Industrial Open Water	546	546	450	504	0
	Subtotal Area	**3875**	**3875**	**3875**	**3875**	**3875**
	Subtotal Cumulative Rounding & Interpolation Error	**0**	**0**	**0**	**0**	**0**
	Total Area [a]	**38785**	**38597**	**38598**	**38594**	**38625**
	Total Cumulative Rounding and Spatial Interpolation Error	**2**	**190**	**190**	**194**	**162**

[a] The actual total area of the Local Study Area is ~40 002 ha. The totals presented here do not include the area of the Athabasca River, and other water bodies which are ~1200 ha in total area.

TABLE 4.5

CUMULATIVE VEGETATION IMPACT ASSESSMENT, YEAR 2020 RELATIVE TO 1995 BASELINE

ELC Vegetation/Landuse Class	Total Coverage Area (ha)		Suncor	Syncrude Mildred L/Aurora	Solv-Ex	ALPAC & NORTHLANDS[1]	Cumulative Loss/Gain (ha)	Percentage of 1995 Baseline
	1995 Baseline	2020						
Closed Jack Pine	29119	26551	-224	-587	-26	-1731	-2568	-9
Closed White Spruce	43728	23151	-178	349	-3	-20745	-20577	-47
Closed Deciduous Forest	78738	95640	-673	-2266	-32	19873	16902	21
Closed Mixedwood	62530	60383	566	-183	-3	-2527	-2147	-3
Closed Mixed Coniferous, Black Spruce Dominant	86949	82409	-111	-3750	0	-679	-4540	-5
Peatland: Closed Black Spruce Bog	42494	38513	-391	-2771	-190	-629	-3981	-9
Peatland: Black Spruce-Tamarack Fen	50720	48882	-827	-1011	0	0	-1838	-4
Closed Mixedwood, White Spruce Dominant	129594	110858	355	-1895	-3	-17193	-18736	-14
Peatland: Open Black Spruce Bog	80554	79030	-755	-769	0	0	-1524	-2
Peatland: Open Tamarack Fen	57951	57315	-24	-575	-37	0	-636	-1
Peatland: Shrub Dominated Fen/Patterned Fen	58751	53654	0	-5097	0	0	-5097	-9
Wetland Closed Shrub Complex	214209	209657	-87	-4465	0	0	-4552	-2
Disturbed/Herb, Grass and Crop Tree Regeneration	18073	54477	1794	10684	295	23631	36404	201
Industrial/Sparsely-Vegetated [a]	10387	23394	587	12421	-1	0	13007	125
Wetland Open Water - Emergent Vegetation Zone	13502	13384	-32	-85	0	0	-117	-1
Urban Areas	2109	2109	0	0	0	0	0	0
Net Total Area	**979408**	**979407**	**0**	**0**	**0**	**0**	**0**	**n/a**

[a] Includes industrial areas and tailings ponds.

Notes: 1. Areas Harvested by ALPAC and Northlands return rapidly to a forest cover type, however, to qualify for a forest cover type, crown closure was set at 70%, which takes decades for seedlings to acheive.

TABLE 4.6

LOCAL STUDY AREA ELC CLASSIFICATION ACCURACY

ELC Class	Class % Correct
Closed Jack Pine	74.2
Closed White Spruce	86.0
Closed Deciduous Forest	82.0
Closed Mixedwood	79.0
Closed Mixed Coniferous, Black Spruce Dominant	80.0
Peatland: Closed Black Spruce Bog	73.9
Peatland: Black Spruce-Tamarack Fen	84.5
Closed Mixedwood, White Spruce Dominant	69.7
Peatland: Open Black Spruce Bog	76.4
Peatland: Open Tamarack Fen	80.0
Wetland Shrub Complex	65.1
Disturbed/Herb, Grasses	90.0
Industrial/Sparsely Vegetated	100.0
Wetland Open Water- Emergent Vegetation Zone	100.0
Overall Accuracy	**77.9**
Overall Adjusted Accuracy[a]	**75.7**

TABLE 4.7

REGIONAL STUDY AREA ELC CLASSIFICATION ACCURACY

ELC Class	Class % Correct
Closed Jack Pine	79.6
Closed White Spruce	72.5
Closed Deciduous Forest	70.5
Closed Mixedwood	60.6
Closed Mixed Coniferous, Black Spruce Dominant	79.2
Peatland: Closed Black Spruce Bog	71.5
Peatland: Black Spruce-Tamarack Fen	79.8
Closed Mixedwood, White Spruce Dominant	67.4
Peatland: Open Black Spruce Bog	72.0
Peatland: Open Tamarack Fen	65.9
Wetland Shrub Complex	64.7
Disturbed/Herb, Grasses	80.5
Industrial/Sparsely Vegetated	91.8
Wetland Open Water- Emergent Vegetation Zone	100.0
Overall Accuracy	**74.2**
Overall Adjusted Accuracy[a]	**71.5**

[a]Accuracy adjusted for expected agreement by chance alone (Kappa analysis).

Region: Suncor Local Study Area Ecosite Accuracy Assessment

TABLE 5.1
ERROR MATRIX

Class Code	Field Reference Data	Ecosite Classification 1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total Observed	Errors of Omission
1	Closed Jack Pine	72	10	5	4			3	3							97	25
2	Closed White Spruce	12	184	5					8		3	2				214	30
3	Closed Deciduous Forest			228	12	3			17	3		13	2			278	50
4	Closed Mixedwood		5	5	132	8	1	1	8	2	1	3	1			167	35
5	Closed Mixed Coniferous, Black Spruce Dominant		8			72		6					4			90	18
6	Peatland: Closed Black Spruce Bog		5	5	8	13	178			15	3	9	5			241	63
7	Peatland: Black Spruce-Tamarack Fen				4			60		4	3					71	11
8	Closed Mixedwood, White Spruce Dominant	8	24	8	12		8		189		8	14				271	82
9	Peatland: Open Black Spruce Bog	2	4		4		21	13		188	10	4				246	58
10	Peatland: Open Tamarack Fen							8		5	52					65	13
11	Wetland Shrub Complex		2	12	3		5	2	4	16	12	108	2			166	58
12	Disturbed/Herb, Grasses			8									72			80	8
13	Industrial/Sparsely Vegetated													34		34	0
14	Wetland Open Water- Emergent Vegetation Zone														25	25	0
	Total	94	242	276	179	96	213	93	229	233	92	153	86	34	25		
	Errors of Commission	22	58	48	47	24	35	33	40	45	40	45	14	0	0		1594
																sum x	2045
																sum y	2045
																Total Obs.	2045

TABLE 5.2
ERRORS OF OMISSIONS & COMMISSION

Class	% Errors of Commission	%Errors of Omission	Class % Correct
Closed Jack Pine	22.68	25.77	74.23
Closed White Spruce	27.10	14.02	85.98
Closed Deciduous Forest	17.27	17.99	82.01
Closed Mixedwood	28.14	20.96	79.04
Closed Mixed Coniferous, Black Spruce Dominant	26.67	20.00	80.00
Peatland: Closed Black Spruce Bog	14.52	26.14	73.86
Peatland: Black Spruce-Tamarack Fen	46.48	15.49	84.51
Closed Mixedwood, White Spruce Dominant	14.76	30.26	69.74
Peatland: Open Black Spruce Bog	18.29	23.58	76.42
Peatland: Open Tamarack Fen	61.54	20.00	80.00
Wetland Shrub Complex	27.11	34.94	65.06
Disturbed/Herb, Grasses	17.50	10.00	90.00
Industrial/Sparsely Vegetated	0.00	0.00	100.00
Wetland Open Water- Emergent Vegetation Zone	0.00	0.00	100.00

Total Correctly Classified	1594
Total Observations	2045
Overall Accuracy	0.779462
Overall Accuracy (%)	77.95

TABLE 5.3
OMISSION/COMMISSION CROSS-PRODUCT MATRIX

															OMISSION
550	1450	1200	1175	600	875	825	1000	1125	1000	1125	350	0	0		25
660	1740	1440	1410	720	1050	990	1200	1350	1200	1350	420	0	0		30
1100	2900	2400	2350	1200	1750	1650	2000	2250	2000	2250	700	0	0		50
770	2030	1680	1645	840	1225	1155	1400	1575	1400	1575	490	0	0		35
396	1044	864	846	432	630	594	720	810	720	810	252	0	0		18
1386	3654	3024	2961	1512	2205	2079	2520	2835	2520	2835	882	0	0		63
242	638	528	517	264	385	363	440	495	440	495	154	0	0		11
1804	4756	3936	3854	1968	2870	2706	3280	3690	3280	3690	1148	0	0		82
1276	3364	2784	2726	1392	2030	1914	2320	2610	2320	2610	812	0	0		58
286	754	624	611	312	455	429	520	585	520	585	182	0	0		13
1276	3364	2784	2726	1392	2030	1914	2320	2610	2320	2610	812	0	0		58
176	464	384	376	192	280	264	320	360	320	360	112	0	0		8
0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
22	58	48	47	24	35	33	40	45	40	45	14	0	0		

COMMISSION

TABLE 5.4
CALCULATION OF EXPECTED AGREEMENT

Expected agreement by chance alone = $\frac{\text{Sum of diagonal entries}}{\text{Grand Total}}$

$= \frac{18467}{203401}$

Expected agreement by chance alone = 0.09079

Calculation of Kappa-hat

k-hat = $\frac{\text{erved-Expected}}{\text{1-Expected}}$

k-hat = $\frac{0.688671}{0.90921}$

k-hat = 0.75744

Overall Adjusted Accuracy (%) 75.74

Therefore, the classification is 76% more accurate than would be expected from a random assignment of pixels to categories

Region: Regional Study Area Ecosite Classification Accuracy Assessment

TABLE 5.5
ERROR MATRIX

Class Code	Field Reference Data	Ecosite Classification 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total Observed	Errors of Omission
1	Closed Jack Pine	74	11	3	3				2								93	19
2	Closed White Spruce	12	185	5	21	4	1	2	20	2	2	1					255	70
3	Closed Deciduous Forest		2	160	38	2	3		8	1		12	1				227	67
4	Closed Mixedwood		23	45	180	23	1	1	15	3	1	4	1				297	117
5	Closed Mixed Coniferous, Black Spruce Dominant		9	1	8	240	20	9	5	5	1	4	1				303	63
6	Peatland: Closed Black Spruce Bog		2	2	8	13	198	18	1	18	3	9	5				277	79
7	Peatland: Black Spruce-Tamarack Fen				4	3	23	130			3						163	33
8	Closed Mixedwood, White Spruce Dominant	8	28	12	12	1	8	2	192		8	14					285	93
9	Peatland: Open Black Spruce Bog	9	4		4	8	21	14		190	10	4					264	74
10	Peatland: Open Tamarack Fen					2		8		19	56						85	29
11	Wetland Shrub Complex		2	15	3	4	5	3	4	9	12	108	2				167	59
12	Disturbed/Herb, Grasses		2	10		1		1	2	2		11	120				149	29
13	Industrial/Sparsely Vegetated		1	3					1					56			61	5
14	Wetland Open Water- Emergent Vegetation Zone													0	230		230	0
15	Peatland: Shrub Dominated Fen/Patterned Fen															0	0	0
	Total	103	269	256	281	301	280	188	250	249	96	167	130	56	230		2856	
	Errors of Commission	29	84	96	101	61	82	58	58	59	40	59	10	0	0	0		2119
																	sum x	2856
																	sum y	2856
																	Total Ob	5712

TABLE 5.6
ERRORS OF OMISSION AND COMISSION

Class	% Errors of Omission	%Errors of Commission	Class % Correct
Closed Jack Pine	20.43	31.18	79.57
Closed White Spruce	27.45	32.94	72.55
Closed Deciduous Forest	29.52	42.29	70.48
Closed Mixedwood	39.39	34.01	60.61
Closed Mixed Coniferous, Black Spruce Dominant	20.79	20.13	79.21
Peatland: Closed Black Spruce Bog	28.52	29.60	71.48
Peatland: Black Spruce-Tamarack Fen	20.25	35.58	79.75
Closed Mixedwood, White Spruce Dominant	32.63	20.35	67.37
Peatland: Open Black Spruce Bog	28.03	22.35	71.97
Peatland: Open Tamarack Fen	34.12	47.06	65.88
Wetland Shrub Complex	35.33	35.33	64.67
Disturbed/Herb, Grasses	19.46	6.71	80.54
Industrial/Sparsely Vegetated	8.20	0.00	91.80
Wetland Open Water- Emergent Vegetation Zone	0.00	0.00	100.00
Peatland: Shrub Dominated Fen/Patterned Fen	#DIV/0!	#DIV/0!	#DIV/0!

Total Correctly Classified	2119
Total Observations	2856
Overall Accuracy	0.741947
Overall Accuracy (%)	74.19

TABLE 5.7
OMISSION/COMMISSION CROSS-PRODUCT MATRIX

Omission

551	1596	1824	1919	1159	1558	1102	1102	1121	760	1121	190	0	0	0	19
2030	5880	6720	7070	4270	5740	4060	4060	4130	2800	4130	700	0	0	0	70
1943	5628	6432	6767	4087	5494	3886	3886	3953	2680	3953	670	0	0	0	67
3393	9828	11232	11817	7137	9594	6786	6786	6903	4680	6903	1170	0	0	0	117
1827	5292	6048	6363	3843	5166	3654	3654	3717	2520	3717	630	0	0	0	63
2291	6636	7584	7979	4819	6478	4582	4582	4661	3160	4661	790	0	0	0	79
957	2772	3168	3333	2013	2706	1914	1914	1947	1320	1947	330	0	0	0	33
2697	7812	8928	9393	5673	7626	5394	5394	5487	3720	5487	930	0	0	0	93
2146	6216	7104	7474	4514	6068	4292	4292	4366	2960	4366	740	0	0	0	74
841	2436	2784	2929	1769	2378	1682	1682	1711	1160	1711	290	0	0	0	29
1711	4956	5664	5959	3599	4838	3422	3422	3481	2360	3481	590	0	0	0	59
841	2436	2784	2929	1769	2378	1682	1682	1711	1160	1711	290	0	0	0	29
145	420	480	505	305	410	290	290	295	200	295	50	0	0	0	5
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	84	96	101	61	82	58	58	59	40	59	10	0	0	0	

Commission

TABLE 5.8
CALCULATION OF EXPECTED AGREEMENT

Sum of diagonal entries
Expected agreement by chance alone = Grand Total

$$= \frac{51606}{543169}$$

Expected agreement by chance alone = 0.09501

Calculation of Kappa-hat

$$\text{k-hat} = \frac{\text{erved-Expected}}{\text{1-Expected}}$$

$$\text{k-hat} = \frac{0.646938}{0.90499}$$

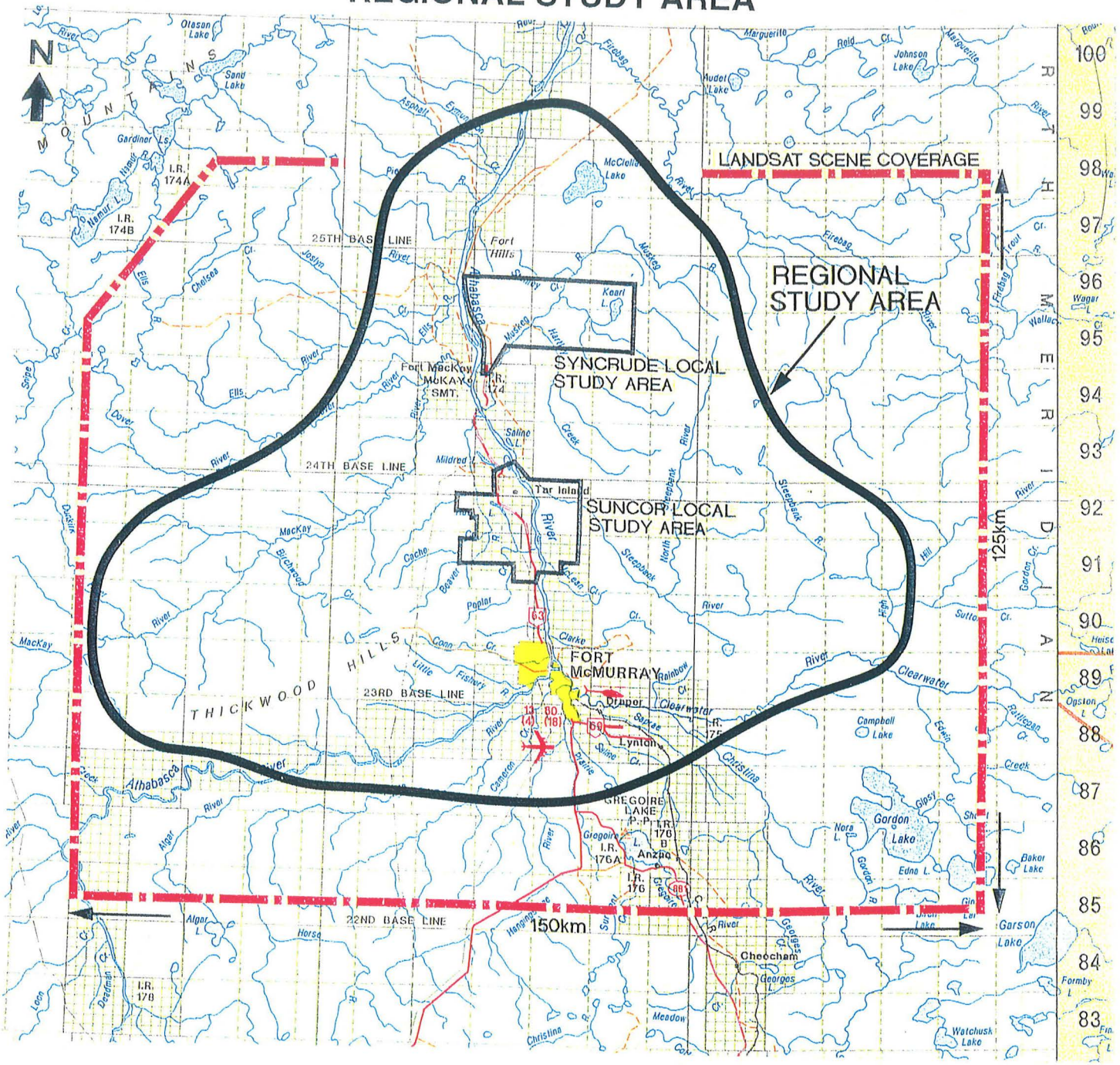
k-hat = 0.71486

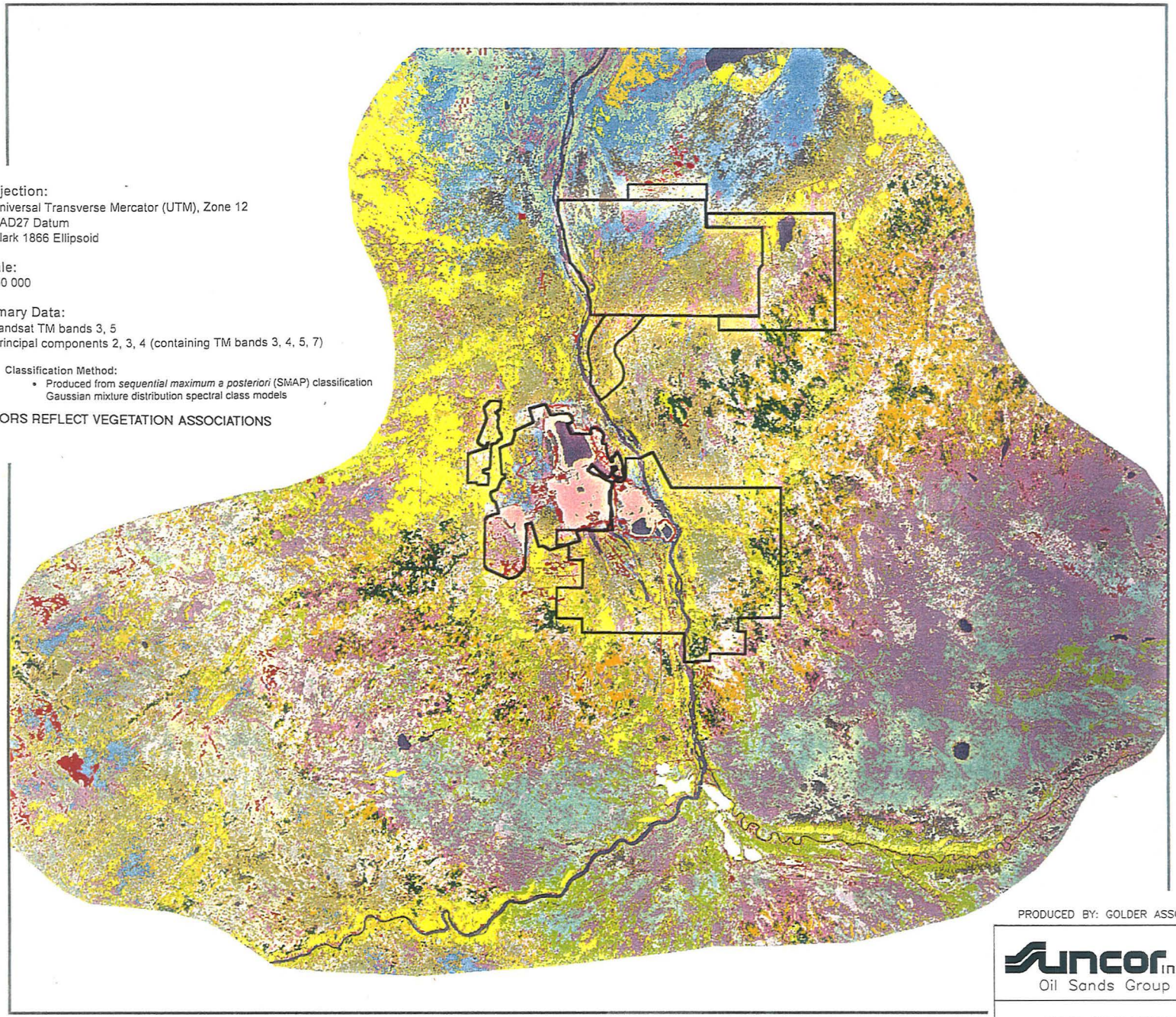
Overall Adjusted Accuracy (%) 71.49

Therefore, the classification is 72% more accurate than would be expected from a random assignment of pixels to categories

FIGURES

Figure 1.0
JOINT SUNCOR/SYNCRUDE REGIONAL STUDY AREA





Projection:
- Universal Transverse Mercator (UTM), Zone 12
- NAD27 Datum
- Clark 1866 Ellipsoid

Scale:
1:160 000

Primary Data:
- Landsat TM bands 3, 5
- Principal components 2, 3, 4 (containing TM bands 3, 4, 5, 7)

Classification Method:
- Produced from *sequential maximum a posteriori* (SMAP) classification Gaussian mixture distribution spectral class models

COLORS REFLECT VEGETATION ASSOCIATIONS

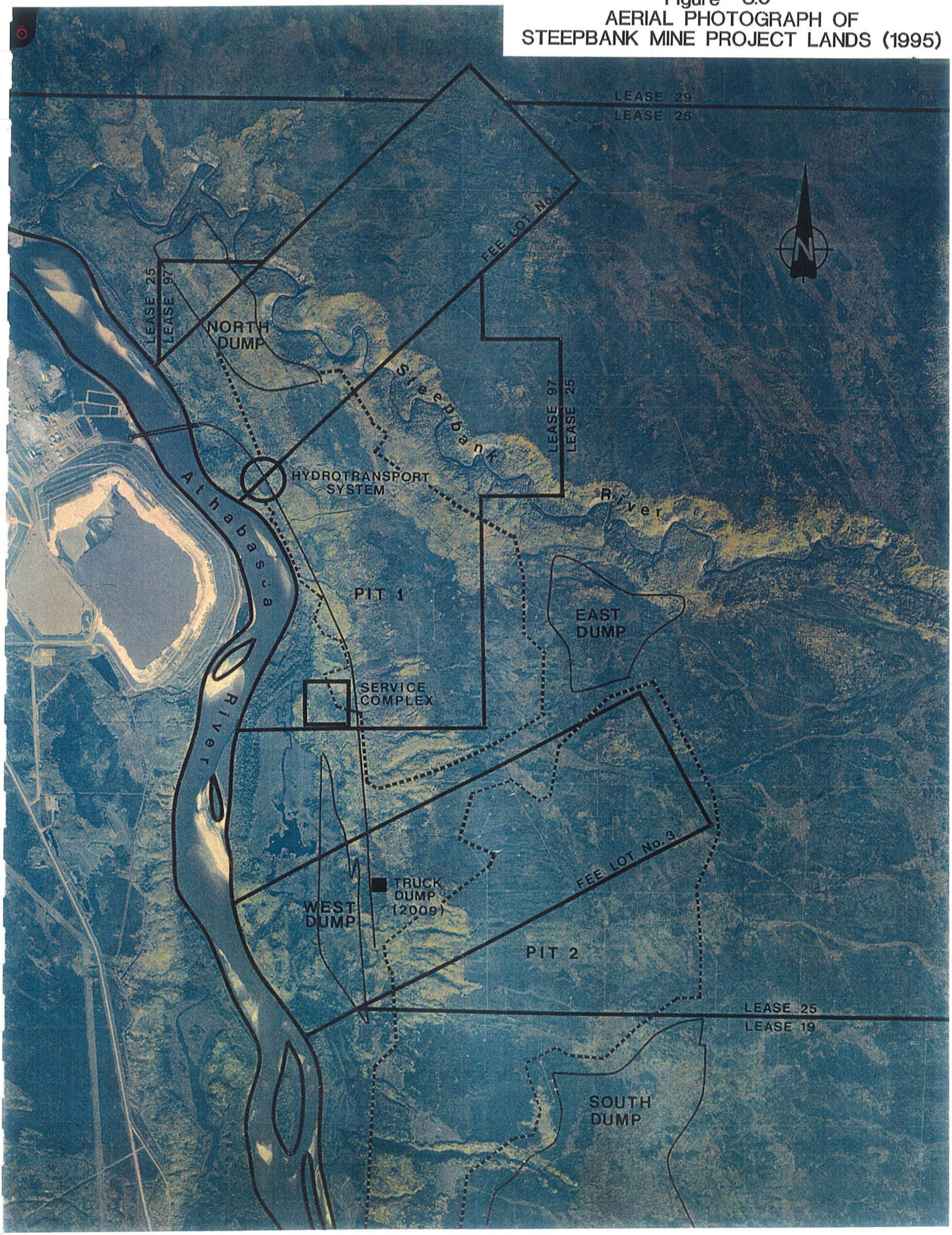
PROJECTION: UTM
PRODUCED BY: GOLDER ASSOCIATES LTD. FOR SUNCOR INC.

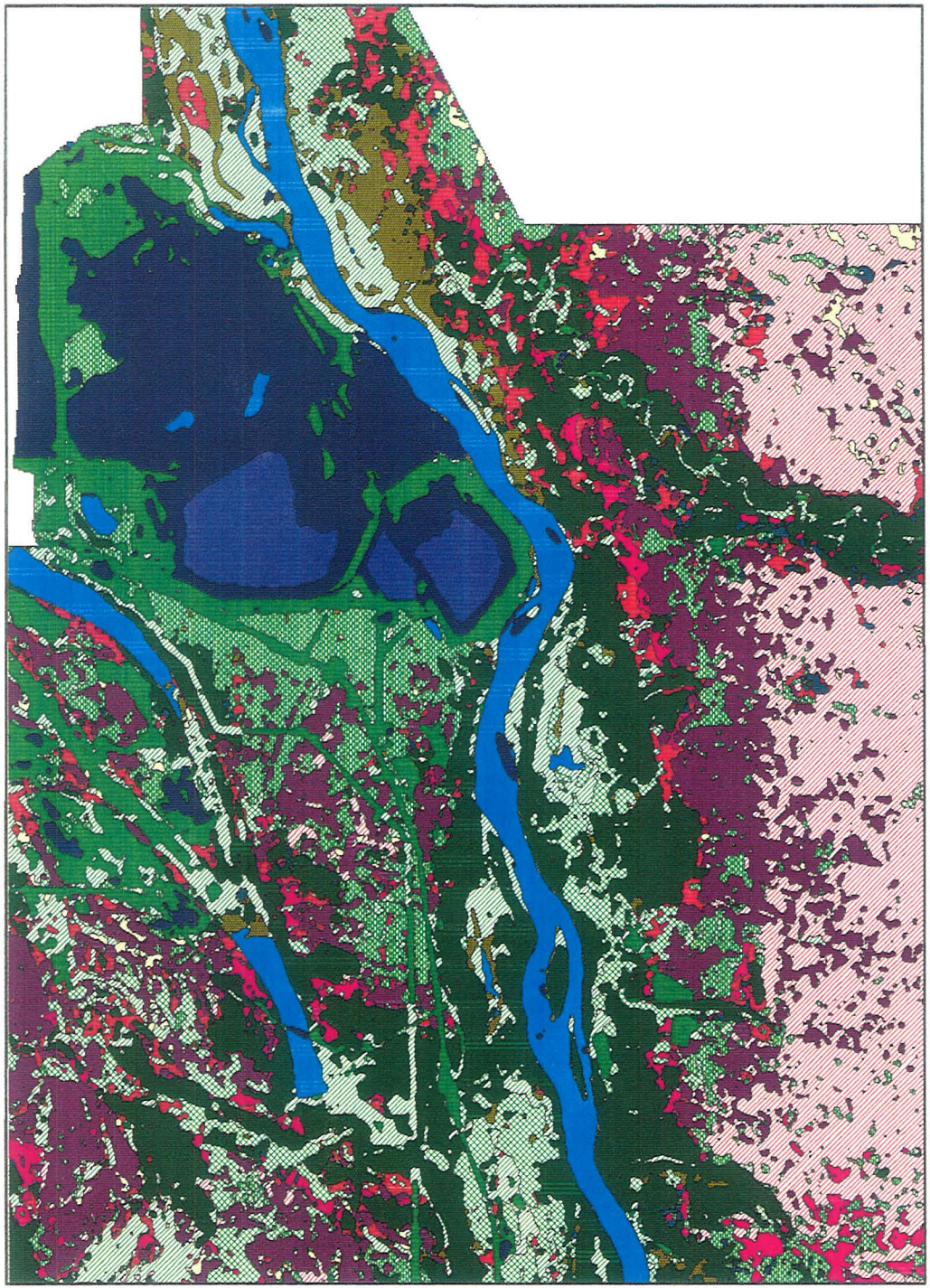
Suncor Inc.
Oil Sands Group

JOINT SUNCOR/SYNCRUDE REGIONAL ECOLOGICAL LAND (ELC) CLASSIFICATION

SCALE: AS SHOWN	Steepbank Mine Application	REVIEWED BY:
DATE: 22 APR 96		REVISION No.: 2
DRAWN BY:		FIGURE No.: 2.0

Figure 3.0
AERIAL PHOTOGRAPH OF
STEEPBANK MINE PROJECT LANDS (1995)





SUNCOR ELC CLASSIFICATION
LOCAL STUDY AREA, YEAR 1995

LEGEND

- Closed Jack Pine
- Closed White Spruce
- Deciduous forest
- Closed Mixedwood
- Closed Mixed Coniferous, Black Spruce Dominant
- Peatland: Closed Black Spruce Bog
- Peatland: Black Spruce-Tamarack Fen
- Closed Mixedwood, White Spruce Dominant
- Peatland: Open Black Spruce Bog
- Peatland: Open Tamarack Fen
- Wetland Closed Shrub Complex
- Disturbed/Herb, Grasses
- Industrial/Sparsely Vegetated
- Industrial Open Water
- Wetland Open Water-Emergent Vegetation Zone

Scale = 1:100,000

0 2 4 6

KILOMETRES

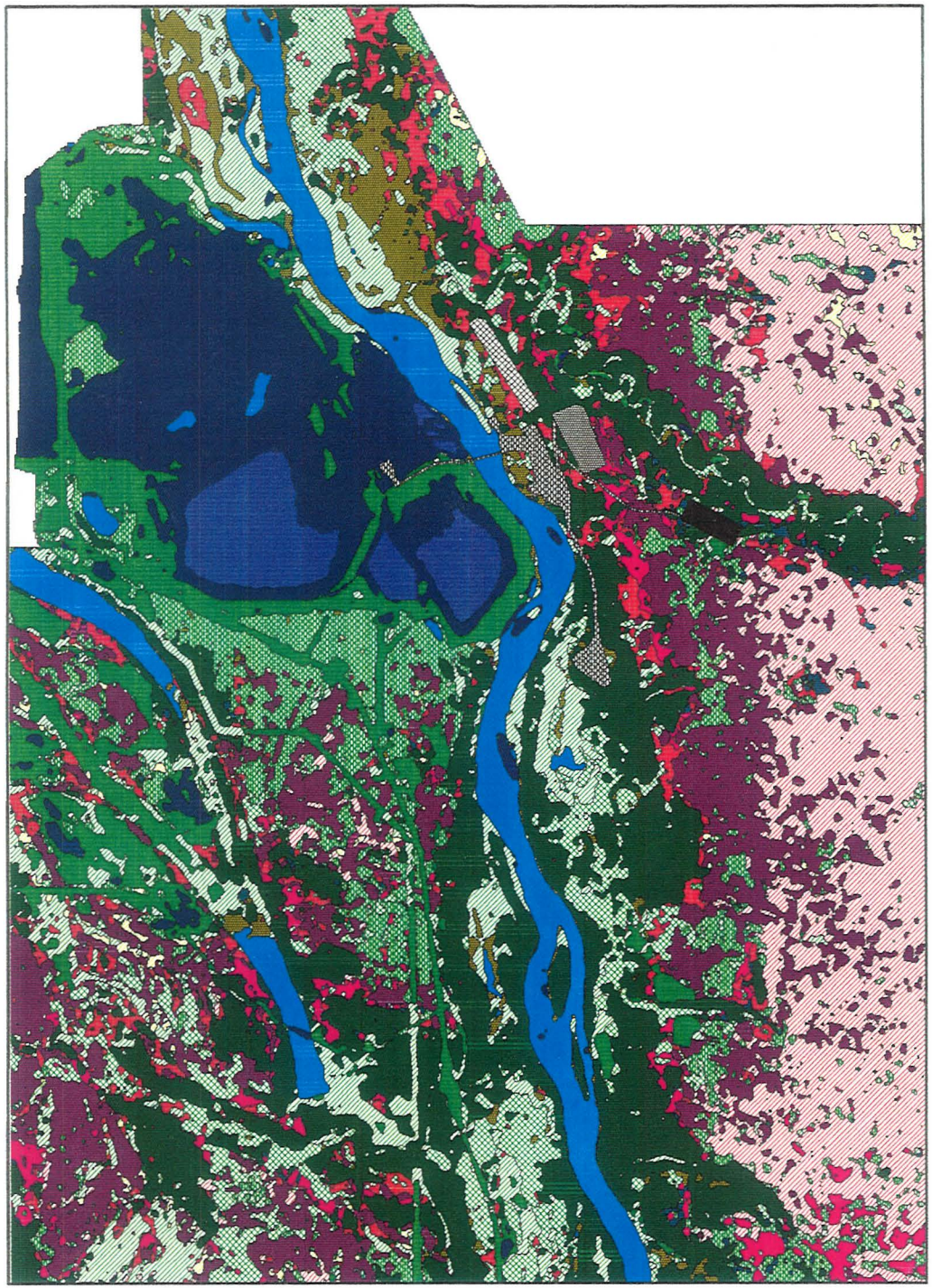
N

Suncor Inc.

Golder Associates

SUNCOR STEEPBANK MINE ADVANCE,
ELC ECOSITE CLASSIFICATION

4-19-96 RP/KS	Steepbank Mine Application	Figure No. 4.1
952-2307.5685		



SUNCOR ELC CLASSIFICATION
LOCAL STUDY AREA, YEAR 2001

LEGEND

- Closed Jack Pine
- Closed White Spruce
- Deciduous forest
- Closed Mixedwood
- Closed Mixed Coniferous, Black Spruce Dominant
- Peatland: Closed Black Spruce Bog
- Peatland: Black Spruce-Tamarack Fen
- Closed Mixedwood, White Spruce Dominant
- Peatland: Open Black Spruce Bog
- Peatland: Open Tamarack Fen
- Wetland Closed Shrub Complex
- Disturbed/Herb, Grasses
- Industrial/Sparsely Vegetated
- Industrial Open Water
- Steepbank Mine Infrastructure
- North Overburden Storage
- Active Mine Pit (Pit 7)
- East Steepbank Gravel Pit
- Wetland Open Water-Emergent Vegetation Zone

Scale = 1:100,000

0 2 4 6

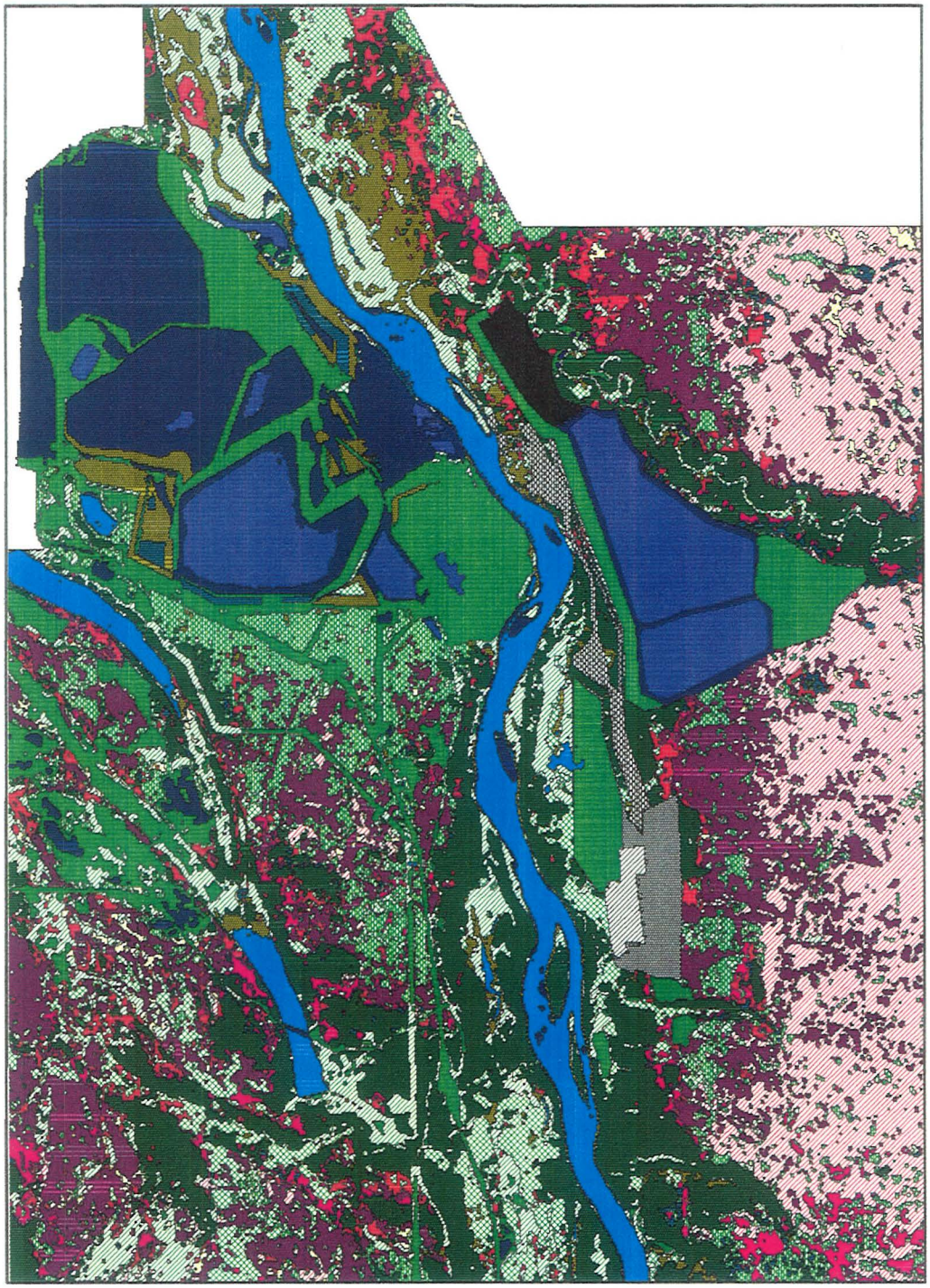
KILOMETRES

N

Suncor Inc. | Golder Associates

SUNCOR STEEPBANK MINE ADVANCE,
ELC ECOSITE CLASSIFICATION

4-19-96 RP/KS 952-2307.5685	Steepbank Mine Application	Figure No. 4.2



SUNCOR ELC CLASSIFICATION
LOCAL STUDY AREA, YEAR 2010

LEGEND

- Closed Jack Pine
- Closed White Spruce
- Deciduous forest
- Closed Mixedwood
- Closed Mixed Coniferous, Black Spruce Dominant
- Peatland: Closed Black Spruce Bog
- Peatland: Black Spruce-Tamarack Fen
- Closed Mixedwood, White Spruce Dominant
- Peatland: Open Black Spruce Bog
- Peatland: Open Tamarack Fen
- Wetland Closed Shrub Complex
- Disturbed/Herb, Grasses
- Industrial/Sparsely Vegetated
- Industrial Open Water
- Lease 97 Mine Infrastructure
- Lease 97 Active Mine Area
- Lease 97 Dyke 11
- Lease 97 North Overburden Storage
- Wetland Open Water-Emergent Vegetation Zone

Scale = 1:100,000

0 2 4 6

KILOMETRES

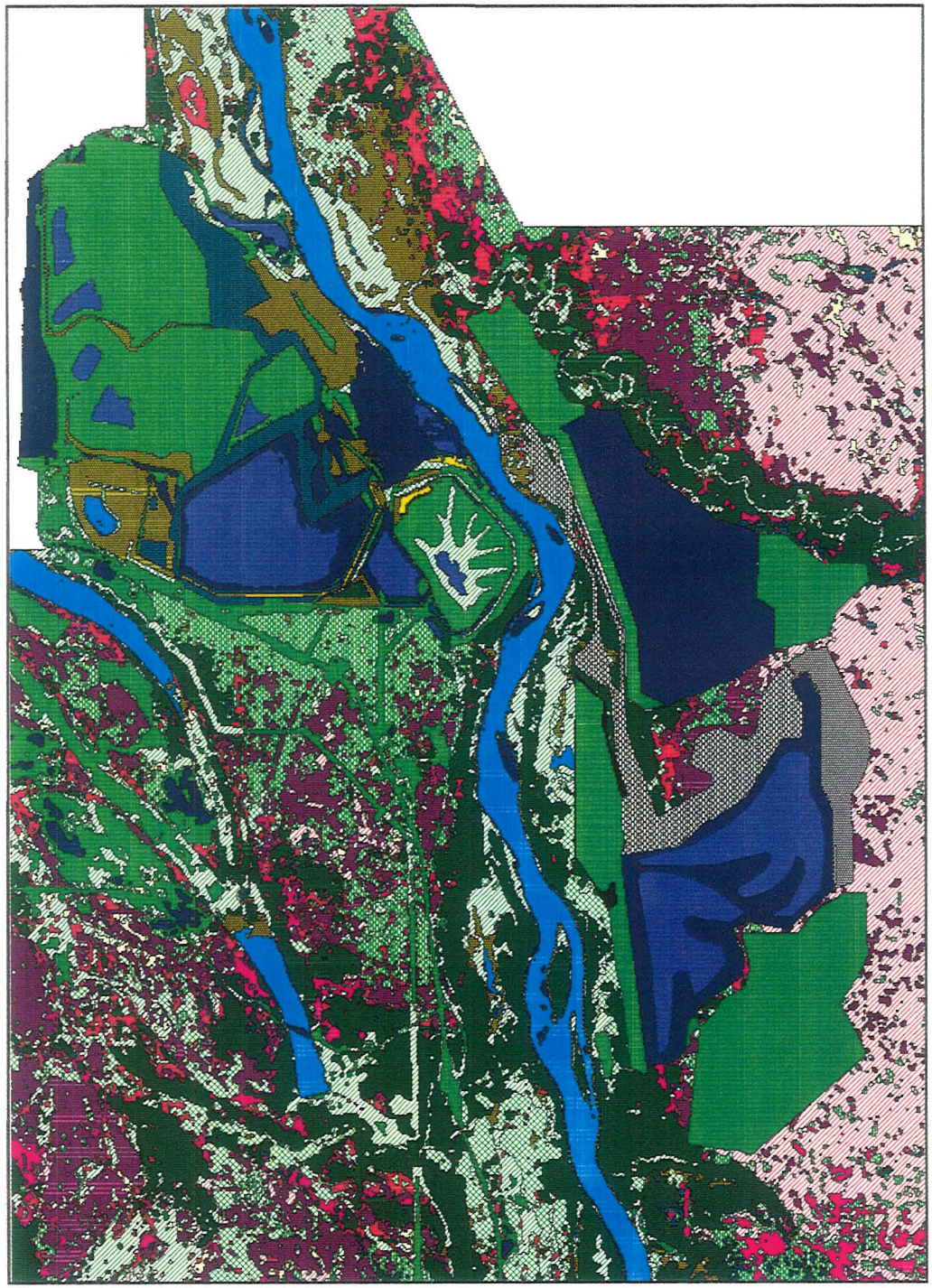
N

Suncor Inc.

Golder Associates

SUNCOR STEEPBANK MINE ADVANCE,
ELC ECOSITE CLASSIFICATION

4-19-96 RP/KS	Steepbank Mine Application	Figure No.
952-2307.5685		4.3



SUNCOR ELC CLASSIFICATION
LOCAL STUDY AREA, YEAR 2020

LEGEND

- Closed Jack Pine
- Closed White Spruce
- Deciduous forest
- Closed Mixedwood
- Closed Mixed Coniferous, Black Spruce Dominant
- Peatland: Closed Black Spruce Bog
- Peatland: Black Spruce-Tamarack Fen
- Closed Mixedwood, White Spruce Dominant
- Peatland: Open Black Spruce Bog
- Peatland: Open Tamarack Fen
- Wetland Closed Shrub Complex
- Disturbed/Herb, Grasses
- Industrial/Sparsely Vegetated
- Industrial Open Water
- Upland Lodgepole Pine (Reclaimed)
- Lease 97 Mine Infrastructure
- Lease 97 West Overburden Pile
- Lease 97 Active Mine Pit
- Wetland Open Water-Emergent Vegetation Zone

Scale = 1:100,000

0 2 4 6

KILOMETRES

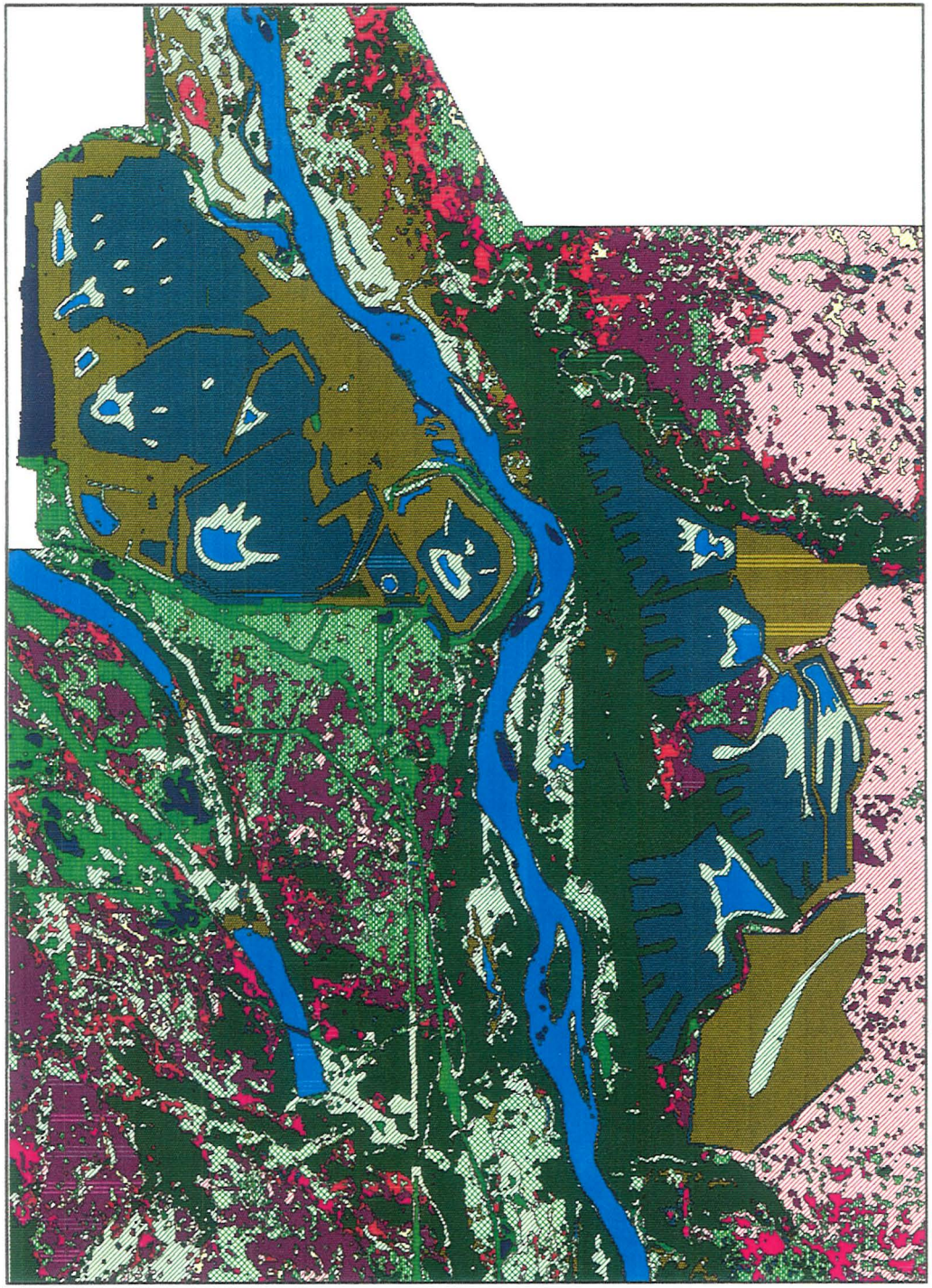
N

Suncor Inc.

Golder Associates

SUNCOR STEEPBANK MINE ADVANCE,
ELC ECOSITE CLASSIFICATION

4-19-96 RP/KS 952-2307.5685	Steepbank Mine Application	Figure No. 4.4



SUNCOR ELC CLASSIFICATION
LOCAL STUDY AREA, LONGTERM PLANNED

LEGEND

- Closed Jack Pine
- Closed White Spruce
- Deciduous forest
- Closed Mixedwood
- Closed Mixed Coniferous, Black Spruce Dominant
- Peatland: Closed Black Spruce Bog
- Peatland: Black Spruce-Tamarack Fen
- Closed Mixedwood, White Spruce Dominant
- Peatland: Open Black Spruce Bog
- Peatland: Open Tamarack Fen
- Wetland Closed Shrub Complex
- Disturbed/Herb, Grasses
- Industrial/Sparsely Vegetated
- Wetland Open Water-Emergent Vegetation Zone

Scale = 1:100,000

0 2 4 6

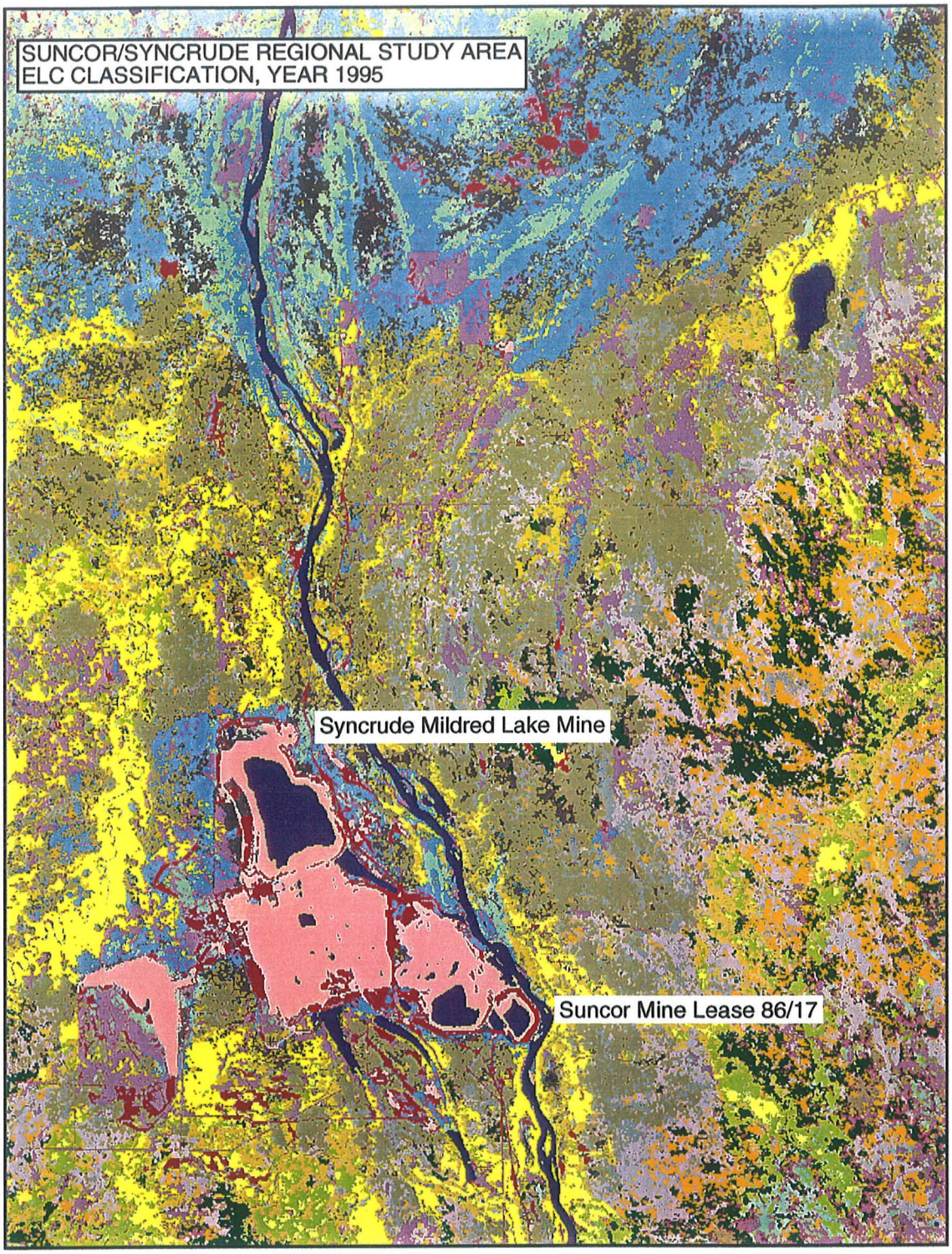
KILOMETRES

N

Suncor Inc. | Golder Associates

SUNCOR STEEPBANK MINE ADVANCE,
ELC ECOSITE CLASSIFICATION

4-19-96 RP/KS	Steepbank Mine Application	Figure No.
952-2307.5685		4.5



LEGEND
- Closed Jack Pine
- Closed White Spruce
- Closed Deciduous Forest
- Closed Mixedwood
- Closed Mixed Conif. Black Sp. Dom.
- Peatland: Closed Black Spruce Bog
- Peatland: Black Spruce-Larch Fen
- Closed Mixedwood, White Spruce Dominant
- Peatland: Open Black Spruce Bog
- Peatland: Open Larch Fen
- Wetland Closed Shrub Complex
- Disturbed/Herb, Grasses
- Industrial/Sparsely Vegetated
- Wetland Open Water-Emergent Vegetation
- Peatland: Shrub Dom. Fen/Pat. Fen

SCALE: 1 : 300000

REGION: 447750 492100
6363700
6305000

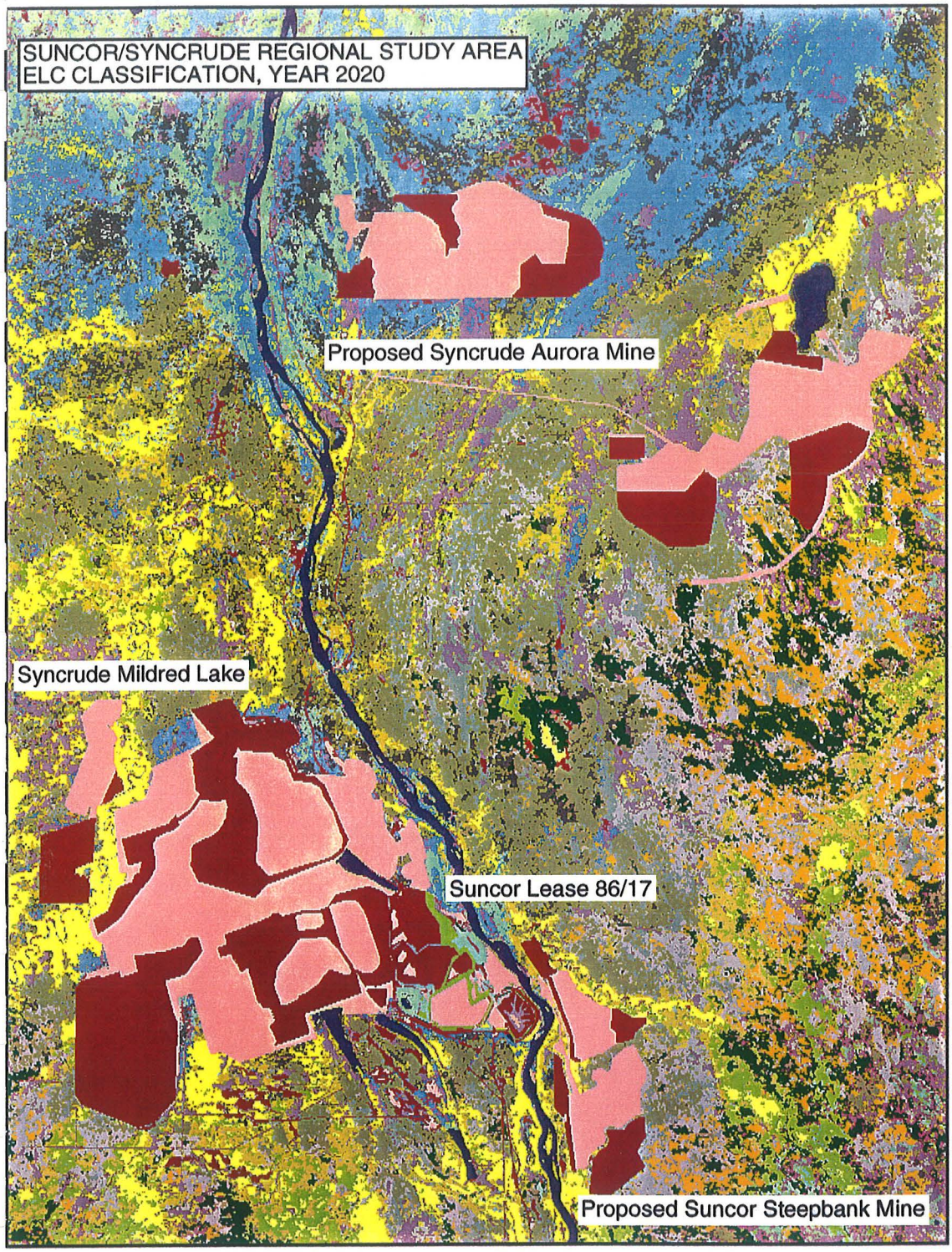
SCALE: 1:300,000
PROJECTION: UTM
PRODUCED BY: GOLDER ASSOCIATES LTD. FOR SUNCOR INC.

Suncor Inc.
Oil Sands Group

SUNCOR / SYNCRUDE REGIONAL STUDY AREA ELC CLASSIFICATION, 1995

SCALE: AS SHOWN	Steepbank Mine Application	REVIEWED BY:
DATE: 23 APR 96		REVISION No.: 1
DRAWN BY: KS/RK		FIGURE No.: 4.6

952-2307.5685\KSTBLKNB.dwg



LEGEND
- Closed Jack Pine
- Closed White Spruce
- Deciduous Forest
- Closed Mixedwood
- Closed Mixed Conif. Black Sp. Dominant
- Peatland: Closed Black Spruce Bog
- Peatland: Black Spruce-Larch Fen
- Closed Mixedwood, White Spruce Dominant
- Peatland: Open Black Spruce Bog
- Peatland: Open Larch Fen
- Wetland Closed Shrub Complex
- Disturbed/Herb, Grasses
- Industrial/Sparsely Vegetated
- Wetland Open Water-Emergent Veg.
- Peatland: Shrub Dom. Fen/Pat. Fen

SCALE: 1 : 300000

REGION: 447750 492100
6363700
6305000

SCALE: 1:300,000
PROJECTION: UTM
PRODUCED BY: GOLDER ASSOCIATES LTD. FOR SUNCOR INC.

Suncor Inc.
Oil Sands Group

SUNCOR / SYNCRUDE
REGIONAL STUDY AREA
ELC CLASSIFICATION, 2020

SCALE: AS SHOWN	Steepbank Mine Application	REVIEWED BY: .
DATE: 23 APR 96		REVISION No.: 1
DRAWN BY: KS/RK		FIGURE No.: 4.7

962-2307.5685\KSTBLKNB.dwg

APPENDICES

APPENDIX I

SUNCOR LOCAL STUDY AREA
ECOSITE CLASSIFICATION ACCURACY ASSESSMENT

The class designations of 101 field sites retained from the classification process were applied to a 5 by 5 pixel window centered on the field sampled pixel. This provided a 50 m (2 pixel) buffer around the field-sampled pixel in which 25 pixels were labelled according to the center pixel. This was done under the assumption that the original field site was to have sampled a patch with a minimum 100 m size. This theoretically meant that up to 2525 pixels could be sampled in the accuracy assessment, however this total was reduced to 2045 due to some overlap and proximity to boundaries such as water bodies, roads, disturbed area and study area boundaries.

The 2045 field-referenced pixels were compared to pixels taken from the same locations in the original 25 m Ecosite classification. These data were put into an error matrix to calculate the individual and overall class accuracies as well as errors of omission and commission (Campbell 1987) shown in Table 5.1. Table 5.2 shows the errors of omission and commission, as well as the individual class accuracies and the over- all accuracy of the Local Study Area ELC Ecosite Classification which was calculated to be 78%.

In order to factor in the probability of chance agreements into the overall accuracy of the classification, a Kappa-hat (k-hat) analysis was performed on the error matrix. K-hat coefficient represents that portion of the classification that can not be attributed by chance assignments alone. In calculating this coefficient, the summed errors of omission and commission for each class are multiplied together in a cross-product matrix, shown in Table 5.3. The expected agreement by chance alone is calculated by dividing the sum of the diagonal by the cross-product grand total. Table 5.4 shows how this value was calculated and factored into the k-hat coefficient calculations. Expressed as a percent, the k-hat coefficient shows the Local Study Area Ecosite Classification to be 76% more accurate than would be expected by the chance assignment of pixels to categories.

The Regional Ecosite Classification Accuracy Assessment

Joint field work conducted primarily for regional accuracy assessment purposes was conducted byBOVAR-CONCORD Environmental and Golder Associates Ltd., in early September 1995. A total of 34 pseudo-randomly selected sites were sampled and classified according to the scheme

adopted by this study. It should be noted as a result of the large size of the regional study (979,407 ha^2) it was logistically possible to sample only a very small portion of the overall potential variation in the regional system. As in the Suncor Local Area Ecosite Classification accuracy assessment, the field sites were used to select representative polygons in order to increase the size of the sample from 34 pixels to 856. However, an initial accuracy assessment showed that the 34 field-referenced polygons were insufficient to provide a basic exploration of error.

It was decided that Suncor Local Area Ecosite Classification, which had been previously validated at an over-all adjusted accuracy of 75% (over-all unadjusted base accuracy of 78%), would be a suitable referenced data set with which to explore the accuracy of the regional classification. Subsequently, a 2000-pixel random sample was selected from the Suncor Local Study Area Classification to enhance the 856 pixels that were sampled based on a supervised selection process for a total of 2856 observations.

The error matrix resulting from this exercise (shown in Table 5.5) displayed a pattern of commission and omission errors very similar to that of the Suncor local area classification, but at a much higher magnitude. Individual class accuracies were lower than the Suncor local classification due to the higher spatial and spectral variation of types in the regional versus the smaller Local Study Areas. It is also thought that the lack of a regional DEM lowered the over-all accuracy of the regional classification, which was calculated at 74% without adjustments (refer to Table 5.6). A omission/commission cross-product matrix was calculated from these data (Table 5.7) and used to calculate the k-hat coefficient for the regional classification (Table 5.8). Expressed as a percentage, the Regional Study Area Ecosite Classification is 72% more accurate than would be expected from a random assignment of pixel to classes.